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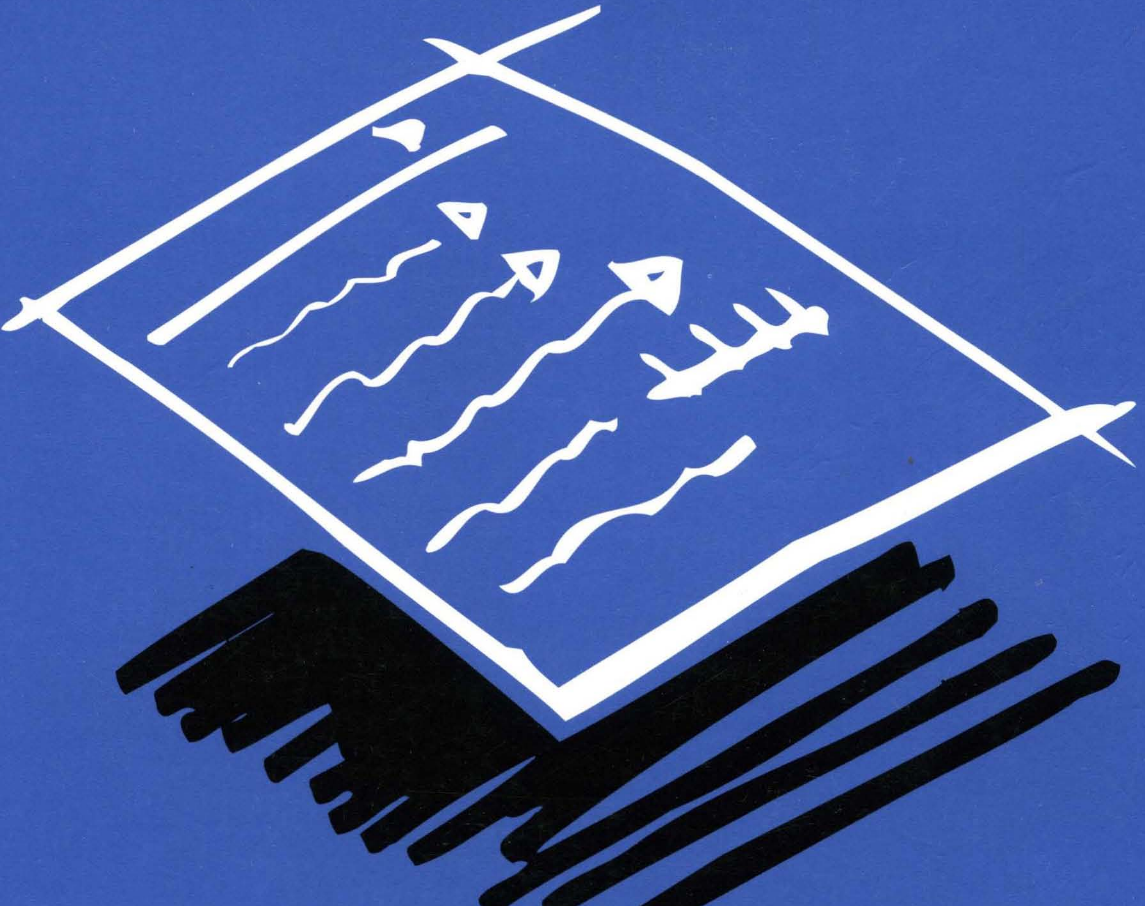
PenPoint™ Application Programmatic Interface
Volume II



PenPoint

PenPoint™

PenPoint™ API Reference

VOLUME II

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Preface

The *PenPoint API Reference* provides reference information on the subsystems of the PenPoint™ operating system. Volume I describes the functions and messages that you use to manipulate classes and describes the fundamental classes used by almost all PenPoint applications. Volume II describes the supplemental classes and functions that provide many different capabilities to PenPoint applications. The text in this volume was generated from the header files in \PENPOINT\SDK\INC.

Intended Audience

The *PenPoint API Reference* is written for people who are developing applications and services for the PenPoint operating system. We assume that you are familiar with the C language, understand the basic concepts of object-oriented programming, and have read the *PenPoint Application Writing Guide.*

What's Here

The *PenPoint API Reference* is divided into several parts, which are split across two volumes. Volume I contains these parts:

- *Part 1: Class Manager* describes the PenPoint class manager classes, which supports object-oriented programming in PenPoint.
- *Part 2: PenPoint Application Framework* describes the PenPoint Application Framework classes, which provides you the tools you use to allow your application to run under the notebook metaphor.
- *Part 3: Windows and Graphics* describes ImagePoint classes and how applications can control the screen (or other output devices).
- *Part 4: UI Toolkit* describes the PenPoint classes that implement many of the common features required by the PenPoint user interface.
- *Part 5: Input and Handwriting Translation* describes the PenPoint input system classes and classes that provide programmatic access to the handwriting translation subsystems.

Volume II contains these parts:

- *Part 6: Text Component* describes the PenPoint classes that allow any application to provide text editing and formatting capabilities to its users.
- *Part 7: File System* describes the PenPoint file system classes.
- *Part 8: System Services* describes the function calls that applications can use to access kernel functions, such as memory allocation, timer services, process control, and so on.

- *Part 9: Utility Classes* describes a wide variety of classes that save application writers from implementing fundamental things such as, list manipulation, data transfer, and so on.
- *Part 10: Connectivity* describes the classes that applications can use to access remote devices.
- *Part 11: Resources* describes the classes used to read, write, and create PenPoint resource files.
- *Part 12: Installation API* describes the PenPoint classes that support installing applications, services, fonts, dictionaries, handwriting prototypes, and so on.
- *Part 13: Writing PenPoint Services*, describes classes used in writing an installable service.

Other Sources of Information

As mentioned above, the *PenPoint Application Writing Guide* provides a tutorial on writing PenPoint applications. The tutorial is illustrated with several sample applications.

The *PenPoint Development Tools* describes how to run PenPoint on a PC, how to debug programs, and how to use a number of tools to enhance or debug your applications. This volume also contains a master index to the five volumes included in the PenPoint SDK.

The *PenPoint Architectural Reference* groups the PenPoint classes into several functional areas and describes how to use these classes. The *PenPoint Architectural Reference* is divided into two volumes. The first volume describes the fundamental classes that all application developers will use; the second volume describes supplemental classes that application developers may, or may not, use.

To learn how to use PenPoint, you should refer to the PenPoint user documentation. The user documentation is included with the PenPoint SDK, and is usually packaged with a PenPoint computer. The user documentation consists of these books:

- *Getting Started with PenPoint*, a primer on how to use PenPoint.
- *Using PenPoint*, a detailed book on how to use PenPoint to perform tasks and procedures.

Type Styles in This Book

To emphasize or distinguish particular words or text, we use different fonts.

Computerese

We use fonts to distinguish two different forms of "computerese":

- C language keywords and preprocessor directives, such as `switch`, `case`, `#define`, `#ifdef`, and so on.
- Functions, macros, class names, message names, constants, variables, and structures defined by PenPoint, such as **msgListAddItem**, **clsList**, **stsBadParam**, P_LIST_NEW, and so on.

Although all these PenPoint terms use the same font, you should note that PenPoint has some fixed rules on the capitalization and spelling of messages, functions, constants, and types. By the spelling and capitalization, you can quickly identify the use of a PenPoint term.

- Classes begin with the letters "**cls**"; for example, **clsList.**
- Messages begin with the letters "**msg**"; for example, **msgNew.**
- Status values begin with the letters "**sts**"; for example, **stsOK.**
- Functions are mixed case with an initial upper case letter and trailing parentheses; for example, **OSMemAvailable**().
- Constants are mixed case with an initial lower case letter; for example, **wsClipChildren**.
- Structures and types are all upper case (with underscores, when needed, to increase comprehension); for example, U32 or LIST_NEW_ONLY.

Placeholders

Anything you do *not* have to type in exactly as printed is generally formatted in italics. This includes C variables, suggested filenames in dialogs, and pseudocode in file listings.

Other Text

The documentation uses *italics* for emphasis. When a Part uses a significant term, it is usually emphasized the first time. If you aren't familiar with the term, you can look it up in the glossary in the *PenPoint Application Writing Guide* or the index of the book.

DOS filenames such as \\BOOT\PENPOINT\APP are in small capitals. PenPoint file names can be upper and lower case, such as \My Disk\\Package Design Letter.

Book names such as *PenPoint Application Writing Guide* are in italics.

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Part 6 / Text

TENCODE.H

This file contains the byte encodings used by **clsText** and **clsTextView**.

The byte encoding employed by the Text subsystem is based on the IBM-PC code page 850. However, there are differences as noted by the constants below; the differences are peculiar to Text's interpretation of bytes, they are not part of the interpretation used by the Imaging subsystem. This byte encoding causes Text to use the font encoding **sysDcEncodeHWX850** defined by sysfont.h.

In addition to the constants that define the byte encoding, classifications and routines that map from a byte to a class are defined, similar to those classification routines provided by ctype.h. Use of these routines should be carefully isolated as they will be replaced by a different package in the "internationalized" version of PenPoint.

The functions described in this file are contained in TEXT.LIB.

```
#ifndef TENCODE_INCLUDED
#define TENCODE_INCLUDED $Revision:   1.205  $
#ifndef GO_INCLUDED
#include <go.h>
#endif
```

Types and Constants

"Text encoding" abbreviates to "te".

Format effectors: recognized

```
#define teEmbeddedObject    0x13        // ASCII's DC3, 850's !!
#define teSpace             0x20
#define teTab               0x09
#define teNewLine           0x0D        // ASCII's CR,  850's music glyph
#define teNewPage           0x0C        // ASCII's FF,  850's female glyph
#define teNewParagraph      0x14        // ASCII's DC4, 850's para glyph
#define teUnrecognized      0x15        // ASCII's NAK, 850's sect glyph
```

Format effectors: unrecognized

```
#define teBackSpace         0x08
#define teLineFeed          0x0A
#define teVerticalTab       0x0B
```

The classification package is designed to support multiple classification schemes. The type TEXT_CHAR_TABLE represents the abstraction of a classification scheme; as such, a parameter of this type is required by each of the classification routines. TXTCTYPE_DEF represents the default classification scheme used by the Text subsystem. Thus, to see if a particular byte encodes a sentence ending character in the default classification scheme, the client would call:

TEIsSentenceEnd(TXTCTYPE_DEF, **aByte**)

```
typedef U16 TEXT_CTYPE_FLAG, *P_TEXT_CTYPE_FLAG;
typedef P_TEXT_CTYPE_FLAG TEXT_CHAR_TABLE;
#define TXTCTYPE_DEF ((TEXT_CHAR_TABLE)(-1L))
```

Exported Functions and Macros

TEIsSentenceEnd

Determines if 'c' is a sentence-ending character.

Returns BOOLEAN.

```
BOOLEAN EXPORTED
```

Function Prototype
```
TEIsSentenceEnd(
    TEXT_CHAR_TABLE table,
    CHAR            c);
```

Comments
Returns true if and only if 'c' is a sentence-ending character.

TEIsLineBreak

Determines if 'c' forces a line-break.

Returns BOOLEAN.

```
BOOLEAN EXPORTED
```

Function Prototype
```
TEIsLineBreak(
    TEXT_CHAR_TABLE table,
    CHAR            c);
```

Comments
Returns true if and only if 'c' forces a line-break.

TEIsBlank

Determines if 'c' acts as a blank/space character.

Returns BOOLEAN.

```
BOOLEAN EXPORTED
```

Function Prototype
```
TEIsBlank(
    TEXT_CHAR_TABLE table,
    CHAR            c);
```

Comments
More than one character may act as a blank/space for some purposes. For example, a non-breaking blank/space; none is defined for the PenPoint Developers Release. Returns true if and only if 'c' acts as a blank/space character.

TEIsSpecialPunct

Determines if 'c' is a "special" punctuation character.

Returns BOOLEAN.

```
BOOLEAN EXPORTED
```

Function Prototype
```
TEIsSpecialPunct(
    TEXT_CHAR_TABLE table,
    CHAR            c);
```

Comments
Such characters end a word or sentence unless surrounded by alphanumerics. The period and commas in numbers are the most obvious case. Special punctuation might also include the periods in something like "Section II.A.i: The Rise and Fall of Punctuation". Since the surrounding context is not available to this function, it simply indicates whether the character can function as special punctuation; the caller must then examine the context to decide whether the character is actually special punctuation.

Returns true if and only if 'c' is a "special" punctuation character.

TEIsWord

Determines if 'c' is part of a "normal" word.

Returns BOOLEAN.

```
BOOLEAN EXPORTED
```

Function Prototype

```
TEIsWord(
    TEXT_CHAR_TABLE table,
    CHAR            c);
```

Comments

Returns true if and only if 'c' is part of a "normal" word.

TV_TAGS.H

This file contains **clsTextView**'s well-known TAGs and associated constants.

The usage of well-known TAGS by **clsTextView** falls into these categories:

1) Quick Help identifiers

2) Option Sheet card and item (i.e., window) tags

3) Option Sheet card labels

4) User note identifiers

Most of **clsTextView**'s Option Sheet components use the same tag for both the window tag and the quick help tag. This causes category 1 above to be almost identical to category 2.

All of the Quick Help resources for **clsTextView** can be enumerated by finding all resources whose .wkn.admin == **resForQuickHelp** (see **qHelp.h**) and Cls(.wkn.id) == Cls(**clsTextView**).

```
#ifndef TV_TAGS_INCLUDED
#define TV_TAGS_INCLUDED
#                                                      ifndef GO_INCLUDED
#include <go.h>
#                                                      endif
#                                                      ifndef UID_INCLUDED
#include <uid.h>
#                                                      endif
// Allocated clsTextView TAGs: 1-54, 94-95
```

Tags for Option Sheet

```
typedef enum TV_CARD_INDEX {     // TVMakeCardTag(TV_CARD_INDEX) => tag
    tvCardChar = 0,
    tvCardPara,
    tvCardTabs,
    tvCardView,
    tvCardLength                 // Pseudo-card index which gives # cards
} TV_CARD_INDEX;
```

Labels for Option sheet & cards. All Card Label strings are in a single resource: a string array with ResId = **tagTVOptResAdmin** and indexed via TV_CARD_INDEX.

```
#define tagTVOptResAdmin    MakeTag(clsTextView, 95)
typedef enum TV_CHAR_OPTION {    // TVMakeCharTag(TV_CHAR_OPTION) => tag
    tvCharOptBold = 0,
    tvCharOptFont,
    tvCharOptItalic,
    tvCharOptSize,
    tvCharOptSizeOther,
    tvCharOptSizeOtherVal,
    tvCharOptSmallCaps,
    tvCharOptStrike,
    tvCharOptStyle,
    tvCharOptUnderlineNormal,
    tvCharOptUnderlineHeavy,
    tvCharOptLength              // Pseudo item which gives # char options
} TV_CHAR_OPTION;
```

```
typedef enum TV_PARA_OPTION {      // TVMakeParaTag(TV_PARA_OPTION) => tag
    tvParaOptAfterSpacing = 0,
    tvParaOptBeforeSpacing,
    tvParaOptFirstLineOffset,
    tvParaOptInterLineHeight,
    tvParaOptJustification,
    tvParaOptLeftMargin,
    tvParaOptLineHeight,
    tvParaOptRightMargin,
    tvParaOptLength                // Pseudo item which gives # para options
} TV_PARA_OPTION;
typedef enum TV_VIEW_OPTION {      // TVMakeViewTag(TV_VIEW_OPTION) => tag
    tvViewOptSpecial = 0,
    tvViewOptMagnification,
    tvViewOptLength                // Pseudo item which gives # show options
} TV_VIEW_OPTION;
```

The following macros combine all of the sub-ranges into a universal name space, suitable for both win.tag and gwin.**helpId**. Note that the labels of options are not tagged, only the value fields; if the labels must be tagged, use a new administered range so that it does not conflict with these **helpIds**.

```
            //   tv_glbl.c performs runtime consistency checks.
#define TVMakeTag(tag)        MakeTag(clsTextView, (tag))
#define tagTextView           TVMakeTag(1)
#define tagTextViewOption     TVMakeTag(2)
#define TVMakeCardTag(i)      TVMakeTag(3+i)
#define TVMakeCharOptTag(i) TVMakeTag(10+i) // min 7  => 3 spare Card
#define TVMakeParaOptTag(i) TVMakeTag(30+i) // min 21 => 9 spare Char
#define tagQHTabStop          TVMakeTag(42)   // min 38 => 4 spare Para
#define TVMakeViewOptTag(i) TVMakeTag(45+i) // min 43 => 2 spare Tabs
#define TVMakeXXXTag(i)       TVMakeTag(55+i) // min 48 => 7 spare View
```

Tags for Notes

A Note is a string displayed to the user when a Text View encounters difficulties processing a user action. All of the Note strings are in a single resource: a string array with ResId = **resForStdMsgDialog(clsTextView)** and indexed via the following ids.

```
#define tagTVNoteResAdmin    MakeTag(clsTextView, 94)
    // Allocated note ids - recycled: none; next: 12L
```

"text view note" abbreviates to "tvn".

```
#define tvnHazardousSetting     1L      // margins may overlap
#define tvnInvalidFieldValue    2L
#define tvnTranslateOutOfMem    3L
#define tvnTabsOverlap          4L
#define tvnReadOnlyChars        5L
#define tvnReadOnlyAttrs        6L
#define tvnNotAnIP              7L
#define tvnNotAComponent        8L
#define tvnApplyWithoutSeln     9L
#define tvnNegForUnsignedField  10L     // a negative number entered for an
                                        // unsigned field in an option sheet
#define tvnNewParasAdded        11L
```

TXTDATA.H

This file contains the API definition for **clsText**.

clsText inherits from **clsObject.**

clsText is the Data Object for the Text subsystem. These objects hold characters, their attributes and embedded objects.

The functions described in this file are contained in TEXT.LIB.

Road Map

Clients manipulating the character contents of the **textData** might use:

- msgTextGet
- msgTextGetBuffer
- msgTextModify

Clients manipulating the attributes stored in **textData** might use:

- msgTextChangeAttrs
- msgTextClearAttrs
- msgTextGetAttrs
- msgTextInitAttrs
- msgTextPrintAttrs
- TextInitCharAttrs()
- TextInitCharMask()
- TextInitParaAttrs()
- TextInitParaMask()
- TextDeleteMany()
- TextInsertOne()

Clients manipulating a **textData**'s embedded objects might use:

- msgTextEmbedObject
- msgTextExtractObject
- msgTextEnumEmbeddedObjects

Clients needing to work with words, sentences or paragraphs might use:

- msgTextSpan
- msgTextSpanType

Clients needing to import or export text might use:

- msgTextRead
- msgTextWrite

Clients observing a **textData** might want to handle:

- msgTextAffected
- msgTextReplaced

Characters and Encodings

Text data objects hold bytes representing characters using the encoding specified in tencode.h. In PenPoint 1.0, this encoding is derived from the IBM-PC's code page 850, and uses one byte per character. There are characters representing line, paragraph, and page breaks.

Characters are indexed starting from zero.

Formatting Information

Text data objects also hold "formatting" or "attribute" information. The types of attributes stored are:

- character attributes such as font face, size and weight
- paragraph attributes such margins, first line offset, first line offset
- tab attributes for a paragraph
- embedded object info (specifically the embedded object's uid)
- link termination (specifically the destination information for marks)

Attributes "tile" ranges of characters. In other words, no character can have two different sets of character attributes associated with it, although it can have both character and paragraph attributes. This tiling is enforced by the **textData**.

Any character that does not have explicit character or paragraph attributes takes on the "default" character or paragraph attributes of the data object. There are messages to inspect, enumerate, and modify all the attributes, including the defaults.

Relation to UI Classes

A **textData** only provides storage for characters and attributes. It does not provide any user interface (UI). The UI is provided by an instance of **clsTextView**.

To assist the class providing the UI, the **textData** provides notifications whenever either the characters or the attributes are modified.

Implementation Note

clsText is actually composed of three layers of classes. Clients need not be concerned by these layers, and should not rely on their existence as they may disappear in future releases.

clsTextBlock (usually referred to as **clsText**) is a descendant of **clsTextMarkStore**, which in turn is a descedant of **clsTextChar**.

```
#ifndef TXTDATA_INCLUDED
#define TXTDATA_INCLUDED $Revision:   1.224  $
```

```
#ifndef                 CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef                 BYTARRAY_INCLUDED
#include <bytarray.h>                       // For BYTE_INDEX
#endif
#ifndef                 GEO_INCLUDED
#include <geo.h>                            // Required by sysfont.h
#endif
#ifndef                 SYSFONT_INCLUDED
#include <sysfont.h>                        // For SYSDC_FONT_ATTR
#endif
```

Types and Constants: Atoms

Atoms are used as parameters to many of **textData** messages. All valid atoms are defined below.

```
typedef U16 ATOM;
#define atomChar        ((ATOM) 1)
#define atomWord        ((ATOM) 2)
#define atomLine        ((ATOM) 3)
#define atomSentence    ((ATOM) 4)
#define atomPara        ((ATOM) 5)
#define atomDivision    ((ATOM) 6)
#define atomDoc         ((ATOM) 7)
#define atomMisc        ((ATOM) 8)
#define atomEmbedded    ((ATOM) 9)
#define atomParaTabs    ((ATOM)10)
#define atomLink        ((ATOM)11)
#define atomWSDelimit   ((ATOM)12)
#define atomClient1     ((ATOM)28)
#define atomClient2     ((ATOM)29)
#define atomClient3     ((ATOM)30)
#define atomClient4     ((ATOM)31)
#define minValidAtom    atomChar
#define maxValidAtom    atomClient4
```

AtomGetName

Passes back a pointer to the string value of the atom.

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
AtomGetName(
    ATOM        atom,
    PP_STRING   ppString);
```

Comments

Most clients and subclasses do not use this function. It is occasionally useful for debugging.

Return Value

stsBadParam atom is out of the range of valid atoms

stsOK atom is within the valid range. *ppString may still be NULL if the atom falls into one of the gaps.

Types and Constants: Character Indices

Character Indices

```
typedef U32                 TEXT_INDEX;
typedef TEXT_INDEX *        P_TEXT_INDEX;
#define maxTEXT_INDEX       maxU32
```

Some messages and functions which take a TEXT_INDEX as a parameter may use special values to achieve certain effects. Each message and function description indicates which special values can be used.

```
#define lpoTEXT_INDEX   (maxTEXT_INDEX-maxU16)
#define lastTEXT_INDEX  (lpoTEXT_INDEX-1)
#define infTEXT_INDEX   (maxTEXT_INDEX-1)
#define mInfTEXT_INDEX  maxTEXT_INDEX
```

"Magic" value for **msgTextChangeAttrs**, **msgTextGetAttrs** and **msgTextInitAttrs**.

```
#define textDefaultAttrs    infTEXT_INDEX
```

Types and Constants: Character Attributes

The prefixes "TA_" and "ta" indicate that an identifier is related to "text attributes."

Use these in the **alignBase** field of a TA_CHAR_ATTRS.

```
typedef enum {                          // Must fit in 2 bits
    taNormalLineBase    = 0,
} TA_ALIGN_BASE;
```

Character Attributes

```
typedef struct TA_CHAR_ATTRS {
    U16             size;               // Font size in twips. Not all
                                        // values are available -- some are
                                        // rounded down. Max of 160*20 twips.
    U16             tacSpare    : 8,    // Reserved.
                    highlight   : 1,
                    smallCaps   : 1,
                    upperCase   : 1,
                    strikeout   : 1,
                    underlines  : 2,    // As defined in sysfont.h. Must be
                                        // 0, 1, or 2.
                    alignBase   : 2;    // Use a TA_ALIGN_BASE value. Only
                                        // taNormalLineBase is implemented.
    SYSDC_FONT_SPEC font;
} TA_CHAR_ATTRS, *P_TA_CHAR_ATTRS;
```

Character Attributes Mask.

The highlight and encoding fields contain extra bits. These bits are automatically zero-ed by assigning a legitimate values to the field.

```
typedef struct {                    // Must fit in 32 bits
    U16         tacSpare    : 8,    // Reserved. Should be set to 0.
                highlight   : 2,    // true or false (and 1 spare bit)
                size        : 1,
                smallCaps   : 1,
                upperCase   : 1,
                strikeout   : 1,
                underlines  : 1,
                alignBase   : 1;
    U16         id          : 1,    // mask bit for attrs.font.id
                group       : 1,    // mask bit for attrs.font.attr.group
                weight      : 1,    // mask bit for attrs.font.attr.weight
                aspect      : 1,    // mask bit for attrs.font.attr.aspect
                italic      : 1,    // mask bit for attrs.font.attr.italic
                monospaced  : 1,    // mask bit for attrs.font.attr.monospaced
                encoding    : 10;   // mask bit for attrs.font.attr.encoding
                                    // true or false (and 9 spare bits)
} TA_CHAR_MASK, *P_TA_CHAR_MASK;
```

Types and Constants: Tab Attributes

Each paragraph can have up to TA_MAX_TABS tab stops. A paragraph without its own explicit tab stops "inherits" the document's "default" tab stops.

Paragraphs that desire uniformly spaced tab stops can compactly define the stops by setting at least two explicit stops and then setting **repeatAtEnd** to true. This has the effect of defining an unlimited number of implicit stops, each of which follows the prior stop by the distance between the last two explicit stops.

NOTE: Even though each tab store has a type and leader, only the type **taTabLeft** and the leader **taLeadSpace** are implemented.

```
typedef enum {                      // Must fit in 2 bits
    taTabLeft       = 0,
    taTabCenter     = 1,            // Not Implemented
    taTabRight      = 2,            // Not Implemented
    taTabDecimal    = 3             // Not Implemented
} TA_TAB_TYPE;
typedef enum {                      // Must fit in 2 bits
    taLeadSpace     = 0,
    taLeadDot       = 1,            // Not Implemented
    taLeadDash      = 2,            // Not Implemented
    taLeadUnderline = 3             // Not Implemented
} TA_TAB_LEADER;
```

Tab Stop.

The type and leader fields contain extra bits. These bits are automatically zero-ed by assigning a legitimate values to the field.

```
typedef struct TA_TAB_STOP {
    U16         x;                  // In twips
    U8          type;               // TA_TAB_TYPE (and 6 spare bits)
    U8          leader;             // TA_TAB_LEADER (and 6 spare bits)
} TA_TAB_STOP, *P_TA_TAB_STOP;
```

The maximum number of tab stops for a paragraph.

```
#define TA_MAX_TABS 31
```

Tab Stops.

The count and **repeatAtEnd** fields contain extra bits. These bits are automatically zero-ed by assigning a legitimate values to the field.

```
typedef struct TA_TABS {
    U16             count       : 8,    // Number of tab stops, in the range
                                        // 0..TA_MAX_TABS. (plus 3
                                        // spare bits.)
                    repeatAtEnd : 8;    // true or false (and 7 spare bits)
    TA_TAB_STOP     tabs[1];            // Actually variable size array
} TA_TABS, *P_TA_TABS;
```

Another representation of tab stops.

```
typedef struct TA_MANY_TABS {
    U16             count       : 8,    // Number of tab stops, in the range
                                        // 0..TA_MAX_TABS. (plus 3
                                        // spare bits.)
                    repeatAtEnd : 8;    // true or false (and 7 spare bits)
    TA_TAB_STOP     tabs[TA_MAX_TABS];
} TA_MANY_TABS, *P_TA_MANY_TABS;
#define textNoTabs  ((P_TA_MANY_TABS)1)     // Not Implemented
```

Types and Constants: Paragraph Attributes

Use these in the alignment field of a TA_PARA_ATTRS.

```
typedef enum {                          // Must fit in 2 bits
    taParaLeft      = 0,
    taParaCenter    = 1,
    taParaRight     = 2,
    taParaSpare     = 3                 // Reserved
} TA_PARA_ALIGN;
```

Paragraph Attributes.

All of the fields in TA_PARA_ATTRS that are linear measurements are in twips.

The alignment and justify fields contain extra bits. These bits are automatically zero-ed by assigning a legitimate values to the field.

```
typedef struct TA_PARA_ATTRS {
    U16         alignment   : 8,    // TA_PARA_ALIGN (and 6 spare bits)
                justify     : 8;    // 0 or 1. (0x80 is used internally,
                                    // so there are 6 spare bits.)
    U16         lineHeight;         // The special value textUseMaxHeightOnLine
                                    // causes the line height to be as high
                                    // as the highest thing in the line.
                                    // Don't use zero!
    U16         interLineHeight;
    U16         beforeSpacing;      // Adds to previous paragraphs's
                                    // afterSpacing
    U16         afterSpacing;
    S16         firstLineOffset;    // Add to leftMargin to get the effective
                                    // left margin for the first line of the
                                    // paragraph.
    U16         leftMargin;
    U16         rightMargin;
} TA_PARA_ATTRS, *P_TA_PARA_ATTRS;
```

Special **lineHeight** value

```
#define textUseMaxHeightOnLine  maxU16
```

Paragraph Attribute Mask

The **lineHeight**, **interLineHeight**, **beforeSpacing** and **afterSpacing** fields contain extra bits. These bits are automatically zero-ed by assigning a legitimate values to the field.

```
typedef struct {                    // Must fit in 32 bits
    U16     alignment           : 1,
            justify             : 1,
            firstLineOffset     : 1,
            leftMargin          : 1,
            rightMargin         : 1,
            lineHeight          : 3,        // 0 or 1 (2 spare bits)
            interLineHeight     : 8;        // 0 or 1 (7 spare bits)
    U16     beforeSpacing       : 8,        // 0 or 1 (7 spare bits)
            afterSpacing        : 8;        // 0 or 1 (7 spare bits)
} TA_PARA_MASK, *P_TA_PARA_MASK;
```

Types and Constants: Embedding

```
typedef struct TEXT_EMBED_OBJECT {
    TEXT_INDEX  first;
    OBJECT      toEmbed;
    U8          clientFlags;
    U8          action;             // One of the values below (6 spare bits)
} TEXT_EMBED_OBJECT, *P_TEXT_EMBED_OBJECT;
```

Use these in the action field of a TEXT_EMBED_OBJECT.

```
#define textEmbedCopy   0       // For internal use only.
#define textEmbedFree   1       // For internal use only.
#define textEmbedInsert 2
#define textEmbedMove   3       // For internal use only.
```

The fields of this structure are described in the comments for **msgTextEnumEmbeddedObjects**.

```
typedef struct TEXT_ENUM_EMBEDDED {
    TEXT_INDEX              first;
    TEXT_INDEX              length;
    U16                     flags;      // One ofthe values below
    U16                     max;
    U16                     count;
    P_TEXT_EMBED_OBJECT     pItems;
} TEXT_ENUM_EMBEDDED, *P_TEXT_ENUM_EMBEDDED;
```

The prefix "tee" indicates that an identifier is related to "TEXT_ENUM_EMBEDDED."

Use these in the flags field of a TEXT_ENUM_EMBEDDED.

```
#define teeFloat    flag0                   // Include floating embedded
                                            // objects. (These will be
                                            // children of theRootWindow.)
#define teeInline   flag1                   // Include embedded objects
#define teeDefault  (teeFloat|teeInline)
```

Types and Constants: Import/Export

More information about the fields of this structure is in the comments for for **msgTextRead**.

The **freeAfter** and **inputIsObject** fields contain extra bits. These bits are automatically zero-ed by assigning a legitimate values to the field.

```
typedef struct TEXT_READ {
    TEXT_INDEX  first;
    P_UNKNOWN   input;
    U16         embeddedAction: 2,
                freeAfter:      6,  // true or false (and 5 spare bits)
                inputIsObject:  8;  // true or false (and 7 spare bits)
    TAG         format;
} TEXT_READ, *P_TEXT_READ;
```

More information about the fields of this structure is in the comments for for **msgTextWrite**.

The flags and **outputIsObject** fields contain extra bits. These bits are automatically zero-ed by assigning legitimate values to the fields.

```
typedef struct TEXT_WRITE {
    TEXT_INDEX  first;
    TEXT_INDEX  length;
    P_UNKNOWN   output;
    U16         flags;              // One of the values below (and 13
                                    // spare bits)
    TAG         format;
    U8          outputIsObject;
} TEXT_WRITE, *P_TEXT_WRITE;
```

The prefix "tw" indicates that an identifier is related to "text write."

Use these in the flags field of a TEXT_WRITE. They are described in the comments for **msgTextWrite**.

```
#define twExtractEmbedded   flag0
#define twTempFile          flag1
#define twForUndo           flag3
```

Other Types and Constants

```
typedef OBJECT TEXT_DATA;
```

Resource ids

```
#define textResDefaultCharAttrs     MakeWknResId(clsText, 1)
#define textResDefaultParaAttrs     MakeWknResId(clsText, 2)    // Not Impl.
#define textResDefaultParaTabs      MakeWknResId(clsText, 3)    // Not Impl.
```

Public Functions and Macros

Utility Functions

TextDeleteMany

Deletes characters from a **textData**.

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
TextDeleteMany(
    const OBJECT        dataObj,
    const TEXT_INDEX    pos,            // first character to delete
    const TEXT_INDEX    length);        // number to delete
```

Comments — The return values are the same as those for **msgTextModify**.

TextInsertOne

Inserts one character into a **textData**.

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
TextInsertOne(
    const OBJECT        dataObj,
    const TEXT_INDEX    pos,                // position at which to insert
    const CHAR          toInsert);          // character to insert
```

Comments — The return values are the same as those for **msgTextModify**.

TextFindNextParaTab

Passes back the next tab stop to the right of the passed-in stop.

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
TextFindNextParaTab(
    const P_TA_TABS         p,
    const P_TA_TAB_STOP     pTab,
    const P_U16             pIndex);
```

Comments — Note that if p->repeatAtEnd is true, there are effectively an infinite number of tab stops.

Return Value — **stsNoMatch** no tabs, or this is the last tab.

Attribute and Mask Initialization Routines

TextInitCharAttrs

Initialzes a character attribute structure.

Returns nothing.

```
void EXPORTED
```

Function Prototype
```
TextInitCharAttrs(
    P_TA_CHAR_ATTRS p);
```

Comments — This function reads the default character attributes from the process's resource list (using the resource id **textResDefaultCharAttrs**), or sets all values to 0 if the resource cannot be found.

See Also — **msgTextChangeAttrs**

TextInitCharMask

Initialzes a character attribute mask to all zeros.

Returns nothing.

```
void EXPORTED
```

Function Prototype
```
TextInitCharMask(
    P_TA_CHAR_MASK  p);
```

See Also — **msgTextChangeAttrs**

TextInitParaAttrs

Initialzes a paragraph attribute structure to all zeros.

Returns nothing.

```
void EXPORTED
```

Function Prototype
```
TextInitParaAttrs(
    P_TA_PARA_ATTRS p);
```

See Also — **msgTextChangeAttrs**

TextInitParaMask

Initialzes a paragraph attribute mask to all zeros.

Returns nothing.

```
void EXPORTED
```

Function Prototype
```
TextInitParaMask(
    P_TA_PARA_MASK  p);
```

See Also — **msgTextChangeAttrs**

Message Arguments

The prefix "TD_" indicates that an identifier is related to "text data."

The prefix "tdm" indicates that an identifier is related to "text data metrics."

```
typedef struct TD_METRICS {
    U16         flags;                  // One of the values below
    U16         spareBits;              // Reserved.
    P_UNKNOWN   spares[2];              // Reserved.
} TD_METRICS, *P_TD_METRICS;
```

Use these in the flags field of a TD_METRICS.

```
#define tdmCanUndo          flag8       // if on, textData supports undo
#define tdmFileCharsOnOwn   flag1       // Not Implemented
#define tdmReadOnly         flag0       // characters cannot be modified
```

expectedSize is a hint about the expected number of characters in a **textData**. An accurate hint can improve performance.

```
typedef struct TD_NEW_ONLY {
    TD_METRICS  metrics;
    TEXT_INDEX  expectedSize;
    U16         expectedTagCount;       // Private. For internal use only.
} TD_NEW_ONLY, *P_TD_NEW_ONLY;
typedef struct TD_NEW {
    OBJECT_NEW_ONLY     object;
    TD_NEW_ONLY         text;
} TD_NEW, *P_TD_NEW;
typedef struct TEXT_BUFFER {
    TEXT_INDEX  first;              // In
    TEXT_INDEX  length;             // In
    TEXT_INDEX  bufLen;             // In
    P_CHAR      buf;                // In:Out via *buf
    TEXT_INDEX  bufUsed;            // Out
} TEXT_BUFFER, *P_TEXT_BUFFER;
typedef enum {                      // Used as a SET
    tdForward   = 1,
    tdBackward  = 2
} TEXT_DIRECTION;
typedef struct TEXT_SPAN {
    TEXT_INDEX              first;          // In:Out
    TEXT_INDEX              length;         // In:Out
    ATOM                    type;           // In:Out (for msgTextSpanType)
    TEXT_DIRECTION          direction;      // In
    BOOLEAN                 needPrefix;     // In
    BOOLEAN                 needSuffix;     // In
    U16                     prefixLength;   // Out: valid if and only if
                                            // needPrefix is true
    U16                     suffixLength;   // Out: valid if and only if
                                            // needSuffix is true
    U8                      firstNormal;    // Out: 0 or 1 (7 spare bits)
    U8                      lastNormal;     // Out: 0 or 1 (7 spare bits)
    U32                     spares[4];      // Reserved
} TEXT_SPAN, *P_TEXT_SPAN;
typedef struct TEXT_SPAN_AFFECTED {
    OBJECT      sender;
    U32         changeCount;
    TEXT_INDEX  first;
    TEXT_INDEX  length;
} TEXT_SPAN_AFFECTED, *P_TEXT_SPAN_AFFECTED;
```

```
typedef struct TEXT_REPLACED {
    TEXT_SPAN_AFFECTED  span;
    TEXT_INDEX          bytesTakenFromBuf;
} TEXT_REPLACED, *P_TEXT_REPLACED;
typedef struct TEXT_AFFECTED {
    TEXT_SPAN_AFFECTED  span;
    U16                 remeasure;
    P_UNKNOWN           spare;
} TEXT_AFFECTED, *P_TEXT_AFFECTED;
typedef struct TEXT_COUNTER_CHANGED {
    OBJECT      sender;
    U32         changeCount;
    U32         oldCount;
} TEXT_COUNTER_CHANGED, *P_TEXT_COUNTER_CHANGED;
typedef struct TEXT_CHANGE_ATTRS {
    ATOM                tag;
    TEXT_INDEX          first;
    TEXT_INDEX          length;
    P_UNKNOWN           pNewMask;
    P_UNKNOWN           pNewValues;
} TEXT_CHANGE_ATTRS, *P_TEXT_CHANGE_ATTRS;
typedef struct TEXT_GET_ATTRS {
    ATOM                tag;
    TEXT_INDEX          first;
    TEXT_INDEX          length;         // Not defined.
    P_UNKNOWN           pValues;
} TEXT_GET_ATTRS, *P_TEXT_GET_ATTRS;
```

Messages Defined by Other Classes

msgNewDefaults

Initializes the NEW struct.

Takes P_TD_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct TD_NEW {
    OBJECT_NEW_ONLY     object;
    TD_NEW_ONLY         text;
} TD_NEW, *P_TD_NEW;
```

Comments

In response to this message, **clsText** does the following:

```
    pNew->object.cap                |= objCapCreate;
    memset(&(pNew->text), 0, sizeof(pNew->text));
    pNew->text.expectedSize         = 5;
    pNew->text.expectedTagCount     = 5;
```

msgNew

Creates a new instance of **clsText**.

Takes P_TD_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct TD_NEW {
    OBJECT_NEW_ONLY     object;
    TD_NEW_ONLY         text;
} TD_NEW, *P_TD_NEW;
```

msgTextChangeCount

Passes back (and optionally sets) the **textData**'s **changeCount**.

Takes S32, returns S32.

```
#define msgTextChangeCount  TCMakeMsg(0)
```

Comments

Each instance of **clsText** keeps a monotonically increasing count of the number of changes that have been made to it (via **msgTextModify**). In response to this message, a **textData** passes back that count. The counter's value is always greater than or equal to 0.

If the value of **pArgs** is:

< 0 the counter's current value is returned and the counter is unchanged.

maxS32 the counter is incremented by one, and the new value returned.

>= 0 the counter is set to **pArgs**, and its previous value is returned.

In general, clients should only increment the counter, not decrement it.

msgTextGet

Returns the character in a **textData** at the specified position.

Takes TEXT_INDEX, returns STATUS.

```
#define msgTextGet          TCMakeMsg(1)
```

Return Value

stsEndOfData pArgs->first is too large

>= 0 the 8 bit character is returned as the low byte of the returned STATUS; the high 3 bytes are zero.

msgTextGetBuffer

Passes back a contiguous range of characters from a **textData.**

Takes P_TEXT_BUFFER, returns STATUS.

```
#define msgTextGetBuffer        TCMakeMsg(5)
```

Message Arguments

```
typedef struct TEXT_BUFFER {
    TEXT_INDEX  first;            // In
    TEXT_INDEX  length;           // In
    TEXT_INDEX  bufLen;           // In
    P_CHAR      buf;              // In:Out via *buf
    TEXT_INDEX  bufUsed;          // Out
} TEXT_BUFFER, *P_TEXT_BUFFER;
```

Comments

Use this message to get the values of several characters at a time. This message is a high-performance alternative to **msgTextGet.**

If **pArgs**->length > **pArgs**->bufLen, then up to **bufLen** characters are placed into **pArgs**->buf.

Upon return, **pArgs**->bufUsed is set to the count of characters read, even if there was a problem with the request.

Return Value

stsBadParam pArgs->length was 0 or **pArgs**->bufLen was 0 or **pArgs**->buf was **pNull.**

stsEndOfData pArgs->first is too large

< **stsOK** some other error occurred.

msgTextGetMetrics

Passes back the **textData**'s metrics.

Takes P_TD_METRICS, returns STATUS.

```
#define msgTextGetMetrics       TCMakeMsg(2)
```

Message Arguments

```
typedef struct TD_METRICS {
    U16         flags;              // One of the values below
    U16         spareBits;          // Reserved.
    P_UNKNOWN   spares[2];          // Reserved.
} TD_METRICS, *P_TD_METRICS;
```

msgTextLength

Returns the number of characters stored in the **textData**.

Takes nothing, returns TEXT_INDEX.

```
#define msgTextLength           TCMakeMsg(3)
```

Return Value

< **stsOK** some error occurred.

>= **stsOK** Cast the returned value to a TEXT_INDEX; that's the number of characters.

msgTextModify

Modifies the characters stored in the **textData**.

Takes P_TEXT_BUFFER, returns STATUS..

```
#define msgTextModify           TCMakeMsg(4)
```

Message Arguments

```
typedef struct TEXT_BUFFER {
    TEXT_INDEX  first;          // In
    TEXT_INDEX  length;         // In
    TEXT_INDEX  bufLen;         // In
    P_CHAR      buf;            // In:Out via *buf
    TEXT_INDEX  bufUsed;        // Out
} TEXT_BUFFER, *P_TEXT_BUFFER;
```

Comments

Use this message to insert, delete or replace characters in a **textData**.

In response to this message, the **textData** replaces the characters in the range [pArgs->first .. **pArgs**->first+pArgs->length) with the characters from **pArgs**->buf.

If **pArgs**->buf is **pNull**, the effect is a deletion. If **pArgs**->length is 0, the effect is an insertion. Otherwise the effect is a replacement. If **pArgs**->first is **infTEXT_INDEX**, the current length minus **pArgs**->length is substituted. If **pArgs**->length is **maxTEXT_INDEX**, strlen(**pArgs**->buf) is substituted.

Return Value

stsReadOnly request refused because object is read only.

stsOK modification successful.

msgTextSetMetrics

Sets a **textData**'s metrics.

Takes P_TD_METRICS, returns STATUS.

```
#define msgTextSetMetrics       TCMakeMsg(6)
```

Message Arguments

```
typedef struct TD_METRICS {
    U16         flags;              // One of the values below
    U16         spareBits;          // Reserved.
    P_UNKNOWN   spares[2];          // Reserved.
} TD_METRICS, *P_TD_METRICS;
```

msgTextSpan

Determines the range corresponding to the requested span.

Takes P_TEXT_SPAN, returns STATUS..

```
#define msgTextSpan          TCMakeMsg(9)
```

Message Arguments

```
typedef struct TEXT_SPAN {
    TEXT_INDEX            first;          // In:Out
    TEXT_INDEX            length;         // In:Out
    ATOM                  type;           // In:Out (for msgTextSpanType)
    TEXT_DIRECTION        direction;      // In
    BOOLEAN               needPrefix;     // In
    BOOLEAN               needSuffix;     // In
    U16                   prefixLength;   // Out: valid if and only if
                                          // needPrefix is true
    U16                   suffixLength;   // Out: valid if and only if
                                          // needSuffix is true
    U8                    firstNormal;    // Out: 0 or 1 (7 spare bits)
    U8                    lastNormal;     // Out: 0 or 1 (7 spare bits)
    U32                   spares[4];      // Reserved
} TEXT_SPAN, *P_TEXT_SPAN;
```

Comments

A span is a consecutive range of characters that share some common trait. Given a position and the desired span type, this message returns the range of the span. For instance, a client can use this message to ask a **textData** to find the bounds of the word containing a position.

Actually, this message can be used to find the start of one span and the end of another. If **pArgs**->length is 1, then the start and end of the same span is returned.

If the client only needs only the beginning or the end of the span, then **pArgs**->direction should be set to the needed end. This substantially improves performance.

Using this message, a **textData** can find the range of the following types of spans:

- atomWSDelimit: passes back a white-space delimited span
- atomWord: passes back a word span using the definitions in tencode.h

pArgs->type specifies the desired span's type.

pArgs->direction indicates whether the span should be searched for in preceding characters, succeeding characters, or both.

It is often useful to know something about the characters immediately preceding or succeeding the span. This information is returned if **pArgs**->needPrefix or **pArgs**->needSuffix (or both) are true. Upon return, **pArgs**->prefixLength and/or **pArgs**->suffixLength identifies the appropriate characters.

pArgs->firstNormal and **pArgs**->lastNormal indicate whether the corresponding portions of the span are normal or abnormal characters for the span. For instance, for **atomWord**, an "a" is a normal character, but an "!" is abnormal.

Return Value

stsBadParam Neither the two directions in **pArgs**->direction was on.

msgTextSpanType

Determines the span type of the specified range.

Takes P_TEXT_SPAN, returns STATUS..

```
#define msgTextSpanType     TCMakeMsg(10)
```

Message Arguments

```
typedef struct TEXT_SPAN {
    TEXT_INDEX              first;          // In:Out
    TEXT_INDEX              length;         // In:Out
    ATOM                    type;           // In:Out (for msgTextSpanType)
    TEXT_DIRECTION          direction;      // In
    BOOLEAN                 needPrefix;     // In
    BOOLEAN                 needSuffix;     // In
    U16                     prefixLength;   // Out: valid if and only if
                                            // needPrefix is true
    U16                     suffixLength;   // Out: valid if and only if
                                            // needSuffix is true
    U8                      firstNormal;    // Out: 0 or 1 (7 spare bits)
    U8                      lastNormal;     // Out: 0 or 1 (7 spare bits)
    U32                     spares[4];      // Reserved
} TEXT_SPAN, *P_TEXT_SPAN;
```

Comments

In response to this message, a **textData** passes back the span type that corresponds to the range.

The same range often has several span types. For instance, all ranges have the span type **atomChar**. All ranges that include a complete paragraph also have the span types **atomChar**, **atomWord** and **atomSentence**. When the passed-in range has multiple span types, the largest span type is returned.

The span type ordering from smallest to largest is as follows. This is also the complete list of span types returned in response to this message.

- atomChar
- atomWord
- atomSentence
- atomPara
- atomDoc

msgTextChangeAttrs

Changes the attributes of the specified range.

Takes P_TEXT_CHANGE_ATTRS, returns STATUS.

```
#define msgTextChangeAttrs          TAMakeMsg(taVersion, 1)
```

Message Arguments

```
typedef struct TEXT_CHANGE_ATTRS {
    ATOM                tag;
    TEXT_INDEX          first;
    TEXT_INDEX          length;
    P_UNKNOWN           pNewMask;
    P_UNKNOWN           pNewValues;
} TEXT_CHANGE_ATTRS, *P_TEXT_CHANGE_ATTRS;
```

Comments

Clients use this message to change the formatting attributes of characters in a **textData**. They can manipulate three types of attributes:

- character attributes (indicated by **atomChar**)
- paragraph attributes (indicated by **atomPara**)

- tab attributes (indicated by **atomParaTabs**)

The **pArgs** type for this message is P_TEXT_CHANGE_ATTRS. This structure has a tag, which must be one of the three atoms mentioned above. The structure also has two P_UNKNOWN fields: **pNewMask** and **pNewValues**. The true type of these two fields depends on the value of the tag.

```
tag             pNewValues type     pNewMask type
========        ================    ===============
atomChar        P_TA_CHAR_ATTRS     P_TA_CHAR_MASK
atomPara        P_TA_PARA_ATTRS     P_TA_PARA_MASK
atomParaTabs    P_TA_MANY_TABS      none; always null
```

The mask field allows the client to change only some of the attributes. If the appropriate bit in the mask if off, then the value of the attribute is not changed. To simplify initializing attribute and mask structures, **textData** has a few utility messages and functions:

msgTextInitAttrs The client must set the tag **pArgs**->first. In response to this message, a **textData** initializes **pNewValues** to the values in effect at **pArgs**->first and sets all of the bits in the mask to zero.

TextInitCharAttrs reads the default character attributes from the process's resource list (using the resource id **textResDefaultCharAttrs**), or sets all values to 0 if the resource cannot be found.

TextInitCharMask Turns off all bits in the mask

TextInitParaAttrs Sets all values to 0.

TextInitParaMask Turns off all bits in the mask

If **pArgs**->first is the "magic value" **textDefaultAttrs**, the **textData**'s default attributes are modified.

If **pArgs**->tag is **atomPara** or **atomParaTabs**, then the passed-in range is automatically extended to complete paragraph boundaries. (The resulting range is passed back in **pArgs**->first and **pArgs**->length updated.)

Return Value

stsBadParam Either **pArgs**->tag or the range was invalid. No attributes have changed.

< **stsOK** Some other error occurred. No attributes have changed.

msgTextClearAttrs

Clears all attributes of the specified type to the default values.

Takes ATOM, returns STATUS.

```
#define msgTextClearAttrs            TBMakeMsg(5)
```

Comments

In response to this message, a **textData** clears all formatting for the specified type. This message is "all or nothing" -- no mask or range can be specified.

The attributes have not changed the return value is < **stsOK**:

Return Value

stsBadParam pArgs was invalid. No attributes have changed.

< **stsOK** Some other error occurred. No attributes have changed.

msgTextEmbedObject

Embeds an object at a specified position.

Takes P_TEXT_EMBED_OBJECT, returns STATUS.

```
#define msgTextEmbedObject           TBMakeMsg(2)
```

Message Arguments

```
typedef struct TEXT_EMBED_OBJECT {
    TEXT_INDEX  first;
    OBJECT      toEmbed;
    U8          clientFlags;
    U8          action;             // One of the values below (6 spare bits)
} TEXT_EMBED_OBJECT, *P_TEXT_EMBED_OBJECT;
```

Comments

Each embedded object is represented by a character with the encoding value **teEmbeddedObject**. (See tencode.h.)

In response to this message, the **textData** inserts the embedded object anchor character and "remembers" the embedded object's id.

msgTextExtractObject

Extracts the specified embedded object.

Takes OBJECT, returns STATUS.

```
#define msgTextExtractObject           TBMakeMsg(4)
```

Comments

In response to this message, the **textData** "forgets" the specified embedded object. It also deletes the associated embedded object anchor character.

Nothing is done to the object itself. In particular, the client should probably **msgWinExtract** the object.

msgTextGetAttrs

Gets the attributes of the specified type.

Takes P_TEXT_GET_ATTRS, returns STATUS.

```
#define msgTextGetAttrs             TAMakeMsg(taVersion, 2)
```

Message Arguments

```
typedef struct TEXT_GET_ATTRS {
    ATOM                tag;
    TEXT_INDEX          first;
    TEXT_INDEX          length;         // Not defined.
    P_UNKNOWN           pValues;
} TEXT_GET_ATTRS, *P_TEXT_GET_ATTRS;
```

Comments

Clients can retrieve the attributes of a character in the **textData** using **msgTextGetAttrs**.

The client specifies the type of attributes it is interested in by filling in **pArgs**->tag. The client must set **pArgs**->pValues to point to a structure with the "real" type of the attributes corresponding to the tag. This "real" type is described in the comments for **msgTextChangeAttrs**.

The client also specifies the character whose attributes the client wants by specifying **pArgs**->first. If **pArgs**->first is **textDefaultAttrs** then the default attribute values are returned.

Return Value

stsBadParam pArgs->tag is not valid

stsEndOfData pArgs->first is too large

stsOK the attribute values have been copied into **pArgs**->pValues

msgTextInitAttrs

Initialize the attributes and mask before a **msgTextChangeAttrs**.

Takes P_TEXT_CHANGE_ATTRS, returns STATUS.

```
#define msgTextInitAttrs            TAMakeMsg(taVersion 3)
```

Message Arguments

```
typedef struct TEXT_CHANGE_ATTRS {
    ATOM                tag;
    TEXT_INDEX          first;
    TEXT_INDEX          length;
    P_UNKNOWN           pNewMask;
    P_UNKNOWN           pNewValues;
} TEXT_CHANGE_ATTRS, *P_TEXT_CHANGE_ATTRS;
```

Comments

The type of attributes is specified by **pArgs**->tag. **pArgs**->pNewValues and **pArgs**->pNewMask must be set as appropriate to an invocation of **msgTextChangeAttrs**.

If **pArgs**->first is **textDefaultAttrs**, the default attributes are used to initialize **pArgs**->pNewValues. Otherwise the attributes in effect at **pArgs**->first are used. All bits of **pArgs**->pNewMask are set to 0.

Return Value

stsBadParam Either **pArgs**->tag or the range was invalid.

< **stsOK** Some other error occurred. No change has been made to the attributes and mask.

See Also

msgTextChangeAttrs

msgTextPrintAttrs

Prints the values of an attribute set and a mask.

Takes P_TEXT_CHANGE_ATTRS, returns **stsOK**.

```
#ifdef DEBUG
#define msgTextPrintAttrs           TAMakeMsg(taVersion, 4)
#endif
```

Message Arguments

```
typedef struct TEXT_CHANGE_ATTRS {
    ATOM                tag;
    TEXT_INDEX          first;
    TEXT_INDEX          length;
    P_UNKNOWN           pNewMask;
    P_UNKNOWN           pNewValues;
} TEXT_CHANGE_ATTRS, *P_TEXT_CHANGE_ATTRS;
```

Comments

This message takes the same parameters as **msgTextChangeAttrs** and the **pArgs** must be filled in the same way. In response to this message, a **textData** prints out a useful dump of the contents of **pArgs**.

Internal Use Only: If **pArgs**->first is **txtPrvAttrs**, then **pArgs**->pNewValues must be in the internal format.

See Also

msgTextChangeAttrs

msgTextRead

Inserts Ascii, RTF, etc. at the specified location.

Takes P_TEXT_READ, returns STATUS.

```
#define msgTextRead         TBMakeMsg(0)
```

Message Arguments

```
typedef struct TEXT_READ {
    TEXT_INDEX  first;
    P_UNKNOWN   input;
    U16         embeddedAction: 2,
                freeAfter:      6,  // true or false (and 5 spare bits)
                inputIsObject:  8;  // true or false (and 7 spare bits)
    TAG         format;
} TEXT_READ, *P_TEXT_READ;
```

Comments

The **textData** reads data and inserts the data into itself.

The fields of **pArgs** are:

first the read text is inserted into the **textData** starting at this position. After a successful return, **pArgs**->first is position immediately after the inserted text.

input the input source. If **pArgs**->inputIsObject is true, this field must hold a FILE_HANDLE object. If **pArgs**->inputIsObject is false, then this field must hold a P_FILE.

embeddedAction Client must set this to **textEmbedInsert**. (Other values are for internal use only.)

freeAfter If true, then **pArgs**->input is freed after reading successfully.

inputIsObject describes the type of **pArgs**->input.

format one of the file types defined in filetype.h, or **fileTypeUndefined**. If the latter, the **textData** object attempts to deduce the form at from the contents of the data found in **pArgs**->input.

The **textData** reads **pArgs**->input using the functions defined in stdio.h. Thus, if **pArgs**->inputIsObject is true, **pArgs**->input must be an object which supports the stream protocol as used by stdio.

Return Value

stsReadOnly request refused because object is read only.

stsNoMatch RTF error: first character of input is not "{" or format version > 1 or unrecognized font name.

stsFailed StdioStreamBind() or fseek() failed.

stsBadParam pArgs->format is invalid.

stsFS... see <fs.h>.

stsOK request completed successfully; **pArgs**->first updated.

msgTextWrite

Outputs the specified span as one of Ascii, RTF, etc.

Takes P_TEXT_WRITE, returns STATUS.

```
#define msgTextWrite          TBMakeMsg(1)
```

Message Arguments

```
typedef struct TEXT_WRITE {
    TEXT_INDEX  first;
    TEXT_INDEX  length;
    P_UNKNOWN   output;
    U16         flags;             // One of the values below (and 13
                                   // spare bits)
    TAG         format;
    U8          outputIsObject;
} TEXT_WRITE, *P_TEXT_WRITE;
```

Comments

The fields of **pArgs** are:

first first character of range to be written

length length of range to be written

output if null, the **textData** creates a P_FILE and returns that handle. If non-null, then this field is either an object or a P_FILE, depending on the value of **outputIsObject**.

flags described below

format one of the file types defined in filetype.h.

outputIsObject If output is non-null and **outputIsObject** is true, then output is an object. If output is non-null and **outputIsObject** is false, then output is a P_FILE.

Possible values for the flags field of a TEXT_WRITE are:

twExtractEmbedded embedded objects in the specified span are extracted from their parent window.

twTempFile if output is null, then a temporary file is created. (Developer's Note: If you're debugging the behavior of **msgTextWrite**, you probably don't want to turn this flag on as your file will be deleted before **msgTextWrite** returns.)

twForUndo add additional information needed for supporting UNDO.

Return Value

stsBadParam pArgs->format is invalid.

stsFailed StdioStreamBind() failed.

stsFS... see <fs.h>.

stsOK request completed successfully.

msgTextEnumEmbeddedObjects

Enumerates the **textData**'s embedded objects.

Takes P_TEXT_ENUM_EMBEDDED, returns STATUS.

```
#define msgTextEnumEmbeddedObjects          TMMakeMsg(9)
```

Message Arguments

```
typedef struct TEXT_ENUM_EMBEDDED {
    TEXT_INDEX              first;
    TEXT_INDEX              length;
    U16                     flags;      // One ofthe values below
    U16                     max;
    U16                     count;
    P_TEXT_EMBED_OBJECT     pItems;
} TEXT_ENUM_EMBEDDED, *P_TEXT_ENUM_EMBEDDED;
```

Comments

There are two ways of enumerating the embedded objects:

1) Get all the objects in one send. The **textData** allocates an array of TEXT_EMBED_OBJECT elements and passes it back in **pArgs**->pItems. You must OSHeapBlockFree() the array when you are done with it. TEXT_ENUM_EMBEDDED is used as follows:

first position at which you want to start the enumeration. Use 0 to start at the beginning of the data.

length length of the range you want the enumeration to include. Use **infTEXT_INDEX** to go to the end of the data.

flags Usually **teeDefault**. Use **teeFloat** to get only floating embedded objects. Use **teeInline** to get only in-line embedded objects.

max Pass in 0. The object passes back the number of items in the allocated block

count Pass in **maxU16**. The object passes back the number of items returned (same as max).

pItems Pass in **pNull**. The object passes back a pointer to the allocated block

2) Get the objects a few at a time. You repeatedly send **msgTextEnumEmbeddedObjects** re-using the same TEXT_ENUM_EMBEDDED structure. When the message returns **stsEndOfData**, there are no more objects in the enumeration. You should set the fields of TEXT_ENUM_EMBEDDED only before the first call. For successive calls you must not modify the fields.

first Same as Case 1.

length Same as Case 1.

flags Same as Case 1.

max number of objects the **pItems** block can hold.

count Pass in the same value as max. **textData** passes back the number of objects returned in block. May be less than max for the last chunk, and is 0 when no further objects are left to enumerate.

pItems pointer to a block that can hold at least max objects.

Return Value

stsOK next chunk of objects has been enumerated

stsEndOfData no more objects to enumerate. Passed back count is be zero. If **pItems** was nil and max was 0, then no block has been allocated.

Notifications

msgTextAffected

Notifies observers that a range of text has been affected.

Takes P_TEXT_AFFECTED, returns STATUS..

```
#define msgTextAffected         MsgNoError(TCMakeMsg(7))
```

Message Arguments

```
typedef struct TEXT_AFFECTED {
    TEXT_SPAN_AFFECTED  span;
    U16                 remeasure;
    P_UNKNOWN           spare;
} TEXT_AFFECTED, *P_TEXT_AFFECTED;
```

Comments

This message informs observers that the attributes of the range have been modified.

msgTextCounterChanged

Notifies observers that **textData**'s **changeCount** has been modified.

Takes P_TEXT_COUNTER_CHANGED, returns STATUS..

```
#define msgTextCounterChanged   MsgNoError(TCMakeMsg(11))
```

Message Arguments

```
typedef struct TEXT_COUNTER_CHANGED {
    OBJECT      sender;
    U32         changeCount;
    U32         oldCount;
} TEXT_COUNTER_CHANGED, *P_TEXT_COUNTER_CHANGED;
```

Comments

The **changeCount** is normally incremented by 1 as a result of handling **msgTextModify**. Observers here about these changes via **msgTextReplaced** and **msgTextAffected** notification messages.

However, the **changeCount** can change in other ways. For instance, the **changeCount** is rolled back as part of undoing certain operations. Also, clients and/or subclasses can explicitly set the **changeCount** via **magTextChangeCount**.

Whenever the **changeCount** changes in some way OTHER than a single increment by 1, **msgTextCounterChanged** is sent to the observers to allow them to synchronize any caches they keep based on the **changeCount**.

msgTextReplaced

Notifies observers that a range of text was replaced via **msgTextModify**.

Takes P_TEXT_REPLACED, returns STATUS..

```
#define msgTextReplaced         MsgNoError(TCMakeMsg(8))
```

Message Arguments

```
typedef struct TEXT_REPLACED {
    TEXT_SPAN_AFFECTED  span;
    TEXT_INDEX          bytesTakenFromBuf;
} TEXT_REPLACED, *P_TEXT_REPLACED;
```

TXTVIEW.H

This file contains the API definition for **clsTextView** and **clsTextIP**.

clsTextView inherits from **clsView.**

clsTextView implements the user interface of a text editor. It uses an instance of **clsText** (or one of its subclasses) to hold its data.

clsTextIP inherits from **clsIP.**

clsTextIP is a specialization of **clsIP** used by a Text Views.

The functions described in this file are contained in TEXT.LIB.

Introduction

An instance of **clsTextView** (or **textView**) provides a user interface which presents text data to the user and lets the user edit that data.

Every **textView** has an associated data object of **clsText** (or a subclass of **clsText**). This object is referred to as **textData.**

Painting Model

A **textView** displays the **textData** as a series of non-overlapping, exhaustively tiling, horizontal display lines. With the possible exception of space below the last line, there is no area between lines that does not belong to any line. Characters are laid out left to right with lines running from top to bottom.

When first created, the **textView** positions the first line of **textData** at the top of itself. Subsequent user or client actions (e.g. scrolling) can position some other line to the top of the window. However, the top line is always completely visible unless the view is too small to allow this. The last visible line, in contrast, may be clipped at the bottom.

Even though a **textView** is a descendant subclass of **clsBorder**, **clsTextView** ignores all **clsBorder** functionality relating to display of the view's background and border.

Deferred Repaint

A **textView** uses a "delayed repair" model in which several changes to the **textData** may be made before the visible display lines are repainted. For certain operations (e.g. selection change), such a delay can be misleading to the user and the individual operations provide a way to override the normal delay. If no override is available within a message's arguments, **msgTextViewRepair** can be used.

Word Wrap

By default, a **textView** displays each line beginning at the left edge of its window and "word wraps" at the right edge. That is, if a word would be clipped by the right edge of the window, it is instead placed at the beginning of the next line. By modifying paragraph margin attributes the line can be adjusted to have uninked margins in which no character is displayed.

Word wrap can be turned off by setting the **textView's** style (see **msgTextViewSetStyle**). When off, a line breaks only when a "hard break" character (such as **teNewLine** or **teNewParagraph**) is encountered. As a result, a significant portion of many lines may be invisible to the user.

Embedded Objects

Other objects can be embedded within a **textView** (see **msgTextViewAddIP** and **msgTextViewEmbed**). (All embedded instances of some subclasses of **clsEmbeddedWin.**)

A **textView** handles an embedded object as if it is a "very large" character.

The **textView's** displayed lines are always as tall as the tallest character or embedded object in the line. Therefore the presence of a large embedded object causes the containing line to be quite tall. (Not all embedded objects are large. For instance, closed application icons and reference buttons are only slightly larger than typical text.)

The baseline of the line containing embedded objects is determined, in part, by the embedded object's response to **msgWinGetBaseline**. (See win.h.)

Text IPs

An instance of **clsTextIP** (or **textIP**) implements two special features that are useful to **textViews**.

The first is size management. An embedded **textIP** tracks the width of its parent window. When the parent's width changes, an embedded **textIP** modifies its own width so that it fits within and completely fills the parent window (in the horizontal direction).

The second is special filtering of text going from the IP into a **textView**. A **textIP** filters translated data from its superclass (**clsIP**) before passing its data onto its client (typically a **textView**). Two kinds of filtering are performed: paragraph break insertion and space correction. A **textIP** inserts paragraph breaks based on how many blank lines there are between scribbles on an IP. **textIP** also filters out unnecessary spaces between words and adds spaces after a sentence-ending character such as a period or question-mark.

Limitations

textView is not WYSIWYG: although it will closely match font sizes and line breaks and spacing on a printer, it is based on a "make the printer match the screen" model that has enough variability that clients requiring WYSIWYG will find unacceptable (e.g., an overlaying mark-up layer).

textViews do not support multiple views of a single data object. Thus each **textView** is the unique view for its **textData** object. This restriction is not checked by **clsTextView**.

Although TV_NEW_ONLY has a "dc" field, there are so many restrictions on its use in PenPoint 1.0 that the field should always be left at the default value of Nil(OBJECT). In addition, changing the units or scale used by the view-allocated "dc" is forbidden. This prevents "magnifying glass" and "pan in or out" effects from being used with a **textView**.

```
#ifndef TXTVIEW_INCLUDED
#define TXTVIEW_INCLUDED $Revision:   1.214  $
#ifndef                     TXTDATA_INCLUDED
#include <txtData.h>        // For TEXT_INDEX
#endif
```

Types and Constants

```
typedef OBJECT TEXT_VIEW;
```

Message Arguments

Text View Style

The prefix "TV" indicates that an identifier is related to "TextView."

The prefix "tvs" indicates that an identifier is related to "text view style."

```
typedef struct TV_STYLE {
    U16     flags;              // One of the values below
    S8      magnification;      // when tvsFormatForPrint is not on, this
                                // value (in points) is added to the
                                // character font sizes.
    U8      showSpecial;        // 0: show no special characters.
                                // 1: undefined -- do not use.
                                // 2: undefined -- do not use.
                                // 3: show all special characters.
                                // (6 spare bits)
    OBJECT  printer;            // Not implemented. Should be null.
} TV_STYLE, *P_TV_STYLE;
```

Use these flags in the flags field of TV_STYLE:

tvsEmbedOnlyComponents can only embed components. Cannot embed apps

tvsEmbedOnlyIPs can only embed subclasses of **clsIP**. Can embed no other objects.

tvsFormatForPrinter printer preview. style.magnification is ignored.

tvsQuietWarning don't display warning notes to user

tvsQuietError don't display error notes to user

tvsQuiet both **tvsQuietWarning** and **tvsQuietError**

tvsReadOnlyChars characters are read-only; user cannot add, remove or replace characters.

tvsReadOnlyAttrs attributes are read-only; user cannot change any attribute information.

tvsReadOnly both **tvsReadOnlyChars** and **tvsReadOnlyAttrs**

tvsWordWrap break display line by wrapping words that don't fit at the right edge of the view.

```
#define tvsEmbedOnlyComponents  flag0
#define tvsEmbedOnlyIPs         (tvsEmbedOnlyComponents|flag1)
#define tvsFormatForPrinter     flag2
#define tvsQuietWarning         flag3
#define tvsQuietError           flag4
#define tvsQuiet                (tvsQuietWarning|tvsQuietError)
#define tvsReadOnlyChars        flag5
#define tvsReadOnlyAttrs        flag6
#define tvsReadOnly             (tvsReadOnlyChars|tvsReadOnlyAttrs)
#define tvsWordWrap             flag7
#define tvsSpare1               flag8                           // Reserved
#define tvsSpare2               flag9                           // Reserved
#define tvsSpare3               (flag10|flag11|flag12|flag13)   // Reserved
#define tvsSpare4               flag14                          // Reserved
#define tvsSpare5               flag15                          // Reserved
```

Embedding

TV_EMBED_METRICS describes where and how to embed an object. The client either specifies the object to embed, or sets the embedded field to Nil and lets the text view create a new object based on the flags field. In the latter case, the UID of the newly created object is passed back in the embedded field.

```
typedef struct TV_EMBED_METRICS {
    TEXT_INDEX      pos;            // In: embedded object is inserted
                                    // just before this position.
    U16             flags;          // One of the values below
    OBJECT          embedded;       // In-Out: the UID of the embedded object
} TV_EMBED_METRICS, *P_TV_EMBED_METRICS;
```

Use these in the flags field of a TV_EMBED_METRICS.

```
#define tvEmbedAnnotate     flag0   // Not implemented
#define tvEmbedFloat        flag1   // Make the embeddee floating
#define tvEmbedReplace      flag2   // The IP's contents replace the
                                    // character following the IP.
```

Use this in the flags field of a TV_EMBED_METRICS.

```
#define tvEmbedAddMargin    flag5   // Leave small between previous line
                                    // and the IP.
```

Use these in the flags field of a TV_EMBED_METRICS when using the struct as the **pArgs** to **msgTextViewAddIP**.

```
#define tvEmbedAtEnd        flag8   // IP should be last char of data.
#define tvEmbedPara         flag9   // IP is a paragraph pad
#define tvEmbedOneChar      flag10  // IP is only 1-char
#define tvEmbedPreload      flag11  // preload the selection into the IP
#define tvEmbedDisplayType  (flag13|flag14|flag15)  // Obsolete.
```

Resolution

The prefix "tvr" indicates that an identifier is related to "text view resolve."

The values for the **xRegion** and **yRegion** fields of a TV_RESOLVE struct are illustrated here. The values are of the form (**xRegion**, **yRegion**).

```
            |              |
  (-1,1)    |     (0,1)    |  (1,1)
            |              |
         ---+--------------+---
            |              |
            |  Line's ink  |
  (-1,0)    |     (0,0)    |  (1,0)
            |              |
         ---+--------------+---
            |              |
  (-1,-1)   |     (0,-1)   |  (1,-1)
            |              |
```

The fields of this structure are described in more detail in the comments for **msgTextViewResolveXY**.

```
typedef struct TV_RESOLVE {
    XY32          xy;         // In:Out: Units are LWC
    U16           flags;      // One of the values below
    TEXT_INDEX    pos;        // Out: Pos of char containing xy, or
                              // maxTEXT_INDEX if no such char
    TEXT_INDEX    lineStart;  // Out: Pos of first char on line
                              // containing xy, or maxTEXT_INDEX
                              // if no line contains xy.
    S8            xRegion;    // Out: Region x was in. See diagram.
    S8            yRegion;    // Out: Region y was in. See diagram.
    TEXT_INDEX    selects;    // Out: Pos of char "selected" by xy
    XY32          offset;     // Out: Offset to prev/next char's ink
    P_UNKNOWN     spares[4];  // Reserved.
} TV_RESOLVE, *P_TV_RESOLVE;
```

Use these flags in the flags field of TV_RESOLVE. Note that they are not completely orthogonal; in particular, only one of [tvrSelFirst, **tvrSelLPO** and **tvrBalance**] should be enabled at once, similarly for [tvrPrevChar and **tvrNextChar**].

tvrSelFirst causes TV_RESOLVE.selects to be <= TV_RESOLVE.pos (i.e., the "selected" character is at or before the character "hit" by TV_RESOLVE.xy.)

tvrSelLPO causes TV_RESOLVE.selects to be >= TV_RESOLVE.pos (i.e., the "selected" character is after the character "hit" by TV_RESOLVE.xy, unless the line contains only one character in which case TV_RESOLVE.selects == TV_RESOLVE.pos,)

tvrBalance has the effect of **tvrSelFirst** or **tvrSelLPO**, depending on which edge of the character "hit" by TV_RESOLVE.xy is closest to TV_RESOLVE.xy.x.

tvrSelWord causes the "selection" behavior specified by any of the previous three flags to occur for the "word" containing the character "hit" by TV_RESOLVE.xy.x.

tvrPrevChar normally TV_RESOLVE.offset.x is 0 upon return. Enabling **tvrPrevChar** causes TV_RESOLVE.offset.x to contain the amount that TV_RESOLVE.xy.x exceeds the x coordinate of the lower-left corner of the character specified by TV_RESOLVE.pos (i.e., the distance past the previous character's right edge).

tvrNextChar normally TV_RESOLVE.offset.x is 0 upon return. Enabling **tvrNextChar** causes TV_RESOLVE.offset.x to contain the amount that TV_RESOLVE.xy.x falls short of the x coordinate of the lower-right corner of the character specified by TV_RESOLVE.pos (i.e., the distance before the next character's left edge).

tvrPastEOL normally a line contains only those character positions for the characters displayed on the line. **tvrPastEOL** permits TV_RESOLVE.selects to return with the TEXT_INDEX of the first character of the following line if the specified TV_RESOLVE.xy.x is to the right of the last character in the line.

tvrNLIfPastEOL when disabled, if TV_RESOLVE.xy.x is to the right of the last character in a line with a hard line break (e.g., **teNewLine** or **teNewParagraph**) and at least one other character, TV_RESOLVE.selects specifies the character immediately before the hard line break. When enabled, if **tvrPastEOL** is also enabled and would have caused TV_RESOLVE.selects to be after the hard line break, **tvrNLIfPastEOL** will override and cause TV_RESOLVE.selects to specify the break character instead.

```
#define tvrSelFirst     flag0
#define tvrSelLPO       flag1
#define tvrSelWord      flag5
#define tvrPrevChar     flag2
#define tvrNextChar     flag3
#define tvrBalance      flag4
#define tvrPastEOL      flag6
#define tvrNLIfPastEOL  flag7
```

Selection

The prefix "tvs" indicates that an identifier is related to "text view select."

The fields of this structure are described in more detail in the comments for **msgTextViewSetSelection.**

```
typedef struct TV_SELECT {
    TEXT_INDEX      first;      // lpoTEXT_INDEX means "clear selection"
    TEXT_INDEX      length;     // 0 results in an 0 length selection
    U16             flags;      // either 0 or wsSynchRepaint (see win.h)
    ATOM            level;      // Obsolete. Don't use.
} TV_SELECT, *P_TV_SELECT;
```

Scrolling

The prefix "ts" indicates that an identifier is related to "text view scroll."

```
typedef struct TV_SCROLL {
    TEXT_INDEX      pos;        // Position to scroll to
    U32             flags;      // One of the values below
} TV_SCROLL, *P_TV_SCROLL;
```

Use these in the flags field of a TV_SCROLL.

tsAlignAtTop scroll so that **pArgs**->pos is "near the top." See **tsAlignEdge.**

tsAlignAtBottom scroll so that **pArgs**->pos is "near the bottom." See **tsAlignEdge.**

tsAlignAtCenter scroll so that **pArgs**->pos is in the center displayed line

tsAlignEdge If set, and **tsAlignAtTop** or **tsAlignAtBottom** is set, this flag forces the line containing **pArgs**->pos to be the exact edge. If this flag is off, and **tsAlignAtTop tsAlignAtBottom** is set, the **textView** tries to leave an extra line or two between the line containing **pArgs**->pos and the view's edge.

tsIffInvisible If set, the **textView** scrolls only if **pArgs**->pos is not already visible. If not set, the **textView** scrolls even if **pArgs**->pos is visible.

textNoScrollNotify By default, the scrollbar(s) for the view are notified (via a **msgWinSend** of **msgScrollbarUpdate**) that they should update after a **msgTextViewScroll.** If this flag is set, the notification is not sent.

```
#define tsAlignAtTop        0L
#define tsAlignAtBottom     1L
#define tsAlignAtCenter     2L
#define tsAlignEdge         ((U32)flag2)
#define tsIffInvisible      ((U32)flag3)
#define textNoScrollNotify  ((U32)flag15)
```

Messages Defined by Other Classes

msgNewDefaults

Initializes the NEW structure.

Takes P_TV_NEW, returns STATUS. Category: class message.

Comments

Zeros out **pNew**->tv and sets:

```
    tv.style.flags          = tvsWordWrap;
    tv.flags                = tvFillWithIP;
```

```
win.flags.style         |= wsGrowBottom | wsSendFile |
                           wsSendGeometry | wsCaptureGeometry;
win.flags.style         &= ~(wsSendLayout | wsCaptureLayout);
win.flags.input         |= inputMoveDown | inputMoveDelta |
                           inputHoldTimeout | inputOutProx |
                           inputTip | inputEnter | inputExit;
view.createDataObject   = true;
gWin.helpId             = tagTextView;
```

msgNew

Creates a new instance of **clsTextView**.

Takes P_TV_NEW, returns STATUS. Category: class message.

Comments

If **pArgs**->view.**createDataObject** is true, then the **textView** creates a Text data object (**clsText**; see txtdata.h) and sets the view's data object If **pArgs**->tv.dc is NULL the **textView** creates a DC for its exclusive use.

msgGWinXList

Defined in gwin.h.

Takes P_XLIST, returns STATUS.

Comments

In response to this message, a **textView** typically performs some editing operation on its associated data object. A **textView** can process both "vanilla" xlists as described in xlist.h or text-specific xlists as txtxlist.h.

Here's how a **textView** responds to each xlist element:

xtBounds remembers the bounds of a gesture element

xtGesture processes the gesture

xtText inserts the text

xtObject embeds the object

xtCharAttrs modifies the character attributes of the specified characters

xtParaAttrs modifies the attributes of the specified paragraphs

xtTabs modifies the tabs of the specified paragraphs

xtCharPos sets the insertion point for text to the specified character position

Messages

msgTextViewAddIP

Adds an insertion pad to the **textView**.

Takes P_TV_EMBED_METRICS, returns STATUS.

```
#define msgTextViewAddIP        TVMakeMsg(0)
```

Message Arguments

```
typedef struct TV_EMBED_METRICS {
    TEXT_INDEX      pos;            // In: embedded object is inserted
                                    // just before this position.
    U16             flags;          // One of the values below
    OBJECT          embedded;       // In-Out: the UID of the embedded object
} TV_EMBED_METRICS, *P_TV_EMBED_METRICS;
```

Comments

The client must set all of the fields of **pArgs** as described in the discussion of TV_EMBED_METRICS.

msgTextViewCheck

A **textView** performs a self-consistency check.

Takes P_UNKNOWN, returns STATUS.

```
#define msgTextViewCheck          TVMakeMsg(5)
```

Comments

This message is only available in the debugging version of text.dll. The only currently defined value for **pArgs** is zero.

Return Value

stsOK no problems detected

< **stsOK** problems detected

msgTextViewEmbed

Embeds an object in the **textView**. Makes associated changes in text data.

Takes P_TV_EMBED_METRICS, returns STATUS.

```
#define msgTextViewEmbed          TVMakeMsg(1)
```

Message Arguments

```
typedef struct TV_EMBED_METRICS {
    TEXT_INDEX      pos;            // In: embedded object is inserted
                                    // just before this position.
    U16             flags;          // One of the values below
    OBJECT          embedded;       // In-Out: the UID of the embedded object
} TV_EMBED_METRICS, *P_TV_EMBED_METRICS;
```

Comments

The client must set all of the fields of **pArgs** as described in the discussion of TV_EMBED_METRICS.

msgTextViewGetEmbedMetrics

Passes back the **textView**-specific metrics for an embedded object.

Takes P_TV_EMBED_METRICS, returns STATUS.

```
#define msgTextViewGetEmbedMetrics        TVMakeMsg(2)
```

Message Arguments

```
typedef struct TV_EMBED_METRICS {
    TEXT_INDEX      pos;            // In: embedded object is inserted
                                    // just before this position.
    U16             flags;          // One of the values below
    OBJECT          embedded;       // In-Out: the UID of the embedded object
} TV_EMBED_METRICS, *P_TV_EMBED_METRICS;
```

Comments

The client need only fill in **pArgs**->embedded.

msgTextViewRepair

Forces a delayed paint operation to take place immediately.

Takes **pNull**, returns **stsOK**.

```
#define msgTextViewRepair         TVMakeMsg(3)
```

Comments

Use with caution, as overuse of this message significantly degrades performance.

msgTextViewResolveXY

Given an point in LWC space, passes back the character at (or near) the point.

Takes P_TV_RESOLVE, returns STATUS.

```
#define msgTextViewResolveXY      TVMakeMsg(4)
```

Message Arguments

```
typedef struct TV_RESOLVE {
    XY32            xy;             // In:Out: Units are LWC
    U16             flags;          // One of the values below
    TEXT_INDEX      pos;            // Out: Pos of char containing xy, or
                                    // maxTEXT_INDEX if no such char
    TEXT_INDEX      lineStart;      // Out: Pos of first char on line
                                    // containing xy, or maxTEXT_INDEX
                                    // if no line contains xy.
    S8              xRegion;        // Out: Region x was in. See diagram.
    S8              yRegion;        // Out: Region y was in. See diagram.
    TEXT_INDEX      selects;        // Out: Pos of char "selected" by xy
    XY32            offset;         // Out: Offset to prev/next char's ink
    P_UNKNOWN       spares[4];      // Reserved.
} TV_RESOLVE, *P_TV_RESOLVE;
```

Comments

pArgs->flags control exactly which character is "selected", and how much information is provided by the message.

Clients can also use this message to "reverse resolve" as follows. If both **pArgs**->xy.x and **pArgs**->xy.y are **maxS32**, then the **textView** sets **pArgs**->xy to the coordinates of the lower left corner of the character at **pArgs**->pos.

Warning: The response to this message always updates **pArgs**->xy to reflect information about the line either containing (or near) the original xy (or pos).

"LWC" is short for Local Window Coordinates. See win.h for more information.

Return Value

stsBadParam if no line's y extents include **pArgs**->xy.y

stsNoMatch if a containing line exists but it has no character under **pArgs**->xy.x; of if reverse resolve of a character not contained in any display line

msgTextViewScroll

Repositions displayed text within the **textView**.

Takes P_TV_SCROLL, returns **stsOK**.

```
#define msgTextViewScroll       TVMakeMsg(6)
```

Message Arguments

```
typedef struct TV_SCROLL {
    TEXT_INDEX      pos;            // Position to scroll to
    U32             flags;          // One of the values below
} TV_SCROLL, *P_TV_SCROLL;
```

Comments

The client must set the fields of **pArgs** as described in the discussion of TV_SCROLL.

msgTextViewGetStyle

Passes back a **textView**'s style.

Takes P_TV_STYLE, returns **stsOK**.

```
#define msgTextViewGetStyle     TVMakeMsg(8)
```

Message Arguments

```
typedef struct TV_STYLE {
    U16     flags;                  // One of the values below
    S8      magnification;          // when tvsFormatForPrint is not on, this
                                    // value (in points) is added to the
                                    // character font sizes.
    U8      showSpecial;            // 0: show no special characters.
                                    // 1: undefined -- do not use.
                                    // 2: undefined -- do not use.
                                    // 3: show all special characters.
                                    // (6 spare bits)
    OBJECT  printer;                // Not implemented. Should be null.
} TV_STYLE, *P_TV_STYLE;
```

msgTextViewSetSelection

Selects one or more characters displayed by the **textView**.

Takes P_TV_SELECT, returns **stsOK**.

```
#define msgTextViewSetSelection TVMakeMsg(9)
```

Message Arguments

```
typedef struct TV_SELECT {
    TEXT_INDEX      first;      // lpoTEXT_INDEX means "clear selection"
    TEXT_INDEX      length;     // 0 results in an 0 length selection
    U16             flags;      // either 0 or wsSynchRepaint (see win.h)
    ATOM            level;      // Obsolete. Don't use.
} TV_SELECT, *P_TV_SELECT;
```

Comments

The fields of **pArgs** are used as follows:

first The first character to select. The value **lpoTEXT_INDEX** means that cause the selection to be cleared.

length Number of characters to select. The value 0 results in a zero-length I-Bean selection.

flags if this field is **wsSynchRepaint** (defined in win.h) the **textView** repaint immediately. Otherwise this field must be zero.

While handling this message, the **textView** becomes the selection owner unless **pArgs**->first is **lpoTEXT_INDEX**, in which case the text view ensures that it is NOT the selection owner.

msgTextViewSetStyle

Sets a **textView**'s style.

Takes P_TV_STYLE, returns **stsOK**.

```
#define msgTextViewSetStyle     TVMakeMsg(10)
```

Message Arguments

```
typedef struct TV_STYLE {
    U16     flags;              // One of the values below
    S8      magnification;      // when tvsFormatForPrint is not on, this
                                // value (in points) is added to the
                                // character font sizes.
    U8      showSpecial;        // 0: show no special characters.
                                // 1: undefined -- do not use.
                                // 2: undefined -- do not use.
                                // 3: show all special characters.
                                // (6 spare bits)
    OBJECT  printer;            // Not implemented. Should be null.
} TV_STYLE, *P_TV_STYLE;
```

Comments

pArgs->printer should be set to Nil(OBJECT).

Definitions for msgNew

```
#ifndef NO_NEW
#ifndef txtViewNewFields
#ifndef                     VIEW_INCLUDED
#include <view.h>
#endif
```

See comment with **msgNew** and **msgNewDefaults** for more information.

```
typedef struct TV_NEW_ONLY {
    U16             flags;          // One of the values below
    OBJECT          dc;
    TV_STYLE        style;
} TV_NEW_ONLY, *P_TV_NEW_ONLY;
```

Use this in the flags field of a TV_NEW_ONLY.

```
#define tvFillWithIP    flag0
#define txtViewNewFields    \
    viewNewFields           \
    TV_NEW_ONLY             tv;
typedef struct TV_NEW {
    txtViewNewFields
} TV_NEW, *P_TV_NEW;
```

Utility Functions

TextCreateTextScrollWin

Utility function that creates a **textView** (with a data object) placed inside a scroll window. (See swin.h.)

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
TextCreateTextScrollWin(
    P_TV_NEW    pNew,
    P_OBJECT    scrollWin);     // Out:
#endif // txtViewNewFields
#endif // NO_NEW
```

Comments

Clients often need a "vanilla" **textView** inside a vanilla **scrollWin.** This function does just that. Clients can modify the created objects after the creation if this function doesn't do quite the right thing. Client who need more control over the creation should probably create the objects manually.

The **pNew** parameter should be null or should point at an already initialized NEW struct. If it is null, then the function creates a default instance of **clsTextView.**

Because the view is created with **formatForPrinter** FALSE, the **scrollWin**'s **expandChildWidth** is set to true. This causes the **scrollWin** to manage the width of the **textView.**

Here's a simplified indication of how the **scrollWin** is created:

```
    ObjectCall(msgNewDefaults, clsScrollWin, &sn)
    sn.scrollWin.clientWin                = <the text view>
    sn.scrollWin.style.vertScrollbar      = true;
    sn.scrollWin.style.autoVertScrollbar  = false;
    sn.scrollWin.style.expandChildWidth   = true;
    sn.scrollWin.style.expandChildHeight  = true;
    sn.scrollWin.style.contractChildWidth  = true;
    sn.scrollWin.style.contractChildHeight = true;
    sn.scrollWin.style.vertClient         = swClientWin;
    sn.scrollWin.style.horizClient        = swClientScrollWin;
    sn.win.flags.input                    |= inputHoldTimeout;
    sn.scrollWin.style.forward            = swForwardGesture;
    if (<creating on screen>) {
        sn.border.style.leftMargin = bsMarginMedium;
        sn.border.style.rightMargin = bsMarginMedium;
        sn.border.style.topMargin = bsMarginMedium;
    } else {
        sn.border.style.leftMargin = bsMarginNone;
        sn.border.style.rightMargin = bsMarginNone;
        sn.border.style.topMargin = bsMarginNone;
    }
    ObjectCall(msgNew, clsScrollWin, &sn);
    *scrollWin = sn.object.uid;
```

Warning: When printing, the **scrollWin** and **textView** are probably restored, not created anew. Therefore the client needs to go in and set the **scrollWin**'s margins to 0.

TextIP

```
typedef struct TEXTIP_METRICS {
    U16     flags;                  // Reserved.
} TEXTIP_METRICS, *P_TEXTIP_METRICS,
  TEXTIP_NEW_ONLY, *P_TEXTIP_NEW_ONLY;
```

msgNewDefaults

Initializes the NEW struct.

Takes P_TEXTIP_NEW, returns STATUS. Category: class message.

Comments

In response to this message, **clsTextIP** does the following:

```
    pArgs->win.flags.style          |= wsSendGeometry | wsSendFile |
                                       wsShrinkWrapHeight;
    pArgs->ip.rows                  = 5;
    pArgs->ip.lines                 = 5;
```

If the user input pad style preference is Boxed:

```
    pArgs->ip.style.displayType     = ipsCharBox;
    pArgs->ip.style.delayed         = 1;
```

If the user input pad style preference is Ruled:

```
    pArgs->ip.style.displayType     = ipsRuledLines;
```

If the user input pad style preference is RuledAndBoxed:

```
    pArgs->ip.style.displayType     = ipsRuledLines;
    pArgs->ip.style.ruledToBoxed    = true;
```

msgNew

Creates a new instance of **clsTextIP**.

Takes P_TEXTIP_NEW, returns STATUS. Category: class message.

msgTextIPGetMetrics

Passes back a **textIP**'s metrics.

Takes P_TEXTIP_METRICS, returns **stsOK**.

```
#define msgTextIPGetMetrics         MakeMsg(clsTextIP, 1)
```

Message Arguments

```
typedef struct TEXTIP_METRICS {
    U16     flags;                  // Reserved.
} TEXTIP_METRICS, *P_TEXTIP_METRICS,
```

msgTextIPSetMetrics

Sets a **textIP**'s metrics.

Takes P_TEXTIP_METRICS, returns **stsOK**.

```
#define msgTextIPSetMetrics        MakeMsg(clsTextIP, 2)
#ifndef NO_NEW
#ifndef textIPNewFields
#ifndef                    INSERT_INCLUDED
#include <insert.h>
#endif
#define textIPNewFields        \
    ipNewFields                \
    TEXTIP_NEW_ONLY            textIP;
```

Arguments

```
typedef struct TEXTIP_NEW {
    textIPNewFields
} TEXTIP_NEW, *P_TEXTIP_NEW;
#endif // textIPNewFields
#endif // NO_NEW
```

Message Arguments

```
typedef struct TEXTIP_METRICS {
    U16     flags;                 // Reserved.
} TEXTIP_METRICS, *P_TEXTIP_METRICS,
```

TXTXLIST.H

This file contains the Text subsystem additions to xlist (see xlist.h).

A Text View (see **txtView.h**) gathers input directly from the user via

keyboard input   delivered by **msgInputEvent**, with Cls(**pArgs**->devCode) == Cls(**clsKey**);

low-level pen input   also **msgInputEvent**, but Cls(**clsPen**);

gestures   delivered by **msgGWinXlist**; and

insertion pads   which provide data starting with **msgIPDataAvailable.**

The user input delivered to a Text View from an insertion pad is communicated via an xlist. As a result of its processing of the xlist, the Text View modifies its associated data object. Each xlist moves through the following stages: (1) it comes into being as a way for the hwx system to provide low-level information about the user input to **clsIP** (see insert.h); (2) **clsIP** packages the low-level information into medium-level information which is self-sent; (3) finally, **clsTextIP** re-interprets this information and packages it into high-level information which requires concepts specific to the Text subsystem. Thus, an xlist from a TextIP (see **txtView.h**) can contain one or more elements of the following specialized types. For each type, the constraint on the structure of the information pointed to by the **pData** field of the XLIST_ELEMENT is listed.

xtCharAttrs   pData points to an XLIST_CHAR_ATTRS;

xtParaAttrs   pData points to an XLIST_PARA_ATTRS;

xtTabs   pData points to an XLIST_TABS;

xtCharPos   pData is a TEXT_INDEX (cast to a P_UNKNOWN).

The types themselves are defined as part of XTYPE in xlist.h; the data structures and their semantics are defined below.

In general, an xlist is position-independent. However, the caller of **msgGWinXlist** often wants the associated xlist to modify a Text View's data object beginning at a particular character index; an element of type **xtCharPos** allows the caller to specify such an index.

To make it easier to maintain the position-independent property of an xlist, Text Views recognize **maxTEXT_INDEX** (see **txtData.h**) as having a special meaning when used as the value of the first field of the **pData** in an xlist element of type **xtCharAttrs**, **xtParaAttrs** and **xtTabs** (i.e., **pData**->first == **maxTEXT_INDEX**). If the **pData**->length is 0, a **pData**->first of **maxTEXT_INDEX** causes the xlist processing code to remember the current index in the Text data object and to take no other action; if the **pData**->length is non-zero, the **pData**->first of **maxTEXT_INDEX** causes the xlist processing code to update **pData**->first with the previously remembered index. This allows the caller of **msgGWinXlist** to generate an xlist with the following structure:

xtCharPos   to start processing at a particular index;

xtText   one or more times, to add characters;

xtCharAttrs   with first of **maxTEXT_INDEX**, length of 0;

xtText   one or more times, to add more characters;

xtCharAttrs with first of **maxTEXT_INDEX**, length not 0, thereby setting the character attributes for exactly the bracketed characters.

```
#ifndef TXTXLIST_INCLUDED
#define TXTXLIST_INCLUDED
#ifndef XLIST_INCLUDED
#include <xlist.h>
#endif
#ifndef TXTDATA_INCLUDED
#include <txtData.h>
#endif
```

Upon encountering an xlist element of type **xtCharAttrs**, a Text View does a **msgTextChangeAttrs** to its data object, making use of the fields of the P_XLIST_CHAR_ATTRS by mapping them to the corresponding fields of TEXT_CHANGE_ATTRS as follows:

tag forced to **atomChar**

first copied from first

length copied from length

pNewMask set to &mask

pNewValues set to &attrs

```
typedef struct {
    TEXT_INDEX      first;
    TEXT_INDEX      length;
    TA_CHAR_MASK    mask;
    TA_CHAR_ATTRS   attrs;
} XLIST_CHAR_ATTRS, *P_XLIST_CHAR_ATTRS;
```

Upon encountering an xlist element of type **xtParaAttrs**, a Text View does a **msgTextChangeAttrs** to its data object, making use of the fields of the P_XLIST_PARA_ATTRS by mapping them to the corresponding fields of TEXT_CHANGE_ATTRS as follows:

tag forced to **atomPara**

first copied from first

length copied from length

pNewMask set to &mask

pNewValues set to &attrs

```
typedef struct {
    TEXT_INDEX      first;
    TEXT_INDEX      length;
    TA_PARA_MASK    mask;
    TA_PARA_ATTRS   attrs;
} XLIST_PARA_ATTRS, *P_XLIST_PARA_ATTRS;
```

Upon encountering an xlist element of type **xtTabs**, a Text View does a **msgTextChangeAttrs** to its data object, making use of the fields of the P_XLIST_TABS by mapping them to the corresponding fields of TEXT_CHANGE_ATTRS as follows:

tag forced to **atomParaTabs**

first copied from first

length copied from length

pNewMask set to Nil()

pNewValues set to &tabs

```
typedef struct {
    TEXT_INDEX      first;
    TEXT_INDEX      length;
    TA_MANY_TABS    tabs;
} XLIST_TABS, *P_XLIST_TABS;
```

Part 7 / File System

FILETYPE.H

This file defines common file types used for import and export between PenPoint and other operating systems.

```
#ifndef FILETYPE_INCLUDED
#define FILETYPE_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef UID_INCLUDED
#include <uid.h>
#endif
```

The following file types are common enough to merit a central registry. Contact GO Developer Technical Support if you want to add a file type to the registry.

The file types are defined as tags; they are primarily intended to be stored as the value of the **fsAttrFileType** file attribute. If a file is explicitly typed via this mechanism, applications can more easily decide if they can import it.

```
#define fileTypeUndefined                   ((TAG)0L)
```

fileTypeASCII implies 8-bit bytes encoding the 7-bit ASCII set defined by ANSI X3.64. Any byte with value greater than 0x7F will be interpreted in a manner dependent on the subsystem involved; e.g. **clsText** (and thus the MiniText application) will assume the bytes encode IBM-PC Code Page 850.

```
#define fileTypeASCII                       MakeTag(clsFileHandle, 0)
```

fileTypeASCIISoftLineBreaks is similar to **fileTypeASCII**. The difference is that in a line that has no explicit new line or carriage return, a space is transformed into a line feed near the 72nd character.

```
#define fileTypeASCIISoftLineBreaks         MakeTag(clsFileHandle, 1)
```

fileTypeRTF implies Microsoft Corporation's Rich Text Format (RTF).

```
#define fileTypeRTF                         MakeTag(clsFileHandle, 2)
```

fileTypeTIFF implies Aldus Corporation and Microsoft Corporation's Tag Image File Format (TIFF).

```
#define fileTypeTIFF                        MakeTag(clsFileHandle, 3)
```

fileTypePicSeg implies Go Corporation's Picture Segment format.

```
#define fileTypePicSeg                      MakeTag(clsFileHandle, 4)
```

FS.H

This file contains the API for **clsDirHandle** and **clsFileHandle**. The functions described in this file are contained in PENPOINT.LIB.

clsFileSystem inherits from **clsObject.**

Provides file system support. **theFileSystem** is the only instance of **clsFileSystem.**

clsDirHandle inherits from **clsObject.**

Provides file system directory support. **theBootVolume** is a well known instance of **clsDirHandle. theSelectedVolume** is a well known instance of **clsDirHandle. theWorkingDir** is a well known instance of **clsDirHandle.**

clsFileHandle inherits from **clsStream.**

Provides file system file access support.

```
#ifndef FS_INCLUDED
#define FS_INCLUDED
```

Debugging Flags

FileSystem Debugging Flag is '$', values are:

0001	Debug info when fs cache layer calls volume layer
0200	Breaks into debugger before asking to insert disk
20000	Display list of known volumes when prompting for unmounted disk

Include file dependencies for this include file

```
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef UID_INCLUDED
#include <uid.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef UUID_INCLUDED
#include <uuid.h>
#endif
#ifndef STREAM_INCLUDED
#include <stream.h>
#endif
```

Common abbreviations, terms:

FS	File System
Node	A file or a directory
Dir	A directory

Rules concerning the destination of file system messages:

All messages defined in this file are directed to their destination via ObjectCall, the file system does not accept messages that are sent. All messages (with the exception of **msgFSGetInstalledVolumes**) of **clsFileSystem** can be "sent" to either a file or a dir object. Messages of **clsDirHandle** can only be "sent" to directory objects. Messages of **clsFileHandle** can only be "sent" to file objects.

Common #defines and typedefs

Defines

```
#define fsMaxPathLength        254          // Max path length
                                            // (Excluding null terminator)
#define fsPathBufLength (fsMaxPathLength+1) // Buffer size for max path
#define fsSeparator            '\\'         // Pathname separator
#define fsEscapeChar           '|'          // Escape char (invalid in paths)
#define fsUniqueSeparator      ' '          // Char for unique name postfix
#define fsMaxHandles           255          // Max handles on a single node
#define fsMaxUnique            255          // Max tries to make name unique
#define fsMaxReadWrite         0x40000000   // Max size for single read/write
#define fsMaxNestingLevel      20           // Max nesting for recursive ops
```

FS Attribute Intrinsics

These are used to build file/directory attribute labels or to get component pieces from an attribute label.

A client can define their own attribute using one of the FSMakeXXXAttr intrinsics, specifying a class and a tag. The attribute type will allow for storage of a 32 bit value (Fix32), a 64 bit value (Fix64), a null terminated string of any length up to 32K (Str), or a variable length value up to 32K (Var). The messages **msgFSGetAttr**, **msgFSSetAttr**, **msgFSReadDir**, **msgFSReadDirFull** and **msgFSTraverse** use file system attributes to represent the attribute label.

```
#define fsFixAttr              0
#define fsFix64Attr            1
#define fsVarAttr              2
#define fsStrAttr              3
#define fsMaxAttrLength        255
#define FSMakeAttr(cls,t,f)    \
            MakeTagWithFlags(cls,t,f)
#define FSMakeFix32Attr(cls,t)  FSMakeAttr(cls,t,fsFixAttr)
#define FSMakeFix64Attr(cls,t)  FSMakeAttr(cls,t,fsFix64Attr)
#define FSMakeVarAttr(cls,t)    FSMakeAttr(cls,t,fsVarAttr)
#define FSMakeStrAttr(cls,t)    FSMakeAttr(cls,t,fsStrAttr)
#define FSAttr(attr)            TagNum(attr)
#define FSAttrCls(attr)         ClsNum(attr)
#define FSAttrIsFix32(attr)     (TagFlags(attr) == fsFixAttr)
#define FSAttrIsFix64(attr)     (TagFlags(attr) == fsFix64Attr)
#define FSAttrIsVar(attr)       (TagFlags(attr) == fsVarAttr)
#define FSAttrIsStr(attr)       (TagFlags(attr) == fsStrAttr)
```

File System Attributes

These are the predefined attributes managed by the file system.

```
#define fsNullAttrLabel         FSMakeFix32Attr(objNull,0)
#define fsAttrName              FSMakeStrAttr(clsFileSystem,0)
#define fsAttrFlags             FSMakeFix32Attr(clsFileSystem,0)
#define fsAttrDateCreated       FSMakeFix32Attr(clsFileSystem,2)
#define fsAttrDateModified      FSMakeFix32Attr(clsFileSystem,3)
#define fsAttrFileSize          FSMakeFix32Attr(clsFileSystem,4)
```

```
#define fsAttrDirIndex          FSMakeFix64Attr(clsDirHandle, 0)
#define fsAttrOldDirIndex       FSMakeFix64Attr(clsDirHandle, 1)
#define fsAttrFileType          FSMakeFix32Attr(clsFileHandle, 0)
```

See **msgFSGetAttr** for an explanation when to use these constants.

```
#define fsAllocAttrLabelsBuffer ((P_FS_ATTR_LABEL)maxU32)
#define fsAllocAttrValuesBuffer ((P_UNKNOWN)maxU32)
#define fsAllocAttrSizesBuffer  ((P_FS_ATTR_SIZE)maxU32)
```

Status Codes

Common return values:

There are a few status return values that are common to either all messages or to a group of messages (i.e. messages that try to change the volume).

stsFSHandleInvalid The dir/file object refers to a node that has been previously deleted.

stsFSVolDisconnected The volume is not connected.

stsFSVolFull The message cannot complete, due to insufficient space on the volume.

stsFSVolReadOnly The message cannot complete, because the volume is write protected.

Error Status Codes

```
#define  stsFSVolDisconnected   MakeStatus(clsFileSystem,0)
#define  stsFSVolReadOnly       MakeStatus(clsFileSystem,1)
#define  stsFSVolFull           MakeStatus(clsFileSystem,2)
#define  stsFSNodeNotFound      MakeStatus(clsFileSystem,3)
#define  stsFSNodeReadOnly      MakeStatus(clsFileSystem,4)
#define  stsFSAccessDenied      MakeStatus(clsFileSystem,5)
#define  stsFSCircularMoveCopy  MakeStatus(clsFileSystem,6)
#define  stsFSVolBusy           MakeStatus(clsFileSystem,7)
#define  stsFSNodeBusy          MakeStatus(clsFileSystem,8)
#define  stsFSBadPath           MakeStatus(clsFileSystem,9)
#define  stsFSUniqueFailed      MakeStatus(clsFileSystem,10)
#define  stsFSDirFull           MakeStatus(clsFileSystem,11)
#define  stsFSNodeExists        MakeStatus(clsFileSystem,12)
#define  stsFSNotDir            MakeStatus(clsFileSystem,13)
#define  stsFSNotFile           MakeStatus(clsFileSystem,14)
#define  stsFSReadOnlyAttr      MakeStatus(clsFileSystem,15)
#define  stsFSBufTooSmall       MakeStatus(clsFileSystem,16)
#define  stsFSNestingTooDeep    MakeStatus(clsFileSystem,17)
#define  stsFSNoParent          MakeStatus(clsFileSystem,18)
#define  stsFSUnchangeable      MakeStatus(clsFileSystem,19)
#define  stsFSNotAncestor       MakeStatus(clsFileSystem,20)
#define  stsFSDirPositionLost   MakeStatus(clsFileSystem,21)
#define  stsFSHandleInvalid     MakeStatus(clsFileSystem,22)
#define  stsFSDifferent         MakeStatus(clsFileSystem,23)
#define  stsFSTooManyHandles    MakeStatus(clsFileSystem,24)
#define  stsFSDirIndexExists    MakeStatus(clsFileSystem,25)
#define  stsFSDirIndexNotFound  MakeStatus(clsFileSystem,26)
#define  stsFSVolCorrupt        MakeStatus(clsFileSystem,27)
```

Informational Status Codes

```
#define  stsFSAttrBufTooSmall   MakeWarning(clsFileSystem,1)
```

Types

Locators are structures used to describe the location of a file or dir node. There are two types of locators: explicit and implicit. An explicit locator is defined with FS_LOCATOR which specifies both the starting node (uid) and the path relative to the starting node (**pPath**). An implicit locator is made up of a starting node (the object that receives a message) and the path relative to the starting node (**pPath**). **msgFSMove** is a good example of a message that contains both types of locators. The receiver of **msgFSMove** and move.**pSourcePath** defines the implicit location of the source of the move. move.**destLocator** defines the explicit location of the dest of the move.

The uid field of a locator must be filled in and must be non-null. If no other choice can be decided upon, **theWorkingDir** may be a good one. The uid field does not always have to be a dir handle object. The uid can be a file handle object if the **pPath** field points to a path that begins with .. (parent), \ (root) or \\ (fully specified path including volume name).

The path field of locators (explicit and implicit) are relative to the node defined by the uid (or object receiving the message) unless the path begins with a \ (root relative) or \\ (fully specified path).

```
typedef struct  FS_LOCATOR {
    OBJECT              uid;
    P_STRING            pPath;      // Relative to node defined by uid
} FS_LOCATOR, * P_FS_LOCATOR;
```

The file system interface never uses flat locators, but if it is more convenient to hold the entirety of the locator in a linear structure using flat locators.

```
typedef struct  FS_FLAT_LOCATOR {
    OBJECT          uid;
    U8              path[fsPathBufLength];
} FS_FLAT_LOCATOR, * P_FS_FLAT_LOCATOR;
Enum16(FS_NODE_FLAGS) {
    fsNodeReadOnly          = flag0,    // Node is read-only.
    fsNodeHidden            = flag1,    // System hidden file.
    fsNodeDir               = flag4,    // Directory or file?
    fsNodeGoFormat          = flag8,    // Node has non-native attrs
    fsNodePenPointHidden    = flag9     // Should this node be hidden from
                                        // the user in Penpoint browsers?
};
#define validFSNodeFlags \
    (fsNodeReadOnly | fsNodeHidden | fsNodeDir | \
     fsNodeGoFormat | fsNodePenPointHidden)
#define readOnlyFSFlags (fsNodeDir | fsNodeGoFormat)
```

FS_NODE_FLAGS_ATTR is used to set or get the flags attribute stored with a file/dir node. When setting the flags, only those flags with a one in the mask word will be affected. When getting flags, all flags are returned and mask is set to all ones (as a convenience for set after get).

```
typedef struct FS_NODE_FLAGS_ATTR {
    FS_NODE_FLAGS       flags;
    U16                 mask;
} FS_NODE_FLAGS_ATTR, * P_FS_NODE_FLAGS_ATTR;
typedef U32     FS_DATE_TIME, * P_FS_DATE_TIME;
typedef U32     FS_FILE_SIZE, * P_FS_FILE_SIZE;
typedef U16     FS_ATTR_SIZE,   * P_FS_ATTR_SIZE;
typedef U32     FS_ATTR_LABEL,  * P_FS_ATTR_LABEL;
Enum16(FS_VOL_TYPE) {
    fsAnyVolType        = 0,            // Match any vol type for msgNew
    fsVolTypeMemory     = 0,
    fsVolTypeDisk       = 1,
    fsVolTypeRemote     = 2
};
```

```
Enum16(FS_VOL_FLAGS) {
    fsVolReadOnly       = flag0,
    fsVolConnected      = flag1,
    fsVolRemovableMedia = flag2,
    fsVolEjectableMedia = flag3,
    fsVolDirsIndexable  = flag4,
    fsVolFormattable    = flag5,
    fsVolDuplicatable   = flag6
};
```

This information is returned by **msgFSGetVolMetrics.**

```
typedef struct FS_VOL_HEADER {
    FS_VOL_TYPE         type;
    FS_VOL_FLAGS        flags;
    OBJECT              rootDir;
    OBJECT              volObj;
    U32                 serialNum;
    U32                 created;
    U16                 optimalSize;
    U32                 totalBytes;
    U32                 freeBytes;
    U32                 commSpeed;
    U8                  pName [nameBufLength];
    U8                  alignSpare;     // Word align following values
    CLASS               browserClass;   // Class of browser to use for volume
                                        // If null, use system default
    U32                 nativeFS;
    RES_ID              iconResId;
    U32                 spare1;
    U32                 spare2;
    U32                 spare3;
    U32                 spare4;
} FS_VOL_HEADER, * P_FS_VOL_HEADER;
typedef FS_VOL_HEADER   FS_VOL_METRICS, * P_FS_VOL_METRICS;
Enum16(FS_EXIST) {
 // Lower byte: what to do if the node exists
    fsExistOpen         = 0,
    fsExistGenError     = 1,
    fsExistGenUnique    = 2,
    fsExistTruncate     = 3,
 // Upper byte: what to do if the node doesn't exist
    fsNoExistCreate       = MakeU16(0, 0),
    fsNoExistGenError     = MakeU16(0, 1),
    fsNoExistCreateUnique = MakeU16(0, 2),
 // Default setting
    fsExistDefault      = fsExistOpen | fsNoExistCreate
};
Enum16(FS_MOVE_COPY_EXIST) {
 // What to do if the destination node exists
    fsMoveCopyExistOverwrite    = 0,
    fsMoveCopyExistGenError     = 1,
    fsMoveCopyExistGenUnique    = 2,
    fsMoveCopyExistDelete       = 3,
 // Default setting
    fsMoveCopyExistDefault      = fsMoveCopyExistGenError
};
```

```
Enum16(FS_DIR_NEW_MODE) {
 // Delete directory at handle free time?
    fsTempDir           = flag0,
 // Is handle changeable?
    fsUnchangeable      = flag1,
 // Find node via its dir index?
    fsUseDirIndex       = flag2,
 // Disable prompts (insert disk, write protected, etc)
 // fsDisablePrompts    = flag4, (Defined in FS_FILE_NEW_MODE below)
 // System owned dir handle - ring 0 only
    fsSystemDir         = flag7,
 // Default setting
    fsDirNewDefaultMode = 0 // permanent, changeable directory
};
Enum16(FS_FILE_NEW_MODE) {
 // Lower byte: flags
 // Delete file at handle free time?
    fsTempFile          = flag0,
 // Read/write intentions for this handle
    fsReadOnly          = flag2,
 // Memory mapped files accessibility
    fsSharedMemoryMap   = flag3,
 // Disable prompts (insert disk, write protected, etc)
    fsDisablePrompts    = flag4,
 // System owned file handle - ring 0 only
    fsSystemFile        = flag7,
 // Upper byte: exclusivity requirements for other handles
    fsNoExclusivity     = MakeU16(0, 0),
    fsDenyWriters       = MakeU16(0, 1),
    fsExclusiveOnly     = MakeU16(0, 2),
 // Default setting
    fsFileNewDefaultMode= 0 // perm, read/write (noExclusivity)
};
Enum16(FS_GET_PATH_MODE) {
 // Get path relative to root, dir passed in, just name or vol and path
    fsGetPathRoot       = 0,
    fsGetPathRelative   = 1,
    fsGetPathName       = 2,
    fsGetPathAbsolute   = 3,
 // Default setting
    fsGetPathDefaultMode= fsGetPathRoot
};
Enum16(FS_MOVE_COPY_MODE) {
 // Use destination as container.
    fsMoveCopyIntoDest          = flag0,
 // Check but don't move or copy.
    fsMoveCopyVerifyOnly        = flag1,
 // Does source have live dir indexes.
    fsMoveCopySourceArchived    = flag2,
 // Does dest have live dir indexes.
    fsMoveCopyArchiveDest       = flag3,
 // Default setting
    fsMoveCopyDefaultMode    = 0
};
Enum16(FS_TRAVERSE_MODE) {
 // Call back on files?
    fsCallBackOnFiles   = flag0,
 // Call back before stepping into directory?
    fsCallBackPreDir    = flag1,
 // Call back after stepping into directory?
    fsCallBackPostDir   = flag2,
 // Default setting
    fsTraverseDefaultMode= fsCallBackOnFiles | fsCallBackPreDir
};
```

```
Enum16(FS_SEEK_MODE) {
 // Relative to beginning of file, end of file, or Current Byte Position
    fsSeekBeginning     = 0,
    fsSeekEnd           = 1,
    fsSeekCurrent       = 2,
 // Default setting
    fsSeekDefaultMode   = fsSeekBeginning
};
typedef OBJECT          DIR_HANDLE, * P_DIR_HANDLE;
typedef OBJECT          FILE_HANDLE, * P_FILE_HANDLE;
```

Class FileSystem Messages

msgFSGetInstalledVolumes

Returns list of all installed volumes.

Takes P_LIST, returns STATUS.

```
#define msgFSGetInstalledVolumes        MakeMsg(clsFileSystem, 21)
```

Comments

This message can only be directed to the well known class **theFileSystem**. Each object in the list is a directory handle object that references the root node of the volume. The list is passed back and is not used as an input parameter. The caller must free the returned list when finished using it, but do not free any of the objects in the list.

See Also

msgFSEjectMedia to eject media from a floppy drive.

msgFSGetVolMetrics to get more info about the volume

msgFSSame to compare root dir to a well-known dir handle

Class File System Messages understood by dirHandles and fileHandles

msgNew

Creates a directory or file handle object on a new or existing dir/file.

Takes P_FS_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct FS_NEW_ONLY {
    FS_LOCATOR          locator;        // location of the target directory
    FS_VOL_TYPE         volType;        // hint for uninstalled fullpath vols
    UUID                dirIndex;       // used with fsUseDirIndex mode only
    U16                 mode;           // options for opening file/dir handle
    FS_EXIST            exist;          // action to take if exists or doesn't
    P_UNKNOWN           pVolSpecific;   // volume specific information
                                        // Note: this is an in only parm
    U32                 spare1;         // for future use
    U32                 spare2;         // for future use
    BOOLEAN             alreadyExisted; // Out: indicates if already exists
} FS_NEW_ONLY, * P_FS_NEW_ONLY;
#define fsNewFields     \
    objectNewFields     \
    FS_NEW_ONLY         fs;
typedef struct FS_NEW {
    fsNewFields
} FS_NEW, * P_FS_NEW;
```

Comments

The fields you commonly set are:

pNew->fs.locator Location of the node

pNew->fs.mode Options for opening file/dir handle

pNew->fs.exist Action to take if the file/dir exists or doesn't exist

Accessing a directory using a **dirIndex**: Three pieces of information must be provided to open a directory by **dirIndex**. The **fsUseDirIndex** flag must be set in new.fs.mode, a valid **dirIndex** must be supplied in new.fs.**dirIndex** and the volume that the directory resides on must be identified. This can be done by specifying some location on the.volume by filling in new.fs.locator. Either the uid can point to the root or any other handle on the volume or the path can be an absolute path that identifies the volume. See **msgFSSetAttr** on how to store a dir index with a directory so it can later be accessed by its dir index.

Use FS_DIR_NEW_MODE for mode if new is for dir handle. Use FS_FILE_NEW_MODE for mode if new is for file handle.

Return Value

stsBadParam locator.uid is not a valid object.

stsFSAccessDenied Access cannot be granted because node is locked for exclusive access, read only access or write only access.

stsFSBadPath locator.pPath is malformed or a specified dir node is in fact a file.

stsFSDirFull There is no space in the dir for a new node.

stsFSDirIndexNotFound There is not a **dirIndex** for the dir node.

stsFSNodeBusy Node cannot be deleted/truncated because it is being access by another client.

stsFSNodeExists The requested node already exists.

stsFSNodeNotFound The root node does not exist.

stsFSNodeReadOnly Node cannot be deleted/truncated or read/write access has been denied because the read only flag is set on the node.

stsFSNotDir A requested dir node already exists as a file.

stsFSNotFile A requested file node already exists as a dir.

stsFSTooManyHandles There are already **fsMaxHandles** on this node.

stsFSUniqueFailed fsMaxUnique variants of the name already exist.

See Also

FSNameValid

msgNewDefaults

Initializes the FS_NEW structure to default values.

Takes P_FS_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct FS_NEW {
    fsNewFields
} FS_NEW, * P_FS_NEW;
```

Comments

Zeroes out **pNew->fs** and sets:

```
    pNew->fs.locator.uid = theWorkingDir;
    pNew->object.cap |= objCapCall;
```

msgDestroy

Destroys a directory or file handle.

Takes OBJ_KEY, returns STATUS.

Comments
This destroys the handle, NOT the actual node. An exception to this is if the **fsTempFile/fsTempDir** flag was set in **pNew**->fs.mode when the handle was created.

Return Value
stsFSNodeBusy Temporary node cannot be deleted because it is being access by another client.

stsFSNodeReadOnly Temporary node cannot be deleted because the read only flag is set on the node.

msgFSNull

Does nothing.

Takes void, returns STATUS.

```
#define msgFSNull                    MakeMsg(clsFileSystem, 20)
```

This message is used to time entering and exiting the file system.

msgFSGetVolMetrics

Returns metrics of the volume.

Takes P_FS_GET_VOL_METRICS, returns STATUS.

```
#define msgFSGetVolMetrics           MakeMsg(clsFileSystem, 22)
```

Arguments
```
typedef struct FS_GET_VOL_METRICS {
    BOOLEAN             updateInfo;     // have volume recompute values?
    FS_VOL_METRICS      volMetrics;     // Out: the volume's metrics
} FS_GET_VOL_METRICS, * P_FS_GET_VOL_METRICS;
```

Return Value
stsFSVolDisconnected This will never be returned, even if the volume is disconnected. Instead test **fsVolConnected** in **volMetrics.flags**.

You must set **updateInfo** to TRUE if you want the **volMetrics.freeBytes** field or the **fsVolConnected** flag of the **volMetrics.flags** field to be updated before returning the vol metrics. Setting **updateInfo** to FALSE will make this request faster, but these fields may not be correct.

msgFSSetVolName

Changes the name of a volume.

Takes P_STRING, returns STATUS.

```
#define msgFSSetVolName              MakeMsg(clsFileSystem, 36)
```

Return Value
stsBadParam New vol name is invalid (checked by FSNameValid).

stsFSHandleInvalid The dir/file object refers to a node that has been previously deleted.

stsFSVolDisconnected The volume is not connected.

stsFSVolReadOnly The new volume name cannot be set, because the volume is write protected.

See Also
FSNameValid Mechanism to precheck validity of new volume name.

msgFSNodeExists

Tests the existence of a file or directory node.

Takes P_FS_NODE_EXISTS, returns STATUS.

```
#define msgFSNodeExists                    MakeMsg(clsFileSystem, 37)
```

Arguments

```
typedef struct FS_NODE_EXISTS {
    P_STRING            pPath;            // path to node that may exist
    BOOLEAN             isDir;            // Out: dir or file
} FS_NODE_EXISTS, * P_FS_NODE_EXISTS;
```

Comments

The return parm **isDir** is useful in deciding whether the **msgNew**, to create a handle to the node, should be sent to **clsDirHandle** or **clsFileHandle**. The parm **pPath** is relative to the object that receives this message.

Return Value

stsOK The node exists.

stsFSNodeNotFound The node does not exist.

msgFSGetHandleMode

Returns the "new" mode for the object's fs handle.

Takes P_U16, returns STATUS.

```
#define msgFSGetHandleMode                 MakeMsg(clsFileSystem, 23)
```

Comments

Directory handles interpret the P_U16 as a P_FS_FILE_NEW_MODE. File handles interpret the P_U16 as a P_FS_DIR_NEW_MODE.

msgFSSetHandleMode

Changes the "new" mode for the object's fs handle.

Takes P_FS_SET_HANDLE_MODE, returns STATUS.

```
#define msgFSSetHandleMode                 MakeMsg(clsFileSystem, 24)
```

Arguments

```
typedef struct FS_SET_HANDLE_MODE {
    U16                 mode;             // value of mode flags to change
    U16                 mask;             // which mode flags are to change
} FS_SET_HANDLE_MODE, * P_FS_SET_HANDLE_MODE;
```

Comments

Directory handles interpret mode as a FS_FILE_NEW_MODE. File handles interpret mode as a FS_DIR_NEW_MODE.

msgFSSame

Tests if another directory or file handle references the same node.

Takes OBJECT, returns STATUS.

```
#define msgFSSame                          MakeMsg(clsFileSystem, 25)
```

msgFSGetPath

Gets the path to (or name of) a directory or file handle node.

Takes P_FS_GET_PATH, returns STATUS.

```
#define msgFSGetPath                       MakeMsg(clsFileSystem, 26)
```

Arguments

```
typedef struct FS_GET_PATH {
    FS_GET_PATH_MODE    mode;           // options for get path operation
    DIR_HANDLE          dir;            // In-Out: rel dir or root dir
    U16                 bufLength;      // length of pPathBuf
    P_STRING            pPathBuf;       // Out: user buffer for path
} FS_GET_PATH, * P_FS_GET_PATH;
```

Comments

If mode is **fsGetPathRoot** or **fsGetPathAbsolute** the root dir handle is passed back in dir. If mode is **fsGetPathRelative** the path passed back begins at the dir represent by dir and terminates at the node represented by the recipient of this client.

Return Value

stsFSBufTooSmall User supplied **pPathBuf** is not large enough.

stsFSNotAncestor dir is not ancestor of recipient of **msgFSGetPath**.

msgFSGetAttr

Gets an attribute or attributes of a file or directory node.

Takes P_FS_GET_SET_ATTR, returns STATUS.

```
#define msgFSGetAttr                    MakeMsg(clsFileSystem, 27)
```

Arguments

```
typedef struct FS_GET_SET_ATTR {
    P_STRING            pPath;          // path to node to get/set attrs
    U16                 numAttrs;       // number of attrs of interest
    P_FS_ATTR_LABEL     pAttrLabels;    // In-Out: attr labels
    P_UNKNOWN           pAttrValues;    // In-Out: attr values
    P_FS_ATTR_SIZE      pAttrSizes;     // In-Out: attr sizes
} FS_GET_SET_ATTR, * P_FS_GET_SET_ATTR;
```

Comments

Specify which attributes you wish returned via an array of attribute labels pointed to by **pAttrLabels**. The number of attribute labels is specified by **numAttrs**. The values are passed back via an array of values. If the nth value represents a string or variable attribute a pointer must be filled in for the destination of the string/variable. If the nth value represents a Fix64 provide space for two consecutive U32s. The sizes are passed back via an array of sizes.

If either the values are of no interest or the sizes are of no interest, set **pAttrValues** to **pNull** and/or set **pAttrSizes** to **pNull**.

If you want all attributes of a node, but do not know what they may be set **numAttrs** to **maxU16**, **pAttrLabels** to **fsAllocAttrLabelsBuffer**, and **pAttrValues** to **fsAllocAttrValuesBuffer** (or **pNull** if unwanted) and **pAttrSizes** to **fsAllocAttrSizesBuffer** (or **pNull** if unwanted). Any buffers returned as a result of **fsAllocXXXBuffer** must be freed with OSHeapBlockFree.

The parm **pPath** is relative to the object that receives this message.

msgFSSetAttr

Sets the attribute or attributes of a file or directory node.

Takes P_FS_GET_SET_ATTR, returns STATUS.

```
#define msgFSSetAttr                    MakeMsg(clsFileSystem, 28)
```

Message Arguments

```
typedef struct FS_GET_SET_ATTR {
    P_STRING            pPath;          // path to node to get/set attrs
    U16                 numAttrs;       // number of attrs of interest
    P_FS_ATTR_LABEL     pAttrLabels;    // In-Out: attr labels
    P_UNKNOWN           pAttrValues;    // In-Out: attr values
    P_FS_ATTR_SIZE      pAttrSizes;     // In-Out: attr sizes
} FS_GET_SET_ATTR, * P_FS_GET_SET_ATTR;
```

Comments

Specify which attributes you wish to set via an array of attribute labels pointed to by **pAttrLabels**. The number of attribute labels is specified by **numAttrs**. The values are specified via an array of values. If the nth value represents a string or variable attribute supply the pointer to the string/variable. If the nth value represents a Fix64 attribute two consecutive U32 values are expected. If there are no variable length attributes, **pAttrSizes** can be set to **pNull**, because the size of Fix32, Fix64 and string attributes can be inferred.

pAttrLabels, pAttrValues & **pAttrSizes** are inputs only for this message. The parm **pPath** is relative to the object that receives this message.

The attr **fsAttrDirIndex** (dir indexes) can be set on directories to establish an alternate access to a directory without having to specify the path to the directory. See **msgNew** above on how to access directories with a dir index. Only directories that reside under the PenPoint tree (any directories below the PenPoint directory on a given volume) can have dir index attributes. If another directory already has the same dir index as the one given then a **stsFSDirIndexExists** error is returned.

NOTE: Most attributes (with the exception of dir index and old dir index attributes) can be stored with either files or directories. The root of a volume is the exception. No attributes may be stored with the root.

Return Value

stsFSBadPath New name for name attr is invalid.

stsFSNotDir Dir index attr cannot be set on a file.

stsFSReadOnlyAttr File size cannot be set via set attr, use **msgFSSetSize**.

msgFSMove

Moves a node (and any children) to a new destination.

Takes P_FS_MOVE_COPY, returns STATUS.

```
#define msgFSMove                        MakeMsg(clsFileSystem, 29)
```

Arguments

```
typedef struct FS_MOVE_COPY {
    P_STRING            pSourcePath;     // path of source of move or copy
    FS_LOCATOR          destLocator;     // locator to destination node
    FS_MOVE_COPY_MODE   mode;            // options that affect move or copy
    FS_MOVE_COPY_EXIST  exist;           // action to take if exists or doesn't
    P_STRING            pNewDestName;    // Out: See comment above
    BOOLEAN             alreadyExisted;  // Out: indicates if already exists
    U32                 spare;
} FS_MOVE_COPY, * P_FS_MOVE_COPY;
```

Comments

The destination file/dir name of a move is derived as follows.

For "fsMoveCopyToDest" (the default): If non null path is provided then dest name is the leaf name of the path and the path up to the leaf name determines the destination directory. If the path is null then the name of the destination object is used as the dest name and the parent of the destination object is used as the destination directory.

For **fsMoveCopyIntoDest**: The entire destination uid and path are used for the destination directory. And the destination name is taken from the source name.

The parm **pSourcePath** is relative to the object that receives this message.

NOTE: **pNewDestName** is not an in parameter. It is an output parameter that gives the (new, if **fsMoveCopyGenUnique** was specified for exist) name of the copied node. Set **pNewDestName** to a buffer if you want to know the name, set **pNewDestName** to **pNull** if you do not.

Return Value

stsFSBadPath Path or parts of path are too large.

stsFSCircularMoveCopy Occurs when copying dir to an ancestor (parent).

See Also

msgFSMoveNotify, msgFSCopy

msgFSCopy

Copies a node (and any children) to a new destination.

Takes P_FS_MOVE_COPY, returns STATUS.

```
#define msgFSCopy                        MakeMsg(clsFileSystem, 30)
```

Message Arguments

```
typedef struct FS_MOVE_COPY {
    P_STRING            pSourcePath;     // path of source of move or copy
    FS_LOCATOR          destLocator;     // locator to destination node
    FS_MOVE_COPY_MODE   mode;            // options that affect move or copy
    FS_MOVE_COPY_EXIST  exist;           // action to take if exists or doesn't
    P_STRING            pNewDestName;    // Out: See comment above
    BOOLEAN             alreadyExisted;  // Out: indicates if already exists
    U32                 spare;
} FS_MOVE_COPY, * P_FS_MOVE_COPY;
```

Comments

The destination file/dir of a copy is derived as follows.

For "fsMoveCopyTo" (the default): If non null path is provided then dest name is the leaf name of the path and the path up to the leaf name determines the destination directory. If the path is null then the name of the destination object is used as the dest name and the parent of the destination object is used as the destination directory.

For **fsMoveCopyInto**: The entire destination uid and path are used for the destination directory. And the destination name is taken from the source name.

The parm **pSourcePath** is relative to the object that receives this message.

NOTE: **pNewDestName** is not an in parameter. It is an output parameter that gives the (new, if **fsMoveCopyGenUnique** was specified for exist) name of the copied node. Set **pNewDestName** to a buffer if you want to know the name, set **pNewDestName** to **pNull** if you do not.

Return Value

stsFSBadPath Path or parts of path are too large.

stsFSCircularMoveCopy Occurs when copying dir to an ancestor (parent).

See Also

msgFSCopyNotify, msgFSMove

msgFSMoveNotify

Same as **msgFSMove** with notification routine extensions.

Takes P_FS_MOVE_COPY_NOTIFY, returns STATUS.

```
#define msgFSMoveNotify         MakeMsg(clsFileSystem, 70)
// the time that the current event occurred
```

Arguments

```
Enum16 ( FS_NOTIFY_TIME ) {
    fsBeginOperation = 1,                // beginning of whole operation
    fsBeforeOperation = 2,               // before the sub operation
    fsDuringOperation = 3,               // during the sub operation
    fsAfterOperation = 4,                // after the sub operation
    fsEndOperation = 5                   // end of the whole operation
};
```

```
// the operation of the current event
Enum16 ( FS_NOTIFY_OP ) {
    fsReadOperation = 1,                    // read operation
    fsWriteOperation = 2,                   // write operation
    fsCreateOperation = 3,                  // create operation
    fsVerifyOperation = 4,                  // verify operation
    fsDeleteOperation = 5                   // delete operation
};
// information required by the notification routine
typedef struct FS_NOTIFY_RTN_INFO {
    OBJECT              source;             // a handle to the current file
    BOOLEAN             moveOperation;      // if move operation
    BOOLEAN             isADirectory;       // if source is a directory
    P_FS_GET_SET_ATTR   pFSGetSetAttr;      // attributes for current file
    FS_NOTIFY_TIME      fsNotifyTime;       // time context of notification
    FS_NOTIFY_OP        fsNotifyOp;         // op context of notification
    U32                 bufferSize;         // max size of operation buffer
    U32                 operationSize;      // actual size of operation
    U32                 fileSize;           // actual size of file
    U32                 spare1;             // spare: unused
    U32                 spare2;             // spare: unused
} FS_NOTIFY_RTN_INFO, *P_FS_NOTIFY_RTN_INFO;
// the definition of the notification routine
typedef STATUS FunctionPtr ( P_FS_NOTIFY_RTN ) ( P_FS_NOTIFY_RTN_INFO pFSNotifyRtnInfo,
                                                 P_UNKNOWN pClientData );
// the information required for FSMove/CopyNotify
typedef struct FS_MOVE_COPY_NOTIFY {
    P_STRING            pSourcePath;        // path of source of move or copy
    FS_LOCATOR          destLocator;        // locator to destination node
    FS_MOVE_COPY_MODE   mode;               // options that affect move or copy
    FS_MOVE_COPY_EXIST  exist;              // action to take if exists or doesn't
    P_STRING            pNewDestName;       // Out: See comment w/msgFSMove
    BOOLEAN             alreadyExisted;     // Out: indicates if already exists
    P_UNKNOWN           pNotifyRtn;         // notification routine
    P_UNKNOWN           pClientData;        // client data to notification routine
    P_UNKNOWN           pQuickSortRtn;      // quicksort routine
    U32                 spare1;             // spare: unused
    U32                 spare2;             // spare: unused
} FS_MOVE_COPY_NOTIFY, * P_FS_MOVE_COPY_NOTIFY;
```

Comments

The parm **pSourcePath** is relative to the object that receives this message.

msgFSCopyNotify

Same as **msgFSCopy** with notification routine extensions.

Takes P_FS_MOVE_COPY_NOTIFY, returns STATUS.

```
#define msgFSCopyNotify         MakeMsg(clsFileSystem, 71)
```

Message Arguments

```
typedef struct FS_MOVE_COPY_NOTIFY {
    P_STRING            pSourcePath;        // path of source of move or copy
    FS_LOCATOR          destLocator;        // locator to destination node
    FS_MOVE_COPY_MODE   mode;               // options that affect move or copy
    FS_MOVE_COPY_EXIST  exist;              // action to take if exists or doesn't
    P_STRING            pNewDestName;       // Out: See comment w/msgFSMove
    BOOLEAN             alreadyExisted;     // Out: indicates if already exists
    P_UNKNOWN           pNotifyRtn;         // notification routine
    P_UNKNOWN           pClientData;        // client data to notification routine
    P_UNKNOWN           pQuickSortRtn;      // quicksort routine
    U32                 spare1;             // spare: unused
    U32                 spare2;             // spare: unused
} FS_MOVE_COPY_NOTIFY, * P_FS_MOVE_COPY_NOTIFY;
```

Comments

The parm **pSourcePath** is relative to the object that receives this message.

msgFSDelete

Deletes a node (and all of its children).

Takes P_STRING, returns STATUS.

```
#define msgFSDelete                    MakeMsg(clsFileSystem, 31)
```

Comments

The object of **msgFSDelete** is typically a dir handle, but it can also be a file handle, but the argument passed must be set to **pNull**. After a node is deleted, its handle is marked corrupt (since it is no longer valid). A dir handle object can be reused via **msgFSSetTarget** or destroyed via **msgDestroy**. A file handle must be destroyed after the node is deleted. The argument (a path) is relative to the object that receives this message.

Return Value

stsFSVolDisconnected The volume is not connected.

stsFSVolReadOnly A node cannot be deleted, because the volume is write protected.

stsFSNodeReadOnly Node cannot be deleted because the read only flag is set on the node.

stsFSNodeBusy Node cannot be deleted because it is being access by another client.

See Also

msgFSForceDelete

msgFSFlush

Flushes any buffers and attributes associated with the file or directory.

Takes void, returns STATUS.

```
#define msgFSFlush                     MakeMsg(clsFileHandle, 20)
```

Comments

This can be used to guarantee that cached buffers are flushed to the disk and can also be used to flush memory mapped files to disk.

msgFSMakeNative

Removes anything not supported by the native file system.

Takes P_FS_MAKE_NATIVE, returns STATUS.

```
#define msgFSMakeNative                MakeMsg(clsFileSystem, 32)
```

Arguments

```
typedef struct FS_MAKE_NATIVE {
    P_STRING          pPath;           // path to node to make native
    P_STRING          pNewName;        // Out: native name if changed
} FS_MAKE_NATIVE, * P_FS_MAKE_NATIVE;
```

Comments

The parm **pPath** is relative to the object that receives this message.

msgFSEjectMedia

Ejects media from an ejectable, removable volume.

Takes void, returns STATUS.

```
#define msgFSEjectMedia                MakeMsg(clsFileSystem, 34)
```

Return Value

stsOK The volume media has been ejected.

stsFSVolDisconnected The volume media is already ejected.

stsRequestNotSupported The volume does not have ejectable media

msgFSForceDelete

Forcibly deletes a node (and all of its childen).

Takes P_STRING, returns STATUS.

```
#define msgFSForceDelete                MakeMsg(clsFileSystem, 35)
```

Comments

WARNING. Normal restrictions do not apply. The node will still be deleted even if it is being accessed via another handle or if it is marked read only. However, if the volume is not connected or is write protected, the forced delete will still fail.

After a node is deleted, its handle is marked corrupt (since it is no longer valid). A dir handle object can be reused via **msgFSSetTarget** or destroyed via **msgDestroy**. A file handle must be destroyed after the node is deleted. The argument (a path) is relative to the object that receives this message.

See Also

msgFSDelete

msgFSVolSpecific

Sends a volume specific message via a dir or file handle.

Takes P_FS_VOL_SPECIFIC, returns STATUS.

```
#define msgFSVolSpecific                MakeMsg(clsFileSystem, 40)
```

Arguments

```
typedef struct FS_VOL_SPECIFIC {
    P_STRING            pPath;          // path of node to receive msg
    MESSAGE             msg;            // message to pass on to volume
    P_UNKNOWN           pArgs;          // In-Out: message specific args
} FS_VOL_SPECIFIC, * P_FS_VOL_SPECIFIC;
```

Return Value

Volume specific errors.

msgFSChanged

Notifies observers of directory changes.

Takes P_FS_CHANGE_INFO, returns STATUS. Category: observer notification.

```
#define msgFSChanged                    MakeMsg(clsFileSystem, 50)
```

Arguments

```
typedef struct FS_CHANGE_INFO {
    MESSAGE             reason;         // fs message that caused the change
    OBJECT              observed;       // observed dir whose content changed
    U32                 spare1;
    U32                 spare2;
} FS_CHANGE_INFO, * P_FS_CHANGE_INFO;
```

These messages are the reason observers of a dir handle would be notified of a change and the circumstances that the change happens:

msgInit A file or dir has been created.

msgFree A temp file or temp directory has been deleted.

msgFSDelete A file or directory has been deleted.

msgFSForceDelete A file or directory has been deleted.

msgFSMove A file or directory has been "fast" moved.

Comments

This notifies observers of directories (not files) when a file or dir within the directory changes. The change reasons described below are changes to the directory or file node, not the handle referencing the node.

msgFSVolChanged

Notifies observer of volume changes.

Takes P_FS_VOL_CHANGE_INFO, returns STATUS. Category: observer notification.

```
#define msgFSVolChanged                 MakeMsg(clsFileSystem, 51)
```

Arguments

```
Enum16(FS_VOL_CHANGE_FLAGS) {
    fsVolChangeWhilePrompting    = flag0     // FS prompting caused change
};
typedef struct FS_VOL_CHANGE_INFO {
    MESSAGE             reason;         // fs message that caused the change
    OBJECT              rootDir;        // root dh of volume that changed
    FS_VOL_CHANGE_FLAGS flags;          // more info related to reason
    U16                 spare1;
    U32                 spare2;
} FS_VOL_CHANGE_INFO, * P_FS_VOL_CHANGE_INFO;
```

These messages are the reason observers of **theFileSystem** would be notified of a volume addition, removal or change of state. Note: **msgFSSetVolName** (defined above) is also a volume change reason.

```
#define msgFSInstallVol                 MakeMsg(clsFileSystem, 1)
#define msgFSRemoveVol                  MakeMsg(clsFileSystem, 2)
#define msgFSConnectVol                 MakeMsg(clsFileSystem, 3)
#define msgFSDisconnectVol              MakeMsg(clsFileSystem, 4)
```

Observe the well known object, **theFileSystem**, if you want to receive this.

Class DirHandle Messages

msgFSSetTarget

Changes the target directory to directory specified by locator.

Takes P_FS_LOCATOR, returns STATUS.

```
#define msgFSSetTarget                  MakeMsg(clsDirHandle, 20)
```

Message Arguments

```
typedef struct  FS_LOCATOR {
    OBJECT              uid;
    P_STRING            pPath;      // Relative to node defined by uid
} FS_LOCATOR, * P_FS_LOCATOR;
```

Comments

Setting a dir handle object to a new target also resets the read dir pointer.

Return Value

stsFSUnchangeable The recipient of this message has been "opened" with the **fsUnchangeable** flag set in **pNew->mode**.

msgFSReadDir

Reads the next entry (its attributes) from a directory.

Takes P_FS_READ_DIR, returns STATUS.

```
#define msgFSReadDir                    MakeMsg(clsDirHandle, 21)
```

Arguments

```
typedef struct FS_READ_DIR {
    struct FS_READ_DIR  * pNext;        // Out: only used w/msgFSReadDirFull
    U16                 numAttrs;       // In-Out: attrs of interest
    P_FS_ATTR_LABEL     pAttrLabels;    // In-Out: ptr to attr labels
    P_UNKNOWN           pAttrValues;    // In-Out: ptr to attr values
    P_FS_ATTR_SIZE      pAttrSizes;     // In-Out: ptr to attr sizes
} FS_READ_DIR, * P_FS_READ_DIR;
```

Comments

Specify which attributes you wish returned via an array of attribute labels pointed to by **pAttrLabels**. The number of attribute labels is specified by **numAttrs**. See **msgFSGetAttr** for a description on setting **pAttrValues** and **pAttrSizes**.

msgFSReadDirReset

Resets the ReadDir position to the beginning.

Takes void, returns STATUS.

```
#define msgFSReadDirReset                MakeMsg(clsDirHandle, 22)
```

Comments

This will direct **msgFSReadDir** to begin reading from the first entry in the directory. This has no effect on **msgFSReadDirFull**. The default after creating a handle to a directory is to point to the first entry.

msgFSReadDirFull

Reads all the entries in a directory into a local buffer.

Takes P_FS_READ_DIR_FULL, returns STATUS.

```
#define msgFSReadDirFull                 MakeMsg(clsDirHandle, 23)
```

Arguments

```
typedef struct FS_READ_DIR_FULL {
    U16                 numAttrs;       // num of labels in label array
    P_FS_ATTR_LABEL     pAttrLabels;    // attrs of interest to be read
    U32                 numEntries;     // Out: number of dir entries
    U32                 bufLength;      // Out: length of pDirBuf
    P_FS_READ_DIR       pDirBuf;        // Out: points to first entry
} FS_READ_DIR_FULL, * P_FS_READ_DIR_FULL;
```

Comments

Specify which attributes you wish returned via an array of attribute labels pointed to by **pAttrLabels**. The number of attribute labels is specified by **numAttrs**.

The returned data is a linked list of FS_READ_DIR entries, linked by the **pNext** field. The last link is specified by a **pLink** == **pNull**.

The client must free the returned buffer **pDirBuf**, using OSHeapBlockFree. The buffer should not be freed if it has a value of **pNull**, which will be the case if there are any errors or if **numEntries** is zero.

msgFSTraverse

Traverse through the nodes of a tree starting with the target of this msg.

Takes P_FS_TRAVERSE, returns STATUS.

```
#define msgFSTraverse                       MakeMsg(clsDirHandle, 24)
```

Function Prototype

```
typedef STATUS FunctionPtr(P_FS_TRAVERSE_CALL_BACK) (
    OBJECT              dir,                // dir handle to current node
    U16                 level,              // level in the hierarchy
    P_FS_READ_DIR       pNextEntry,         // info about next entry
    P_UNKNOWN           pClientData         // the client's data
);
typedef struct FS_TRAVERSE {
    FS_TRAVERSE_MODE        mode;           // call back order and criteria
    U16                     numAttrs;       // num of labels in label array
    P_FS_ATTR_LABEL         pAttrLabels;    // attr label array
    P_FS_TRAVERSE_CALL_BACK pCallBackRtn;   // called for each dir & file
    P_UNKNOWN               pClientData;    // passed to call back routine
    P_UNKNOWN               pQuickSortRtn;  // optional quick sort routine
} FS_TRAVERSE, * P_FS_TRAVERSE;
```

Comments

This message traverses the file system tree beginning with the directory which is the recipient of this message and traverses the node tree depth first. The client will be called back via **pCallBackRtn** at each node depending on mode (see FS_TRAVERSE_MODE above). Optionally, the nodes at each directory level can be sorted before being returned by specifying a quick sort routine via **pQuickSortRtn** (See quicksort in sort.h).

Specify which attributes you wish returned via an array of attribute labels pointed to by **pAttrLabels**. The number of attribute labels is specified by **numAttrs**. At a minimum, **pAttrLabels** must contain **fsAttrName** and **fsAttrFlags**.

Return Value

stsBadParam Did not specify **fsAttrName/fsAttrFlags** in labels.

stsFSUnchangeable The recipient of this message has been "opened" with the **fsUnchangeable** flag set in **pNew**->mode. This is a common error if trying to traverse from the root dir (which is unchangeable) provided by **msgFSGetInstalledVolumes/msgFSGetVolMetrics**. Create a handle to the root and use that to traverse instead.

stsFSNestingTooDeep Dir tree is deeper than **fsMaxNestingLevel** levels.

Prototype for the call back routine used by **msgFSTraverseTree**

Class FileHandle Messages

msgStreamRead

Reads data from the file.

Takes P_STREAM_READ_WRITE, returns STATUS. Category: descendant responsibility.

Comments

The maximum number of bytes read with a single request is determined by **fsMaxReadWrite**.

Return Value

stsBadParam Requesting more than **fsMaxReadWrite** bytes.

See Also

msgStreamRead in stream.h

msgStreamWrite

Writes data to the file.

Takes P_STREAM_READ_WRITE, returns STATUS. Category: descendant responsibility.

Comments

The maximum number of bytes writable with a single request is determined by **fsMaxReadWrite**. Note that writes to a memory mapped file that cause the file to grow will result in a **stsFSNodeBusy** error. Free the memory map file pointer before growing the file.

Return Value

stsBadParam Requesting more than **fsMaxReadWrite** bytes.

stsFSNodeReadOnly This is a read only file.

stsFSVolFull The file could not be written - no space on volume.

stsFSNodeBusy The file is memory mapped and this write request would cause the file to be grown beyond the memory mapped size.

See Also

msgStreamWrite in stream.h

msgStreamFlush

Flushes any buffers associated with the file.

Takes void, returns STATUS. Category: descendant responsibility.

See Also

msgStreamFlush in stream.h

msgStreamSeek

Seeks to new position within the file.

Takes P_STREAM_SEEK, returns STATUS. Category: descendant responsibility.

Return Value

stsBadParam Seek mode is out of range.

See Also

msgStreamSeek in stream.h

msgFSSeek

Sets the value of the current byte position.

Takes P_FS_SEEK, returns STATUS.

```
#define msgFSSeek                        MakeMsg(clsFileHandle, 21)
```

Arguments

```
typedef struct FS_SEEK {
    FS_SEEK_MODE        mode;           // seek from bof, cur pos, eof
    S32                 offset;         // relative change from seek origin
    U32                 curPos;         // Out: cur byte pos after seek
    U32                 oldPos;         // Out: cur byte pos before seek
    BOOLEAN             eof;            // Out: Is new pos at end of file?
} FS_SEEK, * P_FS_SEEK;
```

Return Value

stsBadParam Seek mode is out of range.

msgFSGetSize

Gets the size of the file.

Takes P_FS_FILE_SIZE, returns STATUS.

```
#define msgFSGetSize                     MakeMsg(clsFileHandle, 22)
```

msgFSSetSize

Sets the size of the file.

Takes P_FS_SET_SIZE, returns STATUS.

```
#define msgFSSetSize                     MakeMsg(clsFileHandle, 23)
```

Arguments

```
typedef struct FS_SET_SIZE {
    FS_FILE_SIZE        newSize;        // new file size
    FS_FILE_SIZE        oldSize;        // Out: prior file size
} FS_SET_SIZE, * P_FS_SET_SIZE;
```

Comments

Note that a set size to a memory mapped file that causes the file to grow will result in a **stsFSNodeBusy** error. Free the memory map file pointer before growing the file.

Return Value

stsFSNodeReadOnly This is a read only file.

stsFSVolFull The file could not be grown - no space on volume.

stsFSNodeBusy The file is memory mapped and this set size request would cause the file to be grown beyond the memory mapped size.

msgFSMemoryMap

Associates the file with a directly accessible memory pointer.

Takes PP_MEM, returns STATUS.

```
#define msgFSMemoryMap                  MakeMsg(clsFileHandle, 24)
```

Comments

To get a memory mapped file pointer from shared memory, the file handle must be created with **pNew->fs.mode |= fsSharedMemoryMap**.

msgFSMemoryMapFree

Frees the memory map pointer currently associated with the file.

Takes void, returns STATUS.

```
#define msgFSMemoryMapFree              MakeMsg(clsFileHandle, 25)
```

Comments

NOTE: Memory map pointers are freed for you at **msgFree** of a file handle.

msgFSMemoryMapSetSize

Sets the size of the file's memory map.

Takes SIZEOF, returns STATUS.

```
#define msgFSMemoryMapSetSize           MakeMsg(clsFileHandle, 26)
```

Comments

Determines the limit of a memory map for the file. The size can't be less than the file size, nor less than a limit set by another client but can be larger. The memory map size must be set before memory mapping the file.

Return Value

stsFSNodeBusy The file is currently memory mapped.

msgFSMemoryMapGetSize

Gets the size of the file's memory map.

Takes P_SIZEOF, returns STATUS.

```
#define msgFSMemoryMapGetSize           MakeMsg(clsFileHandle, 27)
```

Public Functions

FSNameValid

Checks a file/dir name for validity.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED FSNameValid(
    P_STRING            pName           // name of file/dir to validate
);
```

Return Value

stsOK The node name is valid.

stsFailed The node name was invalid.

Name is bad if it has no characters, is greater than 32 characters, has leading or trailing spaces, contains the pathname delimeter char, contains the file system escape character, or is the name of self (.) or parent (..).

FSUTIL.H

This file contains filesystem attribute helper procedures. The functions described in this file are contained in SYSUTIL.LIB.

These procedures make it easier to deal with filesystem attributes. They also support list attributes; variable attributes which maintains lists of 4-byte quanitities.

```
#ifndef FSUTIL_INCLUDED
#define FSUTIL_INCLUDED
#ifndef FS_INCLUDED
#include <fs.h>
#endif
```

GetNodeName

Gets the name attribute of a given filesystem node.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED GetNodeName(
    OBJECT                  handle,     // File or dir handle.
    P_STRING                pName);     // Out: name.
```

Comments

Use this function to easily get the name of a node.

GetAttr

Gets a single FIX32 attribute from a filesystem handle.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED GetAttr(
    FS_ATTR_LABEL           attrLabel,  // Attribute label.
    OBJECT                  handle,     // File or dir handle.
    P_U32                   pValue);    // Out: attribute value.
```

Comments

This is only for FIX32 attributes when you have a handle onto the node; see GetSingleAttr for a more general function.

GetSingleAttr

Gets a single FIX32, FIX64, or known-size STRING attribute.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED GetSingleAttr(
    FS_ATTR_LABEL           attrLabel,  // In: Attribute label.
    OBJECT                  handle,     // In: handle of node.
    P_STRING                pPath,      // In: path of node.
    P_UNKNOWN               pValue);    // Out: attribute value.
```

SetAttr

Sets a single FIX32 attribute on a filesystem handle.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED SetAttr(
    FS_ATTR_LABEL           attrLabel,  // Attribute label.
    OBJECT                  handle,     // File or dir handle.
    U32                     value);     // Attribute value.
```

Comments

This is only for FIX32 attributes when you have a handle onto the node; see SetSingleAttr for a more general function.

SetSingleAttr

Sets a single FIX32, FIX64, or STRING attribute.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED SetSingleAttr(
    FS_ATTR_LABEL           attrLabel,  // In: Attribute label.
    OBJECT                  handle,     // In: handle of node.
    P_STRING                pPath,      // In: path of node.
    P_UNKNOWN               pValue);    // In: attribute value.
```

GetListX

Gets a VAR attribute that is organized as a list of values.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED GetListX(
    OBJECT                  handle,     // File or dir handle.
    P_STRING                pPath,      // Path relative to handle.
    FS_ATTR_LABEL           attrLabel,  // Attribute label.
    PP_UNKNOWN              ppList,     // Out: list.
    P_U16                   pSize);     // Out: size (in bytes) of list.
```

Comments

Allocates **ppList** from the process local stack. Caller must HeapBlockFree **ppList** when done adding, removing, and putting the list.

PutListX

Updates a list attribute with a new list.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED PutListX(
    OBJECT                  handle,     // File or dir handle.
    P_STRING                pPath,      // Path relative to handle.
    FS_ATTR_LABEL           attrLabel,  // Attribute label.
    P_UNKNOWN               pList,      // List.
    U16                     size);      // Size (in bytes) of list.
```

FindListItemX

Finds an element in a list.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED FindListItemX(
    P_UNKNOWN                pItem,       // Data to search for.
    U16                      itemSize,    // Size of data to search for.
    P_UNKNOWN                pList,       // List.
    U16                      listSize,    // Size of list.
    P_U16                    pOffset);    // Out: offset of found item.
```

Comments

The list must first be gotten via GetList. **pOffset** is 0 based. The list array can be indexed with **pOffset** to get the actual data. The comparison is done via a memcmp, so things must be EXACTLY the same.

Return Value

stsNoMatch Item not found.

AddListItemX

Adds an item to the end of a list.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED AddListItemX(
    P_UNKNOWN                pItem,       // Item to add.
    U16                      itemSize,    // Size of item in bytes.
    PP_UNKNOWN               ppList,      // In:Out List.
    P_U16                    pSize);      // In:Out size of list in bytes.
```

Comments

The list must first be gotten via GetList. The heap that the list uses is resized. **pSize** is updated to reflect the new list size.

RemoveListItemX

Removes an item from a list, given an offset.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED RemoveListItemX(
    U16                      offset,      // Offset of item to remove.
    U16                      size,        // Size of item to remove.
    PP_UNKNOWN               ppList,      // In:Out List.
    P_U16                    pSize);      // In:Out Size of list.
```

Comments

The list must first be gotten via GetList. The heap that the list uses is resized. If **pSize** == 1 (only 1 item left) then *pSize is set to 0, but the list heap is not resized. offset is 0-based.

Private

Below are the "old" attribute list functions. These are here for backwards compatability only!

GetList

Gets a VAR attribute that is organized as a list of 4 byte values.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED GetList(
    OBJECT                   handle,      // File or dir handle.
    P_STRING                 pPath,       // Path relative to handle.
    FS_ATTR_LABEL            attrLabel,   // Attribute label.
    PP_OBJECT                ppList,      // Out: list.
    P_U16                    pCount);     // Out: number of elements.
```

Comments

Allocates **ppList** from the process local stack. Caller must HeapBlockFree **ppList** when done adding, removing, and putting the list.

PutList

Updates a list attribute with a new list.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED PutList(
    OBJECT                  handle,     // File or dir handle.
    P_STRING                pPath,      // Path relative to handle.
    FS_ATTR_LABEL           attrLabel,  // Attribute label.
    P_OBJECT                pList,      // List.
    U16                     count);     // Number of elements.
```

FindListItem

Finds an element in a list.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED FindListItem(
    OBJECT                  item,       // Data to search for.
    P_OBJECT                pList,      // List.
    U16                     count,      // Number of elements in list.
    P_U16                   pIndex);    // Out: index of found item.
```

Comments

The list must first be gotten via GetList. **pIndex** is 0 based. The list array can be indexed with **pIndex** to get the actual data.

Return Value

stsNoMatch Item not found.

AddListItem

Adds an item to the end of a list.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED AddListItem(
    OBJECT                  item,       // Item to add.
    PP_OBJECT               ppList,     // In:Out List.
    P_U16                   pCount);    // In:Out number of elements in list.
```

Comments

The list must first be gotten via GetList. The heap that the list uses is resized. **pCount** is updated to reflect the new list size.

RemoveListItem

Removes an item from a list, given an index.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED RemoveListItem(
    U16                     index,      // Index of item to remove.
    PP_OBJECT               ppList,     // In:Out List.
    P_U16                   pCount);    // In:Out Number of elements in list.
```

Comments

The list must first be gotten via GetList. The heap that the list uses is resized. If **pCount** == 1 (only 1 item left) then *pCount is set to 0, but the list heap is not resized. index is 0-based.

STREAM.H

This file contains the API definition for **clsStream**.

clsStream inherits from **clsObject**.

clsStream is an abstract class -- it does not completely implement its own protocol. Subclasses of **clsStream** must complete the implementation. **clsFileHandle** is an important subclass of **clsStream** (see fs.h).

The functions described in this file are contained in PENPOINT.LIB.

```
#ifndef STREAM_INCLUDED
#define STREAM_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef UID_INCLUDED
#include <uid.h>
#endif
#ifndef OSTYPES_INCLUDED
#include <ostypes.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
```

Common #defines and typedefs

```
#define streamNewFields \
    objectNewFields
typedef struct STREAM_NEW {
    streamNewFields
} STREAM_NEW, * P_STREAM_NEW;
```

Several types in this file contain "streamElements."

The **streamElements** fields are:

- numBytes: In: size of buffer
- pBuf: In: buffer
- count: Out: number of bytes transferred

```
#define streamElements          \
    U32          numBytes;      \
    P_UNKNOWN    pBuf;          \
    U32          count;
```

Status codes

```
#define stsTimeOutWithData          MakeWarning(clsStream, 1)
```

stsStreamDisconnected status is returned by all stream calls when the service executing the stream function is no longer in a connected state (A disconnectable service is **clsMILAsyncSIO**).

Clients must not send other stream messages to the disconnected service.

Penpoint can notify clients or clients may find services' connected states (see service.h and servmgr.h).

```
#define stsStreamDisconnected       MakeStatus(clsStream, 1)
```

Messages

msgStreamRead

Reads data from stream.

Takes P_STREAM_READ_WRITE, returns STATUS. Category: descendant responsibility.

```
#define msgStreamRead               MakeMsg(clsStream,1)
```

Arguments

```
typedef struct {
    streamElements
} STREAM_READ_WRITE, * P_STREAM_READ_WRITE;
```

Comments

msgStreamRead reads data from the stream into **pBuf**. **pBuf** must point to a buffer which can hold at least **numBytes** bytes. The number of bytes read is passed back in count.

If you try to read 0 bytes when at the end of the data stream **stsOK** is returned.

Return Value

< **stsOK** No data read.

>= **stsOK** Count of bytes is non-zero.

stsEndOfData Count is zero and at the end of data.

msgStreamWrite

Writes data to stream.

Takes P_STREAM_READ_WRITE, returns STATUS. Category: descendant responsibility.

```
#define msgStreamWrite              MakeMsg(clsStream,2)
```

Message Arguments

```
typedef struct {
    streamElements
} STREAM_READ_WRITE, * P_STREAM_READ_WRITE;
```

Comments

Writes **numBytes** from **pBuf** into the stream. Returns **stsOK** if all bytes are written.

msgStreamReadTimeOut

Reads data from stream with timeout.

Takes P_STREAM_READ_WRITE_TIMEOUT, returns STATUS. Category: descendant responsibility.

```
#define msgStreamReadTimeOut        MakeMsg(clsStream,3)
```

Arguments

```
typedef struct {
    streamElements
    OS_MILLISECONDS         timeOut;        // In: milliseconds until timeout
} STREAM_READ_WRITE_TIMEOUT, * P_STREAM_READ_WRITE_TIMEOUT;
```

Comments

msgStreamReadTimeOut reads data from the stream into **pBuf**. **pBuf** must point to a buffer which can hold least **numBytes** bytes. The number of bytes read is passed back in count.

When count is greater than zero the status returned is always greater than or equal to **stsOK**.

Return Value

stsTimeOutWithData Count is greater than zero but less than **numBytes** because of a timeout.

stsTimeOut Count is zero and the timeout has expired.

stsEndOfData Count is zero and at the end of data.

msgStreamWriteTimeOut

Writes to the stream with timeout.

Takes P_STREAM_READ_WRITE_TIMEOUT, returns STATUS. Category: descendant responsibility.

```
#define msgStreamWriteTimeOut       MakeMsg(clsStream,4)
```

Message Arguments

```
typedef struct {
    streamElements
    OS_MILLISECONDS         timeOut;        // In: milliseconds until timeout
} STREAM_READ_WRITE_TIMEOUT, * P_STREAM_READ_WRITE_TIMEOUT;
```

Comments

Writes **numBytes** from **pBuf** into the stream.

Return Value

stsOK All bytes were written.

stsTimeOut Timeout has expired before all data written.

msgStreamFlush

The stream flushes any buffered data.

Takes **pNull**, returns STATUS. Category: descendant responsibility.

```
#define msgStreamFlush              MakeMsg(clsStream,5)
```

Comments

clsStream's default response is to return **stsMessageIgnored**. Most subclasses override **clsStream**'s response.

Return Value

stsOK Buffers were successfully emptied.

stsFailed Buffers do not empty after some timeout period.

msgStreamSeek

Sets the stream's Current Byte Position.

Takes P_STREAM_SEEK, returns STATUS.

```
#define msgStreamSeek               MakeMsg(clsStream,6)
```

Arguments

```
Enum16(STREAM_SEEK_MODE) {
    // Relative to beginning of file, end of file, or Current Byte Position
    streamSeekBeginning     = 0,
    streamSeekEnd           = 1,
    streamSeekCurrent       = 2,
    // Default setting
    streamSeekDefaultMode   = streamSeekBeginning
};
typedef struct STREAM_SEEK {
    STREAM_SEEK_MODE    mode;           //
    S32                 offset;         // relative change from seek origin
    U32                 curPos;         // Out: byte position after seek
    U32                 oldPos;         // Out: byte position before seek
    BOOLEAN             eof;            // Out: Is new pos at end of file?
} STREAM_SEEK, * P_STREAM_SEEK;
```

Comments

clsStream's default response is to return **stsMessageIgnored**. Most subclasses override **clsStream**'s response.

msgStreamBlockSize

Passes back the most efficient write block size for this stream.

Takes P_STREAM_BLOCK_SIZE, returns STATUS. Category: descendant responsibility.

```
#define msgStreamBlockSize     MakeMsg(clsStream,7)
```

Arguments

```
typedef struct {
    U32         blockSize;      // out: preferred write block size
} STREAM_BLOCK_SIZE, * P_STREAM_BLOCK_SIZE;
```

Comments

clsStream's default response is to return a **blockSize** of 512. Most subclasses override **clsStream**'s response.

Functions

The P_UNKNOWN declarations for the following are assumed to be FILE*. Maintaining a clean separation between ANSI and PenPoint header files prevents the use of the true type.

StdioStreamBind

Returns a stdio file pointer bound to a stream object.

Returns pointer to FILE.

Function Prototype

```
P_UNKNOWN EXPORTED StdioStreamBind(
    OBJECT  obj);
```

StdioStreamUnbind

Frees the stdio file handle bound to a stream object.

Returns int.

Function Prototype

```
int EXPORTED StdioStreamUnbind(
    P_UNKNOWN   pFile);
```

StdioStreamToObject

Returns the stream object bound to a stdio file pointer.

Returns OBJECT.

Function Prototype

```
OBJECT EXPORTED StdioStreamToObject(
    P_UNKNOWN   pFile);
```

UUID.H

This file contains the API for UUID routines. The functions described in this file are contained in PENPOINT.LIB.

This file contains macros for creating and testing Nil and Invalid UUIDs, to compare two UUIDs for equality, and to create a well known UUID and a function to create dynamic uuids.

UUID is an acronym for Universal Unique ID.

```
#ifndef UUID_INCLUDED
#define UUID_INCLUDED
```

Include files

```
#ifndef GO_INCLUDED
#include <go.h>
#endif
```

Common #defines and typedefs

Macros

For setting and testing for a Nil UUID

```
#define MakeNilUUID(uuid)         ((uuid).machine = (uuid).id = 0L)
#define NilUUID(uuid)             (((uuid).machine == 0L) && ((uuid).id == 0L))
```

For setting and testing for an invalid UUID

```
#define MakeInvalidUUID(uuid)     ((uuid).id = (uuid).machine = maxU32)
#define InvalidUUID(uuid)         ((uuid).id == maxU32 && \
                                   (uuid).machine == maxU32)
```

To compare two UUIDs for equality

```
#define SameUUIDs(a,b)            (((a).machine == (b).machine) && \
                                   ((a).id == (b).id))
```

To set the fields of a well known uuid

```
#define MakeWknUUID(uuid,tag,i) \
    ((uuid).machine = (tag), (uuid).id = (U32)(i))
```

Typedefs

```
typedef struct UUID {
    U32                 id;             // Unique counting value
    U32                 machine;        // Unique machine identifier
} UUID, *P_UUID;
```

Public Functions

MakeDynUUID

Creates a dynamic UUID.

Returns nothing.

Function Prototype

```
void EXPORTED MakeDynUUID (
    P_UUID              pUUID
);
```

VOL.H

clsVolume inherits from **clsObject.**

Provides volume support.

Information in this file is useful if you are writing an installable volume. Also see volgodir.h for additional information.

```
#ifndef VOL_INCLUDED
#define VOL_INCLUDED
```

Include file dependencies

```
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef OS_INCLUDED
#include <os.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef FS_INCLUDED
#include <fs.h>
#endif
```

Common #defines and typedefs

Defines

```
#define fsDirPosFirst                (U32)0
#define VOL_METHOD                   STATUS EXPORTED
```

Flag to direct VNCreate to create short directory names (See VNCreate)

```
#define fsShortDirName               fsNodeReadOnly
```

Error status codes

```
#define stsNoMoreBuffers             MakeStatus(clsVolume, 1)
```

Informational status codes

```
#define stsVolFormatIsTimeConsuming MakeWarning(clsVolume, 1)
```

Resource ids for volume icons

Defined with MakeWknResId (**clsVolume**, tag)

Stored in groups of 10 values:

Base value defines large icon,

+1 value defines smaller icon,

+2 thru +9 reserved for future.

```
#define tagVolHardDiskIcon           0   // 1-9   define variants, see above
#define tagVolFloppyDiskIcon         10  // 11-19 define variants, see above
#define tagVolRemotePCIcon           20  // 21-29 define variants, see above
#define tagVolRemoteMacIcon          30  // 31-39 define variants, see above
```

Types

```
typedef OBJECT VOL;
typedef P_FS_ATTR_SIZE  *PP_FS_ATTR_SIZE;
typedef P_FS_ATTR_LABEL *PP_FS_ATTR_LABEL;
typedef U32 FS_ATTR_VALUE, *P_FS_ATTR_VALUE, **PP_FS_ATTR_VALUE;
typedef U32 VOL_VNODE, *P_VOL_VNODE;
typedef struct DIR_ID_CACHE {
    P_MEM               pBuf;           // Sorted array of vol dir ids
    U32                 used;           // Number used, of allocated space
    U32                 free;           // Number free, of allocated space
} DIR_ID_CACHE;
typedef struct VOL_CACHE {
    VOL_VNODE           vnodeNotKnown;  // Used to fake volRAM
    P_MEM               pRoot;          // Cache dir elem for root vnode
    DIR_ID_CACHE        dirIds;         // Dir id cache
    OS_MILLISECONDS     lastAccess;     // Last access to cache layer
    OS_MILLISECONDS     lastVolAccess;  // Last access to volume
    OS_MILLISECONDS     lastVolWrite;   // Last write to volume
    OS_MILLISECONDS     refreshRate;    // Check with volume this often
                                        // to see if volume has changed
                                        // since last vol access
                                        // maxU32 implies unchangeable
    OS_MILLISECONDS     flushRate;      // Flush cached dirty files
                                        // after this much time has passed
                                        // 0 implies flush immediately
                                        // maxU32 implies no flushing
                                        // Default is 2000 (2 secs)
    U16                 numDirs;        // Total num of dirs in the cache
                                        // Includes both open and closed
    U16                 numFiles;       // Total num of files in the cache
                                        // Includes both open and closed
    U16                 openDirs;       // Num of dirs in the cache
                                        // that are opened on the vol
    U16                 openFiles;      // Num of files in the cache
                                        // that are opened on the vol
    U16                 refdDirs;       // Num of opened dirs that have
                                        // non-zero reference counts
    U16                 refdFiles;      // Num of opened files that have
                                        // non-zero reference counts
    U16                 maxOpenDirs;    // Max dirs that can be left open
                                        // for caching purposes.
                                        // 0 implies no dirs
                                        // maxU16 implies as many as wanted
                                        // Default is maxU16
    U16                 maxOpenFiles;   // Max files that can be left open
                                        // for caching purposes.
                                        // 0 implies no files
                                        // maxU16 implies as many as wanted
                                        // Default is maxU16
    P_MEM               pFirst;         // First cache entry
    P_MEM               pLast;          // Last cache entry
    P_MEM               pWrite;         // Write is to this cache entry
    U32                 writePos;       // Write at this position
    U32                 writeAmt;       // Write for this amount
    U8                  readDirFullInProgress;
                                        // If non-zero then fully cached
                                        // dirs will not be "purged".
    U8                  spareU8;
    U16                 spareU16;
    U32                 spares[5];
} VOL_CACHE;
```

```
Enum16(VOL_CMN_FLAGS) {
    vcVolIsOnBootDevice = flag0,        // This volume is on the boot
                                        // device (as defined by the MIL)
                                        // but isn't necessarily THE boot
                                        // volume.
    vcVolIsDetachable   = flag1,        // This volume is not removable
                                        // but may be detachable.
    vcVolIsSwapVolume   = flag2         // This is the swap volume.
};
typedef struct VOL_COMMON {
    struct VOL_RTNS    *pRtns;
    OS_SEMA_ID          fsSema;
    OS_SEMA_ID          volSema;
    VOL_CMN_FLAGS       flags;
    U16                 vnodeCount;
    OS_HEAP_ID          vnodeHeap;
    U16                 spare1;
    U16                 dhCount;
    P_MEM               dhHead;
    U16                 spare2;
    U16                 fhCount;
    P_MEM               fhHead;
    VOL_CACHE           cache;
    OBJECT              dirIndexFile;
    BOOLEAN             dirIndexFileVerified;
    U16                 spare;
    U32                 spares[5];
} VOL_COMMON;
typedef struct VOL_INFO {
    struct VOL_INFO    *pNext;
    FS_VOL_HEADER       hdr;
    VOL_COMMON          cmn;
    // Volume specific volInfo struct goes here...
} VOL_INFO, *P_VOL_INFO, **PP_VOL_INFO;
Enum16(VNODE_ACCESS) {
 // Delete node at handle free time?
    vnodeTemp           = flag0,
 // Read/write intentions for this handle
    vnodeReadOnly       = flag2,
 // Upper byte: exclusivity requirements
    vnodeNoExclusivity  = MakeU16(0, 0),
    vnodeDenyWriters    = MakeU16(0, 1),
    vnodeExclusiveOnly  = MakeU16(0, 2),
 // Uncompress file at VNGet time?
    vnodeUncompress     = flag14,
 // Default
    vnodeDefaultAccess  = 0 // perm, read/write, noExclusivity
};
#define vnodeIgnoreAccessInfo   0x8000
typedef struct VNODE_CMN_ATTRS {
    FS_NODE_FLAGS       nodeFlags;
    FS_DATE_TIME        nodeCreated;
    FS_DATE_TIME        nodeModified;
} VNODE_CMN_ATTRS, *P_VNODE_CMN_ATTRS;
Enum16(VNODE_ATTR_FLAGS) {
    vnAttrNodeFlags     = flag0,
    vnAttrNodeCreated   = flag1,
    vnAttrNodeModified  = flag2,
    vnAttrLabelsBuffer  = flag8,
    vnAttrValuesBuffer  = flag9,
    vnAttrSizesBuffer   = flag10
};
```

Typedefs for functions supported by each volume class

Volume related functions follow:

VolStatus

Has a volume check for readiness.

Returns STATUS.

Function Prototype
```
typedef STATUS FunctionPtr(P_VOL_STATUS) (
    P_VOL_INFO          pVolInfo,
    P_BOOLEAN           pChanged        // In/Out: Has volume changed?
);
#define VolStatus(pVolInfo, pChanged) \
    ((pVolInfo)->cmn.pRtns->pVolStatus) \
        (pVolInfo, pChanged)
```

Comments

Possible return status are **stsOK**, **stsFSVolDisconnected**, other errors. If status is okay, should indicate if volume has changed.

VolSetVolName

Has a volume change its volume name.

Returns STATUS.

Function Prototype
```
typedef STATUS FunctionPtr(P_VOL_SET_VOL_NAME) (
    P_VOL_INFO          pVolInfo,
    P_STRING            pName           // New volume name
);
#define VolSetVolName(pVolInfo, pName) \
    ((pVolInfo)->cmn.pRtns->pVolSetVolName) \
        (pVolInfo, pName)
```

VolUpdateVolInfo

Requests that a volume updates its user accessable volume info.

Returns STATUS.

Function Prototype
```
typedef STATUS FunctionPtr(P_VOL_UPDATE_VOL_INFO) (
    P_VOL_INFO          pVolInfo        // Vol Info
);
#define VolUpdateVolInfo(pVolInfo) \
    ((pVolInfo)->cmn.pRtns->pVolUpdateVolInfo) \
        (pVolInfo)
```

VolSpecificMsg

Passes a volume specific message down to a volume.

Returns STATUS.

Function Prototype
```
typedef STATUS FunctionPtr(P_VOL_SPECIFIC_MSG) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // Handle of vnode
    MESSAGE             msg,            // Message
    P_UNKNOWN           pArgs           // In/Out: Arguments for message
);
#define VolSpecificMsg(pVolInfo, vnode, msg, pArgs) \
    ((pVolInfo)->cmn.pRtns->pVolSpecificMsg) \
        (pVolInfo, vnode, msg, pArgs)
```

Common vnode access/release functions follow:

VNGet

Gets a vnode given **pVolInfo**, **dirVNode** and name of node in the directory.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_GET) (
    P_VOL_INFO          pVolInfo,       // Vol Info
    VOL_VNODE           dirVNode,       // VNode of parent directory
    P_STRING            pName,          // Name of node in directory
    VNODE_ACCESS        access,         // R/W access, exclusivity, etc
    P_UNKNOWN           pVolSpecific,   // Vol specific info
    P_VOL_VNODE         pVNode          // Out: Returned vnode handle
);
#define VNGet(pVolInfo, dirVNode, pName, access, pVolSpecific, pVNode) \
    ((pVolInfo)->cmn.pRtns->pVNodeGet) \
        (pVolInfo, dirVNode, pName, access, pVolSpecific, pVNode)
```

VNNextChild

Gets a vnode given **pVolInfo**, **dirVNode** and dir position in a directory.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_NEXT_CHILD) (
    P_VOL_INFO          pVolInfo,       // Vol Info
    VOL_VNODE           dirVNode,       // VNode of parent directory
    P_U32               pDirPos,        // In/Out: directory position data
    VNODE_ACCESS        access,         // R/W access, exclusivity, etc
    P_STRING            pName,          // Out: Name of node
    P_VOL_VNODE         pVNode          // Out: VNode handle
);
#define VNNextChild(pVolInfo, dirVNode, pDirPos, access, pName, pVNode) \
    ((pVolInfo)->cmn.pRtns->pVNodeNextChild) \
        (pVolInfo, dirVNode, pDirPos, access, pName, pVNode)
```

VNGetByDirId

Gets the vnode of a directory (and its name) given its directory id.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_GET_BY_DIR_ID) (
    P_VOL_INFO          pVolInfo,       // Vol Info
    VOL_VNODE           dirVNode,       // VNode of parent directory
    U32                 dirId,          // Dir id of directory
    P_STRING            pName,          // Out: Name of node
    P_VOL_VNODE         pVNode          // Out: Returned dir vnode handle
);
#define VNGetByDirId(pVolInfo, dirVNode, dirId, pName, pVNode) \
    ((pVolInfo)->cmn.pRtns->pVNodeGetByDirId) \
        (pVolInfo, dirVNode, dirId, pName, pVNode)
```

VNDup

Increments the reference count on a vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_DUP) (
    P_VOL_INFO          pVolInfo,       // Vol Info
    VOL_VNODE           vnode,          // The vnode being dupped
    VNODE_ACCESS        access          // R/W, exclusivity, etc.
);
#define VNDup(pVolInfo, vnode, access) \
    ((pVolInfo)->cmn.pRtns->pVNodeDup) \
        (pVolInfo, vnode, access)
```

VNRelease

Returns a vnode to the volume.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_RELEASE) (
    P_VOL_INFO          pVolInfo,       // Vol Info
    VOL_VNODE           vnode           // The vnode being released
);
#define VNRelease(pVolInfo, vnode) \
    ((pVolInfo)->cmn.pRtns->pVNodeRelease) \
        (pVolInfo, vnode)
```

Directory handle related functions follow:

VNCreate

Creates a new file or directory node in the given (directory) node.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_CREATE) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           dirVNode,       // Handle of directory vnode
    P_STRING            pName,          // Name of the new file
    FS_NODE_FLAGS       type            // File or directory?
);
#define VNCreate(pVolInfo, dirVNode, pName, type) \
        ((pVolInfo)->cmn.pRtns->pVNodeCreate) \
        (pVolInfo, dirVNode, pName, type)
```

Comments

Note: the parameter type only uses the flag **fsNodeDir** to distinguish between directories and files and the flag **fsShortDirName** to direct the volume to use a short name replacement for the directory name. Directories are only shortened if they reside in the PenPoint tree. The flag **fsShortDirName** overlaps **fsNodeReadOnly**, which is never used in conjunction with directories.

VNDelete

Deletes the given node.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_DELETE) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // VNode to delete
    BOOLEAN             visible         // At root of hierarchical delete?
);
#define VNDelete(pVolInfo, vnode, visible) \
    ((pVolInfo)->cmn.pRtns->pVNodeDelete) \
        (pVolInfo, vnode, visible)
```

Comments

VNode may be returned differently to mark it as a vnode that points to a deleted vnode.

VNMove

Moves/renames a node (and any children) to a new node.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_MOVE) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           srcDirVNode,    // Handle of dir node of source
    VOL_VNODE           srcVNode,       // Handle of source vnode of move
    VOL_VNODE           dstDirVNode,    // Handle of dir node of dest
    P_STRING            pDstName        // New name to give the node
);
#define VNMove(pVolInfo, srcDirVNode, srcVNode, dstDirVNode, pDstName) \
    ((pVolInfo)->cmn.pRtns->pVNodeMove) \
        (pVolInfo, srcDirVNode, srcVNode, dstDirVNode, pDstName)
```

VNDirPosDeleteAdjust

Makes any necessary adjustment to the **dirPos** after a node has been deleted.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_DIR_POS_DEL_ADJ) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           dirVNode,       // Handle of directory vnode
    VOL_VNODE           vnode,          // Handle of deleted vnode
    P_U32               pDirPos         // Dir position data before delete
);
#define VNDirPosDeleteAdjust(pVolInfo, dirVNode, vnode, pDirPos) \
    ((pVolInfo)->cmn.pRtns->pVNodeDirPosDelAdj) \
        (pVolInfo, dirVNode, vnode, pDirPos)
```

VNGetDirId

Gets a directory node's dir id, given the vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_GET_DIR_ID) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // Handle of vnode
    P_U32               pDirId          // In/Out: dir id of dir node
);
#define VNGetDirId(pVolInfo, vnode, pDirId) \
    ((pVolInfo)->cmn.pRtns->pVNodeGetDirId) \
        (pVolInfo, vnode, pDirId)
```

File handle related functions follow:

VNRead

Transfers n bytes from position m in a file to a buffer.

Returns STATUS.

Function Prototype
```
typedef STATUS FunctionPtr(P_VNODE_READ) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // Handle of vnode
    U32                 filePos,        // Starting point of read
    U32                 numBytes,       // Number of bytes to be read
    P_U8                pReadBuffer,    // Destination of bytes read
    P_U32               pCount          // In/Out: Actual bytes read
);
#define VNRead(pVolInfo, vnode, filePos, numBytes, pReadBuffer, pCount) \
    ((pVolInfo)->cmn.pRtns->pVNodeRead) \
        (pVolInfo, vnode, filePos, numBytes, pReadBuffer, pCount)
```

VNWrite

Transfers n bytes from a buffer to position m in a file.

Returns STATUS.

Function Prototype
```
typedef STATUS FunctionPtr(P_VNODE_WRITE) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // Handle of vnode
    U32                 filePos,        // Starting point of the write
    U32                 numBytes,       // Number of bytes to write
    P_U8                pWriteBuffer,   // Destination of bytes to write
    P_U32               pCount          // In/Out: Actual bytes written
);
#define VNWrite(pVolInfo, vnode, filePos, numBytes, pWriteBuffer, pCount) \
    ((pVolInfo)->cmn.pRtns->pVNodeWrite) \
        (pVolInfo, vnode, filePos, numBytes, pWriteBuffer, pCount)
```

VNGetSize

Gets a node's size given the vnode.

Returns STATUS.

Function Prototype
```
typedef STATUS FunctionPtr(P_VNODE_GET_SIZE) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // Handle of vnode
    P_FS_FILE_SIZE      pFileSize       // In/Out: Node's size
);
#define VNGetSize(pVolInfo, vnode, pFileSize) \
    ((pVolInfo)->cmn.pRtns->pVNodeGetSize) \
        (pVolInfo, vnode, pFileSize)
```

VNSetSize

Sets a node's size given the vnode and the new size.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_SET_SIZE) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // Handle of vnode
    FS_FILE_SIZE        fileSize        // Node's new size
);
#define VNSetSize(pVolInfo, vnode, fileSize) \
    ((pVolInfo)->cmn.pRtns->pVNodeSetSize) \
        (pVolInfo, vnode, fileSize)
```

Comments

This function could be used to either truncate or grow the file/resFile.

Attribute related functions follow:

VNGetName

Gets a node's name, given the vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_GET_NAME) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // Handle of vnode
    P_STRING            pName           // In/Out: name of node
);
#define VNGetName(pVolInfo, vnode, pName) \
    ((pVolInfo)->cmn.pRtns->pVNodeGetName) \
        (pVolInfo, vnode, pName)
```

VNGetNumAttrs

Returns the number of non-standard attributes, given the vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_GET_NUM_ATTRS) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // Handle of vnode
    P_U16               pNumAttrs       // Out: num of attrs to get
);
#define VNGetNumAttrs(pVolInfo, vnode, pNumAttrs) \
    ((pVolInfo)->cmn.pRtns->pVNodeGetNumAttrs) \
        (pVolInfo, vnode, pNumAttrs)
```

VNGetAttrInfo

Returns a node's attributes, given the vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_GET_ATTR_INFO) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // Handle of vnode
    U16                 num,            // Num of attrs to get
    VNODE_ATTR_FLAGS    flgs,           // Get which attrs
    P_VNODE_CMN_ATTRS   pCmn,           // Common attrs
    P_U8                pWhich,         // Which user defined attrs
    P_FS_ATTR_LABEL     pLbls,          // In/Out: attribute labels
    P_FS_ATTR_VALUE     pVals,          // In/Out: attribute values
    P_FS_ATTR_SIZE      pSizs           // In/Out: attribute sizes
);
#define VNGetAttrInfo(pVolInfo, vnode, num, flgs, pCmn, pWhich, pLbls, pVals, pSizs) \
    ((pVolInfo)->cmn.pRtns->pVNodeGetAttrInfo) \
        (pVolInfo, vnode, num, flgs, pCmn, pWhich, pLbls, pVals, pSizs)
```

Comments

Which common attributes and which arrays of the label/value/size arrays that need to be filled in are defined by the flgs field. Which particular elements of each (label/value/size) array to be filled in is defined by the **pWhich** byte array. If num is 0 or **pWhich** is null then no label/value/size array elements should be filled in. If an element of **pWhich** is **maxU8** then the corresponding label/value/size array element should be filled in. If the data is known and set then the **pWhich** array element should be set to 1 after setting the values.

VNSetAttrInfo

Sets a node's attributes, given the vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_SET_ATTR_INFO) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // Handle of vnode
    U16                 num,            // Num of attrs to set
    VNODE_ATTR_FLAGS    flgs,           // Set which attrs
    P_VNODE_CMN_ATTRS   pCmn,           // Common attrs
    P_U8                pWhich,         // Which user defined attrs
    P_FS_ATTR_LABEL     pLbls,          // In/Out: attribute labels
    P_FS_ATTR_VALUE     pVals,          // In/Out: attribute values
    P_FS_ATTR_SIZE      pSizs           // In/Out: attribute sizes
);
#define VNSetAttrInfo(pVolInfo, vnode, num, flgs, pCmn, pWhich, pLbls, pVals, pSizs) \
    ((pVolInfo)->cmn.pRtns->pVNodeSetAttrInfo) \
        (pVolInfo, vnode, num, flgs, pCmn, pWhich, pLbls, pVals, pSizs)
```

Comments

Which common attributes and which arrays of the label/value/size arrays that need to be stored are defined by the flgs field. Which particular elements of each (label/value/size) array to be filled in is defined by the **pWhich** byte array. If num is 0 or **pWhich** is null then no label/value/size array elements should be stored. If an element of **pWhich** is **maxU8** then the corresponding label/value/size array element should be stored. If the data is stored successfully then the **pWhich** array element should be set to 1.

VNMakeNative

Gets rid of all concepts not native to a file system (ie res/info fields) and return the native form name of the file after being "stripped".

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_MAKE_NATIVE) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode,          // Handle of vnode
    P_STRING            pName           // In/Out: Return buffer for native name
);
#define VNMakeNative(pVolInfo, vnode, pName) \
    ((pVolInfo)->cmn.pRtns->pVNodeMakeNative) \
        (pVolInfo, vnode, pName)
```

Misc functions follow:

VNFlush

Flushes all buffers associated with this vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_FLUSH) (
    P_VOL_INFO          pVolInfo,
    VOL_VNODE           vnode           // Handle of vnode
);
#define VNFlush(pVolInfo, vnode) \
    ((pVolInfo)->cmn.pRtns->pVNodeFlush) \
        (pVolInfo, vnode)
```

DirIdGetParent

Gets the dir id of the parent of a node (also identified by dir id).

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_DIRID_GET_PARENT) (
    P_VOL_INFO          pVolInfo,
    U32                 node,           // Node identified by dir id
    P_U32               pParent,        // In/Out: dir id of parent
    P_BOOLEAN           pParentIsRoot   // In/Out: parent is root
);
#define DirIdGetParent(pVolInfo, node, pParent, pParentIsRoot) \
    ((pVolInfo)->cmn.pRtns->pDirIdGetParent) \
        (pVolInfo, node, pParent, pParentIsRoot)
```

Debugging functions follow:

VNRefCount

Gets the volume's ref count for a vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_VNODE_REF_COUNT) (
    P_VOL_INFO          pVolInfo,       // Vol Info
    VOL_VNODE           vnode,          // The vnode to get info about
    P_U16               pRefCount       // Out: Reference count on vnode
);
#define VNRefCount(pVolInfo, vnode, pRefCount) \
    ((pVolInfo)->cmn.pRtns->pVNodeRefCount) \
        (pVolInfo, vnode, pRefCount)
```

This is the definition for the table of volume routines:

```
typedef struct  VOL_RTNS {
    // Vol General...
    P_VOL_STATUS            pVolStatus;
    P_VOL_SET_VOL_NAME      pVolSetVolName;
    P_VOL_UPDATE_VOL_INFO   pVolUpdateVolInfo;
    P_VOL_SPECIFIC_MSG      pVolSpecificMsg;
    // VNode Access...
    P_VNODE_GET             pVNodeGet;
    P_VNODE_NEXT_CHILD      pVNodeNextChild;
    P_VNODE_GET_BY_DIR_ID   pVNodeGetByDirId;
    P_VNODE_DUP             pVNodeDup;
    P_VNODE_RELEASE        pVNodeRelease;
    // Directory Handle Related...
    P_VNODE_CREATE         pVNodeCreate;
    P_VNODE_DELETE         pVNodeDelete;
    P_VNODE_MOVE           pVNodeMove;
    P_VNODE_DIR_POS_DEL_ADJ pVNodeDirPosDelAdj;
    P_VNODE_GET_DIR_ID     pVNodeGetDirId;
    // File Handle Related...
    P_VNODE_READ           pVNodeRead;
    P_VNODE_WRITE          pVNodeWrite;
    P_VNODE_GET_SIZE       pVNodeGetSize;
    P_VNODE_SET_SIZE       pVNodeSetSize;
    // Attributes...
    P_VNODE_GET_NAME       pVNodeGetName;
    P_VNODE_GET_NUM_ATTRS  pVNodeGetNumAttrs;
    P_VNODE_GET_ATTR_INFO  pVNodeGetAttrInfo;
    P_VNODE_SET_ATTR_INFO  pVNodeSetAttrInfo;
    P_VNODE_MAKE_NATIVE    pVNodeMakeNative;
    // Misc...
    P_VNODE_FLUSH          pVNodeFlush;
    P_DIRID_GET_PARENT     pDirIdGetParent;
    // Debugging...
    P_VNODE_REF_COUNT      pVNodeRefCount;
    // Spares...
    P_UNKNOWN              pSpare1;
    P_UNKNOWN              pSpare2;
    P_UNKNOWN              pSpare3;
} VOL_RTNS, *P_VOL_RTNS;
```

Class FileSystem Messages

These messages are used by volume code

msgFSRegisterVolClass

Registers a volume class with the file system.

Takes P_FS_REGISTER_VOL_CLASS, returns STATUS.

```
#define msgFSRegisterVolClass          MakeMsg(clsFileSystem, 0)
```

Arguments

```
typedef struct FS_REGISTER_VOL_CLASS {
    CLASS               volClass;       // Vol class of volume
    FS_VOL_TYPE         volType;        // Type of volume
} FS_REGISTER_VOL_CLASS, *P_FS_REGISTER_VOL_CLASS;
```

msgFSInstallVol

Creates a volume's root dir handle and register it with the file system.

Takes P_FS_INSTALL_VOL, returns STATUS.

Arguments

```
typedef struct FS_INSTALL_VOL {
    OBJ_KEY             key;            // Volume's key.
    CLASS               volClass;       // Class of the volume.
    VOL_VNODE           vnode;          // Root directory vnode.
    P_VOL_INFO          pVolInfo;       // In/Out: Volume info block.
} FS_INSTALL_VOL, *P_FS_INSTALL_VOL;
```

Comments

The volume should mark itself as connected and all observers of **theFileSystem** will be notified that a volume has been installed. (Note: The message is defined in fs.h so observers can use it.)

#define **msgFSInstallVol** MakeMsg(**clsFileSystem**, 1)

msgFSRemoveVol

Removes a volume from the file system and destroy its root dir handle.

Takes P_FS_REMOVE_VOL, returns STATUS.

Arguments

```
typedef struct FS_REMOVE_VOL {
    OBJ_KEY             key;            // Volume's key.
    CLASS               volClass;       // Class of the volume.
    P_VOL_INFO          pVolInfo;       // Volume info block.
} FS_REMOVE_VOL, *P_FS_REMOVE_VOL;
```

Comments

Observers of **theFileSystem** will be notified of the change. (Note: The message is defined in fs.h so observers can use it.)

#define **msgFSRemoveVol** MakeMsg(**clsFileSystem**, 2)

msgFSConnectVol

Marks a volume as connected and notify observers of **theFileSystem**.

Takes P_FS_CONNECT_VOL, returns STATUS.

Arguments

```
typedef struct FS_CONNECT_VOL {
    P_VOL_INFO          pVolInfo;       // Volume info block.
} FS_CONNECT_VOL, *P_FS_CONNECT_VOL;
```

Comments

(Note: The message is defined in fs.h so observers can use it.)

#define **msgFSConnectVol** MakeMsg(**clsFileSystem**, 3)

msgFSDisconnectVol

Marks a volume as disconnected and notify observers of **theFileSystem**.

Takes P_FS_DISCONNECT_VOL, returns STATUS.

Arguments

```
typedef struct FS_DISCONNECT_VOL {
    P_VOL_INFO          pVolInfo;       // Volume info block.
} FS_DISCONNECT_VOL, *P_FS_DISCONNECT_VOL;
```

Comments

(Note: The message is defined in fs.h so observers can use it.)

#define **msgFSDisconnectVol** MakeMsg(**clsFileSystem**, 4)

msgFSVolList

Returns device list for given class and count of volumes of that class.

Takes P_FS_VOL_LIST, returns STATUS.

```
#define msgFSVolList                    MakeMsg(clsFileSystem, 5)
```

Arguments

```
Enum16(FS_VOL_LIST_ACCESS) {
    fsAccessVolList     = 0,            // Also returns head of list.
    fsReleaseVolList    = 1,
    fsGetHeadOfVolList  = 2
};
typedef struct FS_VOL_LIST {
    FS_VOL_LIST_ACCESS  access;         // See above.
    OBJECT              volClass;       // Class of the volumes.
    U16                 volCount;       // Out: Number of volumes.
    P_VOL_INFO          pVolInfo;       // Out: First vol info block.
} FS_VOL_LIST, *P_FS_VOL_LIST;
```

msgFSUnRegisterVolClass

UnRegisters a volume class from the file system.

Takes P_CLASS, returns STATUS.

```
#define msgFSUnRegisterVolClass        MakeMsg(clsFileSystem, 6)
```

msgFSVolIsBusy

Checks to see if a volume can be removed.

Takes P_FS_VOL_INFO, returns STATUS.

```
#define msgFSVolIsBusy                 MakeMsg(clsFileSystem, 7)
```

Comments

If no user files/dirs are open and all caches have been written to the volume then the volume may be removed. This method should only be called by the volume to be removed.

If the volume can be removed then **stsOK** is returned. If the volume can not be removed then **stsFSVolBusy** is returned.

msgFSExclVolAccess

Allows a volume class to obtain exclusive access to a volume and to release the exclusive access.

Takes P_FS_EXCL_VOL_ACCESS, returns STATUS.

```
#define msgFSExclVolAccess             MakeMsg(clsFileSystem, 8)
```

Arguments

```
Enum16(EXCL_VOL_ACCESS) {
    xvaAcquireVolIfNotBusy  = 1,       // Acquire volume if not accessed
    xvaReleaseVol           = 2
};
typedef struct FS_EXCL_VOL_ACCESS {
    EXCL_VOL_ACCESS     mode;
    P_VOL_INFO          pVolInfo;
} FS_EXCL_VOL_ACCESS, *P_FS_EXCL_VOL_ACCESS;
```

Comments

This is used during the update volume list portions of volume classes. Volume classes should not try to update a volume if it is busy.

If the volume was not busy and was acquired then **stsOK** is returned. If the volume was busy then a non stsOK is returned.

Class Volume Messages

msgVolUpdateVolumes

Has the volume class update its list of volumes.

Takes P_VOL_UPDATE_VOLUMES, returns STATUS.

```
#define msgVolUpdateVolumes            MakeMsg(clsVolume, 0)
```

Arguments

```
Enum16(FS_UPDATE_VOLS_MODE) {
 // An update should be done to all devices
    fsUpdateAllDevices          = flag0,
 // The update request is in response to a power down notification
    fsUpdatePoweringDown        = flag1,
 // The update request is in response to a power up notification
    fsUpdatePoweringUp          = flag2,
 // Update searching for a volume?
    fsUpdateSearchingForVolume  = flag3
};
```

```
typedef struct VOL_UPDATE_VOLUMES {
    FS_UPDATE_VOLS_MODE updateMode;     // See above.
    U32                 spare1;         // For future use.
    U32                 spare2;         // For future use.
} VOL_UPDATE_VOLUMES, *P_VOL_UPDATE_VOLUMES;
```

Comments

All volumes are sent this message every two seconds to give them a chance to do periodic volume updating. If the user has requested a disk/volume that is not connected then volumes are sent this message with the **fsUpdateSearchingForVolume** flag set. Volumes should not notify observers of volume connections, diconnections etc if a search is in progress. The notification should be deferred until a later update request is sent. If the user has triple tapped on the connections notebook, asking to update all volumes, then volumes are sent this message with the **fsUpdateAllDevices** flag set.

Volume Specific Messages

msgVolEjectMedia

Has the volume eject its media.

Takes void, returns STATUS.

```
#define msgVolEjectMedia            MakeMsg(clsVolume, 10)
```

Comments

Passed as a volume specific msg by the file system.

msgVolInvalidateCaches

Allows volumes to invalidate cache buffers at warm boot time.

Takes void, returns STATUS.

```
#define msgVolInvalidateCaches      MakeMsg(clsVolume, 11)
```

Comments

Passed as a volume specific msg by the file system at power up time.

msgVolUpdateBootCode

Reads image of boot sector from mil.res and stores onto boot sector.

Takes void, returns STATUS.

```
#define msgVolUpdateBootCode        MakeMsg(clsVolume, 12)
```

Comments

Passed as a volume specific msg by the installation utility.

Class Volume Messages Formatting

msgVolFormatVolumeInit

This msg is sent to a volume to initiate a reformat of the volume.

Takes P_VOL_FORMAT_MEDIA_INIT, returns STATUS.

```
#define msgVolFormatVolumeInit      MakeMsg(clsVolume, 20)
```

Comments

This initiates the format from the current owner of the block device. The volume object is destroyed (although there is a possibility that the destroy will fail) and then the block device of that volume, the volume offset on the block device and the volume size are returned. Call the volume class that is to format the volume with the message **msgVolFormatMediaInit** passing it this information. It will return a format id.

Note that all other format related messages are sent to the class of the volume, because the volume will no longer exist.

msgVolFormatMediaInit

Takes a block device object and returns a format id to be used with the other format messages.

Takes P_VOL_FORMAT_MEDIA_INIT, returns STATUS.

```
#define msgVolFormatMediaInit           MakeMsg(clsVolume, 21)
```

Arguments

```
typedef struct VOL_FORMAT_MEDIA_INIT {
    OBJECT              blockDevice;    // A block device
    U32                 volumeOffset;   // Format device beginning here
    U32                 volumeSize;     // Amount of device to be formatted
    P_UNKNOWN           formatId;       // Out: Format id
} VOL_FORMAT_MEDIA_INIT, *P_VOL_FORMAT_MEDIA_INIT;
```

Comments

NOTE: **volumeOffset** should be zero and **volumeSize** should be zero if you wish to format the entire device (vs a partition of the device).

msgVolMediaCapacities

Returns the possible format capacities for the device requesting format.

Takes P_VOL_MEDIA_CAPACITIES, returns STATUS.

```
#define msgVolMediaCapacities           MakeMsg(clsVolume, 22)
```

Arguments

```
typedef struct VOL_MEDIA_CAPACITIES {
    P_UNKNOWN           formatId;       // Format id from format/reformat.
    U16                 maxCapacities;  // Size of output capacities array.
    U16                 numCapacities;  // Out: Actual number of capacities.
    P_U32               pCapacities;    // In/Out: Capacities.
} VOL_MEDIA_CAPACITIES, *P_VOL_MEDIA_CAPACITIES;
```

Comments

This messages is sent to the class of the volume.

msgVolFormatMediaSetup

Has the vol class set the media to be ready for a format and determines if the block device will require format media (vs format track).

Takes P_VOL_FORMAT_MEDIA, returns STATUS.

```
#define msgVolFormatMediaSetup          MakeMsg(clsVolume, 23)
```

Arguments

```
typedef struct VOL_FORMAT_MEDIA {
    P_UNKNOWN           formatId;       // Format id from format/reformat.
    U32                 capacity;       // Desired capacity to format for.
    P_STRING            pName;          // Name of re/formatted volume.
    U16                 percentDone;    // Out: Progress report.
} VOL_FORMAT_MEDIA, *P_VOL_FORMAT_MEDIA;
```

Comments

This messages is sent to the class of the volume.

msgVolFormatMediaBegin

Has the vol class begin the format of its media.

Takes P_VOL_FORMAT_MEDIA, returns STATUS.

```
#define msgVolFormatMediaBegin          MakeMsg(clsVolume, 24)
```

Message Arguments

```
typedef struct VOL_FORMAT_MEDIA {
    P_UNKNOWN           formatId;       // Format id from format/reformat.
    U32                 capacity;       // Desired capacity to format for.
    P_STRING            pName;          // Name of re/formatted volume.
    U16                 percentDone;    // Out: Progress report.
} VOL_FORMAT_MEDIA, *P_VOL_FORMAT_MEDIA;
```

Comments

This step may do a format media if format track is not supported by the block device and may partition the media if it needs partitioning.

This messages is sent to the class of the volume.

msgVolFormatMediaCont

Has the vol class do a format of its media.

Takes P_VOL_FORMAT_MEDIA, returns STATUS.

```
#define msgVolFormatMediaCont           MakeMsg(clsVolume, 25)
```

Message Arguments

```
typedef struct VOL_FORMAT_MEDIA {
    P_UNKNOWN           formatId;       // Format id from format/reformat.
    U32                 capacity;       // Desired capacity to format for.
    P_STRING            pName;          // Name of re/formatted volume.
    U16                 percentDone;    // Out: Progress report.
} VOL_FORMAT_MEDIA, *P_VOL_FORMAT_MEDIA;
```

Comments

If format track is supported then this step will format the next track. If the media was formatted during **msgVolFormatMediaBegin** then this will only do verifying of format. If **percentDone** is not 100, then keep calling this until it is.

This messages is sent to the class of the volume.

msgVolCancelFormat

Has the vol class cancel the format.

Takes P_UNKNOWN, returns STATUS.

```
#define msgVolCancelFormat              MakeMsg(clsVolume, 26)
```

Comments

This messages is sent to the class of the volume.

Class Volume Messages Duplicating

msgVolDuplicateVolume

This msg is sent to a volume to initiate a duplication of that volume.

Takes PP_UNKNOWN, returns STATUS.

```
#define msgVolDuplicateVolume           MakeMsg(clsVolume, 30)
```

Comments

A duplicate block is then allocated and a **duplicateId** that can be used with the other duplicate messages is returned. Note that the other messages are sent to the class of the volume.

msgVolDuplicateMedia

Has the volume class duplicate more of the disk.

Takes P_VOL_DUPLICATE_MEDIA, returns STATUS.

```
#define msgVolDuplicateMedia            MakeMsg(clsVolume, 31)
```

Arguments

```
typedef struct VOL_DUPLICATE_MEDIA {
    P_UNKNOWN           duplicateId;    // Duplicate id from duplicate.
    BOOLEAN             sourceDisk;     // Is this source or destination?
    U16                 percentDone;    // Out: Progress report.
} VOL_DUPLICATE_MEDIA, *P_VOL_DUPLICATE_MEDIA;
```

Comments

If source is TRUE then data will be read from the source disk. If source is FALSE then data is written to the destination disk. The value **percentDone** is updated to reflect how much of the duplication has been completed. If **percentDone** is not 100, then keep calling this until it is.

msgVolDuplicateReady

Checks to see if the source/dest disk of the duplicate is ready.

Takes P_VOL_DUPLICATE_MEDIA, returns STATUS.

```
#define msgVolDuplicateReady            MakeMsg(clsVolume, 32)
```

Message Arguments

```
typedef struct VOL_DUPLICATE_MEDIA {
    P_UNKNOWN           duplicateId;    // Duplicate id from duplicate.
    BOOLEAN             sourceDisk;     // Is this source or destination?
    U16                 percentDone;    // Out: Progress report.
} VOL_DUPLICATE_MEDIA, *P_VOL_DUPLICATE_MEDIA;
```

Comments

The return **percentDone** is unused.

msgVolCancelDuplication

Have the vol class cancel the duplication.

Takes P_UNKNOWN, returns STATUS.

```
#define msgVolCancelDuplication         MakeMsg(clsVolume, 33)
```

VOLGODIR.H

This file contains declarations for the common part of godir volumes. Examples of these include **clsVolDisk** and **clsVolTOPS**.

Information in this file is useful if you are trying to understand the format of PenPoint.dir files or if you are writing an installable volume.

```
#ifndef VOLGODIR_INCLUDED
#define VOLGODIR_INCLUDED
```

Include file dependencies for this include file

```
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef OS_INCLUDED
#include <os.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef FS_INCLUDED
#include <fs.h>
#endif
#ifndef VOL_INCLUDED
#include <vol.h>
#endif
```

Common #defines and typedefs

Defines

GO directory related defines

```
#define goNameIndex             0
#define goDirSearchFromFirst    0L
#define goDirHeaderBufSize      112 // Min space for 3 max names plus some.
```

Types

General types

Enumerated constants for searching for particular directory entries

```
Enum16(GO_DIR_FINDTYPE) {
    gdFindEmpty         = 0,
    gdFindNextName      = 1,
    gdFindNativeName    = 2,
    gdFindGoDirName     = 3
};
```

Note that this can also be treated as an array of U32, using the tag part of the associated **fsAttr** as the index into the array, except flags and unused together form a special case of a U32!!!

```
typedef struct VOLGODIR_CMN_ATTRS {
    FS_NODE_FLAGS       flags;
    U16                 unused;         // Was sequence
    FS_DATE_TIME        dateCreated;
    FS_DATE_TIME        dateModified;
    FS_FILE_SIZE        fileSize;
} VOLGODIR_CMN_ATTRS, *P_VOLGODIR_CMN_ATTRS;
```

GO directory related types

Each directory entry is identified as either erased (e) or full (f).

```
Enum16(GO_DIR_ENTRY_TYPES) {
    goDirUnusedEntry    = 'e',
    goDirNodeEntry      = 'f'
};
typedef struct GO_DIR_USER_ATTR {
    FS_ATTR_LABEL       label;          // file system attribute label.
    U16                 size;           // size of value field.
    U8                  value;          // a U32, string or var length attr.
} GO_DIR_USER_ATTR, *P_GO_DIR_USER_ATTR;
typedef struct GO_DIR_ENTRY_HEADER {
    U8                  type;           // 'e': erased or 'f' for file/dir.
    U16                 size;           // Actual size on disk is modulo 32.
} GO_DIR_ENTRY_HEADER, *P_GO_DIR_ENTRY_HEADER;
```

Go name is located at **goDirEntry.buf**, always the first entry. The define **goNameIndex** can be used to index to the name. It is important that the size of GO_DIR_ENTRY is modulo 32.

```
typedef struct GO_DIR_ENTRY {
    GO_DIR_ENTRY_HEADER hdr;
    U16                 numUserAttrs;   // Number of user attributes.
    U8                  nativeNameIndex;// Offset to native file name.
    U8                  rsrvdForLater;  // UNUSED SPARE.
    U8                  userAttrsIndex; // Offset to first user attr.
    FS_NODE_FLAGS       flags;
    U16                 rsrvdForLater2; // WAS SEQUENCE
    FS_DATE_TIME        dateCreated;
    U8                  buf [goDirHeaderBufSize];   // Min space for names.
} GO_DIR_ENTRY, *P_GO_DIR_ENTRY, **PP_GO_DIR_ENTRY;
```

VNode types

VNode related type declarations

```
Enum16(VOLGODIR_VNODE_FLAGS) {
    gdfPenPointDir      = flag1,    // This is a PenPoint.Dir file
    gdfRootDir          = flag2,
    gdfNodeCorrupt      = flag3,
    gdfNodeModified     = flag4,
    gdfHasGoDirParent   = flag5,
    gdfHasGoDirSister   = flag6,
    gdfNoGoDirSister    = flag7
};
typedef struct VOLGODIR_VNODE_COMMON {
    U16                     refCount;
    U16                     numUserAttrs;
    U32                     goDirPos;
    VOLGODIR_VNODE_FLAGS    flags;
    VOLGODIR_CMN_ATTRS      attrs;
} VOLGODIR_VNODE_COMMON;
```

```
typedef struct VOLGODIR_VNODE {
    struct VOLGODIR_VNODE  *pNext;
    VOLGODIR_VNODE_COMMON   cmn;
} VOLGODIR_VNODE, *P_VOLGODIR_VNODE, **PP_VOLGODIR_VNODE;
```

Penpoint dir cache

```
typedef struct GO_DIR_CACHE {
    U32                 size;          // How much of data is valid?
    U32                 base;          // Position in penpoint dir.
    P_VOLGODIR_VNODE    owner;         // Cache for which dir.
    U8                  buffer [512];  // Fixed size buffer.
} GO_DIR_CACHE, *P_GO_DIR_CACHE;
```

VolInfo types

This is the instance data for a GO dir volume object

```
typedef struct VOLGODIR_INFO {
    // Common volume info...
    struct VOLGODIR_INFO   *pNext;
    FS_VOL_HEADER           hdr;
    VOL_COMMON              cmn;
    // Pointer to the low level volumes routines...
    struct VOLGODIR_RTNS   *pRtns;
    // Head of the vnode chain...
    P_VOLGODIR_VNODE        pFirstVNode;
    // Buffer used by the GO DIR volume part - does not need to be inited...
    GO_DIR_ENTRY            goDirEntry;
    // GO DIR buffer & info...
    GO_DIR_CACHE            goDirCache;
    // Beyond this point each volume will have their own info...
    //  .
    //  .
    //  .
} VOLGODIR_INFO, *P_VOLGODIR_INFO;
```

Exported routine that returns pointer GoDirShell entrypoint table

Function Prototype
```
P_VOL_RTNS EXPORTED GoDirShellEntrypoint (void);
```

Typedefs for functions supported by each godir lower level volume

LVStatus

Has a volume check for readiness.

Returns STATUS.

Function Prototype
```
typedef STATUS FunctionPtr(P_LVOL_STATUS) (
    P_VOLGODIR_INFO     pVolInfo,
    P_BOOLEAN           pChanged        // In/Out: Has volume changed?
);
#define LVStatus(pVolInfo, pChanged) \
    ((pVolInfo)->pRtns->pLVolStatus) \
        (pVolInfo, pChanged)
```

Comments

Possible return status are **stsOK**, **stsFSVolDisconnected**, other errors. If status is okay, should indicate if volume has changed.

LVSetVolName

Requests for a volume to set/change its volume name.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVOL_SET_VOL_NAME) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_STRING            pName           // Vol name
);
#define LVSetVolName(pVolInfo, pName) \
    ((pVolInfo)->pRtns->pLVolSetVolName) \
        (pVolInfo, pName)
```

LVUpdateInfo

Requests for a volume to update its user accessable volume info.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVOL_UPDATE_INFO) (
    P_VOLGODIR_INFO     pVolInfo        // Vol Info
);
#define LVUpdateInfo(pVolInfo) \
    ((pVolInfo)->pRtns->pLVolUpdateInfo) \
        (pVolInfo)
```

LVSpecificMsg

Passes a volume specific message down to a volume.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVOL_SPECIFIC_MSG) (
    P_VOLGODIR_INFO     pVolInfo,
    P_VOLGODIR_VNODE    pVNode,         // Handle of vnode
    MESSAGE             msg,            // Message
    P_UNKNOWN           pArgs           // In/Out: Arguments for message
);
#define LVSpecificMsg(pVolInfo, pVNode, msg, pArgs) \
    ((pVolInfo)->pRtns->pLVolSpecificMsg) \
        (pVolInfo, pVNode, msg, pArgs)
```

LVNGet

Gets a vnode given **pVolInfo**, **dirVNode** and name of node in the directory.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_GET) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pDirVNode,      // VNode of parent directory
    P_STRING            pFileName,      // Name of file node
    P_UNKNOWN           pVolSpecific,   // Vol specific info
    PP_VOLGODIR_VNODE   ppVNode         // Out: Returned vnode handle
);
#define LVNGet(pVolInfo, pDirVNode, pFileName, pVolSpecific, ppVNode) \
    ((pVolInfo)->pRtns->pLVNodeGet) \
        (pVolInfo, pDirVNode, pFileName, pVolSpecific, ppVNode)
```

LVNGetAndOpenParent

Gets a vnode's parent given **pVolInfo** and a vnode and open it.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_GET_OPEN_PARENT) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pVNode,         // VNode to get parent of
    PP_VOLGODIR_VNODE   ppDirVNode,     // Out: VNode handle of parent
    P_BOOLEAN           pComplete       // Out: Did the vnode already exist?
);
#define LVNGetAndOpenParent(pVolInfo, pVNode, ppDirVNode, pComplete) \
    ((pVolInfo)->pRtns->pLVNodeGetAndOpenParent) \
        (pVolInfo, pVNode, ppDirVNode, pComplete)
```

LVNGetAndOpenByDirId

Gets a dir vnode given **pVolInfo** and the directory's **dirID**.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_GET_OPEN_BY_DIR_ID) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pDirVNode,      // VNode of parent of dir
    U32                 dirId,          // Dir ID of vnode to get & open
    PP_VOLGODIR_VNODE   ppDirVNode,     // Out: Returned vnode handle of dir
    P_BOOLEAN           pComplete       // Out: Did the vnode already exist?
);
#define LVNGetAndOpenByDirId(pVolInfo, pDirVNode, dirId, ppDirVNode, pComplete) \
    ((pVolInfo)->pRtns->pLVNodeGetAndOpenByDirId) \
        (pVolInfo, pDirVNode, dirId, ppDirVNode, pComplete)
```

Comments

Note: **pDirVNode** could be null. If it isn't then it can be used.

LVNRelease

Releases a vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_RELEASE) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pVNode          // VNode to release
);
#define LVNRelease(pVolInfo, pVNode) \
    ((pVolInfo)->pRtns->pLVNodeRelease) \
        (pVolInfo, pVNode)
```

LVNOpen

Opens a vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_OPEN) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pVNode,         // VNode to open
    P_STRING            pName,          // Name of node
    VNODE_ACCESS        access          // R/W, exclusivity, etc.
);
#define LVNOpen(pVolInfo, pVNode, pName, access) \
    ((pVolInfo)->pRtns->pLVNodeOpen) \
        (pVolInfo, pVNode, pName, access)
```

LVNClose

Closes a vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_CLOSE) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pVNode          // VNode to close
);
#define LVNClose(pVolInfo, pVNode) \
    ((pVolInfo)->pRtns->pLVNodeClose) \
        (pVolInfo, pVNode)
```

LVNCreate

Creates a file or directory within the directory given.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_CREATE) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pDirVNode,      // Directory where new node belongs
    P_STRING            pName,          // Name of new file/dir
    FS_NODE_FLAGS       fileType        // Create a dir or a file
);
#define LVNCreate(pVolInfo, pDirVNode, pName, fileType) \
    ((pVolInfo)->pRtns->pLVNodeCreate) \
        (pVolInfo, pDirVNode, pName, fileType)
```

LVNDelete

Deletes a file system node; either a dir or a file node.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_DELETE) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pVNode,         // VNode to release
    BOOLEAN             visible         // At root of hierarchical delete?
);
#define LVNDelete(pVolInfo, pVNode, visible) \
    ((pVolInfo)->pRtns->pLVNodeDelete) \
        (pVolInfo, pVNode, visible)
```

LVNMove

Moves a file or directory to a directory w/ the new (old) name.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_MOVE) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pSrcDirVNode,   // Dir of source node
    P_VOLGODIR_VNODE    pSrcVNode,      // Source node
    P_VOLGODIR_VNODE    pDstDirVNode,   // Dir of dest
    P_STRING            pDstName        // Name to give the dest node
);
#define LVNMove(pVolInfo, pSrcDirVNode, pSrcVNode, pDstDirVNode, pDstName) \
    ((pVolInfo)->pRtns->pLVNodeMove) \
        (pVolInfo, pSrcDirVNode, pSrcVNode, pDstDirVNode, pDstName)
```

LVNReadDir

Returns the next entry from the specified directory.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_READ_DIR) (
    P_VOLGODIR_INFO     pVolInfo,         // Vol Info
    P_VOLGODIR_VNODE    pDirVNode,        // Directory to read from
    P_U32               pDirPos,          // In/Out: Current position
    P_STRING            pName             // Out: Name of the node
);
#define LVNReadDir(pVolInfo, pDirVNode, pDirPos, pName) \
    ((pVolInfo)->pRtns->pLVNodeReadDir) \
        (pVolInfo, pDirVNode, pDirPos, pName)
```

LVNDirPosDeleteAdjust

Makes any necessary adjustment to the **dirPos** after a node has been deleted.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_DIR_POS_DEL_ADJUST) (
    P_VOLGODIR_INFO     pVolInfo,
    P_VOLGODIR_VNODE    dirVNode,         // Handle of directory vnode
    P_VOLGODIR_VNODE    vnode,            // Handle of deleted vnode
    P_U32               pDirPos           // In/Out: Dir pos data before delete
);
#define LVNDirPosDeleteAdjust(pVolInfo, dirVNode, vnode, pDirPos) \
    ((pVolInfo)->pRtns->pLVNodeDirPosDelAdjust) \
        (pVolInfo, dirVNode, vnode, pDirPos)
```

LVNGetDirId

Returns a well known constant dir id that represents this directory.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_GET_DIR_ID) (
    P_VOLGODIR_INFO     pVolInfo,         // Vol Info
    P_VOLGODIR_VNODE    pVNode,           // Return dir id of this dir vnode
    P_U32               pDirId            // In/Out: The directory's id
);
#define LVNGetDirId(pVolInfo, pVNode, pDirId) \
    ((pVolInfo)->pRtns->pLVNodeGetDirId) \
        (pVolInfo, pVNode, pDirId)
```

LVNName

Returns the name a file system node.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_NAME) (
    P_VOLGODIR_INFO     pVolInfo,         // Vol Info
    P_VOLGODIR_VNODE    pVNode,           // VNode to get name of
    P_STRING            pName             // In/Out: Name
);
#define LVNName(pVolInfo, pVNode, pName) \
    ((pVolInfo)->pRtns->pLVNodeName) \
        (pVolInfo, pVNode, pName)
```

LVNGetNumAttrs

Returns the number of non-standard attributes, given the vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_GET_NUM_ATTRS) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pVNode,         // VNode of node to read from
    P_U16               pNumAttrs       // Out: num of attrs to get
);
#define LVNGetNumAttrs(pVolInfo, pVNode, pNumAttrs) \
    ((pVolInfo)->pRtns->pLVNodeGetNumAttrs) \
        (pVolInfo, pVNode, pNumAttrs)
```

LVNGetAttrInfo

Gets a node's attributes, given the vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_GET_ATTR_INFO) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pVNode,         // VNode of node to read from
    U16                 num,            // Num of attrs to get
    VNODE_ATTR_FLAGS    flgs,           // Get which common attrs
    P_VNODE_CMN_ATTRS   pCmn,           // Common attrs
    P_U8                pWhich,         // Which user defined attrs
    P_FS_ATTR_LABEL     pLbls,          // In/Out: attribute labels
    P_FS_ATTR_VALUE     pVals,          // In/Out: attribute values
    P_FS_ATTR_SIZE      pSizs           // In/Out: attribute sizes
);
#define LVNGetAttrInfo(pVolInfo, pVNode, num, flgs, pCmn, pWhich, pLbls, pVals, pSizs) \
    ((pVolInfo)->pRtns->pLVNodeGetAttrInfo) \
        (pVolInfo, pVNode, num, flgs, pCmn, pWhich, pLbls, pVals, pSizs)
```

Comments

Which common attributes and which arrays of the label/value/size arrays that need to be filled in are defined by the flgs field. Which particular elements of each (label/value/size) array to be filled in is defined by the **pWhich** byte array. If num is 0 or **pWhich** is null then no label/value/size array elements should be filled in. If an element of **pWhich** is **maxU8** then the corresponding label/value/size array element should be filled in. If the data is known and set then the **pWhich** array element should be set to 1 after setting the values.

LVNSetAttrInfo

Sets a node's attributes, given the vnode.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_SET_ATTR_INFO) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pVNode,         // VNode of node to read from
    U16                 num,            // Num of attrs to set
    VNODE_ATTR_FLAGS    flgs,           // Set which common attrs
    P_VNODE_CMN_ATTRS   pCmn,           // Common attrs
    P_U8                pWhich,         // Which user defined attrs
    P_FS_ATTR_LABEL     pLbls,          // In/Out: attribute labels
    P_FS_ATTR_VALUE     pVals,          // In/Out: attribute values
    P_FS_ATTR_SIZE      pSizs           // In/Out: attribute sizes
);
#define LVNSetAttrInfo(pVolInfo, pVNode, num, flgs, pCmn, pWhich, pLbls, pVals, pSizs) \
    ((pVolInfo)->pRtns->pLVNodeSetAttrInfo) \
        (pVolInfo, pVNode, num, flgs, pCmn, pWhich, pLbls, pVals, pSizs)
```

Comments

Which common attributes and which arrays of the label/value/size arrays that need to be stored are defined by the flgs field. Which particular elements of each (label/value/size) array to be filled in is defined by the **pWhich** byte array. If num is 0 or **pWhich** is null then no label/value/size array elements should be stored. If an element of **pWhich** is **maxU8** then the corresponding label/value/size array element should be stored. If the data is stored successfully then the **pWhich** array element should be set to 1.

LVNRead

Transfers n bytes from position m in a file to a buffer.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_READ) (
    P_VOLGODIR_INFO     pVolInfo,        // Vol Info
    P_VOLGODIR_VNODE    pVNode,          // VNode of node to read from
    U32                 filePos,         // Starting point of read
    U32                 numBytes,        // Number of bytes to be read
    P_U8                pReadBuffer,     // Destination of bytes read
    P_U32               pCount           // Out: Actual number of bytes read
);
#define LVNRead(pVolInfo, pVNode, filePos, numBytes, pReadBuffer, pCount) \
    ((pVolInfo)->pRtns->pLVNodeRead) \
        (pVolInfo, pVNode, filePos, numBytes, pReadBuffer, pCount)
```

LVNWrite

Transfers n bytes from a buffer to position m in a file.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_WRITE) (
    P_VOLGODIR_INFO     pVolInfo,        // Vol Info
    P_VOLGODIR_VNODE    pVNode,          // VNode of node to write to
    U32                 filePos,         // Starting point of the write
    U32                 numBytes,        // Number of bytes to write
    P_U8                pWriteBuffer,    // Destination of bytes to write
    P_U32               pCount           // Out: Actual number of bytes written
);
#define LVNWrite(pVolInfo, pVNode, filePos, numBytes, pWriteBuffer, pCount) \
    ((pVolInfo)->pRtns->pLVNodeWrite) \
        (pVolInfo, pVNode, filePos, numBytes, pWriteBuffer, pCount)
```

LVNGetSize

Returns the size of a file.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_GET_SIZE) (
    P_VOLGODIR_INFO     pVolInfo,        // Vol Info
    P_VOLGODIR_VNODE    pVNode,          // VNode of node to change size of
    P_FS_FILE_SIZE      pSize            // The size of the file
);
#define LVNGetSize(pVolInfo, pVNode, pSize) \
    ((pVolInfo)->pRtns->pLVNodeGetSize) \
        (pVolInfo, pVNode, pSize)
```

LVNSetSize

Adjusts the size of a file.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_SET_SIZE) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pVNode,         // VNode of node to change size of
    FS_FILE_SIZE        newSize         // The new size
);
#define LVNSetSize(pVolInfo, pVNode, newSize) \
    ((pVolInfo)->pRtns->pLVNodeSetSize) \
        (pVolInfo, pVNode, newSize)
```

LVNFlush

Flushes a file.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LVNODE_FLUSH) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_VOLGODIR_VNODE    pVNode          // VNode of node to flush
);
#define LVNFlush(pVolInfo, pVNode) \
    ((pVolInfo)->pRtns->pLVNodeFlush) \
        (pVolInfo, pVNode)
```

LVNativeName

Returns the native file system form of this name.

Returns BOOLEAN.

Function Prototype

```
typedef BOOLEAN FunctionPtr(P_LV_NATIVE_NAME) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    P_STRING            pName           // In/Out: Name
);
#define LVNativeName(pVolInfo, pName) \
    ((pVolInfo)->pRtns->pLVNativeName) \
        (pVolInfo, pName)
```

Comments

A return of true implies that the name was not changed (was native), and a return of false implies that the name was changed to be native.

LDirIdGetParent

Gets the dir id of the parent of a node (also identified by dir id).

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_LDIRID_GET_PARENT) (
    P_VOLGODIR_INFO     pVolInfo,       // Vol Info
    U32                 node,           // Node identified by dir id
    P_U32               pParent,        // In/Out: dir id of parent
    P_BOOLEAN           pParentIsRoot   // In/Out: parent is root
);
#define LDirIdGetParent(pVolInfo, node, pParent, pParentIsRoot) \
    ((pVolInfo)->pRtns->pLDirIdGetParent) \
        (pVolInfo, node, pParent, pParentIsRoot)
```

This is the definition for the table of volume routines

```
typedef struct  VOLGODIR_RTNS {
    P_LVOL_STATUS                   pLVolStatus;
    P_LVOL_SET_VOL_NAME             pLVolSetVolName;
    P_LVOL_UPDATE_INFO              pLVolUpdateInfo;
    P_LVOL_SPECIFIC_MSG             pLVolSpecificMsg;
    P_LVNODE_GET                    pLVNodeGet;
    P_LVNODE_GET_OPEN_PARENT        pLVNodeGetAndOpenParent;
    P_LVNODE_GET_OPEN_BY_DIR_ID     pLVNodeGetAndOpenByDirId;
    P_LVNODE_RELEASE                pLVNodeRelease;
    P_LVNODE_OPEN                   pLVNodeOpen;
    P_LVNODE_CLOSE                  pLVNodeClose;
    P_LVNODE_CREATE                 pLVNodeCreate;
    P_LVNODE_DELETE                 pLVNodeDelete;
    P_LVNODE_MOVE                   pLVNodeMove;
    P_LVNODE_READ_DIR               pLVNodeReadDir;
    P_LVNODE_DIR_POS_DEL_ADJUST     pLVNodeDirPosDelAdjust;
    P_LVNODE_GET_DIR_ID             pLVNodeGetDirId;
    P_LVNODE_NAME                   pLVNodeName;
    P_LVNODE_GET_NUM_ATTRS          pLVNodeGetNumAttrs;
    P_LVNODE_GET_ATTR_INFO          pLVNodeGetAttrInfo;
    P_LVNODE_SET_ATTR_INFO          pLVNodeSetAttrInfo;
    P_LVNODE_READ                   pLVNodeRead;
    P_LVNODE_WRITE                  pLVNodeWrite;
    P_LVNODE_GET_SIZE               pLVNodeGetSize;
    P_LVNODE_SET_SIZE               pLVNodeSetSize;
    P_LVNODE_FLUSH                  pLVNodeFlush;
    P_LV_NATIVE_NAME                pLVNativeName;
    P_LDIRID_GET_PARENT             pLDirIdGetParent;
} VOLGODIR_RTNS, *P_VOLGODIR_RTNS;
```

VSEARCH.H

This file contains the API for **clsVolSearch**.

clsVolSearch inherits from **clsObject**.

Provides file system ui support, including formatting & duplicating disks. **theVolSearcher** is the only instance of **clsVolSearch**.

The categories of functionality provided by **theVolSearcher** are:

- Reformatting/duplicating a volume:

These are sent from the disk viewer when a user selects the format or duplicate volume items from the volume menu. The user is lead thru a series of system notes to get the information and for disk swapping.

- Searching for a volume (because it doesn't exist or is write protected):

This is sent from the file system when a file system request internally returns a **stsFSVolDisconnected** or **stsFSVolReadOnly**.

```
#ifndef VSEARCH_INCLUDED
#define VSEARCH_INCLUDED
```

Include file dependencies

```
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef OSTYPES_INCLUDED
#include <ostypes.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef FS_INCLUDED
#include <fs.h>
#endif
```

Common #defines and typedefs

These defines and enums define the text for the notes displayed by the **volSearcher**. The resources are stored in the system resource file.

Defines

Resource ids

```
#define vsResUIStrings          MakeTag (clsVolSearch, 1)
```

Types

Resource string numbers

```
Enum16(VS_STRING_IDS) {
    vsFindVolumeStrsBase        = 0,
    vsFindGenVolumeStr          = 0,
    vsFindDiskVolumeStr         = 1,
    vsFindRemoteVolumeStr       = 2,
    vsWriteProtectedVolumeStr   = 3,
    vsCancelButtonStr           = 4,
    vsContinueButtonStr         = 5,
    vsPercentDoneStr            = 6,
    vsFmtNoticeStr              = 7,
    vsFmtChooseSizeStr          = 8,
    vsFmtWarningStr             = 9,
    vsFmtAskForNameStr          = 10,
    vsFmtBlankNameErrStr        = 11,
    vsFmtBadCharErrStr          = 12,
    vsFmtInProgressStr          = 13,
    vsDupInProgressStr          = 14,
    vsDupInsertSrcDiskStr       = 15,
    vsDupInsertDstDiskStr       = 16,
    vsDupWriteProtectedStr      = 17,
    vsDupReadingStr             = 18,
    vsDupWritingStr             = 19,
    vsFormattingMediaStr        = 20,
};
```

Messages

msgVSFormatVolume

Reformats an existing volume.

Takes P_VS_FORMAT_VOLUME, returns STATUS.

Arguments

```
typedef struct VOL_FORMAT_VOLUME {
    OBJECT  volumeRootDir;                  // Root dir of volume to format
    CHAR    pVolumeName[nameBufLength];     // Suggested or actual name
    U16     reserved:13,                    // Reserved
            noWarning:1,                    // Do not warn about dangers
            maxSize:1,                      // Format to maximum possible size
            withName:1;                     // Name forced to be pVolumeName
    U32     reserved1;
    U32     reserved2;
} VOL_FORMAT_VOLUME, * P_VOL_FORMAT_VOLUME;
#define msgVSFormatVolume               MakeMsg(clsVolSearch, 5)
```

Comments

The **volumeRootDir** must be the actual root of the volume to be formatted and there cannot be any other handles open on the volume or an error will be returned. **pVolumeName** will be the initial name when the user is asked to provide a name or will be the name if the user is not asked to provide a name (controlled by the **withName** flag). The warning message can be controlled with the **noWarning** flag. And the choose a size interaction can be controlled with the **maxSize** flag.

Return Value

stsRequestNotSupported The volume does not support formatting.

msgVSDuplicateVolume

Copy an existing volume from one floppy disk to another floppy disk.

Takes dir/file handle of a volume, returns STATUS.

```
#define msgVSDuplicateVolume            MakeMsg(clsVolSearch, 6)
```

Return Value **stsRequestNotSupported** The volume does not support duplicating.

msgVSFormatMedia

Formats unformatted media that does belong to any volume.

Takes block device object, returns STATUS.

```
#define msgVSFormatMedia                MakeMsg(clsVolSearch, 7)
```

Comments This message is sent by **theBlockDeviceManager** when it receives a block device reset all and in the process discovers unformatted media on a device.

msgVSUpdateVolumes

Requests **theVolSearcher** to update all volumes.

Takes BOOLEAN, returns STATUS.

```
#define msgVSUpdateVolumes              MakeMsg(clsVolSearch, 8)
```

Comments This message requests the **volSearcher** to ask all volume classes to update their list of volumes. This may result in volumes being installed, removed, connected or disconnected. Interested parties should become observers of **theFileSystem** and look for **msgFSVolChanged** (see fs.h). The argument passed should be true to update all volumes.

This message can only be sent via ObjectSendXXX.

msgVSFormatCompleteNotify

Notifies observers of **theVolSearcher** that a format has completed.

Takes BOOLEAN, returns STATUS.

```
#define msgVSFormatCompleteNotify       MakeMsg(clsVolSearch, 20)
```

Comments The argument passed to the observer indicates whether the format was successful or not. False would be returned if there was an error or if the format was cancelled.

msgVSNameVolume

Prompts user to name an unlabelled volume and adds new name.

Takes root dir handle of volume, returns STATUS.

```
#define msgVSNameVolume             MakeMsg(clsVolSearch, 9)
```

Comments This message is used by volumes that have discovered unlabeled volumes. This message can only be sent via ObjectPostXXX.

Part 8 / System Services

CMPSTEXT.H

This file contains the API definition for the compose-text package.

This package is used to compose a text string that needs to have pieces inserted into it. The format of the strings makes it easy to internationalize and localize the text.

The functions described in this file are contained in SYSUTIL.LIB.

Format Strings

The format strings contain literal text and format codes. A format code starts with '^', has a sequence of one or more digits in the middle, and a single letter at the end. The digits specify which argument to the function to use and the letter indicates the type of the argument. For instance, format code "^2s" indicates that the second argument should be inserted, and that the argument should be a string.

The following fills 'buffer' with the string "a B b A c":

```
SComposeText(&buffer, &size, heap, "a ^2s b ^1s c", "A", "B");
```

The available argument types are:

- ^: Literal '^' character. E.g. use "^^" to put a ^ in a string.
- s: String.
- r: Resource ID of a string resource.
- l: Group number and indexed list resource ID for string list. This uses two arguments.
- d: U32 printed as a decimal number.
- x: U32 printed as a hexadecimal number.
- {: Singular/Plural word forms of the form "{is|are}". When this argument type is used, the routine examines the specified argument. If its value is 1, the first string is used. Otherwise the second string is used.

The following code reads in a string from the TK group for a 'sample' project.

```
SComposeText(&buffer, &size, heap,
        "The filled in string is ^1l.", resGrpTK, sampleListResId);
```

As an example of the '{' format code, the following code generates the first string if **numApples==1** and the second string if **numApples==5**.

```
SComposeText(&buffer, &size, heap,
        "There ^1{is|are} ^1d ^1{apple|apples}.", numApples);
"There is 1 apple."
"There are 5 apples."
```

Memory Management

All of the procedures fill in a buffer with the generated string. There are two ways of supplying the buffer memory.

- You can supply a buffer pointer and buffer length. Do this by passing the pointer as *ppString, the length in *pLength, and a null **heapId**. If this technique is used, and the buffer is too small to hold the results, an error status is returned.

- You can specify a heap from which memory will be allocated. Do this by passing in a valid **heapId**. You are obligated to free the memory when finished.

```
#ifndef CMPSTEXT_INCLUDED
#define CMPSTEXT_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef RESFILE_INCLUDED
#include <resfile.h>
#endif
#include <stdarg.h>
```

Common #defines and Typedefs

```
#define ComposeTextMaxArguments 20      // Maximum number of parameters
```

Functions

SComposeText

Composes a string from a format and arguments.

Returns STATUS.

Function Prototype

```
STATUS CDECL SComposeText(
    PP_CHAR         ppString,
    P_U32           pLength,
    OS_HEAP_ID      heap,
    const P_CHAR    pFormat,
    ...
);
```

Comments

Copy the format argument into the output string, doing the appropriate substitutions for the format codes.

See the section "Memory Management" for information on what values to use for the first three arguments.

VSComposeText

Composes a string from a format and a pointer to the argument list.

Returns STATUS.

Function Prototype

```
STATUS CDECL VSComposeText(
    PP_CHAR         ppString,
    P_U32           pLength,
    OS_HEAP_ID      heap,
    const P_CHAR    pFormat,
    va_list         argList
);
```

Comments

This is the same as SComposeText except the arguments are passed as a pointer to a list.

See the section "Memory Management" for information on what values to use for the first three arguments.

GOMATH.H

This file contains the API definition for fixed point arithmetic. The functions described in this file are contained in PENPOINT.LIB.

The API in this file is all function oriented.

```
#ifndef GOMATH_INCLUDED
#define GOMATH_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
```

Math Operation Error Codes

```
#define stsUnderflow        MakeStatus(clsGOMath, 1)
#define stsOverflow         MakeStatus(clsGOMath, 2)
#define stsMathInvOp        MakeStatus(clsGOMath, 3)
#define stsMathInvStrOp     MakeStatus(clsGOMath, 4)
#define stsMathEqual        MakeStatus(clsGOMath, 5)
#define stsMathFirstHigher  MakeStatus(clsGOMath, 6)
#define stsMathFirstLower   MakeStatus(clsGOMath, 7)
#define stsZeroDivide       MakeStatus(clsGOMath, 8)
//  The following two values are used by the runtime.lib as ERRNO values
#define stsMathDomain       MakeStatus(clsGOMath, 9) // Argument too large
#define stsMathRange        MakeStatus(clsGOMath, 10) // Result too large
```

Math Constants

```
#define GoFx0 ((FIXED) 0x00000000)      // 0.0
#define GoFx1 ((FIXED) 0x00010000)      // 1.0
#define GoFxMinus1 ((FIXED) 0xffff0000) // -1.0
```

Fixed-point Function Prototypes

FxCmp

Compares two FIXED.

Returns S16.

Function Prototype `S16 PASCAL FxCmp(FIXED a, FIXED b);`

Return Value

-1 if a < b.

0 if a = b.

1 if a > b.

FxAdd

Adds two FIXED numbers, producing a FIXED.

Returns STATUS.

Function Prototype
```
STATUS PASCAL FxAdd(FIXED a, FIXED b, P_FIXED pC);
```

Return Value

stsOverflow The integer part of the result overflows a 16-bit signed.

FxAddSC

Macro form of FxAdd with no overflow detection.

Returns FIXED.

```
#define FxAddSC(_f1,_f2) ((FIXED)((_f1) + (_f2)))
```

FxSub

Subtracts two FIXED numbers, producing a FIXED.

Returns STATUS.

Function Prototype
```
STATUS PASCAL FxSub(FIXED a, FIXED b, P_FIXED pC);
```

Return Value

stsOverflow The integer part of the result overflows a 16-bit signed.

FxSubSC

Macro form of FxSub with no overflow detection.

Returns FIXED.

```
#define FxSubSC(_f1,_f2) ((FIXED)((_f1) - (_f2)))
```

FxNegate

Negates a FIXED.

Returns FIXED.

```
#define FxNegate(_f) ((FIXED)(-(_f)))
```

FxMul

Multiplies two FIXED numbers, producing a FIXED.

Returns STATUS.

Function Prototype
```
STATUS PASCAL FxMul(FIXED a, FIXED b, P_FIXED pC);
```

Return Value

stsOverflow The integer part of the result overflows a 16-bit signed.

FxMulSC

Multiplies two FIXED numbers returning the product.

Returns FIXED.

Function Prototype
```
FIXED PASCAL FxMulSC(FIXED a, FIXED b);
```

Comments

No overflow detection is performed.

FxMulInt

Multiplies a FIXED number by an S32, producing a FIXED.

Returns STATUS.

Function Prototype `STATUS PASCAL FxMulInt(FIXED a, S32 b, P_FIXED pC);`

Return Value **stsOverflow** The integer part of the result overflows a 16-bit signed.

FxMulIntSC

Multiplies a FIXED number by an S32, returning the FIXED product.

Returns FIXED.

```
#define FxMulIntSC(_a,_b) ((FIXED)(_a*_b))
```

Comments No overflow detection is performed.

FxMulIntToInt

Multiplies a FIXED number by an S32, producing a rounded S32 product.

Returns STATUS.

Function Prototype `STATUS PASCAL FxMulIntToInt(FIXED a, S32 b, P_S32 pC);`

Return Value **stsOverflow** The integer part of the result overflows a 32-bit signed.

FxMulIntToIntSC

Multiplies a FIXED number by an S32, returning a rounded S32 product.

Returns S32.

Function Prototype `S32 PASCAL FxMulIntToIntSC(FIXED a, S32 b);`

Comments No overflow detection is performed.

FxDiv

Divides two FIXED numbers, producing a FIXED quotient.

Returns STATUS.

Function Prototype `STATUS PASCAL FxDiv(FIXED top, FIXED bottom, P_FIXED pC);`

Return Value **stsOverflow** The integer part of the result overflows a 16-bit signed.

stsZeroDivide The input divisor is zero.

FxDivSC

Divides two FIXED numbers, returning a FIXED quotient.

Returns FIXED.

Function Prototype `FIXED PASCAL FxDivSC(FIXED top, FIXED bottom);`

Comments No overflow or zero-divide detection is performed.

FxDivInts

Divides two 32-bit signed integers, producing a FIXED quotient.

Returns STATUS.

Function Prototype `STATUS PASCAL FxDivInts(S32 top, S32 bottom, P_FIXED pC);`

Return Value

stsOverflow The integer part of the result overflows a 16-bit signed.

stsZeroDivide The input divisor is zero.

FxDivIntsSC

Divides two FIXED numbers, returning a FIXED quotient.

Returns FIXED.

Function Prototype `FIXED PASCAL FxDivIntsSC(S32 top, S32 bottom);`

Comments No overflow or zero-divide detection is performed.

FxDivIntToInt

Divides an S32 by a FIXED, producing a rounded S32 quotient.

Returns STATUS.

Function Prototype `STATUS PASCAL FxDivIntToInt(S32 top, FIXED bottom, P_S32 pC);`

Return Value

stsOverflow The integer part of the result overflows a 16-bit signed.

stsZeroDivide The input divisor is zero.

FxDivIntToIntSC

Divides an S32 by a FIXED, producing a rounded S32 quotient.

Returns S32.

Function Prototype `S32 PASCAL FxDivIntToIntSC(S32 top, FIXED bottom);`

Comments No overflow or zero-divide detection is performed.

FxSin

Returns the sine of an integer angle in degrees.

Returns FIXED.

Function Prototype `FIXED PASCAL FxSin(S16 angle);`

FxCos

Returns the cosine of an integer angle in degrees.

Returns FIXED.

Function Prototype `FIXED PASCAL FxCos(S16 angle);`

FxTan

Returns the tangent of an integer angle in degrees.

Returns FIXED.

Function Prototype `FIXED PASCAL FxTan(S16 angle);`

FxSinFx

Returns the sine of a FIXED angle in degrees.

Returns FIXED.

Function Prototype `FIXED PASCAL FxSinFx(FIXED angle);`

FxCosFx

Returns the cosine of a FIXED angle in degrees.

Returns FIXED.

Function Prototype `FIXED PASCAL FxCosFx(FIXED angle);`

FxTanFx

Returns the tangent of a FIXED angle in degrees.

Returns FIXED.

Function Prototype `FIXED PASCAL FxTanFx(FIXED angle);`

FxArcTanInt

Returns an arctangent value as a FIXED angle.

Returns FIXED.

Function Prototype `FIXED PASCAL FxArcTanInt(S32 top, S32 bottom);`

Comments Computes a FIXED angle whose tangent is the value given by the quotient of the two signed 32-bit integers, top / bottom. The value returned ranges from 0 to 359 degrees.

FxArcTanFx

Returns an arctangent value as a FIXED angle.

Returns FIXED.

Function Prototype `FIXED PASCAL FxArcTanFx(S32 top, S32 bottom);`

Comments Computes a FIXED angle whose tangent is the value given by the quotient of the two signed 32-bit numbers, top / bottom. The value returned ranges from 0 to 359 degrees.

FxAbs

Takes the absolute value of a FIXED.

Returns FIXED.

```
#define FxAbs(_f) (((_f)<0)?FxNegate(_f):(_f))
```

FxRoundToInt

Rounds a FIXED number to a 32-bit signed integer.

Returns S32.

Function Prototype

```
S32 PASCAL FxRoundToInt(FIXED fx);
```

FxRoundToIntSC

Rounds a FIXED number to a 16-bit signed integer.

Returns S16.

```
#define FxRoundToIntSC(_f) (S16)(((_f)+0x8000)>>16)
```

Comments

No overflow detection is performed.

FxChop

Returns the 16-bit signed integer part of a FIXED.

Returns S16.

```
#define FxChop(_f) (S16)((_f)>>16)
#define FxChopSC(_f) (S16)((_f)>>16)
```

FxFraction

Returns the 16-bit fractional part of the absolute value a FIXED.

Returns U16.

```
#define FxFraction(_f) (U16)(FxAbs(_f))
```

FxIntToFx

Converts a 16-bit signed integer into a FIXED.

Returns FIXED.

```
#define FxIntToFx(_i) ((FIXED)(((S32)(_i))<<16))
```

FxMakeFixed

Makes a FIXED with an S16 (integer) and a U116(fraction).

Returns FIXED.

FIXED PASCAL FxMakeFixed(S16 whole, U16 frac); (now in go.h)

FxBinToStr

Converts a FIXED format value into an ascii string in decimal.

Returns nothing.

Function Prototype

```
void PASCAL FxBinToStr(
    FIXED   a,
    P_CHAR  pStr,
    U8      fracDigits,
    U8      maxLen,
    BOOLEAN showCommas
```

Comments

The string will have the format:

{-}xxxxx.xxxxx or {-}xx,xxx.xxxxx.

The number of digits to the left of the decimal point is the minimum number required, and the number of digits to the right of the decimal point is specified in **fracDigits**. The last digit is rounded accurately. If the string will not fit within **maxLen** bytes, then the string "*******" (**maxLen**-1 *'s) will be returned; **maxLen** = 9+fracDigits is sufficient, although any higher number is also acceptable. If **showCommas** is true, then commas will separate the thousands.

FxStrToBin

Converts a null-terminated ascii string to a FIXED.

Returns STATUS.

Function Prototype

```
STATUS PASCAL FxStrToBin(
    P_CHAR  pStr,
    P_FIXED pC
);
```

Comments

The fractional portion will be rounded to fit within 16 bits.

Return Value

stsOverflow The integer part of the result overflows a 16-bit signed.

stsMathInvStrOp A character in the string does not represent a valid number. *pC is set to zero.

INTL.H

Definitions used while internationalizing code.

The main content of this file is macros that map the names of UNICODE string functions for PENPOINT 2.0 to the 8-bit functions used currently. They are intended to be used with items of type CHAR, which are 8-bit currently and will switch to 16-bit in 2.0. By using these macros code that deals with strings will have a chance of working in 2.0 with only a recompile.

```
#ifndef INTL_INCLUDED
#define INTL_INCLUDED
```

UNICODE strings/characters

To define characters or strings in PENPOINT 1.0, use the "U_L" macro on them. This maps to the original string, and thus does nothing. In 2.0 the define will be changed so that it inserts "L" in front of the string. This will convert the character or string into a wide character or string to match the 2.0 definition of CHAR.

Here is some sample code to show its use. This code would compile and run under both 1.0 and 2.0, the only difference would be the space allocated for each character (1 vs. 2 bytes).

```
        CHAR    cc;
        P_CHAR  pString;

        pString = U_L("sample string");
        cc      = U_L('s');

        if (cc == pString[0])
            pString[0]  = U_L('S');
#define U_L(str)        str     // Does nothing in PENPOINT 1.0
// #define U_L(str)     L##str  // Definition to be used in PENPOINT 2.0
```

Mapping of 16-bit string/character functions for 1.0

For each of the sections below, it is necessary to include the base header file in order to use the macros defined here.

These macros are intended to be used with variables of type CHAR. CHAR is currently U8, and will be converted to U16 in PENPOINT 2.0.

Extensions to STRING.H

```
#define Ustrcat         strcat
#define Ustrncat        strncat
#define Ustrcmp         strcmp
#define Ustrncmp        strncmp
#define Ustrcpy         strcpy
#define Ustrncpy        strncpy
#define Ustrlen         strlen
#define Ustrdup         strdup
#define Ustrrev         strrev
#define Ustrset         strset
#define Ustrnset        strnset
#define Ustrchr         strchr
#define Ustrrchr        strrchr
#define Ustrspn         strspn
#define Ustrcspn        strcspn
#define Ustrpbrk        strpbrk
#define Ustrstr         strstr
#define Ustrtok         strtok
#define Ustricmp        stricmp
```

'strcmpi' the same as 'stricmp', we don't need U versions of both.

```
#define Ustrnicmp       strnicmp
#define Ustrlwr         strlwr
#define Ustrupr         strupr
#define Umemcpy         memcpy
#define Umemccpy        memccpy
#define Umemchr         memchr
#define Umemcmp         memcmp
#define Umemicmp        memicmp
#define Umemmove        memmove
#define Umemset         memset
#define Ustrerror       strerror
```

Extensions to CTYPE.H

```
#define Uisalpha        isalpha
#define Uisalnum        isalnum
#define Uisascii        isascii
#define Uiscntrl        iscntrl
#define Uisprint        isprint
#define Uisgraph        isgraph
#define Uisdigit        isdigit
#define Uisxdigit       isxdigit
#define Uislower        islower
#define Uisupper        isupper
#define Uisspace        isspace
#define Uispunct        ispunct
#define Utolower        tolower
#define Utoupper        toupper
```

Extensions to STDLIB.H

```
#define Uatoi           atoi
#define Uatol           atol
#define Uitoa           itoa
#define Ultoa           ltoa
#define Uutoa           utoa
#define Ustrtol         strtol
#define Uatof           atof
#define Ustrtod         strtod
#define Ustrtoul        strtoul
```

This goes directly to its 2.0 definition because it does not make sense on an ascii text stream, and if the current text is not ascii, then having it automatically convert to Unicode by recompile in 2.0 won't work. It is included mostly to reserve the name, and let programers know that it will be available.

```
#define Uswab(s,d,n)    swab((char *)s, (char *)d, n*2)
```

Extensions to STDIO.H

```
#define Ufopen          fopen
#define Usprintf        sprintf
#define Uvsprintf       vsprintf
#define Usscanf         sscanf
#define Uputc           putc
#define Ufputc          fputc
#define Ugetc           getc
#define Ufgetc          fgetc
#define Uungetc         ungetc
#define Ufdopen         fdopen
#define Ufreopen        freopen
#define Uprintf         printf
#define Ufprintf        fprintf
#define Uvprintf        vprintf
#define Uvfprintf       vfprintf
#define Uscanf          scanf
#define Ufscanf         fscanf
#define Uvscanf         vscanf
#define Uvfscanf        vfscanf
#define Uvsscanf        vsscanf
#define Ugetchar        getchar
#define Ufgetchar       fgetchar
#define Ugets           gets
#define Ufgets          fgets
#define Uputchar        putchar
#define Ufputchar       fputchar
#define Uputs           puts
#define Ufputs          fputs
#define Uremove         remove
#define Urename         rename
#define Utmpnam         tmpnam
```

Extensions to FCNTL.H

```
#define Uopen           open
#define Usopen          sopen
#define Ucreat          creat
```

Extensions to TIME.H

```
#define Uasctime        asctime
#define Uctime          ctime
```

Extensions to UNISTD.H

```
#define Urmdir          rmdir
#define Uchdir          chdir
#define Ugetcwd         getcwd
```

Extensions to DIRENT.H

```
#define Uopendir        opendir
#define Ureaddir        readdir
```

OS.H

This file contains the API for the PenPoint kernel. The functions described in this file are contained in PENPOINT.LIB.

The PenPoint kernel provides support for tasking, memory management, inter-task communication and timer services.

```
#ifndef OS_INCLUDED
#define OS_INCLUDED
```

Debugging Flags

PenPoint kernel flag is 'G', values are:

0001	User configuration (copy exes from boot to **theSelectedVolume**)
0002	Enter debugger on faults while scavenging
0004	Display memory sizes for each module loaded and run
0008	Display Stack grow/shrink messages
0010	Save page fault information in a memory buffer
0020	Run in the Ram only configuration
0100	Print various memmgr details
1000	see resfile.h
2000	see resfile.h
4000	see resfile.h
8000	see resfile.h
10000	Internal use only
20000	Call the MIL using the common entry point for full debugging

```
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef OSTYPES_INCLUDED
#include <ostypes.h>
#endif
#ifndef OSHEAP_INCLUDED
#include <osheap.h>
#endif
```

Common #defines and typedefs

```
#define osPageSize              (4*1024)
```

Defines for OS_ITMSG_INFO (mode field)

```
// To generate the mode, OR in OS_TASK_MODE with the defines below.
#define osITMsgNoCopy           flag7   // vs copy buffer
#define osITMsgFrontOfQ         flag6   // vs end of queue
#define osITMsgDefaultMode      0       // Copy msg to end of msg queue
```

◆ Defines for setting priority

```
#define osNumPriorities        51
#define osDefaultPriority      0
```

◆ Defines for region information

```
typedef U8                 OS_REGION_ATTRS;
#define osRgnLocal         flag0
#define osRgnHasAliases    flag1
#define osRgnLocked        flag2   // Not yet implemented!!
#define osRgnNotSwappable  flag3
#define osRgnFrozen        flag4   // Not yet implemented!!
#define osRgnInSlowMem     flag5
Enum16(OS_REGION_TYPE) {
  osRgnData,                       // data region
  osRgnHeap,                       // heap region
  osRgnStack,                      // stack region
  osRgnMemMapFile,                 // memory mapped file region
  osRgnCode                        // code region
};
```

◆ Subtask function type

```
typedef void FunctionPtr(P_OS_SUBTASK_ENTRY) (U32 arg);
Enum16(OS_SET_GET) {
  osValuesSet = flag0,             // Set the value(s) passed in
  osValuesReturn = flag1,          // return the value(s)
  osValuesReturnAndSet = flag0 | flag1  // return and set the value(s)
};
```

◆ Memory access attributes

```
Enum16(OS_ACCESS) {            // access rights of a page
  osReadAccess,                // page allows read access only
  osReadWriteAccess,           // page allows read and write access
  osExecuteAccess,             // page allows execute access only
  osExecuteReadAccess          // page allows execute and read access
};
Enum16(OS_SET_TIME_MODE) {
    osSetTime = flag0,                    // set the time
    osSetDate = flag1,                    // set the date
    osSetTimeZone = flag2,                // set only the time zone
    osSetDateAndTime = osSetTime|osSetDate, // set both the date and time
    // set date, time, and time zone
    osSetAll = osSetTime|osSetDate|osSetTimeZone
};
```

◆ Display modes

```
Enum16(OS_DISPLAY_MODE) {
  osConsole,       // display mode is console
  osGraphics       // display mode is graphics
};
```

◆ Beep error tones

```
Enum16(OS_ERROR_TYPE) {
  osWarning,
  osFatal
};
```

◆ System wide memory information

```
typedef struct OS_MEM_INFO {
  U32       taskMemAllocated;       // amt of mem allocated by the task
  U32       localTaskMemAllocated;  // amt of local mem allocated by the task
  U16       numAllocatedRgns;       // # allocated regions by the task
  U16       numAllocatedLocalRgns;  // # local regions allocated
  U32       taskMemResident;        // amt of allocated mem in ram-this task
  U32       taskMemSwapped;         // amt of allocated mem in swap file-this task
  // system wide statistics
  U32       systemRamSize;          // total amt of memory in the system
  U32       amtInMemoryPool;        // amt of memory in the memory pool
  U32       memFree;                // amt of free ram
  U32       memAllocated;           // total amt of mem allocated by all
  U16       numRgnsAllocated;       // total # regions allocated by all
  U16       numSharedRgnsAllocated; // # shared regions used by all
  U32       pageSize;               // system page size
  // swap file statistics
  U32       memNotSwappable;        // amt of memory not swappable
  U32       swapFileSize;           // size of the swap file
  U32       swapMediaFreePages;     // number of pages free on the swap media
  // system wide allocated memory statistics (currently in ram)
  U32       dataAllocated;          // amt of data allocated
  U32       heapsAllocated;         // amt of heap space allocated
  U32       stacksAllocated;        // amt of stack space allocated
  U32       memMapFilesAllocated;   // amt of mem map file space allocated
  U32       codeAllocated;          // amt of code space allocated
} OS_MEM_INFO, * P_OS_MEM_INFO;
```

◆ Memory usage information

```
// Region info, per type of region (code, data, etc)
typedef struct OS_REGTYPE_INFO {
    U32                 allocated;      // Max size of the region
    U32                 swappable;      // swappable pages in memory
    U32                 nonSwappable;   // non-swappable pages in memory
    U32                 committed;      // committed pages
} OS_REGTYPE_INFO, *P_OS_REGTYPE_INFO;
// Region info, per scope of region (local, shared, etc)
typedef struct OS_REGSCOPE_INFO {
    OS_REGTYPE_INFO     code;           // Executable code
    OS_REGTYPE_INFO     data;           // Data
    OS_REGTYPE_INFO     heap;           // Data used as heaps
    OS_REGTYPE_INFO     stack;          // Stack space
    OS_REGTYPE_INFO     memMapFile;     // Memory-mapped files
} OS_REGSCOPE_INFO, *P_OS_REGSCOPE_INFO;
typedef struct OS_MEM_USE_INFO {
    OS_REGSCOPE_INFO    local;          // Owned by this task only, in local memory
    OS_REGSCOPE_INFO    shared;         // Owned by this task only, in shared memory
    OS_REGSCOPE_INFO    multiOwner;     // Owned by this task and at least one other
    OS_REGSCOPE_INFO    total;          // System-wide totals
    U32                 pageSize;       // System page size
    U32                 systemRamSize;  // total amt of memory in the system
    U32                 memFree;        // mem in the "free" list
    U32                 memAllocated;   // mem not in the "free" list
    U32                 swapFileSize;   // size of the swap file
} OS_MEM_USE_INFO, *P_OS_MEM_USE_INFO;
```

◆ Address information

```
typedef struct OS_ADDRESS_INFO {        // Info for a given memory address
    P_MEM           pRegionBase;        // base of region
    SIZEOF          regionLength;       // length of the region
    OS_ACCESS       access;             // access rights of the region
    OS_TASK_ID      owner;              // owning task for this region
    BOOLEAN         userPriv;           // TRUE - user region, FALSE - kernel
    OS_REGION_ATTRS flags;              // see defines above
    SIZEOF          residentSize;       // amount of region that is resident
    SIZEOF          committedSize;      // amount of region that is committed
    OS_REGION_TYPE  regionType;         // type of region
} OS_ADDRESS_INFO, * P_OS_ADDRESS_INFO;
```

◆ System configuration information

```
typedef struct OS_SYSTEM_INFO {         // system configuration information
    BOOLEAN         mathProcessorPresent; // TRUE = present
    OS_MILLISECONDS millisecondsPerSystick; // ms per clock tick
} OS_SYSTEM_INFO, * P_OS_SYSTEM_INFO;
```

◆ Date and time information

```
// The time zone string is a POSIX format string. See the Watcom library
// reference for PenPoint, TZ environment variable set section for more info.
typedef struct OS_DATE_TIME {
  U32               seconds;    // seconds after the minute -- [0,61]
  U32               minutes;    // minutes after the hour   -- [0,59]
  U32               hours;      // hours after midnight     -- [0,23]
  U32               day;        // day of the month         -- [1,31]
  U32               month;      // months since January     -- [0,11]
  U32               year;       // years since 1900
  U32               dayOfWeek;  // days since Sunday        -- [0,6]
  U32               dayOfYear;  // days since January 1     -- [0,365]
  P_CHAR            pTimeZone;  // time zone string (POSIX format)
} OS_DATE_TIME, * P_OS_DATE_TIME;
```

◆ Loaded program information

```
typedef struct OS_PROG_INFO {
    OS_PROG_HANDLE progHandle;  // program identifying handle
    CHAR name[32+1];            // module name (without the .exe)
    U32 initHeapSize;           // .exe-header initial heap allocation
    U32 initStackSize;          // .exe-header initial stack allocation
    U16 initCS;                 // initial CS (selector, not segment#)
    U32 initIP;                 // initial IP
    U32 nRegions;               // # of regions
    U16 initDS;                 // initial DS
    U16 isDLL       :1,         // 0 for .exes, 1 for DLLs
        isUser      :1,         // 1 for user priv, 0  for system priv
        rsvd        :14;        // reserved for future use.
    U32 fixedSize;              // read-only segments + initialization data
    U32 sharedSize;             // shared read/write segments
    U32 privateSize;            // private read/write segments
    U32 nRequiredModules;       // # modules this depends upon
} OS_PROG_INFO, * P_OS_PROG_INFO;
```

◆ Interrupt information

```
// Note: OR in the flag osIntNumIsHardwareLevel if intNum is a hardware
// interrupt level (vs a MIL logical device id). The flag is defined
// in ostypes.h.
typedef struct OS_INTERRUPT_INFO {          // struct used to set interrupts
  OS_INTERRUPT_ID       intNum;             // logical interrupt id
  P_UNKNOWN             pCode;              // ptr to interrupt routine
} OS_INTERRUPT_INFO, * P_OS_INTERRUPT_INFO;
```

◆ Module entrypoint types

```
Enum16(OS_ENTRYPOINT_TYPE) {
  osEntryName,                          // entrypoint is named
  osEntryOrdinal                        // entrypoint is an ordinal
};
```

◆ Message information

```
typedef struct OS_ITMSG_INFO {      // inter-task message information
  OS_ITMSG_FILTER   filter;         // filter of the message
  P_MEM             pITMsg;         // pointer to inter-task message buffer
  SIZEOF            length;         // length of the message buffer
  U32               token;          // user defined info field
  OS_TASK_ID        taskId;         // dest or sending task Id
  U16               mode;           // see defines for OS_ITMSG_INFO
} OS_ITMSG_INFO;
```

◆ Fast sema struct

```
typedef struct OS_FAST_SEMA {
  U16               count;          // top bit for test and set
                                    // bits 0-14 for recursive counting
  U16               nWaits;         // number of waiters
  OS_TASK_ID        owner;
} OS_FAST_SEMA, *P_OS_FAST_SEMA;
```

Functions

OSProgramInstall

Installs a program into the loader database.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSProgramInstall(
    P_CHAR pCommandLine,            // dlc or exe name (and arguments)
    P_CHAR pWorkingDir,             // working dir of the program
    P_OS_PROG_HANDLE pProgHandle,   // Out: program handle
    P_CHAR pBadName,                // Out: If error, dll/exe that was bad
    P_CHAR pBadRef              // Out: If error, reference that was bad
);
```

Comments

If a dlc file is provided, all dlls in the file will also be loaded if not loaded already.

OSProgramInstall will not return until instance 0 of all loaded dlls and exe are completed. No message dispatching will occur during this time. If communication to the calling task is required, use IMProgramInstall (install.h, install.lib).

See Also

OSProgramDeinstall

Return Value

stsOSBadDLCFormat DLC file is incorrectly formatted

stsOSBadExeFormat A DLL or EXE is invalid in the dlc file

stsOSProgInstallError Use debug version of PenPoint for more info

stsOSModuleNotFound Module name specified in dlc file is invalid

stsOSMissingDependency Import module in an exe or dll was not found

stsOSMisingEntryName Import name in an exe or dll was not found

stsOSMissingEntryOrdinal Import number in an exe or dll was not found

OSProgramDeinstall

Deinstalls a program already loaded into the loader database.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSProgramDeinstall(
    OS_PROG_HANDLE progHandle       // program handle
);
```

Comments

This routine will terminate any dll task wrappers before deinstalling the code. If an exe is being deintalled, all tasks must be terminated before calling this routine.

See Also

OSProgramInstall

Return Value

stsOSInvalidProgramHandle Program handle is incorrect

stsOSDependenciesExist Another program requires this dll or a task is using this module

OSProgramInstantiate

Creates an instance of a program.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSProgramInstantiate(
    OS_PROG_HANDLE progHandle,      // program handle from install
    P_CHAR pCommandLine,            // pathname + arguments
    P_OS_TASK_ID pTaskId            // Out: Task id of the new task
);
```

Comments

The newly created process will be set to the same priority as the caller.

Return Value

stsBadParam Program handle is invalid

OSSubTaskCreate

Creates a new execution thread in this context.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSSubTaskCreate(
    P_OS_SUBTASK_ENTRY pEntrypoint,     // Function entrypoint
    SIZEOF stackSize,                   // ignored.
    U16 mustBeZero,                     // reserved
    U32 arg,                            // arg passed to function
    P_OS_TASK_ID pTaskId                // Out: new task id
);
```

Comments

The entrypoint that starts the subtask must NOT return. To terminate the task, use OSTaskTerminate (OSThisTask ()) as the last line in the routine. The newly created task will be set to the same priority as the caller.

The initial stack size of the subtask will be set to 4096 bytes. The **stackSize** parameter will be ignored. Stacks will automatically grow to accomodate a program's stack requirements.

OSTaskTerminate

Terminates a task.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSTaskTerminate(
    OS_TASK_ID taskId,                  // task to terminate
    OS_TASK_ERROR exitCode              // reason for terminating exit code
);
```

Comments

Callers to OSTaskTerminate will not return until the task has successfully terminated. Task termination will cause the following events to occur:

1) if a process is terminated, all subtasks are first terminated
2) observers of **theProcess** will be notified (see clsmgr.h). The error code is provided with the notification.
3) objects owned by the terminating task will be scavenged
4) a broadcast message will be sent to all tasks to notify them of the the task termination. The message will be sent on the filter **osTerminatedTaskFilter**. This filter is by default off.

OSNextTerminatedTaskId

Notifies the caller of the tasks that have terminated.

Returns the next task that has terminated.

Function Prototype

```
OS_TASK_ID EXPORTED0 OSNextTerminatedTaskId(
    P_OS_TASK_ERROR pExitCode       // Out: exit code of terminating task
);
```

Comments

The broadcast message for task termination does not include the task identifier of the task that has terminated. To find this out, this routine should be called to get the list of terminated tasks. When **osNullTaskId** is returned, the list ends.

OSThisTask

Passes back the task identifier of the current running task.

Returns OS_TASK_ID.

Function Prototype

```
OS_TASK_ID EXPORTED OSThisTask(void);
```

OSTaskPrioritySet

Sets the priority of a task or a set of tasks.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSTaskPrioritySet(
    OS_TASK_ID taskId,                  // target task
    OS_TASK_MODE mode,                  // task mode
    OS_PRIORITY_CLASS priorityClass,    // new priority class
    U8 priority                         // new priority number
);
```

Comments

The task mode can be used to set the priority of just one task or all tasks in the process family.

See Also

OSTaskPriorityGet

OSTaskPriorityGet

Passes back the priority of a task.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSTaskPriorityGet(
    OS_TASK_ID taskId,                  // target task
    P_OS_PRIORITY_CLASS pPriorityClass, // Out: task's priority class
    P_U8 pPriority                      // Out: task's priority number
);
```

Comments
Both the priority class and the priority within that class are returned.

See Also
OSTaskPrioritySet

OSTaskDelay

Delays the current task for a specified period of time.

Returns STATUS.

Function Prototype
```
void EXPORTED0 OSTaskDelay(
    OS_MILLISECONDS timeLimit   // milliseconds to delay
);
```

Comments
When the machine is turned off, the delay time freezes until the system is turned back on again. OSTaskDelay cannot be called from an interrupt subtask.

OSITMsgSend

Sends an inter-task message to a task or set of tasks.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED0 OSITMsgSend(
    P_OS_ITMSG_INFO pITMsgInfo      // inter-task message info block
);
```

Comments
OSITMsgSend is used to send an inter-task message to 1) a single task, or 2) all tasks in a task family, or 3) all tasks in the system. The combination of the **taskId** and mode fields are used to accomplish this. If broadcasting to all tasks, the **taskId** field is ignored.

An inter-task message is an array of bytes completely uninterpreted by the kernel stored in the **pITMsg** field. If the inter-task message is short (up to U32), it can be stored in the token field for improved performance. The length field is used to store the length of the inter-task message in **pITMsg**. If the length field is 0, the **pITMsg** field is ignored and can be used for more information passing.

Inter-task messages are passed to the destination task in two ways: copy and alias. In copy mode, the message is copied into a new buffer allocated in the context of the destination task. In alias mode, the message is aliased into the destination task. Messages must be full regions when using alias mode.

Messages are normally inserted into the end of the destination message queue. However, it is possible to specify that a message be inserted into the front of the message queue.

Inter-task messages will get delivered to tasks that have a filter mask set to allow messages of the sending messages filter. If sending a message on multiple filters, the message will be delivered if any one of the filters are allowed by the receiving task. No error status is returned if the receiving task does not receive the message due to its filter mask setting.

See Also
OSITMsgReceive

OSITMsgReceive

Receives a message from the task's message queue.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED0 OSITMsgReceive(
    P_OS_ITMSG_INFO pITMsgInfo,     // In-Out: message info block
    OS_MILLISECONDS timeLimit       // amount of time to wait for message
);
```

Comments

Messages are received by specifying a filter or set of filters in the **pITMsgInfo** struct. Any message with a filter that is in that set will match the receive request. The filter in the **pITMsgInfo** struct must always be set on entry.

When a message is received that matches the input filter, the message is removed from the queue and provided to the client.

See Also

OSITMsgSend

OSITMsgPeek

Gets the next message from the message queue without removing it.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSITMsgPeek(
    P_OS_ITMSG_INFO pITMsgInfo,      // In-Out: message info block
    OS_MILLISECONDS timeLimit,       // amount of time to wait for message
    P_OS_ITMSG_ID pITMsgId           // In-Out: id of message received
);
```

Comments

*pITMsgId of null peeks from the front of the queue. Use the previous message id to peek further into the queue. The filter in the **pITMsgInfo** struct must always be set on entry.

See Also

OSITMsgFromId

OSITMsgFromId

Passes back the message associated with the message identifier.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSITMsgFromId(
    P_OS_ITMSG_INFO pITMsgInfo,      // In-Out: message info block
    OS_ITMSG_ID itMsgId              // message id obtained from OSITMsgPeek
);
```

Comments

The message identifier should be obtained by calling OSITMsgPeek.

See Also

OSITMsgPeek

OSITMsgQFlush

Flushes the message queue of all messages matching the message filter.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSITMsgQFlush(
    OS_ITMSG_FILTER itMsgFilter      // message filter of messages to flush
);
```

Comments

If a message has other filters set in addition to **itMsgFilter**, then the message will NOT be flushed.

OSITMsgFilterMask

Sets the filter mask for this task.

Returns the old filter mask.

Function Prototype

```
OS_ITMSG_FILTER EXPORTED0 OSITMsgFilterMask(
    OS_ITMSG_FILTER newITMsgFilter,     // new filter mask for this task
    BOOLEAN setNewFilter        // if true, the new filter mask will be set
);
```

Comments

Setting the mask bit to 1 indicates the message is allowed by this task; 0 otherwise. Any messages sent to this task whose filter bits are off in the filter mask will be discarded.

If **setNewFilter** is FALSE, **newITMsgFilter** is ignored and only the old filter mask is returned.

See Also

OSITMsgSend

OSSemaCreate

Creates a semaphore.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSSemaCreate(
    P_OS_SEMA_ID pSema      // Out: new open semaphore
);
```

Comments

The semaphore will automatically be opened for the process.

See Also

OSSemaOpen

OSSemaOpen

Opens (accesses) an already existing semaphore.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSSemaOpen(
    OS_SEMA_ID sema,            // semaphore
    OS_TASK_ID task             // task wanting to share ownership of sema
);
```

Comments

Tasks should always open someone else's semaphore to guarantee that the semphore will be around even if the original owner of the semaphore terminates.

See Also

OSSemaCreate

OSSemaDelete

Deletes a semaphore.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSSemaDelete(
    OS_SEMA_ID sema         // the semaphore to delete
);
```

Comments

The semaphore will be removed from the system when all owners of the semaphore have deleted it.

See Also

OSSemaCreate

OSSemaRequest

Locks the counting semaphore (increments the count).

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSSemaRequest(
    OS_SEMA_ID sema,            // the semaphore to lock
    OS_MILLISECONDS timeLimit   // max time to wait if already locked
);
```

Comments

OSSemaRequest should be used in conjunction with OSSemaClear when using semaphores to protect critical sections of code. OSSemaRequest/OSSemaClear implement a counting semaphore model which allows nesting of OSSemaRequest calls. Only after the same number of OSSemaClear calls will the next waiting task enter the critical section. Up to 64K nestings are allowed.

If a task has obtained a semaphore via OSSemaRequest and subsequently dies, the semaphore will be given to the next requestor and that requestor will be given the status **stsOSSemaLockBroken**.

Return Value **stsOSSemaLockBroken** Previous locker of semaphore died without clearing the semaphore

stsOSTimeOut The timelimit expired before obtaining the semaphore

See Also OSSemaClear

OSSemaClear

Unlocks the counting semaphore (decrements the count).

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSSemaClear(
    OS_SEMA_ID sema         // the semaphore to unlock
);
```

Comments OSSemaClear should be used in conjunction with OSSemaRequest when using semaphores to protect critical sections of code. OSSemaRequest/OSSemaClear implement a counting semaphore model which allows nesting of OSSemaRequest calls. Only after the same number of OSSemaClear calls will the next waiting task enter the critical section. Up to 64K nestings are allowed.

See Also OSSemaRequest

OSSemaReset

Resets event semaphore (no matter what count).

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSSemaReset(
    OS_SEMA_ID sema         // the semaphore to reset
);
```

Comments OSSemaReset is used with OSSemaSet and OSSemaWait to support event handling. In this model, the client waiting on the event should use OSSemaSet to set the semaphore to 1, and OSSemaWait to wait until the semaphore has been reset to 0. OSSemaReset will reset the semaphore to 0, thereby notifying all tasks waiting on the event. OSSemaReset is normally used in interrupt tasks. The task that is processing the event may actually have received more than one event and should process all events after resetting the semaphore to avoid losing any events.

See Also OSSemaSet

OSSemaSet

Sets the event semaphore to 1.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSSemaSet(
    OS_SEMA_ID sema         // the semaphore to set
);
```

Comments OSSemaSet is used with OSSemaWait and OSSemaReset to support event handling. In this model, the client waiting on the event should use OSSemaSet to set the semaphore to 1, and OSSemaWait to wait until the semaphore has been reset to 0. OSSemaReset will reset the semaphore to 0, thereby notifying the task waiting on the event.

See Also OSSemaReset

OSSemaWait

Waits for the event semaphore to be reset.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED0 OSSemaWait(
    OS_SEMA_ID sema,            // the semaphore to wait on
    OS_MILLISECONDS timeLimit   // max time to wait for the count to go to 0
);
```

Comments OSSemaWait is used with OSSemaSet and OSSemaReset to support event handling. In this model, the client waiting on the event should use OSSemaSet to set the semaphore to 1, and OSSemaWait to wait until the semaphore has been reset to 0. OSSemaReset will reset the semaphore to 0, thereby notifying the task waiting on the event.

Return Value **stsOSSemaLockBroken** Previous locker of semaphore died without clearing the semaphore

stsOSTimeOut The timelimit expired before obtaining the semaphore

See Also OSSemaReset

OSFastSemaInit

Initialize fast sema.

Returns nothing..

```
#define OSFastSemaInit(_pSem) memset ( (_pSem), 0, sizeof(OS_FAST_SEMA) )
```

Comments Fast semaphores provide a fast but unprotected semaphore model. Fast semaphores are simply memory provided by the client as storage area for the state of the semaphore. This storage area must initially be set to 0.

See Also OSFastSemaRequest

OSFastSemaRequest

Fast version of sema request.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED OSFastSemaRequest (
   P_OS_FAST_SEMA pSema
);
```

Comments OSFastSemaRequest should be used in conjunction with OSFastSemaClear when using semaphores to protect critical sections of code. OSFastSemaRequest/OSFastSemaClear implement a counting semaphore model which allows nesting of OSFastSemaRequest calls. Only after the same number of OSFastSemaClear calls will the next waiting task enter the critical section. Up to 64K nestings are allowed.

Fast semaphores are fast by sacrificing protection. The semaphore structure passed into this routine is modified in the same privilege level as the caller. Only if another task owns the semaphore will a privilege level transition occur.

There are a number of important limitations that a developer should understand about fast semaphores.

1) If a task owns a fast semaphore and then dies before releasing it, the

semaphore will not be released automatically by the system.

2) The fast semaphores should not be copied from one location to another.

The routines rely on the address of the semaphore structure being

the same.

See Also OSFastSemaClear

OSFastSemaClear

Fast version of sema clear.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED OSFastSemaClear (
    P_OS_FAST_SEMA pSema
);
```

Comments OSFastSemaClear should be used in conjunction with OSFastSemaRequest when using semaphores to protect critical sections of code. OSFastSemaRequest/OSFastSemaClear implement a counting semaphore model which allows nesting of OSFastSemaRequest calls. Only after the same number of OSFastSemaClear calls will the next waiting task enter the critical section. Up to 64K nestings are allowed.

Fast semaphores are fast by sacrificing protection. The semaphore structure passed into this routine is modified in the same privilege level as the caller. Only if another task is waiting on the semaphore will a privilege level transition occur.

There are a number of important limitations that a developer should understand about fast semaphores.

1) If a task owns a fast semaphore and then dies before releasing it, the

semaphore will not be released automatically by the system.

2) The fast semaphores should not be copied from one location to another.

The routines rely on the address of the semaphore structure being

the same.

See Also OSFastSemaRequest

OSGetTime

Returns local time.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED0 OSGetTime(
    SIZEOF structLength,        // size of the date/time struct
    P_OS_DATE_TIME pDateTime    // Out: date, time and time zone information
);
```

Comments If an error is returned, the time returned will be Jan 1, 1900.

OSSetTime

Sets the time or time zone.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED0 OSSetTime(
    OS_SET_TIME_MODE setMode,    // which attributes to set
    SIZEOF structLength,         // size of the date/time struct
    P_OS_DATE_TIME pDateTime     // date, time and time zone information
);
```

OSProgramInfo

Returns information on the program from the loader.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED0 OSProgramInfo(
    OS_PROG_HANDLE progHandle,       // program handle given out by the loader
    P_OS_PROG_INFO pInfo             // Out: information buffer
);
```

OSProgramInfo will return information on the program handle passed in.no valid handle exists for that number, then the routine will returnon the numerically smallest program handle just largerthe number passed in. The program handle found will be put in theinformation buffer. If no valid handle exists that islarger than **progHandle**, then Nil will be returned in thehandle field of the information structure with **stsOK** beingfrom the function.

To iterate over all program handles in the system, simply start byOSProgramInfo with a **progHandle** of 0. This will return thesmallest program handle. On the next call, use thathandle + 1, and on and on until the returned program handle0.

OSPowerUpTime

Passes back the number of milliseconds since the last reset.

Returns OS_MILLISECONDS.

Function Prototype
```
OS_MILLISECONDS EXPORTED0 OSPowerUpTime(void);
```

ScreenOnlyStringPrint

Prints a string onto the console.

Returns nothing.

Function Prototype
```
void EXPORTED0 ScreenOnlyStringPrint(
    P_STRING pString            // string to print
);
```

Comments: This routine will not log output through the debug log. It will only display characters on the screen.

Debugger

Enters the debugger.

Returns nothing.

```
#ifdef DEBUG
  #define Debugger()         OSDebugger()
#else
  #define Debugger()
#endif
```

Comments

This macro will call the symbolic debugger (DB). If the symbolic debugger is not available the low-level kernel debugger is called. In production code (i.e., compiled without /DDEBUG) this macro does nothing.

OSDebugger

Enters the debugger, should only be called in special situations.

Returns nothing.

Function Prototype

```
void EXPORTED OSDebugger(void);
```

Comments

Most clients should call Debugger NOT OSDebugger. OSDebugger is used in special situations were a debugger needs to be called in production code. When a call to the production version of OSDebugger is made, the debug flag /DD10000 must be set to actually enter the debugger. If the debug flag is not set the call is a NOP.

NOTE: OSDebugger should only be called in exceptional cases, such as, page fault handling.

KeyPressed

Determines if a key is available.

Returns BOOLEAN.

Function Prototype

```
BOOLEAN EXPORTED0 KeyPressed(
    P_U16 pCh           // Out: the char if true is returned
);
```

Comments

This routine is provided for support of low level code below the input system.

The high byte of the key is the scan code.

Return Value

TRUE if a key is available

FALSE if no key is available

See Also

KeyIn

KeyIn

Passes back the next key and the scan code from the keyboard.

Returns a keyboard character.

Function Prototype

```
U16 EXPORTED0 KeyIn(void);
```

Comments

The KeyIn routine is provided for support of low level code below the input system.

The high byte of the key is the scan code.

See Also

KeyPressed

OSDisplay

Changes the display to the console or the graphics screen.

Returns the old display mode.

Function Prototype

```
OS_DISPLAY_MODE EXPORTED0 OSDisplay(
    OS_DISPLAY_MODE newDisplayMode        // set the display mode.
);
```

Comments

This call is only valid on single headed development systems. In all other configurations, the call does nothing.

OSSetInterrupt

Sets up an interrupt handler.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSSetInterrupt(
    P_OS_INTERRUPT_INFO  pIntInfo    // In-Out: interrupt info
);
```

Comments

The old interrupt info is also returned. Callable only in ring 0.

OSTimerAsyncSema

Reset a semaphore after time milliseconds.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSTimerAsyncSema(
    OS_MILLISECONDS time,           // waiting period before sema reset
    OS_SEMA_ID sema,                // semaphore to reset
    P_OS_HANDLE pTransactionHandle  // Out: ptr to transaction handle
);
```

Comments

The transaction handle can be used to stop the request if desired.

OSTimerIntervalSema

Resets a semaphore after each time interval has elapsed.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSTimerIntervalSema(
    OS_MILLISECONDS timeInterval,       // time interval in milliseconds
    OS_SEMA_ID sema,                    // semaphore to reset
    P_OS_HANDLE pTransactionHandle      // Out: timer transaction handle
);
```

Comments

The transaction handle can be used to stop the request if desired.

OSTimerStop

Stops a timer request given its transaction handle.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSTimerStop(
    OS_HANDLE transactionHandle         // transaction to stop
);
```

OSTimerTransactionValid

Checks to see if the timer transaction is valid.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSTimerTransactionValid(
  OS_HANDLE transactionHandle
);
```

OSModuleLoad

Loads a module into the loader's database.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSModuleLoad(
    P_CHAR moduleName,              // Module name or dlc name
    P_CHAR pWorkingDir,             // Working dir of the app
    P_OS_PROG_HANDLE pProgHandle,   // Out: Program handle
    P_CHAR pBadMod,                 // Out: If error, name of module that
                                    // failed, buffer must be
                                    // maxModNameLength+1 long
    P_CHAR pBadReference            // Out: If error, ref name not understood
                                    // buffer must be maxModNameLength+1 long
);
```

Comments

If a dlc file is provided, all dlls in the file will also be loaded if not loaded already.

OSModuleLoad will not return until instance 0 of all loaded dlls are completed. No message dispatching will occur during this time. If communication to the calling task is required, use IMModuleLoad (install.h, install.lib).

See Also

OSProgramInstall

OSEntrypointFind

Finds an entrypoint in a loaded module either by name or by ordinal.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSEntrypointFind(
    OS_ENTRYPOINT_TYPE entryType,       // name or ordinal
    P_STRING pName,                     // name if entryType is name
    U16 ordinal,                        // ordinal if entryType is ordinal
    OS_PROG_HANDLE progHandle,          // Program handle
    PP_MEM ppEntrypoint                 // Out: ptr to entrypoint address
);
```

See Also

OSModuleLoad

OSProcessProgHandle

Passes back the program handle for the process.

Returns the program instance number.

Function Prototype

```
U16 EXPORTED0 OSProcessProgHandle(
    P_OS_PROG_HANDLE pProgHandle        // Out: ptr to program handle
);
```

OSEnvSearch

Searches the environment for the specified variable and returns its value.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSEnvSearch(
    P_STRING  pVariable,            // variable name
    P_STRING  outBuf,               // Out: Output buffer for variable value
    SIZEOF bufLen                   // output buffer length
);
```

OSTaskNameSet

Sets a 4 character name for the given task.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSTaskNameSet(
  OS_TASK_ID       taskId,         // task to name
  P_CHAR           name            // name of task
);
```

OSThisApp

Passes back the application object stored with the current process.

Returns OBJECT.

Function Prototype

```
OBJECT EXPORTED0 OSThisApp(void);
```

OSTaskApp

Passes back the application object for a given process.

Returns OBJECT.

Function Prototype

```
OBJECT EXPORTED0 OSTaskApp(OS_TASK_ID task);
```

OSAppObjectPoke

Stores the application object for the current process.

Returns nothing.

Function Prototype

```
void EXPORTED0 OSAppObjectPoke(
  OBJECT object                 // current processes application object
);
```

OSPowerDown

Powers down the machine.

Returns nothing.

Function Prototype

```
void EXPORTED0 OSPowerDown(void);
```

OSErrorBeep

Outputs a tone based on the type of error encountered.

Returns nothing.

Function Prototype

```
void EXPORTED0 OSErrorBeep(
  OS_ERROR_TYPE  errorType      // type of error
);
```

OSTone

Sends a tone for a given duration at the specified volume level.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSTone(
    U16                 frequency,      // in Hertz
    U16                 duration,       // in milliseconds
    U16                 volumeLevel     // 0 for off; 1 for on
);
```

OSThisWinDev

Passes back the windowing device for this application.

Returns OBJECT.

Function Prototype
```
OBJECT EXPORTED0 OSThisWinDev(void);
```

OSWinDevPoke

Stores the windowing device for the specified process.

Returns nothing.

Function Prototype
```
void EXPORTED0 OSWinDevPoke(
    OS_TASK_ID  process,        // owner of application
    OBJECT      winDev          // Window device object
);
```

OSTaskProcess

Returns the process id for the task specified.

Returns OS_TASK_ID.

Function Prototype
```
OS_TASK_ID EXPORTED0 OSTaskProcess(
    OS_TASK_ID task
);
```

Comments: If the task parameter is invalid, the routine will return **osNullTaskId**.

OSTaskInstallTerminate

Notifies tasks waiting on OSProgramInstall that the instance is finished.

Returns nothing..

Function Prototype
```
void EXPORTED0 OSTaskInstallTerminate(
    BOOLEAN             wait
);
```

Comments: If the parameter is set the TRUE, then the caller will go into an infinite wait state in order to keep the task and it's allocated resources alive.

OSMemInfo

Returns information on memory usage for a specified task.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED0 OSMemInfo (
    SIZEOF          memBufSize,         // size of the info buffer (in bytes)
    P_OS_MEM_INFO   pMemInfo            // Out: info buffer
);
```

OSMemUseInfo

Returns information on memory usage for a specified task.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED0 OSMemUseInfo (
    SIZEOF              memBufSize,     // size of the info buffer (in bytes)
    P_OS_MEM_USE_INFO   pMemInfo        // Out: info buffer
);
```

OSMemAvailable

Return amount of swappable memory available (to caution zone).

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSMemAvailable (
    P_U32               pAvailable
);
```

OSSystemInfo

Passes back information on the system configuration.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSSystemInfo (
    SIZEOF              bufSize,            // size of the info buffer (in bytes)
    P_OS_SYSTEM_INFO    pSystemInfo         // Out: info buffer
);
```

osPrintBufferRoutine

Function variable print routine.

Returns nothing..

Function Prototype

```
extern void FunctionPtr(osPrintBufferRoutine)(P_CHAR pStr, SIZEOF len);
```

Comments

All debug out (Debugf, DPrintf, printf, etc) flows through this function.

OSHEAP.H

This file describes the heap memory management routines.

Heaps are used to allocate local and shared memory efficiently.

The functions described in this file are contained in PENPOINT.LIB.

Introduction

Heaps allocate regions of virtual memory and manage the allocation and freeing of smaller blocks within those regions.

Heaps have many different characteristics which are specified when the heap is created (see OSHeapCreate). For example, heaps can be shared (i.e. put in the shared memory space) or local.

A heap is identified by a heap handle. PenPoint pre-defines two heap handles for each process, as described below. OSHeapCreate also returns the handle of a new heap. Most heap routines take the heap handle as a parameter to identify the heap.

Pre-defined Heaps

PenPoint pre-defines two heaps for every process. These heaps can be used without calling OSHeapCreate.

osProcessHeapId is the handle for the pre-defined local heap in each process.

osProcessSharedHeapId is the handle for the shared heap. The shared heap behavior is the same as the local heap except that the shared heap resides in shared memory. Blocks allocated from the shared heap are accessible from any process.

Quick Start

Many clients call only the following functions, using one of the two pre-defined heaps.

- OSHeapBlockAlloc
- OSHeapBlockFree

Clients who need to create their own heaps also call the following functions:

- OSHeapCreate
- OSHeapDelete

Debugging Flags

Heap Manager debugging flag set is '*'. Defined flags are:

1: Validate heap before OSHeapBlockAlloc and before OSHeapBlockFree
2: Display message for each heap block allocate and free
4: Display message for each heap create and delete10: Validate heap after OSHeapBlockAlloc and after OSHeapBlockFree 20: Display messages about internal region operation (private)

1000	Display messages about the internal workings (private)
8000	Enter the debugger after printing warnings.

Memory Overhead

A heap consists of the memory allocated by the client plus the structures needed by the heap manager itself to maintain the heap. This section describes the overhead imposed by these structures.

A heap is constructed as a collection of REGIONS. The overhead for a region is 36 bytes. By default, regions are 16Kb long; however, a request larger than ~16K causes the creation of a special region whose size is a multiple of 4K and large enough to handle the request.

Each region have any number of allocated blocks within it. The overhead of an allocated block (beyond the size requested) is 4 bytes, plus 0-3 bytes as necessary to pad the whole block up the nearest 32-bit boundary.

```
#ifndef OSHEAP_INCLUDED
#define OSHEAP_INCLUDED
#ifndef GO_INCLUDED
  #include <go.h>
#endif
#ifndef OSTYPES_INCLUDED
  #include <ostypes.h>
#endif
```

Common #defines and typedefs

Heap attributes for OSHeapCreate

```
Enum16(OS_HEAP_MODE) {
  osHeapLocal = 0,              // heap is local to the owning process
  osHeapShared = flag0,         // heap is accessible by all processes
  osHeapReadWrite = 0,          // heap is writable
  osHeapReadOnly = flag1,       // heap is only readable
  osHeapOptSpace = 0,           // heap is optimized for space
  osHeapOptTime = flag2,        // heap is optimized for speed
  osHeapWaitForMem = 0,         // wait for memory to become available
  osHeapOutOfMemErrOK = flag3   // doesn't wait, returns out-of-memory error
  // flags 5-10 reserved as supervisor flags
};
```

Heap information

```
typedef struct OS_HEAP_BLOCK_INFO {
    SIZEOF      numBlocks;      // total number of blocks
    SIZEOF      totalSize;      // total # bytes in all blocks
    SIZEOF      minSize;        // # bytes in smallest block
    SIZEOF      maxSize;        // # bytes in largest block
} OS_HEAP_BLOCK_INFO, * P_OS_HEAP_BLOCK_INFO;
typedef struct OS_HEAP_INFO {                   // info on a given heap
    OS_HEAP_BLOCK_INFO      alloc;              // info for allocated blocks
    OS_HEAP_BLOCK_INFO      free;               // info for free blocks
    U32                     numRegions;         // # regions in heap
    U32                     committedSize;      // # bytes committed
    U32                     decommittedSize;// # bytes decommitted
    U32                     reservedSize;       // # bytes reserved
    U32                     numOwners;          // # tasks which have heap open
    OS_HEAP_MODE            heapMode;           // Mode used in heap creation
} OS_HEAP_INFO, * P_OS_HEAP_INFO;
#define OSTaskSharedHeapId(t) ((OS_HEAP_ID)OSTaskProcess(t))
```

Functions

OSHeapCreate

Creates a heap.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSHeapCreate(
    OS_HEAP_MODE    mode,        // heap create mode
    SIZEOF          size,        // initial region size
    P_OS_HEAP_ID    pHeapId      // Out: heap id
);
```

Comments

The size of the initial region allocated by the heap manager is a parameter to OSHeapCreate. If the amount of memory required by the heap is more than the size of the initial region, the heap manager allocates additional regions of 16K or the last request size, whichever is larger. An initial region size of 0 will default to 16K.

Return Value

stsOSRequestTooBig The requested size is greater than **maxS32**.

stsOutOfMem The heap cannot be created because there is not enough memory available within the system.

stsBadParam The mode parameter specified an illegal mode.

See Also

OSHeapDelete

OSHeapDelete

Deletes a heap. Frees all memory allocated by clients and by the heap manager.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSHeapDelete(
    OS_HEAP_ID  heapId           // heap id of heap to delete
);
```

Comments

Even heap blocks that are still allocated are deleted.

If other tasks have opened the heap (using OSHeapOpen), the heap is not actually deleted until all tasks that have opened the heap have closed it (using OSHeapClosed). Note that this routine is similar to calling OSHeapClose with the current task.

Return Value

stsOSInvalidHeapId The **heapId** was invalid or inaccessible.

See Also

OSHeapCreate

OSHeapAllowError

Changes the "out of memory" behavior of heap block allocation.

Returns OS_HEAP_ID.

```
#define OSHeapAllowError(heap)  \
    ((OS_HEAP_ID)((U32)(heap)|osHeapIdOutOfMemErrOKBit))
#define osHeapIdOutOfMemErrOKBit    flag0
```

Comments

Normally when a heap block is requested, the heap manager returns only when the memory is available. Calling OSHeapAllowError changes the heap so that if the system has insufficient memory the heap manager returns immediately with **stsOutOfMem**.

OSHeapClear

Clears a heap. Deletes all the allocated heap blocks but not the heap.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSHeapClear(
    OS_HEAP_ID  heapId          // heap id of heap to clear
);
```

Return Value

stsOSHeapOpen Heap has multiple owners and cannot be cleared.

stsOSInvalidHeapId The **heapId** was invalid or inaccessible.

See Also

OSHeapDelete

OSHeapBlockAlloc

Allocates a block within the heap.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSHeapBlockAlloc(
    OS_HEAP_ID  heapId,         // heap id
    SIZEOF      size,           // size of block to allocate
    PP_UNKNOWN  ppHeapBlock     // Out: pointer to new heap block
);
```

Comments

The memory for the heap block is obtained from the list of regions in the heap. If a heap allocate request is larger than the available space in the region, a new region is allocated for the request.

The newly allocated block is at least as large as the requested length. Sometimes, the heap manager allocates a block larger than the requested size. Heap blocks are always allocated on 32-bit boundaries.

Heap blocks are allocated on behalf of the creator of the heap. Even if the allocate occurs in a different task than the creator, the new memory is owned by the creator of the heap.

WARNING. This function expects a valid heap identifier. Using an invalid heap identifer can cause unpredictable results (including a page fault). A **heapId** for a heap that has been deleted is considered to be invalid.

See Also

OSHeapBlockFree

Return Value

stsOSRequestTooBig The requested block size greater than **maxS32**.

stsOutOfMem The heap cannot grow any bigger because the system is out of memory.

stsOSInvalidHeapId The **heapId** given is invalid.

stsOSHeapIntegrityError The heap has been corrupted (heap flag 1).

OSHeapBlockFree

Frees a heap block.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSHeapBlockFree(
    P_UNKNOWN   pHeapBlock      // pointer to heap block
);
```

Comments

WARNING. This function expects a valid heap block. Using an invalid heap block can cause unpredictable results (including a page fault).

See Also OSHeapBlockAlloc

Return Value **stsOSInvalidHeapId** The **heapId** given is invalid.

stsOSHeapIntegrityError The heap has been corrupted (heap flag 1) or heap block pointer is bad (debug only).

stsBadParam The heap block pointer is bad (debug only).

OSHeapBlockResize

Resizes a heap block.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED OSHeapBlockResize(
    SIZEOF      newSize,        // new size to allocate
    PP_UNKNOWN  ppHeapBlock     // Out: New pointer is returned here.
);
```

Comments The heap block is resized to the new size. This may be slightly faster than allocating a new block and copying the original block's contents.

After the call the heap block may be identified with a new pointer value, which is returned in *ppHeapBlock.

The actual size of the new heap block may be slightly larger than the request.

WARNING. This function expects a valid heap block. Using an invalid heap block can cause unpredictable results (including a page fault).

OSHeapId

Passes back the heap id from which a heap block has been allocated.

Returns OS_HEAP_ID.

Function Prototype
```
OS_HEAP_ID EXPORTED OSHeapId(
    P_UNKNOWN   pHeapBlock      // pointer to a heap block
);
```

Comments WARNING. This function expects a valid heap block. Using an invalid heap block can cause unpredictable results (including a page fault).

OSHeapBlockSize

Passes back the size of the heap block.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED OSHeapBlockSize(
    P_UNKNOWN   pHeapBlock,     // pointer to the heap block
    P_SIZEOF    pSize           // Out: size of the heap block
);
```

Comments The size returned is the actual size of the heap block. This may be slightly larger than the requested size.

WARNING. This function expects a valid heap block. Using an invalid heap block can cause unpredictable results (including a page fault).

See Also OSHeapBlockAlloc

OSHeapPoke

Stores 32 bits of client info in the heap header.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSHeapPoke(
    OS_HEAP_ID  heapId,         // heap id
    P_UNKNOWN   info            // uninterpreted pointer stored in heap header
);
```

Comments

The client info is not interpreted by the heap manager.

There is only client info field per heap; if more than one call is made to OSHeapPoke, the most recent caller determines the value stored.

WARNING. This function expects a valid heap identifier. Using an invalid heap identifer can cause unpredictable results (including a page fault). An **heapId** for a heap that has been deleted is considered to be invalid.

OSHeapPeek

Passes back the client info previously set via OSHeapPoke().

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSHeapPeek(
    OS_HEAP_ID  heapId,         // heap id
    PP_UNKNOWN  pInfo           // Out: pointer stored by OSHeapPoke
);
```

Comments

WARNING. This function expects a valid heap identifier. Using an invalid heap identifer can cause unpredictable results (including a page fault). A **heapId** for a heap that has been deleted is considered to be invalid.

OSHeapInfo

Passes back information on a heap.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSHeapInfo(
    OS_HEAP_ID      heapId,         // heap id
    SIZEOF          heapInfoSize,   // size of heap info buffer
    P_OS_HEAP_INFO  pHeapInfo       // Out: heap info buffer
);
```

Return Value

stsOSInvalidHeapId The **heapId** was invalid or inaccessible.

stsOSHeapIntegrityError The heap has been corrupted. Under debug version additional info is printed.

OSHeapOpen

Adds the specified task as an owner of the specified heap.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSHeapOpen(
    OS_HEAP_ID heapId,              // heap id
    OS_TASK_ID taskId               // task to add as an owner
);
```

Comments

Heaps are owned by the task that creates them. When the task is destroyed the heap is automatically destroyed. If one task wants to access another task's heap, the heap should be opened. Opening a heap is not required, but if the task owning the heap is destroyed while the second task is accessing the heap, the second task will fault.

Memory resources allocated in the heap are not actually destroyed until the last owner of the heap deletes the heap. Note that if the heap is opened multiple times by the same owner, a corresponding OSHeapClose or OSHeapDelete must occur for each before resources are deallocated.

The kernel automatically destroys heap resources when all of the owners of the heap have terminated.

The heap is automatically opened on the behalf of the creator during an OSHeapCreate.

Return Value

stsOSInvalidHeapId The heap must be a shared heap to be opened, the **heapId** was invalid or inaccessible.

See Also

OSHeapCreate

OSHeapClose

Remove the specifed task as an owner of the specified heap.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSHeapClose(
    OS_HEAP_ID heapId,             // heap id
    OS_TASK_ID taskId              // task to remove as an owner
);
```

Comments

When the heap has been closed by the last owner, the heap is automatically deleted.

Return Value

stsOSInvalidHeapId The **heapId** was invalid or inaccessible.

See Also

OSHeapClose

OSHeapEnumerate

Enumerates all the heaps in the given process.

Returns STATUS.

Function Prototype

```
typedef STATUS FunctionPtr(P_OS_HEAP_ENUMERATE) (
    OS_HEAP_ID          heapId,         // next heap
    OS_HEAP_MODE        heapMode,       // mode of heap
    P_UNKNOWN           clientData      // client data of OSHeapEnumerate
);
```

Function Prototype

```
STATUS EXPORTED OSHeapEnumerate(
    P_OS_HEAP_ENUMERATE pEnumProc,
    P_UNKNOWN           clientData      // passed EnumProc on each call
);
```

Comments

For each heap in the current process, OSHeapEnumerate calls the supplied callback procedure. This routine is supplied with a **heapId** and its mode.

OSHeapEnumerate continues until it has exhausted all the heaps in the current process or the callback routine returns an error status. If the callback procedure returns an error status, processing is terminated and the error status is returned to the caller of OSHeapEnumerate.

Return Value

stsOSInvalidHeapId The **heapId** was invalid or inaccessible.

See Also

OSHeapWalk

OSHeapWalk

Traverses the given heap.

Returns STATUS.

Arguments

```
typedef struct OS_HEAP_WALK_INFO {
    P_UNKNOWN   pBlock;         // address of heap block
    U32         size;           // size of block
    BOOLEAN     inUse;          // true if the block is allocated
    P_UNKNOWN   clientData;     // set to the client data of OSHeapWalk
    // The following fields are only supported by a debugging version of
    // PenPoint's kernel. Changing their value modifies the heap block.
    BOOLEAN     marked;         // true if the block was marked w/OSHeapMark
    OS_TASK_ID  owner;          // last task to allocate or free this block
    P_UNKNOWN   caller;         // address of the last OSHeapBlockAlloc/Free
} OS_HEAP_WALK_INFO, * P_OS_HEAP_WALK_INFO;
typedef STATUS FunctionPtr(P_OS_HEAP_WALK)(P_OS_HEAP_WALK_INFO pInfo);
```

Function Prototype

```
STATUS EXPORTED OSHeapWalk(
    OS_HEAP_ID      heapId,         // heap to walk
    P_OS_HEAP_WALK  pWalkProc,      // procedure to call for each heap block
    P_UNKNOWN       clientData      // passed directly to pWalkProc
);
```

Comments

For each allocated block in the given heap, calls the supplied callback routine, providing the address and size of the block. OSHeapWalk continues until it has exhausted all allocated blocks in the heap or the callback routine returns an error status. If the callback procedure returns an error status, processing is terminated and the error status is immediately returned to the caller of OSHeapWalk.

Return Value

stsOSInvalidHeapId The **heapId** was invalid or inaccessible.

See Also

OSHeapEnumerate

OSHeapMark

Marks all the allocated blocks in given heap.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSHeapMark(
    OS_HEAP_ID heapId               // heap to mark
);
```

Comments

Combining OSHeapMark with OSHeapWalk provides a simple means to track down storage leaks. For example:

```
    // Program is in a known state
    OSHeapMark(myHeap);

    // Lots of OSHeapBlockAlloc/Free calls
    OSHeapBlockAlloc(myHeap, xx, &blk);
    OSHeapBlockFree(blk);

    // Program is back to the known state.
    // Any unmarked heap blocks probably indictate a storage leak
    OSHeapWalk(myHeap, MyHeapWalker);
```

Return Value

stsOSInvalidHeapId The **heapId** was invalid or inaccessible.

See Also

OSHeapWalk

OSHeapPrint

Prints debugging info about the given heap.

Returns STATUS.

Arguments

```
typedef enum OS_HEAP_PRINT_FLAGS {
    osHeapSuppressFree =        flag0,  // Don't print the free blocks
    osHeapSuppressInUse =       flag1,  // Don't print the allocated blocks
    osHeapSuppressMarked =      flag2,  // Don't print the marked blocks
    osHeapSuppressUnmarked =    flag3,  // Don't print the unmarked blocks
    osHeapSuppressSummary =     flag4,  // Don't print the heap summary
    osHeapDisplayRegions =      flag5,  // Print regions in heap
    osHeapPrintAll =            0,      // Display summary and all blocks
    osHeapPrintSummaryOnly =            // Display summary
        osHeapSuppressFree|osHeapSuppressInUse|
        osHeapSuppressMarked|osHeapSuppressUnmarked,
    // Show blocks created since the last call to OSHeapMark
    osHeapPrintActiveBlocks = osHeapSuppressFree|osHeapSuppressMarked
} OS_HEAP_PRINT_FLAGS;
STATUS EXPORTED OSHeapPrint(OS_HEAP_ID heapId, OS_HEAP_PRINT_FLAGS suppress);
```

Comments

OSHeapPrint is only available in a debugging version of the PenPoint kernel. This request is not supported in production versions of Penpoint.

OSHeapPrint assumes the heap is not corrupted; in other words, OSHeapPrint does not duplicate any of the integrity tests done by OSHeapInfo.

Return Value

stsOSInvalidHeapId The **heapId** was invalid or inaccessible.

Flags for OSHeapPrint

OSPRIV.H

This include file describes the prototypes for supervisor privilege PenPoint routines. The functions described in this file are contained in PENPOINT.LIB.

```
#ifndef OSPRIV_INCLUDED
#define OSPRIV_INCLUDED
#ifndef OS_INCLUDED
#include <os.h>
#endif
```

Common #defines and typedefs

The following are heap modes for supervisor level clients

```
#define osHeapSupervisor flag5  // heap memory access is limited to supervisor
#define osHeapNoSwap flag6      // heap memory is never swapped
#define osHeapSystem flag10     // heap is owned by the system not a process
```

Special heap defines for supervisor level clients

```
#define osGlobalHeapId ((OS_HEAP_ID)10)     // predefined heap for sys clients
```

Physical address types

```
typedef U32                 OS_PHYS_ADDR;       // physical mem address
typedef OS_PHYS_ADDR *      P_OS_PHYS_ADDR;
```

Program region information

```
typedef struct OS_PROGRAM_REGION_INFO {
    P_MEM           base;
    SIZEOF          length;
} OS_PROGRAM_REGION_INFO, *P_OS_PROGRAM_REGION_INFO;
```

Functions

OSIntMask

Sets the interrupt mask for a given interrupt.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSIntMask (
    OS_INTERRUPT_ID intNum,     // logical interrupt id
    P_BOOLEAN pEnable           // In-Out: TRUE = enable, returns old mask
);
```

Comments

Note: OR in the flag **osIntNumIsHardwareLevel** if **intNum** is a hardware interrupt level (vs a MIL logical device id). The flag is defined in ostypes.h.

Warning!!! Supervisor privilege only.

OSIntEOI

Send an EOI request to the interrupt controller device.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSIntEOI (
    OS_INTERRUPT_ID intNum      // MIL device id or hw interrupt level
);
```

Comments

Note: OR in the flag **osIntNumIsHardwareLevel** if **intNum** is a hardware interrupt level (vs a MIL logical device id). The flag is defined in ostypes.h.

Warning!!! Supervisor privilege only.

OSProgramRegionInfo

Passes back region information for the debugger.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSProgramRegionInfo (
    OS_PROG_HANDLE              progHandle,     // program handle
    P_U32                       pNRegions,      // Out: number of regions
    P_OS_PROGRAM_REGION_INFO    pRI             // Out: region information
);
```

Comments

Warning!!! Supervisor privilege only.

OSSysSemaRequest

Requests access to a system semaphore.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSSysSemaRequest (
    OS_SEMA_ID sema     // the semaphore to lock
);
```

Comments

System semaphores are regular semaphores with a little more protection. If a task owns a system semaphore, then that task cannot be terminated or suspended by another task until the system semaphore is relinquished. With this feature, tasks can be sure that any system critical data structures will be completely updated.

If the task terminates itself while it owns a system semaphore, then the next task that acquires the system semaphore will get the warning **stsOSSemaLockBroken**.

OSSysSemaClear should be used to relinquish the system semaphore. The function OSSemaCreate is used to create the system semaphore. Any semaphore can become a system semaphore simply by calling this routine. System semaphores are only used for critical section management. Do NOT use system semaphores for event handling.

Like regular semaphores, system semaphores are counting semaphores.

Warning!!! Supervisor privilege only.

Return Value

stsOSSemaLockBroken	Previous locker of semaphore died without clearing the semaphore

See Also

OSSemaCreate

OSSysSemaClear

Releases access to the the system semaphore.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSSysSemaClear (
    OS_SEMA_ID sema     // the semaphore to unlock
);
```

Comments

System semaphores are regular semaphores with a little more protection. If a task owns a system semaphore, then that task cannot be terminated or suspended by another task until the system semaphore is relinquished. With this feature, tasks can be sure that any system critical data structures will be completely updated.

If the task terminates itself while it owns a system semaphore, then the next task that acquires the system semaphore will get the warning **stsOSSemaLockBroken**.

OSSysSemaClear should be used to relinquish the system semaphore. The function OSSemaCreate is used to create the system semaphore. Any semaphore can become a system semaphore simply by calling OSSysSemaRequest/ OSSysSemaClear. System semaphores are only used for critical section management. Do NOT use system semaphores for event handling.

Like regular semaphores, system semaphores are counting semaphores.

Warning!!! Supervisor privilege only.

See Also

OSSysSemaRequest

OSSupervisorCall

Performs a privilege transition to supervisor privilege.

Returns U32.

```
#if defined(__WATCOMC__) && defined(__386__)
#pragma aux OSSupervisorCall parm [eax] [edx] [ecx] modify [gs];
```

Function Prototype

```
U32 __far OSSupervisorCall(
    P_UNKNOWN   pFunction,
    P_UNKNOWN   pStackParms,
    U32         nStackParms
);
#endif
```

Comments

The function passed into the routine will be called by OSSupervisorCall in supervisor privilege. This function will check to verify that the routine passed in is actually a supervisor level routine.

OSSupervisorCall will work correctly if called in supervisor level.

OSTaskAddressInfo

Passes back task and system memory information.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSTaskAddressInfo (
    P_MEM              pAddr,           // memory address
    OS_TASK_ID         owner,           // owner of address
    SIZEOF             statBufSize,     // size of info buffer (in bytes)
    P_OS_ADDRESS_INFO  pAddrInfo        // Out: info buffer
);
```

Comments

Warning!!! Supervisor privilege only.

Data structures used by OSResourcesAvailable

```
Enum16(OS_RESOURCE_ZONE) {
    osResourceZoneNormal,              // Normal: plenty of resource
    osResourceZoneCaution,             // Caution: resource is getting low
    osResourceZoneWarning,             // Warning: resource is low
    osResourceZoneDanger,              // Danger: resource is really low
    osResourceZoneCritical             // Critical: PenPoint will reboot
};
#define numResourceZones        5
typedef struct OS_RESOURCE_AVAILABLE {
    OS_RESOURCE_ZONE        currentZone;
    U32                     resourceAvailable;
    U32                     zoneLimits[numResourceZones];
} OS_RESOURCE_AVAILABLE, *P_OS_RESOURCE_AVAILABLE;
typedef struct OS_RESOURCES_INFO {
    OS_RESOURCE_AVAILABLE   swappableMemory;
    OS_RESOURCE_AVAILABLE   nonSwappableMemory;
    OS_RESOURCE_AVAILABLE   objects;
} OS_RESOURCES_INFO, *P_OS_RESOURCES_INFO;
```

OSResourcesAvailable

Returns info on the available resources in the system.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED0 OSResourcesAvailable (
    SIZEOF                  bufSize,    // size of the info buffer (in bytes)
    P_OS_RESOURCES_INFO     pInfo       // Out: info buffer
);
```

OSMemMapAlloc

Allocates linear memory for memory mapped hardware

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSMemMapAlloc (
    U32                 physAddr,       // address of memory mapped area
    U32                 length,         // length of memory to allocate
    PP_MEM              ppMem           // Out: return ptr to the memory
);
```

Comments

Creates a guard page after the memory. The memory is created with the attributes: read/write data, system privilege, owned by **systemTId**.

Note: the physical address passed in **physAddr** must be within the first 16MB of physical memory.

Warning!!! Supervisor privilege only.

OSMemMapFree

Frees memory which was allocated by OSMemMapAlloc

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSMemMapFree (
    P_MEM               pMem            // ptr to memory to free
);
```

Comments

Warning!!! Supervisor privilege only.

OSDMAMemAlloc

Allocates linear memory that is DMA-able

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSDMAMemAlloc (
    U32             length,         // length of memory to allocate
    OS_TASK_ID      owner,          // owning task id.
    PP_MEM          ppMem           // Out: return ptr to the memory
);
```

Comments

Creates a guard page after the memory. The memory is created with the following attributes:

read/write access

supervisor privilege

Not swappable (every page locked).

All pages are mapped in and are physically contiguous in memory. For machines that have DMA boundary conditions (e.g. can't cross 64k physical boundary), the memory allocated in this region is guaranteed to honor those conditions. Memory will be allocated on system page size boundaries and all allocations will be a minimum of the processor page size.

Warning!!! Supervisor privilege only.

OSDMAMemFree

Frees memory which was allocated by OSDMAMemAlloc

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSDMAMemFree (
    P_MEM           pMem,           // ptr to memory to free
    OS_TASK_ID      owner           // owning task id.
);
```

Comments

Warning!!! Supervisor privilege only.

OSTaskMemInfo

Provides memory info for the system.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED OSTaskMemInfo (
    OS_TASK_ID      taskId,         // info will be returned for task id
    SIZEOF          memBufSize,     // size of the info buffer (in bytes)
    P_OS_MEM_INFO   pMemInfo        // Out: info buffer
);
```

Comments

Warning!!! Supervisor privilege only.

OSVirtToPhys

Translates a virtual address into a physical address.

Returns U32.

Function Prototype

```
U32 EXPORTED OSVirtToPhys (
    P_UNKNOWN pMem              // virtual address
);
```

Comments

Warning!!! Supervisor privilege only.

OSMemLock

Locks pages in memory.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED OSMemLock (
    P_MEM               pMem,       // pointer to memory
    SIZEOF              length      // length in bytes of memory to lock
);
```

Comments

Locked pages will not be paged out of the system. If the page is paged out before this call, then the page will be brought into memory and then locked.

A counter is maintained to keep track of multiple locks on a given page.

Warning!!! Supervisor privilege only.

OSMemUnlock

Unlocks pages in memory.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED OSMemUnlock (
    P_MEM               pMem,       // pointer to memory
    SIZEOF              length      // length in bytes of memory to unlock
);
```

Comments

When the page is unlocked, it may be paged out by the memory manager.

A counter is maintained to keep track of multiple locks on a given page. When the counter goes to 0 then the page will be unlocked.

Warning!!! Supervisor privilege only.

OSTYPES.H

Module Description: This include file describes types for the Penpoint kernel.

```
#ifndef OSTYPES_INCLUDED
#define OSTYPES_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
```

Defines

- Status values: errors

```
#define stsOSBadPointer                 MakeStatus(clsOS, 1)
#define stsOSOutOfMem                   stsOutOfMem
#define stsOSNoMoreOwners               MakeStatus(clsOS, 3)
#define stsOSInvalidPath                MakeStatus(clsOS, 4)
#define stsOSNoSemaExists               MakeStatus(clsOS, 5)
#define stsOSTimeOut                    MakeStatus(clsOS, 6)
#define stsOSSemaReset                  MakeStatus(clsOS, 7)
#define stsOSAliasesExist               MakeStatus(clsOS, 8)
#define stsOSInvalidOperationForTask    MakeStatus(clsOS, 9)
#define stsOSInvalidTaskId              MakeStatus(clsOS, 10)
#define stsOSTransactionInvalid         MakeStatus(clsOS, 11)
#define stsOSRequestTooBig              MakeStatus(clsOS, 12)
#define stsOSHeapIntegrityError         MakeStatus(clsOS, 13)
#define stsOSInvalidHeapId              MakeStatus(clsOS, 14)
#define stsOSSegmentDiscarded           MakeStatus(clsOS, 16)
#define stsOSFlashEraseFailure          MakeStatus(clsOS, 17)
#define stsOSFlashProgramFailure        MakeStatus(clsOS, 18)
#define stsOSBadExeFormat               MakeStatus(clsOS, 19)
#define stsOSInstallInternalError       MakeStatus(clsOS, 20)
#define stsOSMissingEntryName           MakeStatus(clsOS, 21)
#define stsOSMissingEntryOrdinal        MakeStatus(clsOS, 22)
#define stsOSInitiateInternalError      MakeStatus(clsOS, 23)
#define stsOSInitiateStackOverflow      MakeStatus(clsOS, 24)
#define stsOSProgInstallError           MakeStatus(clsOS, 25)
#define stsOSTooManySelectors           MakeStatus(clsOS, 26)
#define stsOSTooManyInstances           MakeStatus(clsOS, 27)
#define stsOSDependenciesExist          MakeStatus(clsOS, 28)
#define stsOSTooManyRequireds           MakeStatus(clsOS, 29)
#define stsOSPathTooLong                MakeStatus(clsOS, 30)
#define stsOSModuleNotFound             MakeStatus(clsOS, 31)
#define stsOSBadDLCFormat               MakeStatus(clsOS, 32)
#define stsOSMissingDependency          MakeStatus(clsOS, 33)
#define stsOSInvalidProgramHandle       MakeStatus(clsOS, 34)
#define stsOSHeapOpen                   MakeStatus(clsOS, 35)
#define stsOSHeapNotOpen                MakeStatus(clsOS, 36)
```

- Status values: warnings

```
#define stsOSSemaLockBroken             MakeWarning(clsOS, 1)
```

- Misc defines

```
#define osNullTaskId            ((OS_TASK_ID)NULL)
#define osNullOpenSema          ((OS_SEMA_ID)NULL)
#define osInvalidHandle         ((OS_HANDLE)NULL)
#define osInfiniteTime          0xFFFFFFFF
#define maxModNameLength        32
```

- Well known heap ids

```
#define osInvalidHeapId         ((OS_HEAP_ID)0)
#define osProcessHeapId         ((OS_HEAP_ID)&OSProcessHeapValue)
#define osProcessSharedHeapId   ((OS_HEAP_ID)OSThisProcess())
```

- Filters

```
#define osAnyITMessage              0xFFFFFFFF
#define osStartupCommandLineFilter  flag0
#define osClsmgrSend                flag0
#define osClsmgrReply               flag1
#define osMILFilter                 flag2
#define osAppSend                   flag3
#define osAppReply                  flag4
#define osTestManagerFilter         flag5
#define osClsmgrPost                flag6
#define osInstallWaitingFilter      flag30
#define osTerminatedTaskFilter      flag31
```

NOTE: flag25 - flag29 reserved for users

```
#define userDefinedFilters          (flag25|flag26|flag27|flag28|flag29)
#define objSendFilter               ((OS_ITMSG_FILTER)osClsmgrSend)
#define objReplyFilter              ((OS_ITMSG_FILTER)osClsmgrReply)
```

Used to treat the **intNum** field as a hardware interrupt level (vs a MIL logical device id) in the routines OSSetInterrupt, OSIntMask and OSIntEOI.

```
#define osIntNumIsHardwareLevel     flag15
```

Typedefs

```
typedef P_UNKNOWN           P_MEM;              // Pointer to memory
typedef U32                 OS_HANDLE;          // Handle to an object
typedef U16                 OS_TASK_ID;         // Task Id
typedef OS_HANDLE           OS_SEMA_ID;         // Open semaphore Id
typedef P_UNKNOWN           OS_PROG_HANDLE;     // Loaded program handle
typedef OS_HANDLE           OS_ITMSG_ID;        // message identifier
typedef U32                 OS_ITMSG_FILTER;    // Inter-task msg filter
typedef U16                 OS_INTERRUPT_ID;    // logical interrupt ID
typedef U32                 OS_MILLISECONDS;    // number of milliseconds
typedef U32                 OS_TASK_ERROR;
typedef P_MEM*              PP_MEM;
typedef OS_HANDLE*          P_OS_HANDLE;
typedef OS_TASK_ID*         P_OS_TASK_ID;
typedef OS_SEMA_ID*         P_OS_SEMA_ID;
typedef OS_PROG_HANDLE*     P_OS_PROG_HANDLE;
typedef OS_ITMSG_ID*        P_OS_ITMSG_ID;
typedef OS_ITMSG_FILTER*    P_OS_ITMSG_FILTER;
typedef OS_TASK_ERROR*      P_OS_TASK_ERROR;
typedef P_UNKNOWN           OS_HEAP_ID, * P_OS_HEAP_ID;
typedef enum OS_TASK_MODE {
  osThisTaskOnly,           // "act" on this task only
  osTaskFamily,             // "act" on all tasks in the task family
  osAllTasks                // "act" on all tasks in the system
} OS_TASK_MODE, * P_OS_TASK_MODE;
```

```
typedef enum OS_PRIORITY_CLASS {
  osDefaultClass,             // use existing class
  osHighPriority,             // the class is "high priority"
  osMedHighPriority,          // the class is "med high priority"
  osMedLowPriority,           // the class is "med low priority"
  osLowPriority               // the class is "low priority"
} OS_PRIORITY_CLASS, * P_OS_PRIORITY_CLASS;
typedef struct OS_ITMSG_INFO* P_OS_ITMSG_INFO;
```

Public Functions

OSThisProcess

Passes back the task id of this tasks process.

Returns OS_TASK_ID.

Function Prototype `OS_TASK_ID EXPORTED0 OSThisProcess(void);`

Comments Note: This function is defined here (instead of in os.h) to satisfy the definition for **osProcessSharedHeapId** above.

SORT.H

Interfaces to sorting routines.

This file contains the API definition for the quicksort sorting algorithm.

NOTE: qsort can be found in stdlib.h

```
#ifndef SORT_INCLUDED
#define SORT_INCLUDED    Version 1.0
```

Public Functions

quicksort

Sorts a linked list of records using the "quicksort" algorithm.

Returns pointer.

```
extern  void ** quicksort(void **head, int (*comp)(void **, void **));
```

Comments

Usage:

```
     struct record *head;
     int comp (struct record *p, struct record *q);

     head = quicksort (head, comp);
```

The routine "quicksort" takes an argument "head", which is a pointer to the first record of a linked list. It also takes an argument "comp", which is the name of a user-supplied routine for comparing two list records. The routine "comp" must take as its arguments a pointer to each of two list records, and must return an integer, either (-1) if the first record is "smaller than" the second, (0) if the first record is "equal to" the second, or (+1) if the first record is "larger than" the second.

After sorting, "quicksort" returns a pointer to the new first record of the linked list (i.e., the new "head" of the list).

The structure of the linked list records is as follows. The first field of each list record must be the "next" pointer. The actual data in the list records may be of variable size.

```
     +------+     +------+     +------+     +------+     +------+
     | head |---->| next |---->| next |---->| next |---->| next |---->pNull
     +------+     +------+     +------+     +------+     +------+
                  | data |     | data |     | data |     | data |
                  | .... |     | .... |     | .... |     | .... |
                  | .... |     +------+     | .... |     | .... |
                  +------+                  | .... |     +------+
                                            +------+
```

The "quicksort" algorithm is fast. However, it is recursive. When there are N records in the list, the maximum recursion depth will average around (ln N) calls. Each recursion puts about 30 bytes on the stack.

TIMER.H

This file contains the API definition for **clsTimer**.

Notes:

"theTimer" is a well known object that provides timer and alarm support.

clsTimer inherits from **clsObject.**

```
#ifndef TIMER_INCLUDED
#define TIMER_INCLUDED
```

Include file dependencies for this include file

```
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef OS_INCLUDED
#include <os.h>
#endif
```

Class Timer Messages

msgTimerRegister

Registers a request for notification.

Takes P_TIMER_REGISTER_INFO, returns STATUS.

```
#define msgTimerRegister            MakeMsg(clsTimer, 1)
```

Arguments

```
typedef struct TIMER_REGISTER_INFO {
  OBJECT            client;             // client object to notify
  OS_MILLISECONDS   time;               // waiting period before msg is sent
  P_UNKNOWN         clientData;         // Uninterpreted client data
  OS_HANDLE         transactionHandle;  // Out: transaction handle
} TIMER_REGISTER_INFO, * P_TIMER_REGISTER_INFO;
```

Comments

Sent by the client to the timer object for notification after a specified time period has elapsed. At that time, **msgTimerNotify** will be sent (via ObjectPost) to the client. See that message for details.

When the machine is turned off, the time period will stop counting down until the machine is turned back on.

To stop the timeout message, use **msgTimerStop**.

The use of ObjectPost to send the **msgTimerNotify** message means that it will be synchronous with input events.

Return Value

stsBadObject The client field cannot be a local object.

msgTimerRegisterAsync

Registers a request for notification.

Takes P_TIMER_REGISTER_INFO, returns STATUS.

```
#define msgTimerRegisterAsync       MakeMsg(clsTimer, 9)
```

Message Arguments

```
typedef struct TIMER_REGISTER_INFO {
  OBJECT            client;             // client object to notify
  OS_MILLISECONDS   time;               // waiting period before msg is sent
  P_UNKNOWN         clientData;         // Uninterpreted client data
  OS_HANDLE         transactionHandle;  // Out: transaction handle
} TIMER_REGISTER_INFO, * P_TIMER_REGISTER_INFO;
```

Comments

Sent by the client to the timer object for notification after a specified time period has elapsed. At that time, **msgTimerNotify** will be sent (via ObjectPostAsync) to the client. See that message for details.

When the machine is turned off, the time period will stop counting down until the machine is turned back on.

To stop the timeout message, use **msgTimerStop**.

The use of ObjectPostAsync to send the **msgTimerNotify** message means that it will NOT be synchronous with input events.

msgTimerRegisterDirect

Registers a request for notification.

Takes P_TIMER_REGISTER_INFO, returns STATUS.

```
#define msgTimerRegisterDirect      MakeMsg(clsTimer, 12)
```

Message Arguments

```
typedef struct TIMER_REGISTER_INFO {
  OBJECT            client;             // client object to notify
  OS_MILLISECONDS   time;               // waiting period before msg is sent
  P_UNKNOWN         clientData;         // Uninterpreted client data
  OS_HANDLE         transactionHandle;  // Out: transaction handle
} TIMER_REGISTER_INFO, * P_TIMER_REGISTER_INFO;
```

Comments

Sent by the client to the timer object for notification after a specified time period has elapsed. At that time, **msgTimerNotify** will be sent (via ObjectPostDirect) to the client. See that message for details.

When the machine is turned off, the time period will stop counting down until the machine is turned back on.

To stop the timeout message, use **msgTimerStop**.

The use of ObjectPostDirect to send the **msgTimerNotify** message means that it will NOT be synchronous with input events.

msgTimerRegisterInterval

Registers a request for interval notification.

Takes P_TIMER_INTERVAL_INFO, returns STATUS.

```
#define msgTimerRegisterInterval            MakeMsg(clsTimer, 2)
```

Arguments

```
typedef struct TIMER_INTERVAL_INFO {
  OBJECT            client;             // client object to notify
  OS_MILLISECONDS   interval;           // waiting interval before msg is sent
  P_UNKNOWN         clientData;         // Uninterpreted client data
  OS_HANDLE         transactionHandle;  // Out: transaction handle
} TIMER_INTERVAL_INFO, * P_TIMER_INTERVAL_INFO;
```

Comments

Sent by the client to the timer for a notification message on a specified time interval. After each time interval, **msgTimerNotify** will be posted (via ObjectPost) to the client.

When the machine is turned off, the time period will stop counting down until the machine is turned back on.

To stop the interval messages, use **msgTimerStop**.

The use of ObjectPost to send the **msgTimerNotify** message means that it will be synchronous with input events.

Return Value

stsBadObject The client field cannot be a local object.

msgTimerStop

Stops a timer transaction.

Takes OS_HANDLE, returns STATUS.

```
#define msgTimerStop                      MakeMsg(clsTimer, 11)
```

msgTimerTransactionValid

Determines if a timer transaction is valid.

Takes OS_HANDLE, returns STATUS.

```
#define msgTimerTransactionValid          MakeMsg(clsTimer, 10)
```

msgTimerNotify

Notifies the client that the timer request has elapsed.

Takes P_TIMER_NOTIFY, returns nothing. Category: advisory message.

```
#define msgTimerNotify                    MakeMsg(clsTimer, 3)
```

Arguments

```
typedef struct TIMER_NOTIFY {
  P_UNKNOWN clientData;             // client data returned
  OS_HANDLE transactionHandle;      // transaction handle
} TIMER_NOTIFY, * P_TIMER_NOTIFY;
```

Comments

Sent by the timer object to the client.

msgTimerAlarmRegister

Registers a request for alarm notification.

Takes P_TIMER_ALARM_INFO, returns STATUS.

```
#define msgTimerAlarmRegister             MakeMsg(clsTimer, 5)
```

Arguments

```
Enum16(TIMER_ALARM_MODE) {
  timerAbsoluteDate,            // alarm only on specified date and time
  timerEveryWeek,               // alarm when dayOfWeek, hours, minutes match
  timerEveryDay                 // alarm when hours and minutes match
};
typedef struct TIMER_ALARM_INFO {
  OBJECT           client;             // client object to notify
  OS_DATE_TIME     alarmTime;          // alarm time
  P_UNKNOWN        clientData;         // Uninterpreted client data
  OS_HANDLE        transactionHandle;  // Out: transaction handle
  TIMER_ALARM_MODE alarmMode;
} TIMER_ALARM_INFO, * P_TIMER_ALARM_INFO;
```

Comments

Alarms differ from timer requests in that a time and date specifies when an alarm is to occur. The timer will ObjectPost **msgTimerAlarmNotify** to the client when the alarm goes off. See that message for details.

Alarms will alarm within a minute of the alarm time.

When the machine is turned off, the alarm is still active. An alarm will turn the machine on.

To stop the alarm, use the message **msgTimerAlarmStop**.

Return Value

stsBadObject The client field cannot be a local object.

msgTimerAlarmStop

Stops a pending alarm request.

Takes OS_HANDLE, returns STATUS.

```
#define msgTimerAlarmStop                  MakeMsg(clsTimer, 6)
```

msgTimerAlarmNotify

Notifies the client that the alarm request has elapsed.

Takes P_ALARM_NOTIFY, returns nothing. Category: advisory message.

```
#define msgTimerAlarmNotify                MakeMsg(clsTimer, 7)
```

Arguments

```
typedef struct ALARM_NOTIFY {
  P_UNKNOWN clientData;            // client data returned
  OS_HANDLE transactionHandle;     // transaction handle
  BOOLEAN   alarmCausedPoweron;    // power up occurred due to alarm
} ALARM_NOTIFY, * P_ALARM_NOTIFY;
```

Comments

Sent by the timer object to the client.

Part 9 / Utility Classes

BKSHELF.H

This file contains the API definition for **clsDVBookshelf.**

clsDVBookshelf inherits from **clsIconWin.**

It provides a view of bookshelves on external disks.

```
#ifndef BKSHELF_INCLUDED
#define BKSHELF_INCLUDED
#ifndef APPWIN_INCLUDED
#include <appwin.h>
#endif // APPWIN_INCLUDED
#ifndef ICONWIN_INCLUDED
#include <iconwin.h>
#endif // ICONWIN_INCLUDED
```

Common #defines and typedefs

```
typedef struct BOOKSHELF_METRICS {
    U32                 spare1;     // Spare: reserved.
    U32                 spare2;     // Spare: reserved.
} BOOKSHELF_METRICS, *P_BOOKSHELF_METRICS;
```

msgNew

Creates a new bookshelf viewer.

Takes P_BOOKSHELF_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct BOOKSHELF_NEW_ONLY {
    BOOKSHELF_METRICS   metrics;    // Initial metrics setting.
    OBJECT              rootDH;     // Dir handle of volume for this bkshelf.
    OBJECT              win;        // Window for move/copy.
    U32                 reserved1;
    U32                 reserved2;
} BOOKSHELF_NEW_ONLY, *P_BOOKSHELF_NEW_ONLY;
#define bookshelfNewFields  \
    iconWinNewFields        \
    BOOKSHELF_NEW_ONLY      bookshelf;
typedef struct BOOKSHELF_NEW {
    bookshelfNewFields
} BOOKSHELF_NEW, *P_BOOKSHELF_NEW;
```

msgBookshelfGetMetrics

Gets current metrics setting.

Takes P_BOOKSHELF_METRICS, returns STATUS.

```
#define msgBookshelfGetMetrics                  MakeMsg(clsDVBookshelf, 1)
```

Message Arguments

```
typedef struct BOOKSHELF_METRICS {
    U32                 spare1;     // Spare: reserved.
    U32                 spare2;     // Spare: reserved.
} BOOKSHELF_METRICS, *P_BOOKSHELF_METRICS;
```

msgBookshelfSetMetrics

Sets current metrics setting.

Takes P_BOOKSHELF_METRICS, returns STATUS.

```
#define msgBookshelfSetMetrics                    MakeMsg(clsDVBookshelf, 2)
```

Message Arguments

```
typedef struct BOOKSHELF_METRICS {
    U32                 spare1;     // Spare: reserved.
    U32                 spare2;     // Spare: reserved.
} BOOKSHELF_METRICS, *P_BOOKSHELF_METRICS;
```

Miscellaneous

```
// "-- Empty --" label tag
#define tagBookshelfEmpty                         MakeTag(clsDVBookshelf, 1)
#define hlpBKBookshelfEmpty                       MakeTag(clsDVBookshelf, 100)
```

BROWSER.H

This file contains the API definition for **clsBrowser**.

clsBrowser inherits from **clsScrollWin.**

clsBrowser provides the UI for viewing and manipulating notebooks and disks.

clsBrowser provides both the Table Of Contents view of "live" data in the notebook and the Disk Viewer view of "dead" data on disk. **clsBrowser** functions include displaying notebook and disk items, navigating the notebook or file system hierarchy, move/copy of documents, export of notebook documents to disk, import of files from disks into the notebook, deleting notebook and disk items, and creating notebook and disk items.

clsBrowser is useful to applications that need to allow users to select sections or documents in the notebook, or items from disk.

Some messages apply only to the TOC view or to the disk view. Disk View only messages are labeled DskView only, TOC view only messages are labeled TOC only.

Many browser messages are sent to self allowing subclasses to modify browser behavior.

Move/Copy Conventions

See embedwin.h for move/copy protocol.

When the source of a move/copy, the browser responds to **msgXferGetList** with:

XferName   can xfer the name of the selection

XferFullPathName   can xfer the full path name of the selection

XferFlatLocator   can xfer the flat locator of the selection

clsFileSystem   can xfer as a file or directory

clsEmbeddedWin   can xfer as "live" data notebook, section, or document

clsExport   If source is TOC and export mode is in effect then do export instead of copy. (see export.h for details)

If the destination is the disk and the **xferList** contains **clsExport** then do export instead of move/copy.

If not an export, and the **xferList** contains **clsEmbeddedWin** then let the embedded win superclass will handle the move/copy.

If the destination is the TOC and source is not a **clsEmbeddedWin** then invoke the import code.

Otherwise, if the source is **clsFileSystem** do a file system move or copy.

```
#ifndef BROWSER_INCLUDED
#define BROWSER_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
```

```
#ifndef UID_INCLUDED
#include <uid.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef FRAME_INCLUDED
#include <frame.h>
#endif
#ifndef FS_INCLUDED
#include <fs.h>
#endif
#ifndef RESFILE_INCLUDED
#include <resfile.h>
#endif
#ifndef SWIN_INCLUDED
#include <swin.h>
#endif
```

Common #defines and typedefs

Sort Types

Defines the order the browser will sort display items by.

```
Enum16 ( SORT_BY ) {
    browserSortByName = 1,
    browserSortBySize = 2,
    browserSortByDate = 3,
    browserSortByPage = 4,
    browserSortByType = 5
};
```

These are tags for the icons used by **clsBrowser**

```
#define tagBrowserSmallFileIcon        MakeTag(clsBrowser,1)
#define tagBrowserBigFileIcon          MakeTag(clsBrowser,2)
#define tagBrowserSmallClosedDirIcon   MakeTag(clsBrowser,3)
#define tagBrowserBigClosedDirIcon     MakeTag(clsBrowser,4)
#define tagBrowserSmallOpenDirIcon     MakeTag(clsBrowser,5)
#define tagBrowserBigOpenDirIcon       MakeTag(clsBrowser,6)
#define tagBrowserSmallClosedSectIcon  MakeTag(clsBrowser,7)
#define tagBrowserBigClosedSectIcon    MakeTag(clsBrowser,8)
#define tagBrowserSmallOpenSectIcon    MakeTag(clsBrowser,9)
#define tagBrowserBigOpenSectIcon      MakeTag(clsBrowser,10)
#define tagBrowserSmallDefaultDocIcon  MakeTag(clsBrowser,11)
#define tagBrowserBigDefaultDocIcon    MakeTag(clsBrowser,12)
```

These are the help ID's used for the various browser items.

```
#define hlpBrowser              MakeTag(clsBrowser,170) // Generic TOC
#define hlpBrowIcon             MakeTag(clsBrowser,169) // TOC
#define hlpBrowName             MakeTag(clsBrowser,171) // TOC
#define hlpBrowPage             MakeTag(clsBrowser,172) // TOC
#define hlpBrowType             MakeTag(clsBrowser,173) // TOC
#define hlpBrowDate             MakeTag(clsBrowser,174) // TOC
#define hlpBrowTime             MakeTag(clsBrowser,175) // TOC
#define hlpBrowSize             MakeTag(clsBrowser,176) // TOC
#define hlpBrowBookmark         MakeTag(clsBrowser,177) // TOC
#define hlpBrowColumn           MakeTag(clsBrowser,178) // TOC
```

DskViewer help tags

```
#define hlpBrowserDV            MakeTag(clsBrowser,180) // Generic DSKVIEW
```

```
#define hlpBrowNameDV          MakeTag(clsBrowser,181) // DSKVIEW
#define hlpBrowTypeDV          MakeTag(clsBrowser,183) // DSKVIEW
#define hlpBrowDateDV          MakeTag(clsBrowser,184) // DSKVIEW
#define hlpBrowTimeDV          MakeTag(clsBrowser,185) // DSKVIEW
#define hlpBrowSizeDV          MakeTag(clsBrowser,186) // DSKVIEW
```

Column Tag - identify columns for **msgBrowserGesture**

```
#define tagBrowNameColumn      MakeTag(clsBrowser,191)
#define tagBrowPageColumn      MakeTag(clsBrowser,192)
#define tagBrowTypeColumn      MakeTag(clsBrowser,193)
#define tagBrowDateColumn      MakeTag(clsBrowser,194)
#define tagBrowTimeColumn      MakeTag(clsBrowser,195)
#define tagBrowSizeColumn      MakeTag(clsBrowser,196)
#define tagBrowBookmarkColumn  MakeTag(clsBrowser,197)
#define tagBrowUserColumn0     MakeTag(clsBrowser,198)
#define tagBrowUserColumn1     MakeTag(clsBrowser,199)
#define tagBrowUserColumn2     MakeTag(clsBrowser,200)
#define tagBrowUserColumn3     MakeTag(clsBrowser,201)
```

Messages

msgNewDefaults:

Initializes the BROWSER_NEW structure to default values.

Takes P_BROWSER_NEW, returns STATUS. Category: class message.

Comments

Zeros out **pNew->browser**.

msgNew:

Creates a new browser object.

Takes P_BROWSER_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct BROWSER_NEW_ONLY {
    FS_LOCATOR  base;       // Points to where the browser will display.
                            // Note: This UID must not be an absolute path!
    OBJECT      client;     // UID of client.
    U16         tocView;    // TRUE for TOC view, FALSE for disk view.
    U8          spare[8];
} BROWSER_NEW_ONLY, *P_BROWSER_NEW_ONLY;
#define    browserNewFields       \
    scrollWinNewFields        \
    BROWSER_NEW_ONLY    browser;
typedef struct BROWSER_NEW {
    browserNewFields
} BROWSER_NEW, *P_BROWSER_NEW;
```

Comments

Creates a browser which will display the file system within the specified base directory. If the browser will be looking at "live" notebook sections and documents set **tocView** to true; If the browser will be looking at "dead" directories, files, or documents and sections on disk then set **tocView** to false.

msgBrowserCreateDir

Creates a directory at the selection.

Takes nothing, returns STATUS.

```
#define msgBrowserCreateDir          MakeMsg(clsBrowser, 1)
```

Comments

If nothing is selected, this message creates a directory at the top level of the disk. DskView message only. Usually sent from menu.

msgBrowserByName

Sorts by name order.

Takes nothing, returns STATUS.

```
#define msgBrowserByName            MakeMsg(clsBrowser, 2)
```

Comments Displays all displayed items sorted by name order. Usually sent from menu.

msgBrowserByType

Sorts by type order.

Takes nothing, returns STATUS.

```
#define msgBrowserByType            MakeMsg(clsBrowser, 40)
```

Comments Displays all displayed items sorted by type order. Usually sent from menu.

msgBrowserBySize

Sorts by size order.

Takes nothing, returns STATUS.

```
#define msgBrowserBySize            MakeMsg(clsBrowser, 3)
```

Comments Displays all displayed items sorted by size order. Usually sent from menu.

msgBrowserByDate

Sorts by date order.

Takes nothing, returns STATUS.

```
#define msgBrowserByDate            MakeMsg(clsBrowser, 4)
```

Comments Displays all displayed items sorted by date order. Usually sent from menu.

msgBrowserExpand

Expands sections or directories.

Takes nothing or P_FS_FLAT_LOCATOR, returns STATUS.

```
#define msgBrowserExpand            MakeMsg(clsBrowser, 5)
```

Comments If **pArgs** is P_FS_FLAT_LOCATOR, expands P_FS_FLAT_LOCATOR otherwise if **pArgs** is **pNull** and the browser has the selection, the selection is expanded. Otherwise, every displayed closed selection is expanded.

msgBrowserCollapse

Collapses sections or directories.

Takes nothing or P_FS_FLAT_LOCATOR, returns STATUS.

```
#define msgBrowserCollapse            MakeMsg(clsBrowser, 6)
```

Comments If **pArgs** is P_FS_FLAT_LOCATOR, collapses P_FS_FLAT_LOCATOR otherwise if **pArgs** is **pNull** and the browser has the selection, the selection is collapsed; otherwise, every open selection is collapsed.

msgBrowserRefresh

Refreshes the disk image the browser is displaying.

Takes nothing, returns STATUS.

```
#define msgBrowserRefresh          MakeMsg(clsBrowser, 15)
```

msgBrowserDelete

Deletes selection if **pNull** or P_FS_FLAT_LOCATOR otherwise.

Takes nothing or P_FS_FLAT_LOCATOR, returns STATUS.

```
#define msgBrowserDelete           MakeMsg(clsBrowser, 22)
```

Comments Sent to self to allow subclass to override.

msgBrowserRename

Renames browser items.

Takes nothing or P_FS_FLAT_LOCATOR, returns STATUS.

```
#define msgBrowserRename           MakeMsg(clsBrowser, 23)
```

Comments Pops up rename dialog box for the selection if **pNull**; otherwise the item pointed to by P_FS_FLAT_LOCATOR is renamed. Sent to self to allow subclass to override.

msgBrowserConfirmDelete

Sets a flag whether to confirm deletions within a browser.

Takes BOOLEAN, returns STATUS.

```
#define msgBrowserConfirmDelete       MakeMsg(clsBrowser, 24)
```

msgBrowserExport

Puts the selection into export mode.

Takes nothing, returns STATUS.

```
#define msgBrowserExport           MakeMsg(clsBrowser,118)
```

Comments After this message is received by TOC the selected item is highlighted with the copy box. Then if notebook item is dragged to the DiskViewer, it will be exported, not copied. The export mode is cancelled when the selection is cancelled or the export completes. TOC only.

msgBrowserByPage

Sorts by page number.

Takes nothing, returns STATUS.

```
#define msgBrowserByPage           MakeMsg(clsBrowser, 25)
```

Comments TOC only.

msgBrowserWriteState

Writes the current browser expanded/collapsed state to a file.

Takes nothing, returns STATUS.

```
#define msgBrowserWriteState        MakeMsg(clsBrowser, 26)
```

Comments This message saves the name of each expanded section or directory to a disk file. By using **msgBrowserSetSaveFile** clients or subclasses can set which file this information is stored in. By default the state file ends up in the OSThisApp's directory in a file named BROWSTAT.

msgBrowserReadState

Reads the browser expanded/collapsed state from a disk file.

Takes nothing, returns STATUS.

```
#define msgBrowserReadState          MakeMsg(clsBrowser, 27)
```

Comments This message restores the state of the browser view of the notebook or file system. By using **msgBrowserSetSaveFile** clients or subclasses can set which file this information is stored in. By default the state file ends up in the OSThisApp's dir in a file named browstate.

msgBrowserSetSaveFile

Sets the file that the browser will save open/close state to.

Takes P_FS_LOCATOR, returns STATUS.

```
#define msgBrowserSetSaveFile   MakeMsg(clsBrowser,148)
```

msgBrowserGetMetrics

Gets browser metrics.

Takes P_BROWSER_METRICS, returns STATUS.

```
#define msgBrowserGetMetrics        MakeMsg(clsBrowser, 28)
```

SubClass-definable Column Type

Defines attributes of the subclass definable browser columns. Subclasses can control up to **browUserColumns** (4) columns.

User Columns are columns of checkboxes or text, that subclasses of **clsBrowser** can control. The subclass can supply the header above the column and whether or not the boxes appear next to sections or documents or both.

User columns are enabled by setting **pMetrics**->userColumn.**showUserColumn**.

The browser sends **msgBrowserUserColumnQueryState** to subclasses to determine the initial state of the columns.

When a column is tapped, **msgBrowserUserColumnChanged** notifies subclasses that the checkbox has toggled.

```
#define browDefaultColumns          7   // Number of default columns.
#define browUserColumns             4   // Maximum number of user columns.
```

Display justifications

```
Enum16 ( BROW_JUSTIFY ) {
    browserLeftJustify = 0,         // Left justification.
    browserRightJustify = 1,        // Right justification.
    browserCenterJustify = 2,       // Center justification.
    browserUserJustify = 3          // Miscellaneous justification.
};
```

User column type

```
Enum16 ( USER_COLUMN_TYPE ) {
    browserButtonType = 0,          // Button user column.
    browserTextType = 1,            // Text user column.
    browserUserType = 2             // User defined user column.
};
typedef struct {
    BROW_JUSTIFY    headerJustify;               // Justification of header.
    BROW_JUSTIFY    columnJustify;               // Justification of column.
    CHAR            columnHeader[nameBufLength]; // Text for column.
} BROWSER_DEF_COLUMN, *P_BROWSER_DEF_COLUMN;
typedef struct {
    U16                 showUserColumn : 1;         // Must be set to TRUE for the
                                                    // following fields to apply.
    U16                 userColumnOnSections : 1;   // Show userColumn next to sections.
    U16                 userColumnOnDocs : 1;       // Show userColumn next to documents.
    USER_COLUMN_TYPE    userColumnType;             // Type of field if user column.
    CHAR                userColumnHeader[nameBufLength]; // Text of column header.
    TAG                 helpTag;                    // Tag for quick help
    CHAR                checkedChar;                // Character to show when checked.
    CHAR                uncheckedChar;              // Character to show when unchecked.
    BROW_JUSTIFY        headerJustify;              // Justification of header.
    BROW_JUSTIFY        columnJustify;              // Justification of column.
    U8                  spare[4];                   // Spare: reserved.
} BROWSER_COLUMN, *P_BROWSER_COLUMN;
typedef struct BROWSER_METRICS {
    U16                 showIcon : 1;               // Show icons.
    U16                 showType : 1;               // Show type field.
    U16                 showSize : 1;               // Show size field.
    U16                 showDate : 1;               // Show date field.
    U16                 showBookmark : 1;           // Show bookmark field. (TOC only)
    U16                 showHeader : 1;             // Show column header.
    U16                 computeRecursiveSize : 1;   // Computes recursive size
                                                    // for directories.
                                                    // TOC does this by default.
    U16                 showIconButton : 1;         // Show page turn buttons
                                                    // instead of icons. (TOC only)
    SORT_BY             sortBy;                     // Field by which to sort items.
    BROWSER_COLUMN      userColumn[browUserColumns]; // Subclass-definable columns
    BROWSER_DEF_COLUMN  defaultColumn[browDefaultColumns]; // Default columns
    U8                  spare[40];                  // Spare: reserved.
} BROWSER_METRICS, *P_BROWSER_METRICS;
```

msgBrowserSetMetrics

Sets browser metrics.

Takes P_BROWSER_METRICS, returns STATUS.

```
#define msgBrowserSetMetrics            MakeMsg(clsBrowser, 29)
```

Message Arguments

```
typedef struct BROWSER_METRICS {
    U16                 showIcon : 1;               // Show icons.
    U16                 showType : 1;               // Show type field.
    U16                 showSize : 1;               // Show size field.
    U16                 showDate : 1;             // Show date field.
    U16                 showBookmark : 1;         // Show bookmark field. (TOC only)
    U16                 showHeader : 1;           // Show column header.
    U16                 computeRecursiveSize : 1; // Computes recursive size
                                                  // for directories.
                                                  // TOC does this by default.
    U16                 showIconButton : 1;       // Show page turn buttons
                                                  // instead of icons. (TOC only)
    SORT_BY             sortBy;                   // Field by which to sort items.
    BROWSER_COLUMN      userColumn[browUserColumns]; // Subclass-definable columns
    BROWSER_DEF_COLUMN  defaultColumn[browDefaultColumns]; // Default columns
    U8                  spare[40];                // Spare: reserved.
} BROWSER_METRICS, *P_BROWSER_METRICS;
```

Comments

This message will cause a refresh if **userColumn** or recursive size become turned on.

msgBrowserUserColumnGetState

Does nothing.

Takes P_BROWSER_USER_COLUMN, returns STATUS.

```
#define msgBrowserUserColumnGetState    MakeMsg(clsBrowser, 62)
```

Arguments

```
typedef struct {
    BOOLEAN     changed;                // TRUE if this column has changed.
    BOOLEAN     state;                  // State of item check box.
    CHAR        text[nameBufLength];    // Text of field for item.
    BOOLEAN     shown;                  // TRUE if this column is shown.
                                        // Same as showUserColumn of METRICS.
    BOOLEAN     active;                 // TRUE if this column is active
                                        // for this browser item.
} BROWSER_COLUMN_STATE;
typedef struct {
    FS_FLAT_LOCATOR         flat;                   // Locator of browser item.
    BROWSER_COLUMN_STATE    column[browUserColumns]; // Column information.
    U8                      spare[12];              // Spare: reserved.
} BROWSER_USER_COLUMN, *P_BROWSER_USER_COLUMN;
```

msgBrowserUserColumnSetState

Sets the user column states in the browser for columns that are marked changed.

Takes P_BROWSER_USER_COLUMN, returns STATUS.

```
#define msgBrowserUserColumnSetState    MakeMsg(clsBrowser, 63)
```

Message Arguments

```
typedef struct {
    FS_FLAT_LOCATOR         flat;                   // Locator of browser item.
    BROWSER_COLUMN_STATE    column[browUserColumns]; // Column information.
    U8                      spare[12];              // Spare: reserved.
} BROWSER_USER_COLUMN, *P_BROWSER_USER_COLUMN;
```

Comments

If the changed BOOLEAN is set, the user column state will be set. Does not generate a **msgBrowserUserColumnStateChanged**. The entire BROWSER_USER_COLUMN structure must be cleared before setting the fields that are changing.

msgBrowserUserColumnStateChanged

Notifies subclass when user checks a user column checkbox.

Takes P_BROWSER_USER_COLUMN, returns STATUS.

```
#define msgBrowserUserColumnStateChanged     MakeMsg(clsBrowser, 68)
```

Message Arguments

```
typedef struct {
    FS_FLAT_LOCATOR        flat;                      // Locator of browser item.
    BROWSER_COLUMN_STATE   column[browUserColumns]; // Column information.
    U8                     spare[12];                 // Spare: reserved.
} BROWSER_USER_COLUMN, *P_BROWSER_USER_COLUMN;
```

Comments

The changed field is true for the column that was tapped.

msgBrowserUserColumnQueryState

Gets the user column state from subclass.

Takes P_BROWSER_USER_COLUMN, returns STATUS.

```
#define msgBrowserUserColumnQueryState    MakeMsg(clsBrowser, 69)
```

Message Arguments

```
typedef struct {
    FS_FLAT_LOCATOR        flat;                      // Locator of browser item.
    BROWSER_COLUMN_STATE   column[browUserColumns]; // Column information.
    U8                     spare[12];                 // Spare: reserved.
} BROWSER_USER_COLUMN, *P_BROWSER_USER_COLUMN;
```

Comments

This message is sent to self when the browser needs to know the user column states for a notebook item. The FS_FLAT_LOCATOR points to the file system item the browser needs to know the state of. The subclass should pass back the state or the text of each user column for the file system item.

msgBrowserShowIcon

Controls icon field display.

Takes BOOLEAN, returns STATUS.

```
#define msgBrowserShowIcon            MakeMsg(clsBrowser, 100)
```

msgBrowserShowButton

Controls button field display.

Takes BOOLEAN, returns STATUS.

```
#define msgBrowserShowButton        MakeMsg(clsBrowser, 99)
```

msgBrowserShowSize

Controls size field display.

Takes BOOLEAN, returns STATUS.

```
#define msgBrowserShowSize            MakeMsg(clsBrowser, 102)
```

msgBrowserShowDate

Controls date field display.

Takes BOOLEAN, returns STATUS.

```
#define msgBrowserShowDate            MakeMsg(clsBrowser, 103)
```

msgBrowserShowType

Controls type field display.

Takes BOOLEAN, returns STATUS.

```
#define msgBrowserShowType            MakeMsg(clsBrowser, 33)
```

msgBrowserShowBookmark

Controls bookmark field display.

Takes BOOLEAN, returns STATUS.

```
#define msgBrowserShowBookmark        MakeMsg(clsBrowser, 104)
```

Comments TOC only.

msgBrowserShowHeader

Controls column header display.

Takes BOOLEAN, returns STATUS.

```
#define msgBrowserShowHeader        MakeMsg(clsBrowser, 39)
```

msgBrowserGoto

Takes true to goto, false to bringto the selection.

Takes BOOLEAN, returns STATUS.

```
#define msgBrowserGoto               MakeMsg(clsBrowser, 105)
```

Comments TOC only. Used by menu.

msgBrowserGotoBringto

Takes P_BROWSER_GOTO. If **pFlat** is **pNull**, applies to selection.

Takes P_BROWSER_GOTO, returns STATUS.

```
#define msgBrowserGotoBringto        MakeMsg(clsBrowser, 134)
```

Arguments

```
typedef struct {
    BOOLEAN         doGoto;     // TRUE - Goto document.
                                // FALSE - Bringto document.
                                // (Goto if bringto is disabled.)
    FS_FLAT_LOCATOR flat;       // Document to goto-bringto .
} BROWSER_GOTO, *P_BROWSER_GOTO;
```

Comments Sent to self to allow subclass to override. TOC only.

msgBrowserUndo

Does nothing yet...

Takes nothing, returns STATUS.

```
#define msgBrowserUndo                MakeMsg(clsBrowser, 106)
```

msgBrowserSetSelection

Causes browser/TOC to select and display the given file system item.

Takes P_FS_FLAT_LOCATOR, returns STATUS.

```
#define msgBrowserSetSelection      MakeMsg(clsBrowser,32)
```

Comments As long as the locator points to an item within the browser's base directory subtree, the browser will open directories and scroll the display as necessary to display the selected item.

msgBrowserSetClient

Sets the target of the browser client messages.

Takes OBJECT, returns STATUS.

```
#define msgBrowserSetClient          MakeMsg(clsBrowser, 108)
```

Comments This message controls who gets the various browser client messages.

msgBrowserGetClient

Passes back the target of the browser client messages.

Takes P_OBJECT, returns STATUS.

```
#define msgBrowserGetClient          MakeMsg(clsBrowser, 64)
```

msgBrowserGetBaseFlatLocator

Passes back the directory the browser is looking at.

Takes P_FS_FLAT_LOCATOR, returns STATUS.

```
#define msgBrowserGetBaseFlatLocator    MakeMsg(clsBrowser, 65)
```

Comments Passes back the root directory within which the browser is looking.

msgBrowserSelectionPath

Passes back the full path of the selection.

Takes P_BROWSER_PATH, returns STATUS.

```
#define msgBrowserSelectionPath      MakeMsg(clsBrowser, 109)
```

Arguments

```
typedef struct {
    CHAR    path[fsMaxPathLength];
} BROWSER_PATH, *P_BROWSER_PATH;
```

Comments Also responds to **msgXferGet** with id XferFullPathName to get the selections path. Note: If possible use **msgBrowserSelection** with flat locators to avoid duplicate volume name confusion.

msgBrowserSelection

Passes back the flat locator of the selection.

Takes P_FS_FLAT_LOCATOR, returns STATUS.

```
#define msgBrowserSelection      MakeMsg(clsBrowser, 79)
```

Comments Also responds to **msgXferGet** with id XferFlatLocator to get the selections path.

msgBrowserSelectionUUID

Passes back the UUID of the selection.

Takes P_UUID, returns STATUS.

```
#define msgBrowserSelectionUUID     MakeMsg(clsBrowser,117)
```

msgBrowserSelectionDir

Passes back the flat locator of the directory the selection is in.

Takes P_FS_FLAT_LOCATOR, returns STATUS.

```
#define msgBrowserSelectionDir      MakeMsg(clsBrowser, 110)
```

msgBrowserSelectionName

Returns the name of the selection.

Takes P_CHAR, returns STATUS.

```
#define msgBrowserSelectionName MakeMsg(clsBrowser, 111)
```

Comments Also responds to **msgXferGet** with id XferName to get the selections name

msgBrowserSelectionOn

Notifies client when a selection is made inside the browser.

Takes nothing, returns STATUS.

```
#define msgBrowserSelectionOn   MakeMsg(clsBrowser,112)
```

msgBrowserSelectionOff

Notifies client when selection is yielded by the browser.

Takes nothing, returns STATUS.

```
#define msgBrowserSelectionOff  MakeMsg(clsBrowser,113)
```

msgBrowserBookmark

Notifies client that the bookmark specified by locator has toggled.

Takes P_BROWSER_BOOKMARK, returns STATUS.

```
#define msgBrowserBookmark      MakeMsg(clsBrowser,107)
```

Arguments

```
typedef struct {
    FS_LOCATOR  loc;
} BROWSER_BOOKMARK, *P_BROWSER_BOOKMARK;
```

msgBrowserCreateDoc

Creates a directory.

Takes P_BROWSER_CREATE_DOC, returns STATUS.

```
#define msgBrowserCreateDoc     MakeMsg(clsBrowser,152)
```

Arguments

```
typedef struct {
    CLASS       docClass;
    P_CHAR      pName;
    BOOLEAN     atSelection;
    XY32        xy;
} BROWSER_CREATE_DOC, *P_BROWSER_CREATE_DOC;
```

Comments The directory is created at the selection if there is one. If not, the directory is created at the top level shown. DiskView only.

msgBrowserGetBrowWin

Passes back the browser's internal display window.

Takes **pObject**, returns STATUS.

```
#define msgBrowserGetBrowWin    MakeMsg(clsBrowser,149)
```

Comments

The browser's internal display window is the selected object for any selection based operations.

msgBrowserGesture

Sends to self gesture and which file it landed on.

Takes P_BROWSER_GESTURE, returns STATUS.

```
#define msgBrowserGesture       MakeMsg(clsBrowser,59)
```

Arguments

```
typedef struct {
    MESSAGE             gesture;     // Gesture that occurred.
    P_FS_FLAT_LOCATOR   pFlat;       // Item on which to apply the gesture.
    P_GWIN_GESTURE      pGest;       // Original gesture struct.
    TAG                 columnTag;   // Tag of column on which to apply the gesture.
                                     // 0  if not on a column.
    U32                 info;        // Internal browser information.
    U32                 spare[2];    // Spare: reserved.
} BROWSER_GESTURE, *P_BROWSER_GESTURE;
```

Comments

Allows subclasses to respond to gestures targeted at browser items. If the status returned by the subclass is >= **stsOK** the gesture will NOT be sent to browser superclass. So subclasses should ignore this message or return **stsOK** to signify it has been handled.

BYTARRAY.H

This file contains the API definition for the ByteArray interface. The functions described in this file are contained in MISC.LIB.

A ByteArray implements a growing and shrinking array of bytes, indexed from 0 to ByteArrayLength()-1. A ByteArray grabs and releases memory as needed.

The ByteArray implementation is optimized for highly localized series of insertions and deletions.

```
#ifndef BYTARRAY_INCLUDED
#define BYTARRAY_INCLUDED $Revision:   1.17  $
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef DEBUG_INCLUDED
#include <debug.h>
#endif
#ifndef OSHEAP_INCLUDED
#include <osheap.h>
#endif
```

Types and Constants

```
typedef struct BYTE_ARRAY * P_BYTE_ARRAY;
#define stsBAMaxExceeded MakeStatus(clsMisc, 255)
typedef U32 BYTE_INDEX, * P_BYTE_INDEX;
#define SIZE_OF_BYTE_INDEX 4
#define maxBYTE_INDEX maxU32
```

Private

```
typedef struct BYTE_ARRAY {
    BYTE_INDEX  length;             // Number of bytes stored in buffer
    BYTE_INDEX  bufferLength;       // Number of bytes in buffer
    P_U8        firstPart;          // Beginning of the buffer
    BYTE_INDEX  firstPartLength;    // Number of bytes in first part
    P_U8        secondPart;         // see comments above
    U16         mode;               // see comments above
} BYTE_ARRAY;
```

ByteArrayGapLength

Returns the size of the byte array's gap.

Returns BYTE_INDEX.

```
#define ByteArrayGapLength(p) \
    ((p)->bufferLength - (p)->length)
```

ByteArrayPrint

Prints the content of the byte array.

Returns void.

```
#ifdef DEBUG
void EXPORTED
```

Function Prototype

```
ByteArrayPrint(
    P_BYTE_ARRAY    p,
    P_STRING        charFmt,
    int             charWidth);
#endif // DEBUG
```

Exported Functions and Macros

ByteArrayFindByte

Gets address of byte n from ByteArray p.

Returns P_U8.

```
#define ByteArrayFindByte(p,n) ( \
        (n) < (p)->firstPartLength \
        ? &((p)->firstPart[(n)]) \
        : &((p)->secondPart[(n)]) )
```

Comments

Warning 1: n is evaluated twice, so it should not be an expression with an auto-increment or decrement!

Warning 2: to be as fast as possible, ByteArrayFindByte does no error checking!

ByteArrayFindIndex

Determines the index from address addr of byte in ByteArray p.

Returns BYTE_INDEX.

```
#define ByteArrayFindIndex(p,addr) ( \
        (addr) < &((p)->firstPart[(p)->firstPartLength]) \
        ? (BYTE_INDEX)(addr - (p)->firstPart) \
        : (BYTE_INDEX)(addr - (p)->secondPart))
```

Comments

This is the inverse of ByteArrayFindByte.

Warnings from ByteArrayFindByte apply here also.

ByteArrayGetByte

Get byte n from ByteArray p

Returns U8.

```
#define ByteArrayGetByte(p,n) \
        ((n) < (p)->firstPartLength \
        ? (p)->firstPart[(n)] \
        : (p)->secondPart[(n)])
```

Comments

Warnings from ByteArrayFindByte apply here also.

ByteArrayCreate

Creates a byte array.

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
ByteArrayCreate(
    P_BYTE_ARRAY *  pp,
    U16             mode,
    BYTE_INDEX      length);
```

Comments

Only the **osHeapLocal/osHeapShared** flags of mode are meaningful. The initial length doesn't matter very much, since the byte array grows or shrinks as needed. However, if length is approximately correct, then early insertions will be quicker. If length<=0, a length of 1 is assumed.

Returns **stsOK** if able to create the byte array, in which case *pp will be the created byte array, otherwise *pp will be Nil(P_BYTE_ARRAY).

The mode parameter is really of type OS_HEAP_MODE.

ByteArrayDestroy

Destroys a byte array.

Returns void.

```
void EXPORTED
```

Function Prototype

```
ByteArrayDestroy(
    P_BYTE_ARRAY    p);
```

ByteArrayGetMany

Gets one or more characters from contiguous positions in the byte array.

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
ByteArrayGetMany(
    P_BYTE_ARRAY    p,
    BYTE_INDEX      pos,
    P_U8            buf,
    BYTE_INDEX      bufLen);
```

Comments

Retrieves up to **bufLen** characters in p from positions [pos..MIN(pos+bufLen,ByteArrayLength(p)). Client should insure that buf != Nil(P_U8). Returns count of bytes placed in buf.

ByteArrayReplace

Replaces zero or more characters in the byte array.

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
ByteArrayReplace(
    P_BYTE_ARRAY    p,
    BYTE_INDEX      pos,
    BYTE_INDEX      len,
    P_U8            buf,
    BYTE_INDEX      bufLen);
```

Comments

Replaces len characters in p at positions [pos..pos+len) by **bufLen** characters from buf. Client should insure that pos+len <= ByteArrayLength(p).

Returns:

stsOutOfMem if no memory available, or

stsBadParam if range [pos..pos+len) is invalid, or

stsBAMaxExceeded if the maximum ByteArray length is exceeded, or

number bytes taken from buf otherwise.

ByteArrayInsert

Inserts **bufLen** characters from buf into p at position pos.

Returns STATUS.

```
#define ByteArrayInsert(p, pos, buf, bufLen)    \
    ByteArrayReplace((p), (pos), 0, (buf), (bufLen))
```

Comments

This routine does no error checking. Client should insure that: pos <= ByteArrayLength(p).

See ByteArrayReplace for possible return values.

ByteArrayDelete

Delete n characters from p starting at pos.

Returns void.

```
#define ByteArrayDelete(p, pos, len) \
    (void) ByteArrayReplace((p), (pos), (len), Nil(P_U8), 0)
```

Comments

This routine does no error checking. Client should insure that: pos+len <= ByteArrayLength(p).

ByteArrayLength

Returns the number of bytes currently stored in the BYTE_ARRAY.

Returns BYTE_INDEX.

```
#define ByteArrayLength(p) ((p)->length)
```

ByteArrayHeapMode

Returns the heap mode the BYTE_ARRAY was created with.

Returns OS_HEAP_MODE.

```
#define ByteArrayHeapMode(p)     ((p)->mode)
```

ByteArrayReserve

Reserves space in byte array (without actually initializing it).

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
ByteArrayReserve(
    P_BYTE_ARRAY    p,
    BYTE_INDEX      pos,
    BYTE_INDEX      len);
```

Comments

Reserves len characters in p at position pos, but does not initialize them. (The gap is guaranteed to not break the reserved range.) Client should insure that pos <= ByteArrayLength(p).

Returns:

stsOutOfMem if no memory available, or

stsBadParam if pos is invalid, or

stsBAMaxExceeded if the maximum ByteArray length is exceeded, or

stsOK otherwise.

ByteArrayWrite

Writes the content of the byte array to the specified file.

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
ByteArrayWrite(
    P_BYTE_ARRAY    p,
    OBJECT          file);
```

Comments

The file parameter must act like a FILE_HANDLE object.

ByteArrayRead

Reads previously saved content of a byte array from the specified file.

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
ByteArrayRead(
    P_BYTE_ARRAY *  pp,
    OBJECT          file,
    OS_HEAP_MODE    mode);
```

Comments

The file parameter must act like a FILE_HANDLE object.

BAFileWriteString

Debugging utility routine to write a string to a file.

Returns STATUS.

```
#ifdef DEBUG
STATUS EXPORTED
```

Function Prototype

```
BAFileWriteString(
    OBJECT      file,
    P_U8        str);
#endif
```

Comments

Useful when initially writing filing code to insert helpful strings into the file and to then skip over the strings when reading the file.

This routine takes an exception if it encounters an error. Also, it will only work with a string whose length is MAX_STR_LENGTH or less.

The file parameter must act like a FILE_HANDLE object.

BAFileReadString

Debugging utility routine to read a string from a file.

Returns STATUS.

```
#ifdef DEBUG
STATUS EXPORTED
```

Function Prototype

```
BAFileReadString(
    OBJECT      file,
    P_U8        str);
#endif
```

Comments

Useful when initially writing filing code to skip over strings written with BAFileWriteString.

This routine takes an exception if it encounters an error. Also, it will only work with a string whose length is MAX_STR_LENGTH or less.

The file parameter must act like a FILE_HANDLE object.

BYTEBUF.H

This file contains the API definition for **clsByteBuf.**

clsByteBuf inherits from **clsObject.**

clsByteBuf provides a facility to store uninterpreted byte strings. Each object of **clsByteBuf** stores a single buffer. This class provides convenient object filing of the buffer data. Storage for each object's buffer is allocated out of the creator's shared process heap using OSHeapBlockAlloc.

Clients who want to store null terminated strings should use **clsString** (see strobj.h).

```
#ifndef BYTEBUF_INCLUDED
#define BYTEBUF_INCLUDED
#include <go.h>
#include <clsmgr.h>
typedef OBJECT BYTEBUF, *P_BYTEBUF;
typedef struct BYTEBUF_DATA {
    U16     bufLen;     // In/Out: Length (in bytes) of the pBuf buffer.
    P_U8    pBuf;       // In/Out: Object buffer.
} BYTEBUF_DATA, *P_BYTEBUF_DATA;
```

Class Messages

msgNew

Creates a new buffer object.

Takes P_BYTEBUF_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct BYTEBUF_NEW_ONLY {
    BOOLEAN         allowObservers; // In:  Send clsByteBuf observer messages
                                    //      to the object's observers?
    BYTEBUF_DATA    data;           // In/Out: Buffer data.
} BYTEBUF_NEW_ONLY, *P_BYTEBUF_NEW_ONLY;
#define byteBufNewFields        \
    objectNewFields             \
    BYTEBUF_NEW_ONLY    bytebuf;
typedef struct BYTEBUF_NEW {
    byteBufNewFields
} BYTEBUF_NEW, *P_BYTEBUF_NEW;
```

Comments

This message allocates shared heap storage for the specified buffer.

allowObservers indicates whether the object will send the **clsByteBuf** observer messages (See **msgByteBufChanged**). Only **clsByteBuf** messages are affected by this option. Adding and removing observers is not affected by this option.

msgNewDefaults

Initializes the BYTEBUF_NEW structure to default values.

Takes P_BYTEBUF_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct BYTEBUF_NEW {
    byteBufNewFields
} BYTEBUF_NEW, *P_BYTEBUF_NEW;
```

Comments

Sets

```
    pNew->bytebuf.allowObservers    = true;
    pNew->bytebuf.data.bufLen       = 0;
    pNew->bytebuf.data.pBuf         = pNull;
```

allowObservers indicates whether the object will send the **clsByteBuf** observer messages. (See **msgByteBufChanged**)

Object Messages

msgByteBufGetBuf

Passes back the object's buffer.

Takes P_BYTEBUF_DATA, returns STATUS.

```
#define msgByteBufGetBuf                    MakeMsg(clsByteBuf, 1)
```

Message Arguments

```
typedef struct BYTEBUF_DATA {
    U16     bufLen;     // In/Out: Length (in bytes) of the pBuf buffer.
    P_U8    pBuf;       // In/Out: Object buffer.
} BYTEBUF_DATA, *P_BYTEBUF_DATA;
```

Comments

The pointer passed back references the object's global storage. Clients must not modify or free this storage.

msgByteBufSetBuf

Copies the specified buffer data into the object's buffer.

Takes P_BYTEBUF_DATA, returns STATUS.

```
#define msgByteBufSetBuf                    MakeMsg(clsByteBuf, 2)
```

Message Arguments

```
typedef struct BYTEBUF_DATA {
    U16     bufLen;     // In/Out: Length (in bytes) of the pBuf buffer.
    P_U8    pBuf;       // In/Out: Object buffer.
} BYTEBUF_DATA, *P_BYTEBUF_DATA;
```

Comments

Previously retrieved bytebuf pointers will be invalid after this operation. Clients must call **msgByteBufGetBuf** to retrieve a pointer to the valid object buffer.

Observer Messages

msgByteBufChanged

Sent to observers when the object data changes.

Takes OBJECT, returns nothing. Category: observer notification.

```
#define msgByteBufChanged                   MakeMsg(clsByteBuf, 3)
```

Comments

The message argument is the UID of the **clsByteBuf** object that changed.

This message is not sent if the creator did not specify **allowObservers** during **msgNew**.

DSKVIEW.H

This file contains the API definition for **clsDiskViewWin.**

clsDiskViewWin inherits from **clsCustomLayout.**

It is the view window for a multi-volume disk viewer.

Overview

The Disk Viewer also defines **clsDVBrowBar, clsDVTabButton, clsDVIcon**, and **clsDVForward.** These are internal classes which must be well-known uids, since the Disk Viewer component is shared.

The Disk Viewer component implements the heart of the Disk Manager. It is consists of two panels: an icon panel and a browser panel. Each known filesystem volume (connected and disconnected) is represented by an icon in the icon window. Each open volume is represented by a browser card in the browser panel. A browser card is a frame with a menu bar and control tab as decoration and an instance of **clsBrowser** in the view (see browser.h for details).

The icon panel is only as big as it needs to be to fit the known volumes. The browser panel takes up the rest of the space. The open browser cards equally divide up the browser panel.

Clients will typically put the Disk Viewer component inside of a frame. The frame must not be shrink-wrapped; the Disk Viewer must be told what size it should be.

clsDiskViewWin understands the following **clsBrowser**'s messages:

msgBrowserCreateDir

The browser messages that deal with the selection are sent to the browser which has the current selection. Messages that do not deal with the selection or make sense if there is no selection are sent to all browsers in the Disk Viewer.

The Disk Viewer client is made the client of all the open browsers. The client will get all the messages that browsers send to their clients.

The Disk Viewer takes care of setting up browser state files in a directory off the current working directory. The Disk Viewer ensures that the state files for each volume is unique; it handles duplicate volume names.

The Disk Viewer understands **msgSave** and **msgRestore.** It will reopen volumes that were open when it was saved, and restore as much volume state (which directories were expanded) as possible.

```
#ifndef DSKVIEW_INCLUDED
#define DSKVIEW_INCLUDED
#ifndef CLAYOUT_INCLUDED
#include <clayout.h>
#endif
#ifndef BROWSER_INCLUDED
#include <browser.h>
#endif
```

Common #defines and typedefs

Illegal volume name error.

```
#define stsDVIllegalVolumeName      MakeStatus(clsDiskViewWin, 0)
```

Directory where state files go, relative to **theWorkingDir.**

```
#define pDVStateDir                 "diskViewState"
```

Trigger point for going over to 'K' size notation

```
#define dvKSizeUnit                 1024
```

Icon Panel Style

```
#define dvShowIcons                 0   // Show icons.
#define dvShowHelpText              1   // Show informative message about each
                                        // view category.
#define dvShowClientWin             2   // Client sets contents via
                                        // msgDVSetIconPanel.
```

Icon Style

```
#define dvBigPictTitleUnder         0   // Big icon, title under picture.
#define dvBigPictTitleRight         1   // Big icon, title to right of picture.
#define dvSmallPictTitleUnder       2   // Small icon, title under picture.
#define dvSmallPictTitleRight       3   // Small icon, title to right of picture.
```

Disk Viewer Style

```
typedef struct DV_STYLE {
    U16 displayRamVolume: 1,      // Display the RAM volume. Used for debugging.
                                  // Disk Viewer app sets this if /DB0800 is on.
        autoOpen         : 1,     // If there is only one volume, open it.
        enableBookshelf  : 1,     // Should bookshelf viewing be enabled?
        enableDirectoryView : 1,// Should the directory view be enabled?
        showVolumeMenu   : 1,     // Should the volume menu be shown?
        showEditMenu     : 1,     // Should the edit menu be shown?
        showViewMenu     : 1,     // Should the view menu be shown?
        showOptionsMenu  : 1,     // Should the options menu be shown?
        iconPanelStyle   : 3,     // What should be shown in the icon panel?
        iconStyle        : 3,     // Initial icon look, only used if
                                  // iconPanelStyle == dvShowIcons.
        unused1          : 2;
    U16 spare1;
    U16 spare2;
} DV_STYLE, *P_DV_STYLE;
```

Array Element For Volume Name Array

```
typedef struct NAME {
    U8          pName[nameBufLength];
} NAME, *P_NAME;
typedef struct DV_NEW_ONLY {
    DV_STYLE    style;
    P_STRING    pBasePath;        // Path offset for each volume;
                                  // pNull for no offset.
    OBJECT      client;           // Client. Note: client is *not* saved at
                                  // msgSave time. Client must restore with
                                  // msgBrowserSetClient.
    U16         numOpenVols;      // Number of volumes to pre-open.
    P_NAME      pOpenVols;        // Array of volume names.
    TAG         displayType;      // Default display type for new cards.
    CLASS       browserClass;   // Class of browser to mutate volume
                                // default browsers to. objNull says
                                // no mutation.
    CLASS       bookshelfClass; // Class of bookshelf viewer to mutate
                                // volume default bookshelf viewers.
                                // objNull says no mutation.
    U8          spare[24];      // Spare: reserved.
} DV_NEW_ONLY, *P_DV_NEW_ONLY;
#define diskViewWinNewFields        \
    customLayoutNewFields           \
    DV_NEW_ONLY     diskViewWin;
typedef struct DV_NEW {
    diskViewWinNewFields
} DV_NEW, *P_DV_NEW;
```

Messages

msgNew

Creates a new disk view window.

Takes P_DV_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct DV_NEW {
    diskViewWinNewFields
} DV_NEW, *P_DV_NEW;
```

msgNewDefaults

Initializes the DV_NEW structure to default values.

Takes P_DV_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct DV_NEW {
    diskViewWinNewFields
} DV_NEW, *P_DV_NEW;
```

Comments

Zeroes out **diskViewWin** and sets

```
    diskViewWin.style.displayRamVolume = false;
    diskViewWin.style.autoOpen = false;
    diskViewWin.style.iconStyle = dvBigPictTitleUnder;
    diskViewWin.style.enableBookshelf = true;
    diskViewWin.style.enableDirectoryView = true;
    diskViewWin.style.showVolumeMenu = true;
    diskViewWin.style.showEditMenu = true;
    diskViewWin.style.showViewMenu = true;
    diskViewWin.style.showOptionsMenu = true;
    diskViewWin.style.iconPanelStyle = dvShowIcons;
    diskViewWin.numOpenVols = 0;
    diskViewWin.displayType = tagDVViewBookshelf;
    diskViewWin.browserClass = objNull;
    diskViewWin.bookshelfClass = objNull;
```

msgDVGetStyle

Gets current style setting.

Takes P_DV_STYLE, returns STATUS.

```
#define msgDVGetStyle                      MakeMsg(clsDiskViewWin, 1)
```

Message Arguments

```
typedef struct DV_STYLE {
    U16 displayRamVolume: 1,     // Display the RAM volume. Used for debugging.
                                 // Disk Viewer app sets this if /DB0800 is on.
        autoOpen        : 1,     // If there is only one volume, open it.
        enableBookshelf : 1,     // Should bookshelf viewing be enabled?
        enableDirectoryView : 1,// Should the directory view be enabled?
        showVolumeMenu  : 1,     // Should the volume menu be shown?
        showEditMenu    : 1,     // Should the edit menu be shown?
        showViewMenu    : 1,     // Should the view menu be shown?
        showOptionsMenu : 1,     // Should the options menu be shown?
        iconPanelStyle  : 3,     // What should be shown in the icon panel?
        iconStyle       : 3,     // Initial icon look, only used if
                                 // iconPanelStyle == dvShowIcons.
        unused1         : 2;
    U16 spare1;
    U16 spare2;
} DV_STYLE, *P_DV_STYLE;
```

msgDVSetStyle

Sets style setting.

Takes P_DV_STYLE, returns STATUS.

```
#define msgDVSetStyle                      MakeMsg(clsDiskViewWin, 2)
```

Message Arguments

```
typedef struct DV_STYLE {
    U16 displayRamVolume: 1,     // Display the RAM volume. Used for debugging.
                                 // Disk Viewer app sets this if /DB0800 is on.
        autoOpen        : 1,     // If there is only one volume, open it.
        enableBookshelf : 1,     // Should bookshelf viewing be enabled?
        enableDirectoryView : 1,// Should the directory view be enabled?
        showVolumeMenu  : 1,     // Should the volume menu be shown?
        showEditMenu    : 1,     // Should the edit menu be shown?
        showViewMenu    : 1,     // Should the view menu be shown?
        showOptionsMenu : 1,     // Should the options menu be shown?
        iconPanelStyle  : 3,     // What should be shown in the icon panel?
        iconStyle       : 3,     // Initial icon look, only used if
                                 // iconPanelStyle == dvShowIcons.
        unused1         : 2;
    U16 spare1;
    U16 spare2;
} DV_STYLE, *P_DV_STYLE;
```

msgDVGetBasePath

Passes back the current base path.

Takes P_STRING, returns STATUS.

```
#define msgDVGetBasePath                   MakeMsg(clsDiskViewWin, 3)
```

Comments — The argument must point to a string buffer that is at least **fsPathBufLength** in size.

msgDVGetIconPanel

Passes back the current icon panel window.

Takes P_WIN, returns STATUS.

```
#define msgDVGetIconPanel                  MakeMsg(clsDiskViewWin, 4)
```

msgDVSetIconPanel

Sets the icon panel window.

Takes P_WIN, returns STATUS.

```
#define msgDVSetIconPanel                    MakeMsg(clsDiskViewWin, 5)
```

Comments This message is only relevant if style.**iconPanelStyle** is set to **dvShowHelpText** or **dvShowClientWin**.

msgDVGetOpenVols

Passes back the names of all the currently open volumes.

Takes P_DV_GET_OPEN_VOLS, returns STATUS.

```
#define msgDVGetOpenVols                     MakeMsg(clsDiskViewWin, 7)
```

Arguments

```
typedef struct DV_GET_OPEN_VOLS {
    U16                 numOpenVols; // Number of open volumes.
    P_NAME              pOpenVols;   // Out: Array of volume names.
                                     // must be OSHeapBlockFreed.
    U8                  spare[24];
} DV_GET_OPEN_VOLS, *P_DV_GET_OPEN_VOLS;
```

Comments This message allocates a heap block on the process local stack (**pOpenVols**). THE CALLER MUST FREE THIS BLOCK WHEN DONE.

If there are no open volumes then **pOpenVols** is set to **pNull** and nothing is allocated.

Private

msgDVSetOptionVolume

Sets the current volume for our option sheet.

Takes OBJECT, returns STATUS.

```
#define msgDVSetOptionVolume                 MakeMsg(clsDiskViewWin, 8)
```

msgDVCardPopupChanged

Option card's quick installer popup button has changed.

Takes BOOLEAN, returns STATUS.

```
#define msgDVCardPopupChanged                MakeMsg(clsDiskViewWin, 9)
```

msgDVOptionMenuNeed

Sent to the disk view client as notification that the option menu is being provided.

Takes nothing, returns STATUS.

```
#define msgDVOptionMenuNeed                  MakeMsg(clsDiskViewWin, 10)
```

msgDVOpenVolume

Opens the disk browser of the volume specified by the given name.

Takes P_CHAR, returns STATUS.

```
#define msgDVOpenVolume                      MakeMsg(clsDiskViewWin, 11)
```

msgDVCloseVolume

Closes the disk browser of the volume specified by the given name.

Takes P_CHAR, returns STATUS.

```
#define msgDVCloseVolume                    MakeMsg(clsDiskViewWin, 12)
```

msgDVConnectToVolume

Connects a network volume specified in **pArgs**.

Takes P_CONNECTIONS_MENU_ITEM, returns STATUS.

```
#define msgDVConnectToVolume                MakeMsg(clsDiskViewWin, 13)
```

Menu Messages

```
#define msgDVOpenClose                      MakeMsg(clsDVForward, 1)
#define msgDVDuplicate                      MakeMsg(clsDVForward, 2)
#define msgDVAddQuickInstall                MakeMsg(clsDVForward, 3)
#define msgDVRemoveQuickInstall             MakeMsg(clsDVForward, 4)
#define msgDVEjectRemember                  MakeMsg(clsDVForward, 5)
#define msgDVEjectForget                    MakeMsg(clsDVForward, 6)
#define msgDVFormat                         MakeMsg(clsDVForward, 7)
#define msgDVRename                         MakeMsg(clsDVForward, 10)
#define msgDVViewAll                        MakeMsg(clsDVForward, 20)
#define msgDVViewBookshelf                  MakeMsg(clsDVForward, 21)
#define msgDVDisplayInstaller               MakeMsg(clsDVForward, 22)
#define msgDVLayoutOptions                  MakeMsg(clsDVForward, 30)
#define msgDVDiskOptions                    MakeMsg(clsDVForward, 31)
#define msgDVOptionsIcon                    MakeMsg(clsDVForward, 41)
#define msgDVOptionsType                    MakeMsg(clsDVForward, 42)
#define msgDVOptionsDate                    MakeMsg(clsDVForward, 43)
#define msgDVOptionsSize                    MakeMsg(clsDVForward, 44)
#define msgDVOptionsDirSize                 MakeMsg(clsDVForward, 45)
#define msgDVOptionsVersion                 MakeMsg(clsDVForward, 46)
#define msgDVOptionsInstall                 MakeMsg(clsDVForward, 47)
#define msgDVSortByName                     MakeMsg(clsDVForward, 50)
#define msgDVSortByDate                     MakeMsg(clsDVForward, 51)
#define msgDVSortBySize                     MakeMsg(clsDVForward, 52)
#define msgDVSortByType                     MakeMsg(clsDVForward, 53)
// Note: clsDVForward messages 100 and above are used internally.
```

Tags

```
#define tagDVVolumeMenu                     MakeTag(clsDiskViewWin, 1)
#define tagDVEditMenu                       MakeTag(clsDiskViewWin, 2)
#define tagDVViewMenu                       MakeTag(clsDiskViewWin, 3)
#define tagDVOptionsMenu                    MakeTag(clsDiskViewWin, 4)
#define tagDVTabButton                      MakeTag(clsDiskViewWin, 7)
#define tagDVOpenClose                      MakeTag(clsDiskViewWin, 10)
#define tagDVDuplicate                      MakeTag(clsDiskViewWin, 11)
#define tagDVEjectRemember                  MakeTag(clsDiskViewWin, 12)
#define tagDVEjectForget                    MakeTag(clsDiskViewWin, 13)
#define tagDVRefresh                        MakeTag(clsDiskViewWin, 14)
#define tagDVQuickInstall                   MakeTag(clsDiskViewWin, 15)
#define tagDVFormat                         MakeTag(clsDiskViewWin, 16)
#define tagDVRename                         MakeTag(clsDiskViewWin, 17)
#define tagDVCreateDir                      MakeTag(clsDiskViewWin, 18)
#define tagDVViewChoice                     MakeTag(clsDiskViewWin, 20)
```

```
#define tagDVViewAll                    MakeTag(clsDiskViewWin, 21)
#define tagDVViewBookshelf              MakeTag(clsDiskViewWin, 22)
#define tagDVExpand                     MakeTag(clsDiskViewWin, 23)
#define tagDVCollapse                   MakeTag(clsDiskViewWin, 24)
#define tagDVLayoutOptionMenu           MakeTag(clsDiskViewWin, 25)
#define tagDVDiskOptionMenu             MakeTag(clsDiskViewWin, 26)
#define tagDVColumnLayoutOptions        MakeTag(clsDiskViewWin, 30)
#define tagDVBookshelfLayoutOptions     MakeTag(clsDiskViewWin, 31)
#define tagDVDiskIconOptions            MakeTag(clsDiskViewWin, 32)
#define tagDVDiskOptions                MakeTag(clsDiskViewWin, 33)
#define tagDVOptionsIcon                MakeTag(clsDiskViewWin, 40)
#define tagDVOptionsType                MakeTag(clsDiskViewWin, 41)
#define tagDVOptionsSize                MakeTag(clsDiskViewWin, 42)
#define tagDVOptionsDirSize             MakeTag(clsDiskViewWin, 43)
#define tagDVOptionsDate                MakeTag(clsDiskViewWin, 44)
#define tagDVOptionsVersion             MakeTag(clsDiskViewWin, 45)
#define tagDVOptionsInstall             MakeTag(clsDiskViewWin, 46)
#define tagDVSortByChoice               MakeTag(clsDiskViewWin, 50)
#define tagDVSortByName                 MakeTag(clsDiskViewWin, 51)
#define tagDVSortByDate                 MakeTag(clsDiskViewWin, 52)
#define tagDVSortBySize                 MakeTag(clsDiskViewWin, 53)
#define tagDVSortByType                 MakeTag(clsDiskViewWin, 54)
#define tagDVIconCard                   MakeTag(clsDiskViewWin, 60)
#define tagDVIconLabel                  MakeTag(clsDiskViewWin, 61)
#define tagDVIconChoice                 MakeTag(clsDiskViewWin, 62)
#define tagDVIconBigPictTitleUnder      MakeTag(clsDiskViewWin, 63)
#define tagDVIconBigPictTitleRight      MakeTag(clsDiskViewWin, 64)
#define tagDVIconSmallPictTitleUnder    MakeTag(clsDiskViewWin, 65)
#define tagDVIconSmallPictTitleRight    MakeTag(clsDiskViewWin, 66)
#define tagDVDefaultBigBitmap           MakeTag(clsDiskViewWin, 67)
#define tagDVDefaultSmallBitmap         MakeTag(clsDiskViewWin, 68)
#define tagDVCardName                   MakeTag(clsDiskViewWin, 70)
#define tagDVCardTotal                  MakeTag(clsDiskViewWin, 71)
#define tagDVCardFree                   MakeTag(clsDiskViewWin, 72)
#define tagDVCardReadOnly               MakeTag(clsDiskViewWin, 73)
#define tagDVCardPopupViewer            MakeTag(clsDiskViewWin, 74)
#define tagDVCardPopupYes               MakeTag(clsDiskViewWin, 75)
#define tagDVCardPopupNo                MakeTag(clsDiskViewWin, 76)
#define tagDVCardInitialView            MakeTag(clsDiskViewWin, 77)
#define tagDVCardInitialPopupChoice     MakeTag(clsDiskViewWin, 78)
#define tagDVBookshelfLayoutLabel       MakeTag(clsDiskViewWin, 80)
#define tagDVBookshelfLayoutChoice      MakeTag(clsDiskViewWin, 81)
#define hlpDVNoVolumesConnected         MakeTag(clsDiskViewWin, 100)
#define hlpDVSheetBackground            MakeTag(clsDiskViewWin, 101)
#define hlpDVIcon                       MakeTag(clsDiskViewWin, 102)
#define hlpDVIconBackground             MakeTag(clsDiskViewWin, 103)
#define hlpDVTabButton                  MakeTag(clsDiskViewWin, 104)
#define hlpDVVolumeMenu                 MakeTag(clsDiskViewWin, 110)
#define hlpDVEditMenu                   MakeTag(clsDiskViewWin, 111)
#define hlpDVViewMenu                   MakeTag(clsDiskViewWin, 112)
#define hlpDVOptionsMenu                MakeTag(clsDiskViewWin, 113)
#define hlpDVClose                      MakeTag(clsDiskViewWin, 120)
#define hlpDVDuplicate                  MakeTag(clsDiskViewWin, 121)
#define hlpDVEjectRemember              MakeTag(clsDiskViewWin, 122)
#define hlpDVEjectForget                MakeTag(clsDiskViewWin, 123)
#define hlpDVRefresh                    MakeTag(clsDiskViewWin, 124)
#define hlpDVQuickInstall               MakeTag(clsDiskViewWin, 125)
#define hlpDVFormat                     MakeTag(clsDiskViewWin, 126)
```

```
#define hlpDVMove                       MakeTag(clsDiskViewWin, 130)
#define hlpDVCopy                       MakeTag(clsDiskViewWin, 131)
#define hlpDVDelete                     MakeTag(clsDiskViewWin, 132)
#define hlpDVRename                     MakeTag(clsDiskViewWin, 133)
#define hlpDVCreateDir                  MakeTag(clsDiskViewWin, 134)
#define hlpDVViewAll                    MakeTag(clsDiskViewWin, 140)
#define hlpDVViewBookshelf              MakeTag(clsDiskViewWin, 141)
#define hlpDVDisplayInstaller           MakeTag(clsDiskViewWin, 142)
#define hlpDVExpand                     MakeTag(clsDiskViewWin, 143)
#define hlpDVCollapse                   MakeTag(clsDiskViewWin, 144)
#define hlpDVLayoutOptionMenu           MakeTag(clsDiskViewWin, 145)
#define hlpDVDiskOptionMenu             MakeTag(clsDiskViewWin, 146)
#define hlpDVDiskOptions                tagDVDiskOptions
#define hlpDVDiskIconOptions            tagDVDiskIconOptions
#define hlpDVColumnLayoutOptions        tagDVColumnLayoutOptions
#define hlpDVBookshelfLayoutOptions     tagDVBookshelfLayoutOptions
#define hlpDVOptionsColumnsLabel        MakeTag(clsDiskViewWin, 150)
#define hlpDVOptionsIcon                MakeTag(clsDiskViewWin, 160)
#define hlpDVOptionsType                MakeTag(clsDiskViewWin, 161)
#define hlpDVOptionsDate                MakeTag(clsDiskViewWin, 162)
#define hlpDVOptionsSize                MakeTag(clsDiskViewWin, 163)
#define hlpDVOptionsDirSize             MakeTag(clsDiskViewWin, 164)
#define hlpDVOptionsVersion             MakeTag(clsDiskViewWin, 165)
#define hlpDVOptionsInstall             MakeTag(clsDiskViewWin, 166)
#define hlpDVSortByChoice               MakeTag(clsDiskViewWin, 170)
#define hlpDVSortByName                 MakeTag(clsDiskViewWin, 171)
#define hlpDVSortByDate                 MakeTag(clsDiskViewWin, 172)
#define hlpDVSortBySize                 MakeTag(clsDiskViewWin, 173)
#define hlpDVSortByType                 MakeTag(clsDiskViewWin, 174)
#define hlpDVDiskCardName               MakeTag(clsDiskViewWin, 180)
#define hlpDVDiskCardTotalSpace         MakeTag(clsDiskViewWin, 181)
#define hlpDVDiskCardFreeSpace          MakeTag(clsDiskViewWin, 182)
#define hlpDVDiskCardReadOnly           MakeTag(clsDiskViewWin, 183)
#define hlpDVDiskCardQuickInstaller     MakeTag(clsDiskViewWin, 184)
#define hlpDVDiskCardInitialView        MakeTag(clsDiskViewWin, 185)
#define hlpDVIconCardStyle              MakeTag(clsDiskViewWin, 190)
// QH tags for the column headers in diskview
#define hlpDVNameColumn                 MakeTag(clsDiskViewWin, 191)
#define hlpDVTypeColumn                 MakeTag(clsDiskViewWin, 192)
#define hlpDVDateColumn                 MakeTag(clsDiskViewWin, 193)
#define hlpDVTimeColumn                 MakeTag(clsDiskViewWin, 194)
#define hlpDVSizeColumn                 MakeTag(clsDiskViewWin, 195)
#define hlpDVVersionColumn              MakeTag(clsDiskViewWin, 196)
#define hlpDVInstallColumn              MakeTag(clsDiskViewWin, 197)
```

EXPORT.H

This file contains the API definition for **clsExport**.

clsExport inherits from **clsObject**.

clsExport is the abstract class defining the API for exporting data to external disks.

The **clsExport** API provides a common mechanism for documents to translate themselves into foreign file formats and place the file on external disks.

Overview

The export protocol is initiated from the move/copy protocol (see embedwin.h). All moves/copies from the TOC to non-bookshelf views of the DiskViewer are implicitly exports.

More specifically, export happens after **msgSelCopySelection** reaches the DiskViewer, which is the destination of the copy, and the source of the copy includes **clsExport** as an item in the list returned by **msgXferList**. Anything moveable/copyable can potentially invoke export.(See xfer.h and sel.h for information on PenPoint's move/copy protocol and selection management.)

The DiskViewer will send the source of the copy (the selection) **msgExportGetFormats**. The source should pass back an array of possible export formats. From the information in **msgExportGetFormats** **clsApp** generates the export dialog box. If the user selects the external export format and taps the Move/Copy button, the export class sends **msgExport** to the appropriate translator specified in **msgExportGetFormats**. If user selects the PenPoint format and taps the Move/Copy button, the move/copy is equivalent to **msgAppMgrMove/msgAppMgrCopy** (see appmgr.h).

If the source of the export is in the TOC, the DiskViewer activates the source document and sends it **msgExportGetFormats**.

How to Be an Exporting Application

Any application that wants to export must have its subclass of **clsApp** respond to **msgExportGetFormats** and **msgExport**.

```
#ifndef EXPORT_INCLUDED
#define EXPORT_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef UID_INCLUDED
#include <uid.h>
#endif
#ifndef FS_INCLUDED
#include <fs.h>
#endif
```

Common #defines and typedefs

Status codes

```
#define stsExportActivateSource         MakeWarning(clsExport, 1)
#define stsExportFailed                 MakeWarning(clsExport, 2)
#define stsExportFailedUserNotified     MakeWarning(clsExport, 3)
```

Messages

msgExportGetFormats

Passes back the export format array from from the source of the export.

Takes P_EXPORT_LIST, returns STATUS. Category: client responsibility.

```
#define msgExportGetFormats             MakeMsg(clsExport, 1)
```

Arguments

```
typedef struct {
    TAG         documentType;             // Source document type.
    TAG         exportType;               // Export destination type.
    OBJECT      translator;               // Object which to send msgExport.
    CHAR        exportName[nameBufLength]; // Name of export type for
                                          // display in dialog box.
} EXPORT_FORMAT, *P_EXPORT_FORMAT;
typedef struct {
    P_EXPORT_FORMAT     format;         // Array of formats, must be SHARED
                                        // memory, freed by caller.
    U16                 numEntries;     // Number of elements in format array.
} EXPORT_LIST, *P_EXPORT_LIST;
```

Comments

The DiskViewer sends this message to the selection.

The recipient should allocate global memory to hold the EXPORT_FORMAT array which is passed back to the DiskViewer in the format field. The sender of **msgExportGetFormats** must free the memory.

If the source returns **stsExportActivateSource**, the DiskViewer will treat the source as an inactive document (This is how the TOC behaves when it is the source of export). The source will be activated using **msgAppMgrActivate** and the activated doc will be sent **msgExportGetFormats**.

msgExport

Initiates export by the translator.

Takes P_EXPORT_DOC, returns STATUS. Category: client responsibility.

```
#define msgExport                       MakeMsg(clsExport, 2)
```

Arguments

```
typedef struct {
    TAG             exportType;             // Corresponds to exportType from
                                            // msgExportGetFormats EXPORT_FORMAT.
    FS_LOCATOR      source;                 // Source document or null if
                                            // source is not a document.
    FILE_HANDLE     destination;            // Destination file handle.
                                            // If you don't want to export to
                                            // this file, use msgFSGetPath to
                                            // retrieve the destination and
                                            // destroy this file handle.
    CHAR            path[fsPathBufLength];  // Source path.
    TAG             documentType;           // Corresponds to documentType from
                                            // msgExportGetFormats EXPORT_FORMAT.
    U32             spare1;                 // Spare: reserved
    U32             spare2;                 // Spare: reserved
} EXPORT_DOC, *P_EXPORT_DOC;
```

Comments

This message is sent to the translator specified in EXPORT_FORMAT. The translator is passed an open file handle to which the translator can write exported data or the translator can get the path of the file, destroy the file and replace it with its own file structure.

If the export fails, it is the exporter's reponsibility for removing invalid and/or partial files created during the failed export. The minimum the client should do is send **msgFSDelete** to **pArgs**->destination to remove the file created for the exportation.

If the exporter wishes to put their custom dialog box to query the user for more information, the exporter should do this in response to **msgExport**. If the custom dialog allows the user to cancel the export operation, then the exporter should return **stsExportFailedUserNotified** which will cause PenPoint to suppress any error of the aborted export.

msgExportName

Passes back a possibly modified destination name from the translator.

Takes P_EXPORT_FORMAT, returns STATUS.

```
#define msgExportName                      MakeMsg(clsExport, 3)
```

Message Arguments

```
typedef struct {
    TAG         documentType;               // Source document type.
    TAG         exportType;                 // Export destination type.
    OBJECT      translator;                 // Object which to send msgExport.
    CHAR        exportName[nameBufLength];  // Name of export type for
                                            // display in dialog box.
} EXPORT_FORMAT, *P_EXPORT_FORMAT;
```

Comments

This message is sent to the translator specified in EXPORT_FORMATS whenever the user chooses a new export type in the dialog box. When the translator receives the message, export name is set to the source document name. The translator should set export name **exportName** should be set to the "correct" destination file name. For instance the extension '.RTF' or '.WKS' may be appended to the name.

If the translator ignores this message the destination name will remain unchanged (so this message can safely be ignored).

Miscellaneous

Help tags

These are help tags on various pieces of the standard export dialog box.

```
#define hlpExportSheet                     MakeTag(clsExport, 50)
#define hlpExportName                      MakeTag(clsExport, 51)
#define hlpExportNewName                   MakeTag(clsExport, 52)
#define hlpExportChoice                    MakeTag(clsExport, 53)
```

GMARGIN.H

This file contains the API definition for **clsGestureMargin**.

clsGestureMargin inherits from **clsScrollWin.**

clsGestureMargin adds a margin to the scroll win on the opposite side from the scroll bar. Gestures made in the margin are forwarded to the client win.

clsGestureMargin is used in PenPoint by the MiniNote application. MiniNote uses the gesture margin in lieu of a scroll win. When MiniNote is in writing mode, the margin is gray. In gesture mode, the margin is white.

Gesture mode is intended to indicate a "safe" mode in which the 11 core gestures can be used. In ink mode, some gestures do not work and be may interpreted as some other type of data (e.g. ink).

```
#ifndef GMARGIN_INCLUDED
#define GMARGIN_INCLUDED
#ifndef SWIN_INCLUDED
#include <swin.h>
#endif
```

Types and Constants

```
#define clsGestureMargin            MakeGlobalWKN(2572,1)
#define clsGestureMarginInnerWin    MakeGlobalWKN(2573,1)
typedef struct GESTURE_MARGIN_STYLE {
    U16 gestureMargin       : 1,    // gesture margin on/off
        wideGestureMargin   : 1,    // make the gesture margin wide
                                    // (not implemented)
        maskGestureMargin   : 1,    // mask out gestureMargin
        inkMode             : 1,    // margin is gray for if in ink mode
        reserved            :12;
} GESTURE_MARGIN_STYLE, *P_GESTURE_MARGIN_STYLE;
typedef struct {
    GESTURE_MARGIN_STYLE    style;
    S32                     spares[4];
} GESTURE_MARGIN_NEW_ONLY, *P_GESTURE_MARGIN_NEW_ONLY;
#define gestureMarginNewFields      \
    scrollWinNewFields          \
    GESTURE_MARGIN_NEW_ONLY gestureMargin;
typedef struct {
    gestureMarginNewFields
} GESTURE_MARGIN_NEW, *P_GESTURE_MARGIN_NEW;
```

Messages

msgGestureMarginGetStyle

Passes back the receiver's current style values.

Takes P_GESTURE_MARGIN_STYLE, returns STATUS.

```
#define msgGestureMarginGetStyle    MakeMsg(clsGestureMargin, 1)
```

Message Arguments

```
typedef struct GESTURE_MARGIN_STYLE {
    U16 gestureMargin       : 1,    // gesture margin on/off
        wideGestureMargin   : 1,    // make the gesture margin wide
                                    // (not implemented)
        maskGestureMargin   : 1,    // mask out gestureMargin
        inkMode             : 1,    // margin is gray for if in ink mode
        reserved            :12;
} GESTURE_MARGIN_STYLE, *P_GESTURE_MARGIN_STYLE;
```

msgGestureMarginSetStyle

Sets the receiver's style values.

Takes P_GESTURE_MARGIN_STYLE, returns STATUS.

```
#define msgGestureMarginSetStyle    MakeMsg(clsGestureMargin, 2)
```

Message Arguments

```
typedef struct GESTURE_MARGIN_STYLE {
    U16 gestureMargin       : 1,    // gesture margin on/off
        wideGestureMargin   : 1,    // make the gesture margin wide
                                    // (not implemented)
        maskGestureMargin   : 1,    // mask out gestureMargin
        inkMode             : 1,    // margin is gray for if in ink mode
        reserved            :12;
} GESTURE_MARGIN_STYLE, *P_GESTURE_MARGIN_STYLE;
```

msgGestureMarginSetInkMode

Sets margin to be either ink or gesture mode.

Takes BOOLEAN, returns STATUS.

```
#define msgGestureMarginSetInkMode  MakeMsg(clsGestureMargin, 3)
```

HASH.H

This package implements an "Open Addressing, Linear Probe" hash table.

The functions described in this file are contained in SYSUTIL.LIB.

Introduction

This package implements hash tables. Hash tables offer relatively fast key-based random access to data at the expense of some memory. The performance improvement over linear searching is substantial.

The defaults supplied by this package are probably fine for most data. However, hash table performance depends on both a good hash function and proper size parameters. If your data's keys are unevenly distributed then consider writing your own hash function. Try to get the hash table's initial size close to the number of expected entries divided by the fill percentage. You can vary the fill percentage to meet your tradeoffs between space and time.

Creating a Hash Table

To create a hash table:

- Allocate space for the hash table (either on the stack or in a heap block)
- Call HashInitDefaults()
- Optionally customize the HASH_INFO structure
- Call HashInit()

Examples

Here's some sample code based on a 32 bit key. (The package has built-in Hash and Compare functions for 32 bit keys; see section "Hash and Compare Functions.")

```
// Client data structure. (The structure must contain a key field,
// though it need not be named key and it need not be the first field.)
typedef struct {
    U32     data;
    U32     key;
} YOUR_DATA, *P_YOUR_DATA;
{
    P_HASH_INFO     pHashInfo;
    P_YOUR_DATA     pMD;
    U32             key;
    // Create table.
    OSHeapBlockAlloc(osProcessHeapId, sizeof(*pHashInfo), &pHashInfo);
    HashInitDefaults(pHashInfo);
    // Optionally customize between calls to HashInitDefaults() and
    // HashInit(). For instance, if you have 16 bit keys, you
    // might do the following:
    //   pHashInfo->pHashFunction = HashFunction16;
    //   pHashInfo->pHashCompare = HashCompare16;
    HashInit(pHashInfo, offsetof(YOUR_DATA, key));
```

```
        // Add entry to hash table
        OSHeapBlockAlloc(osProcessHeapId, SizeOf(YOUR_DATA), &pMD);
        pMD->key = 25;
        pMD->data = someData;
        HashAddEntry(pHashInfo, pMD);

        // Find entry in hash table. Returns stsNoMatch if not found.
        key = 25;
        HashFindData(pHashInfo, &key, &pMD);
        Debugf("Data for key %d is %d", key, pMD->data);

        // Delete entry in hash table without freeing client data.
        // Returns stsNoMatch if not found.
        key = 25;
        HashDeleteEntry(pHashInfo, &key, &pMD, false);
        OSHeapBlockFree(pMD);

        // Delete entry in hash table and free the client data.
        // Returns stsNoMatch if not found.
        key = 25;
        HashDeleteEntry(pHashInfo, &key, &pMD, true);

        // Free hash table, and call OSHeapBlockFree() on all client data.
        HashFree(pHashInfo, true);

        OSHeapBlockFree(pHashInfo);
    }
```

Enumerating Hash Table Entries

All of the entries in a hash table can be enumerated by examining the entries field of the HASH_INFO structure. Empty entries are null. Note that there are **numEntries** slots, **numFilled** of which are non-null.

```
P_HASH_INFO     pHashInfo;
P_HASH_ENTRY    pEntries;

pEntries = pHashInfo->entries;
for (i = 0; i < pHashInfo->numEntries; i++) {
    if (pEntries[i].pData) {
        // Do something with entry
    }
}
```

Hash and Compare Functions

The package includes good Hash and Compare functions for the following types of keys:

- 16 bit numbers
- 32 bit numbers
- 64 bit numbers
- null-terminated strings

Clients with other key types need to provide their own Hash and Compare functions. Sophisticated clients may want to provide their own Hash and Compare functions even if they have keys with one of the above types.

Replacement Hash and Compare functions should look like the following:

```
typedef struct {
    U8  major;
    U16 minor;
} MY_KEY, * P_MY_KEY;
typedef struct {
    MY_KEY      key;
    P_UNKNOWN   pData;
} MY_DATA, * P_MY_DATA;
U32 EXPORTED
MyKeyHashFunction(
    P_HASH_KEY  pKey)
{
    P_MY_KEY     pMyKey = (P_MY_KEY)pKey;
    U32          hash;
    hash = pMyKey->major * 9551;     // 9551 is prime
    hash += pMyKey->minor * 113;     // 113 is prime
    return hash;
}
BOOLEAN EXPORTED MyKeyHashCompare(
    P_HASH_KEY      pKey1,
    P_HASH_KEY      pKey2)
{
    P_MY_KEY     pMyKey1 = (P_MY_KEY)pKey1;
    P_MY_KEY     pMyKey2 = (P_MY_KEY)pKey2;
    return ((pMyKey1->major == pMyKey2->major) AND
            (pMyKey1->minor == pMyKey2->minor));
}
```

Space / Time Tradeoff

The following table show the space / time tradeoff for a variety of **percentFull** values, normalized to 80%. This table is a gross simplification. Among other things, it assumes well distributed keys.

full percentage	relative speed	relative memory use
10	2.8	8.0
20	2.7	4.0
30	2.5	2.7
40	2.3	2.0
50	2.0	1.6
60	1.7	1.3
70	1.4	1.2
80	1.0	1.0
90	.6	.9
95	.3	.8

```
#ifndef HASH_INCLUDED
#define HASH_INCLUDED
#include <string.h>
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef OSTYPES_INCLUDED
#include <ostypes.h>
#endif
#ifndef OSHEAP_INCLUDED
#include <osheap.h>
#endif
#include <stddef.h>
```

Common #defines and typedefs

Default values

```
#define minHashTableInitialSize 15      // minimum initial size
#define minHashTableExpandSize  16      // minimum expand increment
#define hashTableMaxFillPct     80      // expand when the table gets this
                                        // percentage full.
```

Key and Data Pointer Types

```
typedef void *  P_HASH_KEY;
typedef void *  P_HASH_DATA;
```

Type for Hash function

Function Prototype

```
typedef U32 FunctionPtr(HASH_FUNCTION) (
    P_HASH_KEY  pKey
);
```

Type for Compare function. Function should return true if **pKey1** and **pKey2** point to keys with identical values.

Function Prototype

```
typedef BOOLEAN FunctionPtr(HASH_COMPARE)(
    P_HASH_KEY      pKey1,
    P_HASH_KEY      pKey2
);
```

A hash table entry.

```
typedef struct HASH_ENTRY {
    P_HASH_DATA     pData;  // Points to user data
} HASH_ENTRY, * P_HASH_ENTRY, ** PP_HASH_ENTRY;
```

The hash table itself. Space for the table is allocated by the client. Space for the entries is allocated by hash table functions and is freed via a call to HashFree().

The debugging version of the hash table gathers statistics.

```
typedef struct HASH_INFO {
    U32             numEntries;         // number of entries allocated.
                                        // Should be prime!
    U32             numFilled;          // number of entries in use. Not
                                        // too small or table will expand too
                                        // often. Should be even.
    U32             expandNumber;       // number of entries to expand by
    U32             percentFull;        // max percentage full at expand time.
                                        // Performance falls off rapidly if
                                        // table allowed to get much fuller
                                        // than 80%.
    U16             keyOffset;          // offset of key in P_HASH_DATA
    OS_HEAP_ID      heap;               // heap to expand into
    P_HASH_ENTRY    entries;            // points to hash table array.
                                        // Array can be indexed sequentially
                                        // to find all the entries in the
                                        // table. Empty slots are null.
    HASH_FUNCTION   pHashFunction;      // Hash function
    HASH_COMPARE    pHashCompare;       // Compare function
    // Statistics maintained for DEBUG version
    U32             numProbes;          // Counts number of hash probes
    U32             numProbeMisses;     // Counts number of probe retries
    U32             numAdds;            // Counts number of adds
    U32             numDeletes;         // Counts number of deletes
} HASH_INFO, * P_HASH_INFO;
```

Functions

HashFindData

Given a key, passes back a P_HASH_DATA.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED HashFindData (
    P_HASH_INFO     pInfo,
    P_HASH_KEY      pKey,
    P_HASH_DATA   * ppData);
```

Return Value

stsNoMatch the key is not in the table. *ppData is undefined.

stsOK the key is in the table.

See Also HashFindTableEntry

HashFindTableEntry

Given a key, passes back a pointer to client data.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED HashFindTableEntry (
    P_HASH_INFO     pInfo,
    P_HASH_KEY      pKey,
    PP_HASH_ENTRY   ppEntry);
```

Return Value

stsNoMatch the key is not in the table. *ppEntry is undefined.

stsOK the key is in the table.

See Also HashFindData

HashAddEntry

Adds an entry to a hash table.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED HashAddEntry (
    P_HASH_INFO     pInfo,
    P_HASH_DATA     pData);
```

Comments The hash table expands if adding this entry causes the table to exceed the expand threshold.

Return Value **stsFailed** the key is already in the table

HashDeleteEntry

Deletes entry from hash table.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED HashDeleteEntry (
    P_HASH_INFO     pInfo,
    P_HASH_KEY      pKey,
    P_HASH_DATA   * ppData,
    BOOLEAN         freeClientData);
```

Comments If **freeClientData** is true then the client data is deallocated using **ppData** is undefined. Otherwise *ppData contains the pointer to client data.

Freeing entries does not cause the table to shrink.

Return Value **stsNoMatch** the key is not in the table.

HashInitDefaults

Initializes hash table parameters.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED HashInitDefaults(
    P_HASH_INFO pInfo);
```

Comments

Warning: HashInitDefaults() MUST be called before HashInit. See the section "Examples."

Default values:

```
    memset(pInfo, 0, sizeof(HASH_INFO));
    pInfo->numEntries       = 31;
    pInfo->expandNumber     = 24;
    pInfo->heap             = osProcessHeapId;
    pInfo->pHashFunction    = HashFunction32;   // Default 32 bit key
    pInfo->pHashCompare     = HashCompare32;    // Default 32 bit key
    pInfo->percentFull      = 80;
```

HashInit

Causes the hash table to allocate internal tables.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED HashInit(
    P_HASH_INFO     pInfo,
    U32             keyOffset);     // offset of key in client data.
```

Comments

The client must call this function after calling HashInitDefaults() and performing any optional customization.

Example:

```
    HashInitDefaults(pInfo);
    HashInit(pInfo, offsetof(YOUR_DATA, key));
```

HashFree

Frees internal hash table memory. Optionally deallocates any remaining user data blocks.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED HashFree(
    P_HASH_INFO     pInfo,
    BOOLEAN         freeAllEntries);
```

Comments

If **freeAllEntries** is true, then the hash table calls OSHeapBlockFree() on each remaining piece of client data.

If the client is going to call HashFree() with **freeAllEntries** false, the client must free all client data beforehand.

Note that this function does NOT free the HASH_INFO structure. If the client allocated it before calling HashInit() then the client should free the table after calling HashFree().

Built-in Hash and Compare Functions

The functions in this section are useful default hash and compare functions for common key types. The 64 bit, 32 bit, and 16 bit functions work equally well for signed or unsigned values.

64 bit keys

Function Prototype
```
U32 EXPORTED HashFunction64(P_HASH_KEY pKey);
BOOLEAN EXPORTED HashCompare64(P_HASH_KEY pKey1, P_HASH_KEY pKey2);
```

32 bit keys

Function Prototype
```
U32 EXPORTED HashFunction32(P_HASH_KEY pKey);
BOOLEAN EXPORTED HashCompare32(P_HASH_KEY pKey1, P_HASH_KEY pKey2);
```

16 bit keys

Function Prototype
```
U32 EXPORTED HashFunction16(P_HASH_KEY pKey);
BOOLEAN EXPORTED HashCompare16(P_HASH_KEY pKey1, P_HASH_KEY pKey2);
```

String keys

Function Prototype
```
U32 EXPORTED HashFunctionString(P_HASH_KEY pKey);
BOOLEAN EXPORTED HashCompareString(P_HASH_KEY pKey1, P_HASH_KEY pKey2);
```

IMPORT.H

This file contains the API definition for **clsImport**.

clsImport inherits from **clsObject**.

clsImport is the abstract class defining the API for importing foreign files from external disks into notebook documents.

Overview

The import protocol is triggered when the TOC receives **msgSelMoveSelection** or **msgSelCopySelection** the TOC, and the source of the move/copy includes **clsFileSystem** as an item in the list returned by **msgXferList**, then the TOC initiates the import protocol. (See xfer.h and sel.h for information on PenPoint's move/copy protocol and selection management.)

The import protocol sends **msgImportQuery**, as a class message, to each installed application class to determine the set of applications that can import the file.

Once every installed application has been queried, **clsApp** will put up an import dialog box. An instance of the application is created on the destination and **msgImport** is sent. If the import succeeds, the importer should return **stsOK**. If an error occurs and the user has not been notified of the failure, the importer should return **stsImportFailed**. If an error occurs and the user has been notified, the importer should return **stsImportFailedUserNotified**.

How to Be an Importing Application

Any application that wants to import must handle **msgImportQuery** and **msgImport**.

The import protocol sends **msgImportQuery** as a class message. (See clsmgr.h for more general information about class messages.) For your app to receive a class message you must have an entry something like this in your application class's method table:

```
MSG_INFO myAppMethods [] = {
    ...
    msgImportQuery, "MyAppImportQuery", objClassMessage,
    ...
    0
};
```

The 'ImportQueryHandler' method can look at the contents or the name of the imported file to determine if that file can be imported by the app. If the app can import the file, the 'ImportQueryHandler' method sets the **pArgs**->canImport boolean to true (the default is false) and returns **stsOK**. The TOC will then add the application's name to the list of possible import destinations for the import dialog.

```
#ifndef IMPORT_INCLUDED
#define IMPORT_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef UID_INCLUDED
#include <uid.h>
#endif
#ifndef FS_INCLUDED
#include <fs.h>
#endif
```

Common #defines and typedefs

Status codes

Importing applications should re **stsImportFailedUserNotified** if the importer detected an error during the importation and notified the user of the error. This allows the importer to give a more detailed error message to the user.

```
#define stsImportFailed                 MakeStatus(clsImport, 1)
#define stsImportFailedUserNotified     MakeStatus(clsImport, 2)
#define stsImportInvalidFormat          MakeStatus(clsImport, 3)
```

Messages

msgImportQuery

Queries each app class to see if it is capable of importing the file.

Takes P_IMPORT_QUERY, returns STATUS. Category: client responsibility.

```
#define msgImportQuery                      MakeMsg(clsImport,1)
```

Arguments

```
typedef struct {
    FILE_HANDLE         file;                       // Open file handle to imported file.
    TAG                 fileType;                   // File type if it exists.
    CHAR                fileName[nameBufLength];    // Source file name.
    BOOLEAN             canImport;                  // Out: TRUE if app can import the file.
                                                    // Default setting on entry is false.
    U16                 suitabilityRating;          // Out:   0 - lowest
                                                    //       50 - average (default)
                                                    //      100 - highest
    U8                  spare[64];                  // Spare: reserved.
} IMPORT_QUERY, *P_IMPORT_QUERY;
```

Comments

This message is sent by the browser to each application class. The applicatin should pass back **pArgs**->canImport set to true if it can import the file. **pArgs**->suitabilityRating is the relative rating of how suitable the application is to importing the file. This rating determines the ordering within the list of applications in the import dialog box displayed by PenPoint.

msgImport

Initiates the import.

Takes P_IMPORT_DOC, returns STATUS. Category: client responsibility.

```
#define msgImport                           MakeMsg(clsImport,2)
```

Arguments

```
typedef struct {
    FILE_HANDLE file;                       // Open file handle to file.
    TAG         fileType;                   // File type if exists.
    U8          fileName[nameBufLength];    // Source file name.
    U32         sequence;                   // Sequence number for dest.
    DIR_HANDLE  destHandle;                 // Dir handle to dest section.
} IMPORT_DOC, *P_IMPORT_DOC;
```

Comments

This message is sent by **clsApp** to a newly created instance of the destination application. The application should import the data from the file and return **stsOK**. If this message returns an error status the newly created app instance will be deleted.

Miscellaneous

Help tags

These are help tags on various pieces of the standard export dialog box.

```
#define hlpImportSheet                  MakeTag(clsImport, 50)
#define hlpImportName                   MakeTag(clsImport, 51)
#define hlpImportNewName                MakeTag(clsImport, 52)
#define hlpImportChoice                 MakeTag(clsImport, 53)
```

LIST.H

This file contains the API definition for **clsList**.

clsList inherits from **clsObject**.

Lists are a simple ordered collections of items.

```
#ifndef LIST_INCLUDED
#define LIST_INCLUDED
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
```

Common #defines and typedefs

```
typedef OBJECT LIST, *P_LIST;
typedef P_UNKNOWN LIST_ITEM, *P_LIST_ITEM;
```

LIST_ENTRY is used in many messages. In general, the fields are treated as follows:

- position. An item's location. Locations are zero-based. The first item is 0 and the last item is number of items - 1. When used as an In parameter, position specifies the position of the item to operate on. For adding operations, **maxU16** means beyond the last item. For other operations, **maxU16** means the last item in the list. Values beyond the size of the list but less than **maxU16** are not recommended. When used as an Out parameter, position contains the actual position of the item. **maxU16** is never passed back even if passed in.
- item. When used as an In parameter, item identifies the item to operate on. If the same item added to the list more than once, then all operations work only the first appearance of the item. When used as an Out parameter, item contains the item operated on.

```
typedef struct LIST_ENTRY {
    U16         position;
    LIST_ITEM   item;
} LIST_ENTRY, *P_LIST_ENTRY;
typedef struct LIST_NOTIFY {
  MESSAGE          msg;           // In:  message to send/post
  P_ARGS           pArgs;         // In:  pArgs for message
  SIZEOF           lenSend;       // In:  length of pArgs
} LIST_NOTIFY, * P_LIST_NOTIFY;
```

Status Codes

```
#define stsListFull                    MakeStatus(clsList, 1)
#define stsListEmpty                   MakeStatus(clsList, 2)
```

Messages Defined by Other Classes

msgNew

Creates a new empty list.

Takes P_LIST_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct LIST_STYLE {
    U16         reserved:16;
} LIST_STYLE, * P_LIST_STYLE;
```

List filing behavior.

```
typedef enum LIST_FILE_MODE {
    listFileItemsAsData,            // File list items as U32 data.
    listFileItemsAsObjects,         // Treat list items as objects. Save
                                    // them with msgResPutObject and restore
                                    // them with msgResGetObject.
    listDoNotFileItems              // Don't file list items.
} LIST_FILE_MODE, *P_LIST_FILE_MODE;
typedef struct LIST_NEW_ONLY {
    LIST_STYLE      style;
    LIST_FILE_MODE  fileMode;
    U32             reserved[4];    // Reserved
} LIST_NEW_ONLY, *P_LIST_NEW_ONLY;
#define listNewFields         \
    objectNewFields           \
    LIST_NEW_ONLY           list;
typedef struct LIST_NEW {
    listNewFields
} LIST_NEW, *P_LIST_NEW;
```

Comments

If the heap specified in **pArgs**->object.heap is null, the process heap is used.

msgNewDefaults

Initializes the LIST_NEW structure to default values.

Takes P_LIST_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct LIST_NEW {
    listNewFields
} LIST_NEW, *P_LIST_NEW;
```

Comments

Zeroes out **pNew**->list and sets:

```
    pArgs->list.fileMode = listFileItemsAsObjects
```

msgSave

Defined in clsmgr.h

Takes P_OBJ_SAVE, returns STATUS.

Comments

In response to this message, the list saves itself. Then, based on the list's **fileMode**, it may save the item information. See the commentary with the type LIST_FILE_MODE for more information.

msgRestore

Defined in clsmgr.h

Takes P_OBJ_RESTORE, returns STATUS.

Comments

In response to this message, the list restores itself. Then, based on the list's **fileMode**, it may restore the items information. See the commentary with the type LIST_FILE_MODE for more information.

List Manipulation Messages

msgListFree

Frees a list according to mode.

Takes P_LIST_FREE, returns STATUS.

```
#define msgListFree                    MakeMsg(clsList, 1)
```

Arguments

```
typedef enum LIST_FREE_MODE {
    listFreeItemsAsData,       // Ignore the item's value. Simply destroy
                               // the list itself. Equivalent to sending
                               // msgDestroy to the list.
    listFreeItemsAsObjects,    // Treat items as objects. Send each item
                               // msgDestroy Nil(key) before destroying
                               // the list itself. Any errors are ignored.
    listDoNotFreeItems         // Obsolete. Do not use.
} LIST_FREE_MODE, *P_LIST_FREE_MODE;
typedef struct LIST_FREE {
    OBJ_KEY        key;        // Key for freeing the list object.
    LIST_FREE_MODE mode;
} LIST_FREE, *P_LIST_FREE;
```

Comments

In response to this message, the list destroys itself AND all of its items.

Use **msgDestroy** to destroy the list without affecting the list's items. For both messages, observers are sent **msgListNotifyEmpty**.

msgListAddItem

Adds an item to the end of a list.

Takes LIST_ITEM, returns STATUS.

```
#define msgListAddItem                 MakeMsg(clsList, 2)
```

Comments

Observers are sent **msgListNotifyAddition**.

msgListAddItemAt

Adds an item to a list at **pArgs**->position.

Takes P_LIST_ENTRY, returns STATUS.

```
#define msgListAddItemAt               MakeMsg(clsList, 10)
```

Message Arguments

```
typedef struct LIST_ENTRY {
    U16        position;
    LIST_ITEM  item;
} LIST_ENTRY, *P_LIST_ENTRY;
```

Comments

If the list is empty, **pArgs**->position is treated as if it were 0. If **pArgs**->position is **maxU16**, the item is inserted at the end of the list.

If necessary, list items move to make room for the new item.

Observers are sent **msgListNotifyAddition**.

Return Value

stsOK item added. **pArgs**->position contains the actual position of the new item.

msgListRemoveItem

The list searches for **pArgs** in the list and removes the item if found.

Takes LIST_ITEM, returns STATUS.

```
#define msgListRemoveItem                MakeMsg(clsList, 11)
```

Comments

If the argument is in the list more than once, only the first instance of it is removed.

Observers are sent **msgListNotifyDeletion**.

Return Value

stsListEmpty the list was empty

stsNoMatch item was not found

msgListRemoveItemAt

Removes the item in the list at **pArgs**->position.

Takes P_LIST_ENTRY, returns STATUS.

```
#define msgListRemoveItemAt              MakeMsg(clsList, 3)
```

Message Arguments

```
typedef struct LIST_ENTRY {
    U16          position;
    LIST_ITEM    item;
} LIST_ENTRY, *P_LIST_ENTRY;
```

Comments

Observers are sent **msgListNotifyDeletion**.

Return Value

stsListEmpty the list was empty

stsOK item removed. **pArgs**->position contains the position of the removed item.

msgListReplaceItem

Replaces the item in the list at **pArgs**->position.

Takes P_LIST_ENTRY, returns STATUS.

```
#define msgListReplaceItem               MakeMsg(clsList, 4)
```

Message Arguments

```
typedef struct LIST_ENTRY {
    U16          position;
    LIST_ITEM    item;
} LIST_ENTRY, *P_LIST_ENTRY;
```

Comments

If **pArgs**->position is **maxU16**, the last item in the list is replaced.

Observers are sent **msgListNotifyReplacement**.

Return Value

stsListEmpty the list was empty

stsOK item was replaced. **pArgs**->item contains the old item and **pArgs**->position contains its old position.

msgListGetItem

Gets the item in the list at **pArgs**->position.

Takes P_LIST_ENTRY, returns STATUS.

```
#define msgListGetItem                   MakeMsg(clsList, 5)
```

Message Arguments

```
typedef struct LIST_ENTRY {
    U16         position;
    LIST_ITEM   item;
} LIST_ENTRY, *P_LIST_ENTRY;
```

Comments

If **pArgs**->position is **maxU16**, the last item in the list is returned.

Return Value

stsListEmpty the list was empty.

stsOK item found. **pArgs**->position contains the position of the item.

msgListFindItem

Searches for **pArgs**->item in the list.

Takes P_LIST_ENTRY, returns STATUS.

```
#define msgListFindItem                  MakeMsg(clsList, 6)
```

Message Arguments

```
typedef struct LIST_ENTRY {
    U16         position;
    LIST_ITEM   item;
} LIST_ENTRY, *P_LIST_ENTRY;
```

Return Value

stsNoMatch item was not found.

stsOK item was found. **pArgs**->position contains the position of the item.

msgListNumItems

Passes back the number of items in a list.

Takes P_U16, returns STATUS.

```
#define msgListNumItems                  MakeMsg(clsList, 7)
```

msgListRemoveItems

Removes all of the items in a list.

Takes no arguments, returns STATUS.

```
#define msgListRemoveItems               MakeMsg(clsList, 8)
```

Comments

The list's items are not affected in any way.

Observers are sent **msgListNotifyEmpty**.

msgListEnumItems

Enumerates the items in a list.

Takes P_LIST_ENUM, returns STATUS.

```
#define msgListEnumItems                 MakeMsg(clsList, 9)
```

Arguments

```
typedef struct LIST_ENUM {
    U16         max;
    U16         count;
    P_LIST_ITEM pItems;
    P_UNKNOWN   pNext;
} LIST_ENUM, * P_LIST_ENUM;
```

Comments

This copies successive items from the list into an array. There are two approaches a client can use:

1. Let the list do all the work in one call. The list allocates an array of items which is passed back in **pArgs**->pItems. You must free this array when you are done with a call to OSHeapBlockFree. LIST_ENUM Should be filled in as follows:

max On input, should be 0. On output, will be the the number of items in the allocated block.

count On input, should be **maxU16**. On output will be the same as max.

pItems On input, should be null. On output, will be the pointer to the allocated block.

pNext On input, should be null.

2. Go through the items, a chunk at a time. Repeatedly call **msgListEnumItems** with the same LIST_ENUM structure and processes successive groups of items. The call that returns **stsEndOfData** indicates that the enumeration is finished (there are no more items to process). LIST_ENUM is used as follows:

max On input and output, the number of items your block can hold

count On input, the same as max. On output, will be the number of items returned in block. (This will be less than max the last time through.)

pItems On input, a pointer to a block that can hold at least max items.

pNext On input for first call, should be null. Do not modify thereafter.

Return Value

stsEndOfData There are no more items to enumerate (list may be empty). When **stsEndOfData** is returned, **pArgs**->count is zero. If you passed in **pItems** as null and max as 0, the block may not have been allocated. Check **pItems** for nil and free it if it isn't.

msgListGetHeap

Passes back the heap used by the list.

Takes P_OS_HEAP_ID, returns STATUS.

```
#define msgListGetHeap                    MakeMsg(clsList, 12)
```

Forwarding Messages

clsList responds to these messages by sending the specified message to each item in the list in turn. **clsList** ignores the values returned by sending this message and always returns **stsOK**.

msgListCall

Sends a message to each object in the list using ObjectCall.

Takes P_LIST_NOTIFY, returns STATUS.

```
#define msgListCall                       MakeMsg(clsList, 13)
```

Message Arguments

```
typedef struct LIST_NOTIFY {
  MESSAGE          msg;             // In:  message to send/post
  P_ARGS           pArgs;           // In:  pArgs for message
  SIZEOF           lenSend;         // In:  length of pArgs
} LIST_NOTIFY, * P_LIST_NOTIFY;
```

msgListSend

Sends a message to each object in the list using ObjectSend.

Takes P_LIST_NOTIFY, returns STATUS.

```
#define msgListSend                     MakeMsg(clsList, 14)
```

Message Arguments

```
typedef struct LIST_NOTIFY {
  MESSAGE           msg;           // In:  message to send/post
  P_ARGS            pArgs;         // In:  pArgs for message
  SIZEOF            lenSend;       // In:  length of pArgs
} LIST_NOTIFY, * P_LIST_NOTIFY;
```

msgListPost

Sends a message to each object in the list using ObjectPost.

Takes P_LIST_NOTIFY, returns STATUS.

```
#define msgListPost                     MakeMsg(clsList, 15)
```

Message Arguments

```
typedef struct LIST_NOTIFY {
  MESSAGE           msg;           // In:  message to send/post
  P_ARGS            pArgs;         // In:  pArgs for message
  SIZEOF            lenSend;       // In:  length of pArgs
} LIST_NOTIFY, * P_LIST_NOTIFY;
```

Observer Notifications

A list uses **msgPostObservers** to deliver all of its notification messages. (See clsmgr.h for more information.)

msgListNotifyAddition

Notifies observers that an item has been added to the list.

Takes P_LIST_NOTIFY_ADDITION, returns STATUS.

Arguments

```
typedef struct LIST_NOTIFY_ADDITION {
    LIST                list;       // the affected list
    LIST_ITEM           listItem;   // the affected list item
    U16                 count;      // new number of entries
    U8                  reserved[40];
} LIST_NOTIFY_ADDITION, * P_LIST_NOTIFY_ADDITION;
#define msgListNotifyAddition               MakeMsg ( clsList, 16 )
```

msgListNotifyDeletion

Notifies observers that an item has been deleted from the list.

Takes P_LIST_NOTIFY_DELETION, returns STATUS.

Arguments

```
typedef struct LIST_NOTIFY_DELETION {
    LIST                list;       // the affected list
    LIST_ITEM           listItem;   // the affected list item
    U16                 count;      // new number of entries
    U8                  reserved[40];
} LIST_NOTIFY_DELETION, * P_LIST_NOTIFY_DELETION;
#define msgListNotifyDeletion                  MakeMsg ( clsList, 17 )
```

msgListNotifyReplacement

Notifies observers that an item in the list has been replaced.

Takes P_LIST_NOTIFY_REPLACEMENT, returns STATUS.

Arguments

```
typedef struct LIST_NOTIFY_REPLACEMENT {
    LIST                list;           // the affected list
    LIST_ITEM           newListItem;    // the new list item
    LIST_ITEM           oldListItem;    // the replaced list item
    U16                 index;          // index of replace item
    U8                  reserved[40];
} LIST_NOTIFY_REPLACEMENT, * P_LIST_NOTIFY_REPLACEMENT;
#define msgListNotifyReplacement                MakeMsg ( clsList, 18 )
```

msgListNotifyEmpty

Notifies observers that a list is now empty.

Takes P_LIST_NOTIFY_EMPTY, returns STATUS.

Arguments

```
typedef struct LIST_NOTIFY_EMPTY {
    LIST                list;           // the affected list
    U8                  reserved[40];
} LIST_NOTIFY_EMPTY, * P_LIST_NOTIFY_EMPTY;
#define msgListNotifyEmpty                      MakeMsg ( clsList, 19 )
```

NOTEPAPR.H

This file contains the API definition for **clsNotePaper. clsNotePaper** inherits from **clsView.**

NotePaper is the view class for PenPoint's ink-management or note-taking building block. Most of the code for the MiniNote application actually resides in the building block. Other classes of the building block are **clsNPData** (the data class), **clsNPItem** (the generic data item), **clsNPScribbleItem** (the ink data item), **clsNPTextItem** (the text data item), and **clsGestureMargin** (the subclass of **clsScrollWin** that implements MiniNote's gesture margin).

NotePaper provides standard PenPoint functionality including embedding, undo, move/copy, import, export, option sheets, and marks. (Supporting marks means that search and replace, spell, proof, and reference buttons are all supported.)

NotePaper displays (and alters) the contents of an NPData object. For PenPoint 1.0, NotePaper keeps all of the items in its data object in a coordinate system with (0,0) its upper-left corner. As a result, all the items in the data object have a negative y coordinate. This means that as the NotePaper window grows in width and height, its contents remain relative to the top-left corner of the page.

A sample applications (called npapp or "NotePaper App") demonstrating the use of the ink building block is included in the SDK. The ink building block is distributed as part of the SDK as a distributed DLL. The DLL and all resources used by the ink building block are included in the SDK in the DLL\NOTEPAPR directory. The resources in that directory include:

```
    notepaper.res:      contains all resources used by NotePaper
    paper.res:          contains the 8 bitmaps representing paper styles
    pen.res:            contains the 4 bitmaps representing pen styles
    strings.rc:         contains the source for quick help, error text,
                        and undo strings
```

```
#ifndef NOTEPAPR_INCLUDED
#define NOTEPAPR_INCLUDED
#ifndef VIEW_INCLUDED
#include <view.h>
#endif
#ifndef SYSFONT_INCLUDED
#include <sysfont.h>
#endif
#ifndef ITOGGLE_INCLUDED
#include <itoggle.h>
#endif
```

Types and Constants

```
#define clsNotePaper        MakeGlobalWKN(2567,1)

#define stsNotePaperNoHit           MakeWarning(clsNotePaper, 0)
#define stsNotePaperTreatAsInk      MakeWarning(clsNotePaper, 1)
Enum16(NP_PAPER_STYLE) {
    npPaperRuled                = 0,
    npPaperRuledLeftMargin      = 1,
    npPaperRuledCenterMargin    = 2,
    npPaperRuledLegalMargin     = 7,
    npPaperBlank                = 3,
    npPaperLeftMargin           = 4,
    npPaperCenterMargin         = 6,
    npPaperGrid                 = 5,
};
```

```
typedef struct NOTE_NP_PAPER_STYLE {
    U16     bEditMode       : 1,    // writing/ink vs. gesture/edit mode
            bAutoGrow       : 1,    // auto grow height as user enters data?
            bWidthOpts      : 1,    // include page widths in option sheet
            bHideTopRule    : 1,    // don't paint the top ruling line for
                                    // the npPaperRuledxxx paper style
            bVirtualHeight  : 1,    // if set, NotePaper grows itself into
                                    // a long thin window and responds to
                                    // scroll win messages
            reserved        : 11;   // always set to 0
    U16     reserved1;
} NOTE_PAPER_STYLE, *P_NOTE_PAPER_STYLE;
typedef struct NOTE_PAPER_METRICS {
    NOTE_PAPER_STYLE    style;
    SYSDC_FONT_SPEC     paperFont;      // defines the font for the paper
    NP_PAPER_STYLE      paperStyle;     // one of the NP_PAPER_STYLE values
    COORD16             lineSpacing;    // (in points) determines font size and
                                        // vertical spacing
    U8                  penStyle;       // use the NPPenStyle() macro
} NOTE_PAPER_METRICS, * P_NOTE_PAPER_METRICS;
```

NOTE: in NPPenStyle, color is one of: **bsInkBlack, bsInkGrayXX,** or **bsInkWhite**

NOTE: in NPPenStyle, weight is one of: 1 = bold, 0 = normal

```
#define NPPenStyle(color, weight)   ((color & 0x7) | ((weight & 0x1) << 3))
#define NPPenColor(style)           (style & 0x7)
#define NPPenWeight(style)      ((style & 0x8) >> 3)
```

The following definitions are included for convenience only.

```
#define npPenFineBlack      NPPenStyle(bsInkBlack, 0)
#define npPenFineGray       NPPenStyle(bsInkGray50, 0)
#define npPenBoldBlack      NPPenStyle(bsInkBlack, 1)
#define npPenBoldGray       NPPenStyle(bsInkGray50, 1)
```

Messages

Next up: none; Recycle: 11-51 53 58-101 103 106 120-127

msgNewDefaults

Initialize **pArgs**.

Takes **P_NOTE_PAPER_NEW**, returns **STATUS**.

Arguments

```
typedef struct {
    NOTE_PAPER_STYLE    style;          // as in NOTE_PAPER_METRICS
    NP_PAPER_STYLE      paperStyle;     // as in NOTE_PAPER_METRICS
    SYSDC_FONT_SPEC     paperFont;      // as in NOTE_PAPER_METRICS
    COORD16             lineSpacing;    // as in NOTE_PAPER_METRICS
    U8                  penStyle;       // as in NOTE_PAPER_METRICS
    S32                 spares[6];
} NOTE_PAPER_NEW_ONLY, *P_NOTE_PAPER_NEW_ONLY;
#define notePaperNewFields      \
    viewNewFields           \
    NOTE_PAPER_NEW_ONLY notePaper;
typedef struct {
    notePaperNewFields
} NOTE_PAPER_NEW, *P_NOTE_PAPER_NEW;
```

Comments

Zeroes out pArgs->notePaper and sets:

```
pArgs->notePaper.style.bEditMode       = false;
pArgs->notePaper.style.bAutoGrow       = false;
pArgs->notePaper.style.bWidthOpts      = false;
pArgs->notePaper.style.bHideTopRule    = false;
pArgs->notePaper.style.bVirtualHeight  = false;
pArgs->notePaper.paperStyle            = npPaperRuled;
pArgs->notePaper.paperFont             = current user font preference
pArgs->notePaper.penStyle              = NPPenStyle(bsInkBlack, 1);
pArgs->notePaper.lineSpacing           = 24;   // 24 point
pArgs->view.createDataObject           = true;
```

Various **gWin** and win flags are set and should only be modified by the fearless!

```
pArgs->gWin.style.gestureEnable = true;
pArgs->gWin.style.gestureForward= true;
pArgs->win.flags.input &= ~inputInkThrough;
pArgs->win.flags.input |= inputInk;
pArgs->win.flags.style |= wsSendGeometry;
pArgs->win.flags.style |= wsGrowBottom;
pArgs->win.flags.style |= wsGrowRight;
pArgs->win.flags.style |= wsCaptureGeometry;
```

msgNotePaperGetMetrics

Passes back receiver's metrics.

Takes P_NOTE_PAPER_METRICS, returns STATUS.

```
#define msgNotePaperGetMetrics      MakeMsg(clsNotePaper, 101)
```

Message Arguments

```
typedef struct NOTE_PAPER_METRICS {
    NOTE_PAPER_STYLE    style;
    SYSDC_FONT_SPEC     paperFont;      // defines the font for the paper
    NP_PAPER_STYLE      paperStyle;     // one of the NP_PAPER_STYLE values
    COORD16             lineSpacing;    // (in points) determines font size and
                                        // vertical spacing
    U8                  penStyle;       // use the NPPenStyle() macro
} NOTE_PAPER_METRICS, * P_NOTE_PAPER_METRICS;
```

msgNotePaperGetDcInfo

Passes back the drawing contexts used by receiver.

Takes P_NOTE_PAPER_DC_INFO, returns STATUS.

```
#define msgNotePaperGetDcInfo       MakeMsg(clsNotePaper, 4)
```

Arguments

```
typedef struct {
    U32         units;      // currently, msgDcUnitsTwips
    OBJECT      dc;         // transformed dc in "units"
    OBJECT      dcPen;      // transformed dc in pen units
    U32         reserved[4];
} NOTE_PAPER_DC_INFO, *P_NOTE_PAPER_DC_INFO;
```

msgNotePaperGetSelType

Passes back information about the types of items selected in receiver.

Takes P_NOTE_PAPER_SEL_TYPE, returns STATUS.

```
#define msgNotePaperGetSelType      MakeMsg(clsNotePaper, 116)
```

Arguments

```
typedef struct NOTE_PAPER_SEL_TYPE {
    BOOLEAN bScribble;      // selection contains a scribble
    BOOLEAN bTranslated;    // selection contains untranslatable text
    BOOLEAN bReserved1;
    BOOLEAN bReserved2;
} NOTE_PAPER_SEL_TYPE, * P_NOTE_PAPER_SEL_TYPE;
```

msgNotePaperSetEditMode

Sets receiver to either gesture/edit (true) or writing/ink (false) mode.

Takes BOOLEAN, returns STATUS.

```
#define msgNotePaperSetEditMode     MakeMsg(clsNotePaper, 102)
```

msgNotePaperSetPaperAndPen

Sets **paperStyle**, **lineSpacing**, **penColor**, and **penWeight**.

Takes P_NOTE_PAPER_METRICS, returns STATUS.

```
#define msgNotePaperSetPaperAndPen  MakeMsg(clsNotePaper, 104)
```

Message Arguments

```
typedef struct NOTE_PAPER_METRICS {
    NOTE_PAPER_STYLE    style;
    SYSDC_FONT_SPEC     paperFont;      // defines the font for the paper
    NP_PAPER_STYLE      paperStyle;     // one of the NP_PAPER_STYLE values
    COORD16             lineSpacing;    // (in points) determines font size and
                                        // vertical spacing
    U8                  penStyle;       // use the NPPenStyle() macro
} NOTE_PAPER_METRICS, * P_NOTE_PAPER_METRICS;
```

Comments

This message does not affect the pen style for selected items.

msgNotePaperSetPenStyle

Sets the pen style for selected items as well as the default for new items.

Takes U32, returns STATUS.

```
#define msgNotePaperSetPenStyle     MakeMsg(clsNotePaper, 109)
```

msgNotePaperGetPenStyle

Gets the pen style for selected items (or the default if nothing selected).

Takes U32, returns STATUS.

```
#define msgNotePaperGetPenStyle     MakeMsg(clsNotePaper, 112)
```

msgNotePaperSetStyle

Sets the receiver's style values.

Takes P_NOTE_PAPER_STYLE, returns STATUS.

```
#define msgNotePaperSetStyle        MakeMsg(clsNotePaper, 2)
```

Message Arguments

```
typedef struct NOTE_NP_PAPER_STYLE {
    U16     bEditMode       : 1,    // writing/ink vs. gesture/edit mode
            bAutoGrow       : 1,    // auto grow height as user enters data?
            bWidthOpts      : 1,    // include page widths in option sheet
            bHideTopRule    : 1,    // don't paint the top ruling line for
                                    // the npPaperRuledxxx paper style
            bVirtualHeight  : 1,    // if set, NotePaper grows itself into
                                    // a long thin window and responds to
                                    // scroll win messages
            reserved        : 11;   // always set to 0
    U16     reserved1;
} NOTE_PAPER_STYLE, *P_NOTE_PAPER_STYLE;
```

msgNotePaperGetStyle

Passes back the receiver's style values.

Takes P_NOTE_PAPER_STYLE, returns STATUS.

```
#define msgNotePaperGetStyle        MakeMsg(clsNotePaper, 3)
```

Message Arguments

```
typedef struct NOTE_NP_PAPER_STYLE {
    U16     bEditMode       : 1,    // writing/ink vs. gesture/edit mode
            bAutoGrow       : 1,    // auto grow height as user enters data?
            bWidthOpts      : 1,    // include page widths in option sheet
            bHideTopRule    : 1,    // don't paint the top ruling line for
                                    // the npPaperRuledxxx paper style
            bVirtualHeight  : 1,    // if set, NotePaper grows itself into
                                    // a long thin window and responds to
                                    // scroll win messages
            reserved        : 11;   // always set to 0
    U16     reserved1;
} NOTE_PAPER_STYLE, *P_NOTE_PAPER_STYLE;
```

msgNotePaperTranslate

Translates untranslated scribbles in the selection.

Takes P_NULL, returns STATUS.

```
#define msgNotePaperTranslate       MakeMsg(clsNotePaper, 113)
```

msgNotePaperUntranslate

Untranslates translated scribbles in the selection.

Takes P_NULL, returns STATUS.

```
#define msgNotePaperUntranslate     MakeMsg(clsNotePaper, 114)
```

msgNotePaperEdit

Edits text and translates and edits scribbles in the selection.

Takes P_NULL, returns STATUS.

```
#define msgNotePaperEdit            MakeMsg(clsNotePaper, 115)
```

msgNotePaperTidy

Tidies the selection by normalizing the spacing of items each line.

Takes P_NULL, returns STATUS.

```
#define msgNotePaperTidy            MakeMsg(clsNotePaper, 105)
```

Comments

The inter-item spacing is determined by sending **msgNPItemGetWordSpacing** to each item to be tidied.

msgNotePaperCenter

Centers the entire selection.

Takes P_NULL, returns STATUS.

```
#define msgNotePaperCenter          MakeMsg(clsNotePaper, 107)
```

Comments

The selection is centered on the page as a whole, not line by line.

msgNotePaperAlign

Aligns the selection according to **pArgs**.

Takes U32, returns STATUS.

```
#define msgNotePaperAlign           MakeMsg(clsNotePaper, 108)
#define npAlignLeft 1
#define npAlignRight    2
```

Comments

Alignment takes place relative to the bounding box of the selection.

msgNotePaperMerge

Joins scribbles and text in the selection.

Takes P_NULL, returns STATUS.

```
#define msgNotePaperMerge           MakeMsg(clsNotePaper, 110)
```

Comments

Consecutive scribble items are combined into a single scribble item. Adjacent text items are combined into a single text item. Any subclass of **clsNPItem** that can respond to **msgNPItemCanJoin** and **msgNPItemJoin** can determine its own merging behavior.

msgNotePaperSplit

Splits scribbles and text.

Takes P_NULL, returns STATUS.

```
#define msgNotePaperSplit           MakeMsg(clsNotePaper, 111)
```

Comments

First **msgNotePaperSplitAsWords** is self-sent. If **stsRequestDenied** is returned, then **msgNotePaperSplitAsAtoms** is self-sent.

msgNotePaperAddMenus

Modifies the passed in menu bar and appends standard NotePaper menus.

Takes OBJECT, returns STATUS.

```
#define msgNotePaperAddMenus        MakeMsg(clsNotePaper, 117)
```

msgNotePaperAddModeCtrl

Adds the standard NotePaper mode icon to the passed in menu bar.

Takes OBJECT, returns STATUS.

```
#define msgNotePaperAddModeCtrl     MakeMsg(clsNotePaper, 118)
```

msgNotePaperClear

Deletes all items in receiver.

Takes **pNull**, returns STATUS.

```
#define msgNotePaperClear          MakeMsg(clsNotePaper, 119)
```

msgNotePaperClearSel

Deletes all selected items in receiver.

Takes **pNull**, returns STATUS.

```
#define msgNotePaperClearSel       MakeMsg(clsNotePaper, 11)
```

msgNotePaperInsertLine

Inserts a blank line above the selection.

Takes P_NULL, returns STATUS.

```
#define msgNotePaperInsertLine  MakeMsg(clsNotePaper, 5)
```

msgNotePaperSelectRect

Selects items within rect in the receiver's data.

Takes P_RECT32, returns STATUS.

```
#define msgNotePaperSelectRect     MakeMsg(clsNotePaper, 1)
```

Return Value **stsNotePaperNoHit** Returned if nothing selected.

msgNotePaperSelectLine

Selects items whose baselines intersect rect in the receiver's data.

Takes P_RECT32, returns STATUS.

```
#define msgNotePaperSelectLine     MakeMsg(clsNotePaper, 6)
```

Return Value **stsNotePaperNoHit** Returned if nothing selected.

msgNotePaperDeselectLine

Deselects items whose baselines intersect rect in the receiver's data.

Takes P_RECT32, returns STATUS.

```
#define msgNotePaperDeselectLine   MakeMsg(clsNotePaper, 7)
```

Return Value **stsNotePaperNoHit** Returned if nothing deselected.

msgNotePaperDeleteLine

Deletes items whose baselines intersect rect in the view's data.

Takes P_RECT32, returns STATUS.

```
#define msgNotePaperDeleteLine     MakeMsg(clsNotePaper, 8)
```

Return Value **stsNotePaperNoHit** Returned if nothing deleted.

msgNotePaperScribble

Handles scribble (including creating and insert object into view's data).

Takes OBJECT, returns STATUS.

```
#define msgNotePaperScribble    MakeMsg(clsNotePaper, 9)
```

Comments — The passed scribble's origin should be relative to the lower-left corner of the receiver.

msgGWinGesture

Self-sent to process the gesture.

Takes P_GWIN_GESTURE, returns STATUS.

```
#define msgGWinGesture              MakeMsg(clsGWin, 2)
```

Comments — The standard behavior of this gesture is defined in gwin.h. In addition, subclasses can return **stsNotePaperTreatAsInk** if they want the gesture to be treated as ink. In that case, an instance of **clsNPScribbleItem** will be created from the gesture's strokes.

clsNotePaper's response to the various gestures is described in the MiniNote quick reference card. In gesture mode, gesture can be made anywhere in the window. However, any unrecognized gesture of more than two strokes will be treated as ink. In writing mode, most drawing is treated as ink (unless it is drawn over the selection). However, the following gestures are allowed even in writing mode:

```
    xgsScratchOut:          delete items
    xgsPigtailVert:         delete items
    xgs2Tap:                select item (if over an item)
    xgs3Tap:                select line
    xgsPlus:                toggle item (if over an item)
    xgsTapHold:             begin area selection
    xgsCircleCrossOut:      undo
    xgsDblCircle:           create reference button
    xgsUpCaretDot:          insert date/time
    xgsDblUpCaret:          embed stationery
    xgsHorzCounterFlick:    toggle mode
    xgsVertCounterFlick:    toggle application borders
```

Return Value — **stsNotePaperTreatAsInk** The gesture should be treated as ink.

See Also — gwin.h

msgAppSelectAll

Selects all items in the view.

Takes P_NULL, returns STATUS.

See Also — app.h

msgSelDelete

Deletes selected items in the view.

Takes P_NULL, returns STATUS.

Comments — Close the space that the selection occupies if an entire line or lines is selected and this message does is not sent within a move/copy episode.

See Also — sel.h

msgOptionAddCards

Creates and adds the Pen and Paper option sheets.

Takes P_OPTION_TAG, returns STATUS.

This message is usually send to the NotePaper instance by the app framework if the instance holds the selection, is the client win of the app's main win, or is the client win of a scroll win that is the app's main win. However, to force NotePaper's option sheets to appear in the "Option" menu in other circumstances, this message should be forwarded to the NotePaper instance by the application if **pArgs**->tag is **tagAppDocOptSheet**.

See Also app.h.h

msgImportQuery

Indicates whether or not passed in file can be imported.

Takes P_IMPORT_QUERY, returns STATUS. Category: class message.

NotePaper will respond positively to this message if the first 5of the file are printable ASCII characters.

See Also import.h

msgImport

Imports the passed in file.

Takes P_IMPORT_DOC, returns STATUS.

After the file is imported, receiver's length is grown to accommodateimported text. If receiver's width is zero, it is grown to sixwide.

See Also import.h

msgExportGetFormats

Passes back list of formats that can be exported.

Takes P_EXPORT_LIST, returns STATUS.

See Also export.h

msgExport

Writes an ASCII version of receiver's data to the passed in file.

Takes P_EXPORT_DOC, returns STATUS.

A translated text version of each scribble item is written out.

See Also export.h

Quick help and window tags

Tags used in the UI of NotePaper's option sheets, menus, and quick help.

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Tag values 100-120 are reserved for pen and paper styles.

Tag values 200-255 are reserved for private window tags.

Mode icons

Mode icons (tags from itoggle.h) The bitmaps corresponding to the two tags below are found in **theSystemResFile**.

```
#define tagNotePaperWriteIcon       tagIconToggleOff
#define tagNotePaperEditIcon        tagIconToggleOn
```

Quick help tag for mode icons

```
#define tagNotePaperModeIcon        MakeTag(clsNotePaper, 1)
```

Windows

Quick help tags for the main view and for the gesture margin.

```
#define tagNotePaper                MakeTag(clsNotePaper, 4)
#define tagNotePaperMargin          MakeTag(clsNotePaper, 5)
```

Edit Menu

```
#define tagNotePaperTranslate       MakeTag(clsNotePaper, 6)
#define tagNotePaperEdit            MakeTag(clsNotePaper, 7)
#define tagNotePaperClear           MakeTag(clsNotePaper, 34)
#define tagNotePaperInsertLine      MakeTag(clsNotePaper, 35)
```

Pen Menu

```
#define tagPenMenu                  MakeTag(clsNotePaper, 3)
#define tagPenFineBlack             MakeTag(clsNotePaper, 110)
#define tagPenBoldBlack             MakeTag(clsNotePaper, 111)
#define tagPenFineGray              MakeTag(clsNotePaper, 112)
#define tagPenBoldGray              MakeTag(clsNotePaper, 113)
```

Arrange Menu

```
#define tagArrangeMenu              MakeTag(clsNotePaper, 8)
#define tagNotePaperTidy            MakeTag(clsNotePaper, 9)
#define tagNotePaperCenter          MakeTag(clsNotePaper, 10)
#define tagNotePaperAlignLeft       MakeTag(clsNotePaper, 11)
#define tagNotePaperAlignRight      MakeTag(clsNotePaper, 12)
#define tagNotePaperMerge           MakeTag(clsNotePaper, 13)
#define tagNotePaperSplitAsWords    MakeTag(clsNotePaper, 14)
#define tagNotePaperSplit           MakeTag(clsNotePaper, 15)
```

Paper Option Card

NOTE: For TagPaperStyle(n), tag n is a value in the NP_PAPER_STYLE enumeration For NPPaperStyleFromTag converts a tag to a paper style.

```
#define tagPaperCard                MakeTag(clsNotePaper, 16)
#define tagPaperStyleLabel          MakeTag(clsNotePaper, 17)
#define tagPaperStyle               MakeTag(clsNotePaper, 18)
#define TagPaperStyle(n)            MakeTag(clsNotePaper, 100 + n)
#define NPPaperStyleFromTag(t)      (TagNum(t) - 100)
#define tagLineSpacingLabel         MakeTag(clsNotePaper, 19)
#define tagLineSpacing              MakeTag(clsNotePaper, 20)
#define tagLineOtherRuling          MakeTag(clsNotePaper, 21)
#define tagLineOtherValue           MakeTag(clsNotePaper, 22)
```

```
#define tagPaperWidthLabel          MakeTag(clsNotePaper, 23)
#define tagPaperWidth               MakeTag(clsNotePaper, 24)
#define tagPaperFitScreen           MakeTag(clsNotePaper, 25)
#define tagPaperFitPrinter          MakeTag(clsNotePaper, 26)
#define tagPaperOtherWidth          MakeTag(clsNotePaper, 27)
#define tagPaperOtherValue          MakeTag(clsNotePaper, 28)
#define tagPaperFontLabel           MakeTag(clsNotePaper, 29)
#define tagPaperFont                MakeTag(clsNotePaper, 30)
```

Pen Option Card

```
#define tagPenCard                  MakeTag(clsNotePaper, 31)
#define tagPenStyleLabel            MakeTag(clsNotePaper, 32)
#define tagPenStyle                 MakeTag(clsNotePaper, 33)
```

tagPenFineBlack (same value as in the pen menu)

tagPenBoldBlack (same value as in the pen menu)

tagPenFineGray (same value as in the pen menu)

tagPenBoldGray (same value as in the pen menu)

Insertion Pad

```
#define tagNotePaperSkip            MakeTag(clsNotePaper, 36)
```

Standard Error Resource Tags

```
#define stsNotePaperPageWidth       MakeStatus(clsNotePaper, 2)
```

Undo Resource Tags

```
#define tagNPUndoWriting            MakeTag(clsNotePaper, 1)
#define tagNPUndoDeletion           MakeTag(clsNotePaper, 2)
```

NPDATA.H

This file contains the API definition for **clsNPData**.

clsNPData inherits from **clsObject.**

NPData is the data class of PenPoint's ink-management or note-taking building block. (See notepapr.h for more information on the building block.) An NPData instance is a data base that manages items that follow the **clsNPItem** protocol. (See npitem.h). Its API defines messages for inserting, deleting, and enumerating the items it manages.

```
#ifndef NPDATA_INCLUDED
#define NPDATA_INCLUDED
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#include <geo.h>
```

Types and Constants

```
#define clsNPData           MakeGlobalWKN(2568,1)
```

Messages

Next up: 39; Recycle: 4 5 6 7 15 20 33 34

msgNewDefaults

Initialize **pArgs**.

Takes P_NP_DATA_NEW, returns STATUS.

Arguments

```
typedef struct {
    XY32    lineSpacing;
    XY32    baseline;
    BOOLEAN isSubData;  // private to clsNPData
    S32     spare1;
    S32     spare2;
} NP_DATA_NEW_ONLY,  *P_NP_DATA_NEW_ONLY;
#define npDataNewFields     \
    objectNewFields         \
    NP_DATA_NEW_ONLY    npData;
typedef struct {
    npDataNewFields
} NP_DATA_NEW, *P_NP_DATA_NEW;
```

Comments

Zeroes out **pArgs**->npData and sets:

```
    pArgs->npData.lineSpacing.x = 0;
    pArgs->npData.lineSpacing.y = 360;      // 360 twips = 18 points = 1/4"

    pArgs->npData.baseline.x = 0;
    pArgs->npData.baseline.y = 360;
```

Messages used to manipulate data

msgNPDataInsertItem

Add item to the data base.

Takes OBJECT, returns STATUS.

```
#define msgNPDataInsertItem MakeMsg(clsNPData, 8)
```

msgNPDataInsertItemFromView

Add item to the data base.

Takes P_NP_DATA_ADDED_NP_ITEM_VIEW, returns STATUS.

```
#define msgNPDataInsertItemFromView MakeMsg(clsNPData, 38)
```

Arguments

```
typedef struct {
    OBJECT  item;   // item that has been added
    OBJECT  view;   // view that added the item
} NP_DATA_ADDED_NP_ITEM_VIEW, *P_NP_DATA_ADDED_NP_ITEM_VIEW;
```

Comments

Observers will be notified of which view is responsible for the addition.

msgNPDataDeleteItem

Delete an item from the data base.

Takes OBJECT, returns STATUS.

```
#define msgNPDataDeleteItem MakeMsg(clsNPData, 9)
```

Comments

Returns **stsFailed** if item is not found.

msgNPDataMoveItem

Move an item within the data base.

Takes P_NP_DATA_XY, returns STATUS.

```
#define msgNPDataMoveItem MakeMsg(clsNPData, 10)
```

Arguments

```
typedef struct {
    OBJECT  item;   // item to be moved
    XY32    xy;     // new position for item
} NP_DATA_XY, *P_NP_DATA_XY;
```

msgNPDataMoveItems

Move all items below **pArgs**->y by **pArgs**->yDelta.

Takes P_MOVE_ITEMS, returns STATUS.

```
#define msgNPDataMoveItems      MakeMsg(clsNPData, 1)
```

Arguments

```
typedef struct {
    COORD32 y;
    COORD32 yDelta;
} MOVE_ITEMS, *P_MOVE_ITEMS;
```

Messages used to enumerate over data

ENUM_CALLBACK

This template describes the the callback function used in item enumeration.

Returns STATUS.

Arguments

```
typedef struct {
    OBJECT      data;          // in - the data being enumerated over
    OBJECT      item;          // in - the item being enumerated
    P_UNKNOWN   clientData;    // in - the client supplied data (or pointer)
} NP_DATA_ITEM, *P_NP_DATA_ITEM;
typedef STATUS FunctionPtr(P_ENUM_CALLBACK)(P_NP_DATA_ITEM pItem);
```

Comments

Your callback function takes a single parameter of type P_NP_DATA_ITEM. The **clientData** field is a copy of that you passed into the enumeration message using the ENUM_ITEM or ENUM_RECT_ITEM structures. During enumeration, you can add new items or delete the "current" item begin enumerated. If you delete an item but want to keep using it, use must send it **msgNPItemHold** before deleting it and **msgNPItemRelease** when you are done using it.

Some of the enumeration messages refer to **bPaintOrder** or "Reverse" order. Paint order refers to the top-to-bottom, left-to-right ordering of items. Non-paint or reverse order is simply the opposite ordering. Items are sorted first by line and then by their left edge. An item is considered to be on the line closest to its baseline. The lines are "line spacing" apart starting from the top of the page. If no lines are displayed to the user, it is possible that non-intuitive item ordering will result.

Return an error status from the callback to terminate the enumeration.

msgNPDataEnumOverlappedItems

Enumerates each item that overlaps the given rectangle.

Takes P_ENUM_RECT_ITEMS, returns STATUS.

```
#define msgNPDataEnumOverlappedItems MakeMsg(clsNPData, 2)
```

Arguments

```
typedef struct {
    P_ENUM_CALLBACK function;      // in -- callback function described above
    RECT32          hitRect;       // in -- enum items overlapping hitRect
    BOOLEAN         bPaintOrder;   // in -- enum in paint order?
    P_UNKNOWN       clientData;    // in
} ENUM_RECT_ITEMS, *P_ENUM_RECT_ITEMS;
```

msgNPDataEnumBaselineItems

Enumerates each item whose baseline overlaps the given rectangle.

Takes P_ENUM_RECT_ITEMS, returns STATUS.

```
#define msgNPDataEnumBaselineItems MakeMsg(clsNPData, 19)
```

Message Arguments

```
typedef struct {
    P_ENUM_CALLBACK function;      // in -- callback function described above
    RECT32          hitRect;       // in -- enum items overlapping hitRect
    BOOLEAN         bPaintOrder;   // in -- enum in paint order?
    P_UNKNOWN       clientData;    // in
} ENUM_RECT_ITEMS, *P_ENUM_RECT_ITEMS;
```

msgNPDataEnumSelectedItems

Enumerates each item that is selected (in paint order).

Takes P_ENUM_ITEMS, returns STATUS.

```
#define msgNPDataEnumSelectedItems MakeMsg(clsNPData, 13)
```

Arguments

```
typedef struct {
    P_ENUM_CALLBACK function;       // in -- callback function described above
    P_UNKNOWN       clientData;     // in
} ENUM_ITEMS, *P_ENUM_ITEMS;
```

msgNPDataEnumSelectedItemsReverse

Enumerates each item that is selected (in reverse paint order).

Takes P_ENUM_ITEMS, returns STATUS.

```
#define msgNPDataEnumSelectedItemsReverse MakeMsg(clsNPData, 26)
```

Message Arguments

```
typedef struct {
    P_ENUM_CALLBACK function;       // in -- callback function described above
    P_UNKNOWN       clientData;     // in
} ENUM_ITEMS, *P_ENUM_ITEMS;
```

msgNPDataEnumAllItems

Enumerates each item (in paint order).

Takes P_ENUM_ITEMS, returns STATUS.

```
#define msgNPDataEnumAllItems MakeMsg(clsNPData, 14)
```

Message Arguments

```
typedef struct {
    P_ENUM_CALLBACK function;       // in -- callback function described above
    P_UNKNOWN       clientData;     // in
} ENUM_ITEMS, *P_ENUM_ITEMS;
```

msgNPDataEnumAllItemsReverse

Enumerates each item (in reverse paint order).

Takes P_ENUM_ITEMS, returns STATUS.

```
#define msgNPDataEnumAllItemsReverse MakeMsg(clsNPData, 27)
```

Message Arguments

```
typedef struct {
    P_ENUM_CALLBACK function;       // in -- callback function described above
    P_UNKNOWN       clientData;     // in
} ENUM_ITEMS, *P_ENUM_ITEMS;
```

msgNPDataSendEnumSelectedItems

Enumerates each selected item (in paint order).

Takes P_SEND_ENUM_ITEMS, returns STATUS.

```
#define msgNPDataSendEnumSelectedItems MakeMsg(clsNPData, 22)
```

Arguments

```
typedef struct {
    P_ENUM_CALLBACK function;       // in -- callback function described above
    U8              clientData[32]; // in/out
} SEND_ENUM_ITEMS, *P_SEND_ENUM_ITEMS;
```

Comments

This message is the same as **msgNPDataEnumSelectedItems**, except that it it intended to be used in conjunction with ObjectSend rather than ObjectCall. It is used to enumerate the items in a data object that is not in the caller's process. Rather than a pointer to the client data being passed around, the client data is put into an array that is passed around.

msgNPDataGetCurrentItem

Passes back the current item in the receiver.

Takes P_OBJECT, returns STATUS.

```
#define msgNPDataGetCurrentItem     MakeMsg(clsNPData, 30)
```

msgNPDataGetNextItem

Increments the current item to the next item and sets *pArgs to it.

Takes P_OBJECT, returns STATUS.

```
#define msgNPDataGetNextItem        MakeMsg(clsNPData, 31)
```

Comments

Set *pArgs to the current item before sending this message. If you set it to NULL, the first item will be returned. The next time you call this message after you reach the last item, **stsEndOfData** will be returned and *pArgs will be set to **objNull**.

Messages used to access internal state

msgNPDataItemCount

Passes back the count of items in receiver.

Takes P_U32, returns STATUS.

```
#define msgNPDataItemCount  MakeMsg(clsNPData, 17)
```

msgNPDataSelectedCount

Passes back the count of selected items in receiver.

Takes P_U32, returns STATUS.

```
#define msgNPDataSelectedCount  MakeMsg(clsNPData, 18)
```

msgNPDataSetBaseline

Sets the receiver's baseline (used for alignment).

Takes P_XY32, returns STATUS.

```
#define msgNPDataSetBaseline        MakeMsg(clsNPData, 24)
```

msgNPDataGetBaseline

Gets the receiver's baseline (used for alignment).

Takes P_XY32, returns STATUS.

```
#define msgNPDataGetBaseline        MakeMsg(clsNPData, 25)
```

msgNPDataSetLineSpacing

Sets receiver's line spacing (used as the font size).

Takes P_XY32, returns STATUS.

```
#define msgNPDataSetLineSpacing     MakeMsg(clsNPData, 35)
```

msgNPDataGetLineSpacing

Gets receiver's line spacing (used as the font size).

Takes P_XY32, returns STATUS.

```
#define msgNPDataGetLineSpacing     MakeMsg(clsNPData, 36)
```

msgNPDataGetBounds

Passes back the bounding rectangle for all items in receiver.

Takes P_RECT32, returns STATUS.

```
#define msgNPDataGetBounds      MakeMsg(clsNPData, 23)
```

msgNPDataGetSelBounds

Passes back the bounding rectangle for all selected items in receiver.

Takes P_RECT32, returns STATUS.

```
#define msgNPDataGetSelBounds       MakeMsg(clsNPData, 32)
```

msgNPDataGetFontSpec

Passes back the receiver's font specification.

Takes P_SYSDC_FONT_SPEC, returns STATUS.

```
#define msgNPDataGetFontSpec        MakeMsg(clsNPData, 28)
```

msgNPDataSetFontSpec

Sets the receiver's font specification.

Takes P_SYSDC_FONT_SPEC, returns STATUS.

```
#define msgNPDataSetFontSpec        MakeMsg(clsNPData, 29)
```

msgNPDataGetCachedDCs

Passes back DC's with normal and bold fonts at the given line spacing.

Takes P_NP_DATA_DC, returns STATUS.

```
#define msgNPDataGetCachedDCs       MakeMsg(clsNPData, 37)
```

Arguments

```
typedef struct {
    OBJECT      dcNormal;   // normal font dc
    OBJECT      dcBold;     // bold font dc
} NP_DATA_DCS, *P_NP_DATA_DCS;
```

Comments

Used by items that want to measure text without the overhead of creating a DC. These DC's cannot be used for drawing!!

Messages sent to observers

msgNPDataAddedItem

Observers notified when item has been has been added or moved.

Takes P_NP_DATA_ADDED_ITEM, returns STATUS. Category: observer notification.

```
#define msgNPDataAddedItem MakeMsg(clsNPData, 11)
```

Arguments

```
typedef struct {
    OBJECT  data;   // the data that the item has been added to
    OBJECT  item;   // item that has been added
    OBJECT  view;   // view that added the item
} NP_DATA_ADDED_ITEM, *P_NP_DATA_ADDED_ITEM;
```

msgNPDataItemChanged

Observers notified when item has been changed.

Takes P_NP_DATA_ITEM_CHANGED, returns STATUS. Category: observer notification.

```
#define msgNPDataItemChanged MakeMsg(clsNPData, 12)
```

Arguments

```
typedef struct {
    OBJECT  data;   // the data
    OBJECT  item;   // item that has been changed
    OBJECT  view;   // view that changed the item
    RECT32  bounds; // maximum bounds affected by the change
} NP_DATA_ITEM_CHANGED, *P_NP_DATA_ITEM_CHANGED;
```

Comments

Currently called when item is selected or deselected.

msgNPDataHeightChanged

Observers notified when receiver's height has been changed.

Takes P_NP_DATA_ITEM_CHANGED, returns STATUS. Category: observer notification.

```
#define msgNPDataHeightChanged MakeMsg(clsNPData, 21)
```

Message Arguments

```
typedef struct {
    OBJECT  data;   // the data
    OBJECT  item;   // item that has been changed
    OBJECT  view;   // view that changed the item
    RECT32  bounds; // maximum bounds affected by the change
} NP_DATA_ITEM_CHANGED, *P_NP_DATA_ITEM_CHANGED;
```

Comments

Currently called by **msgNPDataMoveItems**. The bounds.origin.y field of **pArgs** contains the delta in the height of the data object.

msgNPDataItemEnumDone

Observers notified when an enumeration that deleted or moved items is complete.

Takes NULL, returns STATUS. Category: observer notification.

```
#define msgNPDataItemEnumDone   MakeMsg(clsNPData, 16)
```

Comments

When this message is received by an observer client, all deletions have been completed and all moved items have been temporarily removed from the data object. Thus the client has the option of repainting all remaining items at this time and then painting moved items as they are reinserted.

This message is handled by **clsNotePaper** and should not be handled by subclasses of **clsNotePaper**.

NPITEM.H

This file contains the API definition for **clsNPItem**.

clsNPItem inherits from **clsObject**.

NPItem is the item class for PenPoint's ink-management or note-taking building block. While instances of **clsNPItem** are never created, (subclasses like **clsNPScribbleItem** and **clsNPTextItem** are more interesting), NPItem defines a protocol as well as doing much of the work for basic operations.

To add new item types to the ink building block, create a subclass of **clsNPItem** that implements the messages defined below in the section: "Messages that are usually overridden by subclasses." Once this new item is inserted into a **clsNPData** object it will show up in the **clsNotePaper** view that observes that object. The new item will then behave like the other item in terms of basic operations like move, copy, deletion, style changes, etc.

```
#ifndef NPITEM_INCLUDED
#define NPITEM_INCLUDED
#ifndef GEO_INCLUDED
#include <geo.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef BORDER_INCLUDED
#include <border.h>
#endif
```

Types and Constants

```
#define clsNPItem                   MakeGlobalWKN(2569,1)
#define stsNPItemNoSplit            MakeWarning(clsNPItem, 0)
```

The NPData object handles versioning for NPItem's and their subclasses. If the version of the object being restored matches the runtime version, nothing special is done. However, if there is a difference, the version number of the filed object is stamped as a U16 property onto the file using **tagItemVersion** as the property's tag.

```
#define NP_ITEM_VERSION 1
#define tagItemVersion  MakeTag(clsNPItem, 0)
```

Messages

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msgNewDefaults

Initialize **pArgs**.

Takes P_NP_ITEM_NEW, returns STATUS.

Arguments

```
typedef struct NP_ITEM_NEW_ONLY {
    RECT32      bounds;
    XY16        baseline;
    BOOLEAN     selected;
    U32         penStyle;  // (Pen styles are defined in notepapr.h.)
    S32         spare2;
} NP_ITEM_NEW_ONLY,  *P_NP_ITEM_NEW_ONLY;
```

```
#define npItemNewFields     \
    objectNewFields         \
    NP_ITEM_NEW_ONLY    item;
typedef struct NP_ITEM_NEW {
    npItemNewFields
} NP_ITEM_NEW, *P_NP_ITEM_NEW;
```

Comments

Zeroes out **pArgs**->npData and sets:

```
    pArgs->item.penStyle    = penFineBlack;
```

msgNPItemGetPenStyle

Get the pen style of an item. (Pen styles are defined in notepapr.h.)

Takes P_U32, returns STATUS.

```
#define msgNPItemGetPenStyle    MakeMsg(clsNPItem, 35)
```

msgNPItemDelete

Delete item from its data.

Takes **pNull**, returns STATUS.

```
#define msgNPItemDelete MakeMsg(clsNPItem, 11)
```

Comments

Deleting an item decrements its reference count and can cause the item to be destroyed. To prevent, call **msgNPItemHold** before calling **msgNPItemDelete**. Then call **msgNPItemRelease** after working with the item.

msgNPItemPaintBackground

Paints a gray background if the receiver is selected.

Takes P_NP_ITEM_DC, returns STATUS.

```
#define msgNPItemPaintBackground    MakeMsg(clsNPItem, 41)
```

Arguments

```
typedef struct {
    OBJECT      dc;         // DC to paint into
    OBJECT      dcPen;      // equivalent DC in pen units
} NP_ITEM_DC, *P_NP_ITEM_DC;
```

Comments

Subclasses should override this message if they want a different type of selection feedback.

msgNPItemSelect

Selects or deselects item.

Takes BOOLEAN, returns STATUS.

```
#define msgNPItemSelect MakeMsg(clsNPItem, 14)
```

msgNPItemSelected

Passes back item's selection status.

Takes P_BOOLEAN, returns STATUS.

```
#define msgNPItemSelected   MakeMsg(clsNPItem, 15)
```

msgNPItemMove

Moves item to the indicated position.

Takes P_XY32, returns STATUS.

```
#define msgNPItemMove   MakeMsg(clsNPItem, 5)
```

msgNPItemDelta

Moves item by the indicated amount.

Takes P_XY32, returns STATUS.

```
#define msgNPItemDelta  MakeMsg(clsNPItem, 6)
```

msgNPItemGetViewRect

Passes back receiver's bounding rectangle.

Takes P_RECT32, returns STATUS.

```
#define msgNPItemGetViewRect    MakeMsg(clsNPItem, 19)
```

msgNPItemHitRect

Returns **stsOK** if receiver's bounds overlaps **pArgs**.

Takes P_RECT32, returns STATUS.

```
#define msgNPItemHitRect    MakeMsg(clsNPItem, 9)
```

msgNPItemGetMetrics

Gets the item's metrics.

Takes P_NP_ITEM_METRICS, returns STATUS.

```
#define msgNPItemGetMetrics MakeMsg(clsNPItem, 20)
```

Arguments

```
typedef struct NP_ITEM_METRICS {
    U8          selected:  1,  // is item selected?
                marked:    1,  // is item marked (in the clsMark sense)?
                reserved:  6;
    U8          refCount;      // number external references to item
                               // (not generally interesting to subclasses)
    XY16        baseline;      // item's horizontal and vertical baseline
                               // (currently only the y value is used)
    RECT32      bounds;        // window relative bounds
                               //     (with respect to its bounds' origin)
    OBJECT      data;          // data object that item is in
    OBJECT      adjunct;       // see msgNPItemSetAdjunct for more information
    U32         penStyle;      // item's pen style
} NP_ITEM_METRICS, *P_NP_ITEM_METRICS;
```

msgNPItemSetBaseline

Sets receiver's baseline.

Takes P_XY32, returns STATUS.

```
#define msgNPItemSetBaseline        MakeMsg(clsNPItem, 21)
```

msgNPItemSetBounds

Sets receiver's bounds.

Takes P_RECT32, returns STATUS.

```
#define msgNPItemSetBounds      MakeMsg(clsNPItem, 30)
```

msgNPItemHold

Increments the reference count for the item.

Takes NULL, returns STATUS.

```
#define msgNPItemHold   MakeMsg(clsNPItem, 22)
```

Comments: When the reference count for an item drops to zero, it is destroyed.

msgNPItemRelease

Decrements the reference count for the item.

Takes NULL, returns STATUS.

```
#define msgNPItemRelease    MakeMsg(clsNPItem, 23)
```

Comments: When the reference count for an item drops to zero, it is destroyed.

msgNPItemAlignToBaseline

Moves item so that it align to passed in line spacing.

Takes P_XY32, returns STATUS.

```
#define msgNPItemAlignToBaseline    MakeMsg(clsNPItem, 33)
```

Comments: The item should be aligned against the y-value of **pArgs**.

Messages that are usually overridden by subclasses

msgNPItemPaint

Paints item using the passed in drawing contexts.

Takes P_NP_ITEM_DC, returns STATUS.

```
#define msgNPItemPaint  MakeMsg(clsNPItem, 12)
```

Message Arguments

```
typedef struct {
    OBJECT      dc;         // DC to paint into
    OBJECT      dcPen;      // equivalent DC in pen units
} NP_ITEM_DC, *P_NP_ITEM_DC;
```

msgNPItemSetPenStyle

Sets the item's pen style. (Pen styles are defined in notepapr.h.)

Takes U32, returns STATUS.

```
#define msgNPItemSetPenStyle    MakeMsg(clsNPItem, 34)
```

msgNPItemSetOrigin

Set receiver's origin.

Takes P_XY32, returns STATUS.

```
#define msgNPItemSetOrigin  MakeMsg(clsNPItem, 18)
```

msgNPItemScratchOut

Handles the scratch-out gesture on an item.

Takes P_RECT32, returns STATUS.

```
#define msgNPItemScratchOut MakeMsg(clsNPItem, 24)
```

Comments Scribble items handle this message by deleting strokes that overlap **pArgs**. Other items simply delete themselves.

msgNPItemSplitGesture

Handles the split gesture on an item.

Takes P_XY32, returns STATUS.

```
#define msgNPItemSplitGesture   MakeMsg(clsNPItem, 25)
```

Comments The **pArgs** refers to the "hot point" for the gesture.

msgNPItemSplit

Split an item into its constituent items.

Takes NULL, returns STATUS.

```
#define msgNPItemSplit      MakeMsg(clsNPItem, 26)
```

msgNPItemSplitAsWords

Splits receiver into words. Deletes receiver, inserts new items.

Takes NULL, returns STATUS.

```
#define msgNPItemSplitAsWords       MakeMsg(clsNPItem, 16)
```

Return Value **stsItemNoSplit** Returned if nothing was split.

msgNPItemJoin

Joins receiver and OBJECT and deletes OBJECT.

Takes OBJECT, returns STATUS.

```
#define msgNPItemJoin           MakeMsg(clsNPItem, 27)
```

msgNPItemTie

Joins OBJECT and receiver and deletes them. Inserts new object.

Takes OBJECT, returns STATUS.

```
#define msgNPItemTie            MakeMsg(clsNPItem, 17)
```

msgNPItemGetScribble

Pass back the item's scribble.

Takes P_OBJECT, returns STATUS.

```
#define msgNPItemGetScribble        MakeMsg(clsNPItem, 4)
```

Comments Subclasses that do not contain a scribble should not respond to this message.

msgNPItemGetString

Passes back the text string for the item.

Takes PP_STRING, returns STATUS.

```
#define msgNPItemGetString      MakeMsg(clsNPItem, 38)
```

Comments Subclasses that do not have a text representation should not respond to this message.

clsNPScribbleItem responds to this message by translating its scribble and returning the resulting string.

The sender of this message should either use the passed back string immediately or make a copy of it.

msgNPItemSetString

Sets the text string for the item.

Takes P_STRING, returns STATUS.

```
#define msgNPItemSetString      MakeMsg(clsNPItem, 42)
```

Comments Not all items can handle this message.

msgNPItemToText

Item converts itself to a text item, passes back text item.

Takes P_OBJECT, returns STATUS.

```
#define msgNPItemToText     MakeMsg(clsNPItem, 7)
```

Comments Receiver deletes itself from its data and inserts the text item. If **pArgs** is **pNull**, the text item is not passed back.

msgNPItemToScribble

Item converts itself to a scribble item.

Takes P_ARGS, returns STATUS.

```
#define msgNPItemToScribble MakeMsg(clsNPItem, 36)
```

Comments Receiver deletes itself from its data and inserts the scribble item.

msgNPItemHitRegion

Returns **stsOK** if receiver's path overlaps **pArgs**.

Takes P_RECT32, returns STATUS.

```
#define msgNPItemHitRegion  MakeMsg(clsNPItem, 10)
```

msgNPItemCalcBaseline

Calculate and set receiver's baseline.

Takes P_XY32, returns STATUS.

```
#define msgNPItemCalcBaseline   MakeMsg(clsNPItem, 28)
```

Comments The calculation is based on the line spacing specified by **pArgs**.

msgNPItemCalcBounds

Receiver calculates and sets its new bounds.

Takes OBJECT, returns STATUS.

```
#define msgNPItemCalcBounds MakeMsg(clsNPItem, 37)
```

Comments Usually send in response to the item's style changing. OBJECT is the data object in which the item will be inserted. If the item is in a data object, **pArgs** can be **pNull**.

msgNPItemGetWordSpacing

Receiver passes back the size of its "space" character.

Takes P_U16, returns STATUS.

```
#define msgNPItemGetWordSpacing MakeMsg(clsNPItem, 43)
```

Comments This message is used by **msgNotePaperTidy** to determine the spacing of items.

msgNPItemCanBeTranslated

Receiver returns **stsOK** if it can be translated.

Takes **pNull**, returns STATUS.

```
#define msgNPItemCanBeTranslated    MakeMsg(clsNPItem, 13)
```

Comments Translation occurs in response to **msgNPItemToText**.

msgNPItemCanBeUntranslated

Receiver returns **stsOK** if it can be untranslated.

Takes **pNull**, returns STATUS.

```
#define msgNPItemCanBeUntranslated  MakeMsg(clsNPItem, 31)
```

Comments Untranslation occurs in response to **msgNPItemToScribble**.

NPSCR.H

This file contains the API definition for **clsNPScribbleItem.**

clsNPScribbleItem inherits from **clsNPItem.**

NPScribbleItem is the ink class of PenPoint's ink-management or note-taking building block. (See notepapr.h for more information on the building block.) NPScribbleItem overrides NPItem messages as is appropriate. See npitem.h for details.

```
#ifndef NPSCR_INCLUDED
#define NPSCR_INCLUDED
#ifndef NPITEM_INCLUDED
#include "npitem.h"
#endif
```

Types and Constants

```
#define clsNPScribbleItem       MakeGlobalWKN(2570,1)
```

Messages

msgNewDefaults

Initialize **pArgs**. Zeros out **pArgs**->scribbleItem.

Takes P_NP_SCRIBBLE_ITEM_NEW, returns STATUS.

Arguments

```
typedef struct NP_SCRIBBLE_ITEM_NEW_ONLY {
    OBJECT  scribble;
    OBJECT  data;       // data that item will be associated with
    S32     spare1;
} NP_SCRIBBLE_ITEM_NEW_ONLY,  *P_NP_SCRIBBLE_ITEM_NEW_ONLY;
#define npScribbleItemNewFields     \
    npItemNewFields         \
    NP_SCRIBBLE_ITEM_NEW_ONLY   scribbleItem;
typedef struct NP_SCRIBBLE_ITEM_NEW {
    npScribbleItemNewFields
} NP_SCRIBBLE_ITEM_NEW, *P_NP_SCRIBBLE_ITEM_NEW;
```

NPTEXT.H

This file contains the API definition for **clsNPTextItem**.

clsNPTextItem inherits from **clsNPItem.**

NPTextItem is the text class of PenPoint's ink-management or note-taking building block. (See notepapr.h for more information on the building block.) NPTextItem overrides NPItem messages as is appropriate. See npitem.h for details.

```
#ifndef NPTEXT_INCLUDED
#define NPTEXT_INCLUDED
#ifndef NPITEM_INCLUDED
#include "npitem.h"
#endif
```

Types and Constants

```
#define clsNPTextItem          MakeGlobalWKN(2571,1)
```

Messages

msgNewDefaults

Initialize **pArgs**. Zeros out **pArgs**->textItem.

Takes P_NP_TEXT_ITEM_NEW, returns STATUS.

Arguments

```
typedef struct NP_TEXT_ITEM_NEW_ONLY {
    OBJECT      text;       // string object
    P_STRING    pString;    // string if string object not given
    OBJECT      data;       // data that item will be associated with
                            // (item's size measured using data's DC)
    S32         spare1;
} NP_TEXT_ITEM_NEW_ONLY,  *P_NP_TEXT_ITEM_NEW_ONLY;
#define npTextItemNewFields     \
    npItemNewFields         \
    NP_TEXT_ITEM_NEW_ONLY   textItem;
typedef struct NP_TEXT_ITEM_NEW {
    npTextItemNewFields
} NP_TEXT_ITEM_NEW, *P_NP_TEXT_ITEM_NEW;
```

ORDSET.H

This file contains the API definition for the OrderedSet interface. The functions described in this file are contained in MISC.LIB.

Overview

An OrderedSet implements a growable, ordered set of items. Each item has a key and associated data. The ordered set knows about the structure of the key, but treats the data as uninterpreted bytes. The items in an ordered set are homogeneous: there is only one size for the key, and another size for the data, for all the items in the set.

Keys are unsigned quantities, treated as either non-negative integers or indirect access identifiers. The client specifies:

- how keys are treated - direct or indirect;
- for indirect keys - access and comparison functions;
- whether duplicate keys are allowed;
- the key size - it must be 1, 2, or 4 bytes.

The data size (in bytes) is also specified by the client; it must be less than or equal to 1023.

The client provides an initial estimate of the number of items in the ordered set when the set is created; the set will allocate more memory if the estimate proves to be too small.

Performance considerations

The implementation of OrderedSet builds on the ByteArray storage abstraction. This implies that either the number of elements in the set is small enough that it is not a problem to use a linear array representation for the set, or that the number of lookups dominates the number of insertions and deletions.

Indirect Keys and Two Comparison Routines

Ordered sets with indirect keys have a funny property. If you want to search for a key that already exists in the set, everything's just fine. But if you want to do something with a key that ISN'T in the set (e.g. find out if the key is in the set), there is no indirect key to use. (This problem also arises when clients ask ordered sets questions such as "What's the next entry with a key greater than this key k?")

To solve this problem, indirect-keyed ordered sets must be provided two comparison routines by the creator. The first routine (passed as the **compareKey1Indirect** in a called to OrderedSetExtend()) is used when the implementation needs to compare two keys that are both in the set. The second routine (passed as **compareKey1Direct** in a call to OrderedSetExtend()) is used when the implementation needs to compare two keys, only one of which is in the set.

Caution:

If keys are indirect, OrderedSetFindMinMax(), OrderedSetFindMaxMin(), and OrderedSetNext() return the indirect key, not the value the key references.

Known Limitations

This package does not work correctly if the set has indirect keys and 0 (zero) is a legitimate key value.

```
#ifndef ORDSET_INCLUDED
#define ORDSET_INCLUDED $Revision:   1.17  $
#include <bytarray.h>
#include <gosearch.h>      // For ACCESS/COMPARE_FUNC
```

Private

Function Prototype

```
typedef U32 (CDECL *READ_KEY_FUNC)(
                P_ORDERED_SET   p,
                P_UNKNOWN       pKey);
typedef struct ORDERED_SET {
    U16             indirectKeys    : 1;
    U16             uniqueKeys      : 1;    // TRUE => no duplicate keys
    U16             spare           : 2;    // Always set to 0
    U16             sizeofKeyMinus1 : 2;    // Number of bytes -1 a key needs
    U16             sizeofData      :10;    // Number of bytes data occupies
    P_BYTE_ARRAY    items;                  // Storage of actual items
    ACCESS_FUNC     access;
    COMPARE_FUNC    compareKey1Direct;
    COMPARE_FUNC    compareKey1Indirect;
    P_UNKNOWN       context;                // 1st arg to access() & compare()
    READ_KEY_FUNC   readKey;                // For internal use only!
} ORDERED_SET;
```

OrderedSetCountInternal

Returns the number of items currently stored in the ORDERED_SET.

Returns BYTE_INDEX.

```
#define OrderedSetCountInternal(p) \
      (ByteArrayLength(p->items) / OrderedSetSizeofItem(p))
```

Comments

High-performance version of OrderedSetCount, but subject to change if the implementation of ordered sets changes.

Types and Constants

```
#define stsOrdSetDuplicateKey   MakeStatus(clsMisc, 1)
#define findNextKeyInOS     ((P_UNKNOWN)1)
#define findPreviousKeyInOS ((P_UNKNOWN)2)
typedef struct OS_ITEM_INFO {
    U32         key;
    P_UNKNOWN   data;
    BOOLEAN     isDuplicate;
} OS_ITEM_INFO, *P_OS_ITEM_INFO;
```

Exported Functions and Macros

OrderedSetPrint

In debugging version, prints the contents of the ordered set.

Returns void.

```
#ifdef DEBUG
void EXPORTED
```

Function Prototype
```
OrderedSetPrint(
    P_ORDERED_SET   p);
#endif // DEBUG
```

Comments

This function is undefined in the non-debugging version.

OrderedSetCreate

Creates an ordered set.

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype
```
OrderedSetCreate(
    P_ORDERED_SET * pp,
    OS_HEAP_MODE    mode,
    U8              sizeofKey,
    U8              sizeofData,
    U32             initialCount,
    BOOLEAN         uniqueKeys,
    BOOLEAN         indirectKeys);
```

Comments

sizeofKey and **sizeofData** specify the size in bytes of each item's key and data, respectively. The **initialCount** is a hint; the ordered set will grow or shrink as needed. However, if **initialCount** is approximately correct, performance will be better. If **initialCount=0**, 1 will be assumed. **uniqueKeys** should be TRUE if client wants all keys in the set to be unique, FALSE otherwise. Only the **osHeapLocal / osHeapShared** flags in mode are used.

Returns **stsOK** if able to create the set, in which case *pp will be the created set, otherwise *pp will be Nil(P_ORDERED_SET).

OrderedSetSizeofKey

Returns the size of a key in bytes.

Returns U16.

```
#define OrderedSetSizeofKey(p)   ((U16)((p)->sizeofKeyMinus1 + 1))
```

OrderedSetSizeofItem

Returns the size of an item (key plus data) in bytes.

Returns U16.

```
#define OrderedSetSizeofItem(p) \
        ((U16)(OrderedSetSizeofKey(p) + (p)->sizeofData))
```

OrderedSetHeapMode

Returns the heap mode with which the Ordered Set was created.

Returns OS_HEAP_MODE.

```
#define OrderedSetHeapMode(p)    ByteArrayHeapMode((p)->items)
```

OrderedSetExtend

Modifies the functions and context of an ordered set with indirect keys.

Returns STATUS.

```
void EXPORTED
```

Function Prototype

```
OrderedSetExtend(
    P_ORDERED_SET   p,
    ACCESS_FUNC     access,
    COMPARE_FUNC    compareKey1Direct,
    COMPARE_FUNC    compareKey1Indirect,
    P_UNKNOWN       context);
```

Comments

Specifies access and comparison functions for an ordered set with indirect keys, as well as a context for those functions.

See gosearch.h's description of **binarySearch**() for more information about the behaviors and parameters of the access and compare functions.

OrderedSetContext

Get the context passed to access and compare functions.

Returns P_UNKNOWN.

```
#define OrderedSetContext(_p) ((_p)->context)
```

OrderedSetModifyContext

Modify the context passed to access and compare functions.

Returns void.

```
#define OrderedSetModifyContext(_p, _c) ((_p)->context = (_c))
```

OrderedSetDefaultAccess

Can be used as the client-specified access routine in OrderedSetExtend().

Returns P_UNKNOWN.

```
P_UNKNOWN CDECL
```

Function Prototype

```
OrderedSetDefaultAccess(
    const P_ORDERED_SET p,
    const BYTE_INDEX    index);
```

Comments

In ordered sets with indirect keys the client must supply a routine that returns the address of the keys that are passed into the client-supplied comparison routine. OrderedSetDefaultAccess computes the address of the key in the ordered set representation, and so may be used by clients as the access routine passed into OrderedSetExtend().

OrderedSetDestroy

Destroys an ORDERED_SET.

Returns void.

```
void EXPORTED
```

Function Prototype

```
OrderedSetDestroy(
    P_ORDERED_SET   p);
```

OrderedSetInsert

Inserts data with key into ordered set.

Returns STATUS.

```
STATUS EXPORTED
```

Function Prototype

```
OrderedSetInsert(
    P_ORDERED_SET   p,
    U32             key,
    P_UNKNOWN       data);
```

Comments

Copies **sizeofData** bytes from the buffer pointed to by data. Returns:

stsOSOutOfMem if no memory available, or

stsOrdSetDuplicateKey if key is duplicate and unique keys required, or

stsOK otherwise.

If **sizeofKey** is less than 4 bytes, the least significant byte(s) of key are copied.

OrderedSetNthItem

Locates the n-th item in the ordered set (item indices begin with 0).

Returns P_UNKNOWN.

```
P_UNKNOWN EXPORTED
```

Function Prototype

```
OrderedSetNthItem(
    P_ORDERED_SET   p,
    U32             n,
    P_OS_ITEM_INFO  info);
```

Comments

Returns a pointer to ordered set's copy of the data associated with the Nth item. This pointer is only valid until the next call on the same set.

Upon return, the following modifications have been made to the fields of info:

key key of nth item

isDuplicate is not set; use OrderedSetFind() if needed;

data duplicate of return value

OrderedSetItemIndex

Returns the index of an item

Returns BYTE_INDEX..

```
#define OrderedSetItemIndex(p, pData) \
    ((ByteArrayFindIndex((p)->items, ((P_U8)(pData))) \
    - OrderedSetSizeofKey(p)) / OrderedSetSizeofItem(p))
```

OrderedSetFind

Locates the data for a specified key.

Returns P_UNKNOWN.

```
P_UNKNOWN EXPORTED
```

Function Prototype

```
OrderedSetFind(
    P_ORDERED_SET   p,
    P_OS_ITEM_INFO  info);
```

Comments

Returns a pointer to ordered set's copy of the data associated with info->key. This pointer is only valid until the next call on the same set. If the info->key is not in the set, the returned value is Nil(P_UNKNOWN). If duplicate copies of the key exist in the set, an arbitrary item is found and its data returned. All of the other items with the same key may be examined via use of OrderedSetNext(). Upon return, the following modifications have been made to the fields of info:

isDuplicate 0 if key is unique in set, 1 otherwise

data duplicate of return value

OrderedSetFindMinMax

Locates the data for a key >= to specified key.

Returns P_UNKNOWN.

```
P_UNKNOWN EXPORTED
```

Function Prototype

```
OrderedSetFindMinMax(
    P_ORDERED_SET   p,
    P_OS_ITEM_INFO  info);
```

Comments

Returns a pointer to ordered set's copy of the data associated with the minimum key in the ordered set that is >= info->key. If info->key is in the ordered set, this routine is equivalent to OrderedSetFind(). This pointer is only valid until the next call on the same set. Returns Nil(P_UNKNOWN) if info->key has no minmax in the set. If duplicate copies of the minmax key exist in the set, an arbitrary item is found and its data returned. All of the other items with the same key may be retrieved with OrderedSetNext(). Upon return, the following modifications have been made to the fields of info:

key minmax key

isDuplicate 0 if key is unique in set, 1 otherwise

data duplicate of return value

OrderedSetFindMaxMin

Locates the data for a key <= to specified key.

Returns P_UNKNOWN.

```
P_UNKNOWN EXPORTED
```

Function Prototype

```
OrderedSetFindMaxMin(
    P_ORDERED_SET   p,
    P_OS_ITEM_INFO  info);
```

Comments

Returns a pointer to ordered set's copy of the data associated with the maximum key in the ordered set that is <= info->key. If info->key is in the ordered set, this routine is equivalent to OrderedSetFind(). This pointer is only valid until the next call on the same set. Returns Nil(P_UNKNOWN) if info->key has no maxmin in the set. If duplicate copies of the maxmin key exist in the set, an arbitrary item is found and its data returned. All of the other items with the same key may be retrieved with OrderedSetNext(). Upon return, the following modifications have been made to the fields of info:

key maxmin key

isDuplicate 0 if key is unique in set, 1 otherwise

data duplicate of return value

OrderedSetNext

Enumerates the data for keys in the Ordered Set.

Returns P_UNKNOWN.

Function Prototype

```
P_UNKNOWN EXPORTED
OrderedSetNext(
    P_ORDERED_SET   p,
    P_OS_ITEM_INFO  info);
```

Comments

OrderedSetNext()'s behavior depends on whether the set has unique keys or not. In both cases, the enumeration is guaranteed to be complete provided no insertions or deletions are performed on the set during the enumeration.

◆ IF THE SET HAS UNIQUE KEYS

OrderedSetNext() enumerates all of the keys in the set in order.

The first item in the enumeration can be found by either (1) by calling OrderedSetNthItem() with an "N" of 0 or (2) calling OrderedSetNext() with info->data set to Nil and info->key set to the lowest possible key value.

◆ IF THE SET DOES NOT HAVE UNIQUE KEYS

OrderedSetNext() enumerates all of the keys with the same value. The order of enumeration is unspecified.

The first item with a known key can be found by either (1) by calling OrderedSetFind with info->key set to the known key value and info->data set to Nil

◆ IN BOTH CASES

Further items are found by calling OrderedSetNext() with the same info struct until it returns Nil. OrderedSetNext() returns a pointer to the set's copy of the data associated with key. This pointer is only valid until the next call on the same set.

Returns

Nil(P_UNKNOWN) if specified key not in set or the enumeration is complete, or

pointer to set's copy of data or if key is in set or enumeration is incomplete.

Upon return, the following modifications have been made to the fields of info:

```
key:            next key value, iff info->data had been one of the
                three special values: Nil, next, prev.
isDuplicate:    0 if key is unique in set,
                1 otherwise
data:           duplicate of returned value
```

- FOR SETS WITH DIRECT, NON-DUPLICATE KEYS ONLY

  If the set has direct keys, setting info->data to **findNextKeyInOS** (**findPreviousKeyInOS**), OrderSetNext() can be used to enumerate all items in the set in order of increasing (decreasing) key value. Such an enumeration (assuming non-unique keys) will have the structure:

```
info.key = 0;
info.data = Nil(P_UNKNOWN);
if ((firstData = OrderedSetNext(...)) == Nil(P_UNKNOWN)) {
    info.data = findNextKeyInOS;
    if ((firstData = OrderedSetNext(...)) == Nil(P_UNKNOWN)) {
        // handle empty set
        ...
    }
}
// firstData and info now contain first item's information

// enumerate all keys
do {
    // enumerate all data with the same key
    while (OrderedSetNext(...)) {
        ...
    };
    info.data = findNextKeyInOS;
} until (!OrderedSetNext(...));
```

OrderedSetEachItem

Helper macro to simplify the enumeration of an Ordered Set.

Returns P_UNKNOWN.

```
#define OrderedSetEachItem(_p, _item)    \
    for ((_item).key = (U32)0, (_item).data = Nil(P_UNKNOWN); \
         OrderedSetNext((_p), &(_item)) != Nil(P_UNKNOWN);)
         // The condition IS the iteration step
```

Comments

This macro is only useful for sets with direct, non-duplicate keys!

The arguments to OrderedSetEachItem() are:

_p the ordered set to enumerate

_item an OS_ITEM_INFO containing the enumerated item's info

Code using these macros should look like: OS_ITEM_INFO scratch; OrderedSetEachItem(os, scratch) { myPtr = (MY_PTR)scratch.data; ... }

OrderedSetDelete

Deletes specified item from the Ordered Set.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED
OrderedSetDelete(
    P_ORDERED_SET   p,
    P_OS_ITEM_INFO  info);
```

Comments

If duplicates are allowed, both info->key and info->data must be filled in by client; if keys are unique, only info->key need be filled in.

Returns:

stsOK if item was found in set and deleted, or

stsNoMatch if item not found in set, or

STATUS < 0 if internal error during deletion.

OrderedSetCount

Returns the number of items currently stored in the ORDERED_SET.

Returns U32.

Function Prototype

```
U32 EXPORTED
OrderedSetCount(
    P_ORDERED_SET   p);
```

QHELP.H

This file contains the API definition for **clsQuickHelp.**

clsQuickHelp inherits from **clsFrame.**

clsQuickHelp provides an interface to the Quick Help Server.

theQuickHelp is a well-known instance of **clsQuickHelp.**

theQuickHelp provides system wide quick help, and is the only instance of **clsQuickHelp** in the system, built at boot time. Clients should not create instances of this object, nor should they subclass this object. This file defines an interface to display quick help text in the standard quick help window. Programmers should rarely have to call ANY of the functions in this file, as default calling of quick help is provided by default in **clsGWin** (see gwin.h). However, some applications may need to invoke quick help, or change the quick help text, hence the public message to open quick help, and to show a quick help screen.

A quick help resource consists of a string array resource with each array item mapping to a single quick help panel. This resource is identified by creating a List resource ID from the administered portion of the quick help ID (MakeListResId(**helpID**, **resGrpQhelp**, 0)) and the quick help group. The TAG portion of the quick help ID is used to index into the string array. Each quick help strings will have two "parts". The first part will be the title and the second part will be the text. The title will be separated from the text by including two vertical line characters (||) following the title which will NOT be printed.

These resources, which are defined below, are put into the application resource files and displayed using **msgQuickHelpShow**, which takes the resource ID. As mentioned, **gWin** defines a default behavior for calling the object with this message. All application typically need to do is provide their **gWin** objects (or subclasses) with **helpId** resources.

Quick help for an object is generally displayed in one of two ways. The first is when an object decides to display quick help for itself. An example is **gWin**'s response to the '?' gesture. **gWin** posts **theQuickHelp msgQuickHelpShow**, which opens the quick help window and displays quick help for the object. The second is when **theQuickHelp** window is open, and the system is in quick help mode. When the user taps on objects on the screen, the object is sent **msgQuickHelpHelpShow**. The object will respond by posting **msgQuickHelpShow** back to **theQuickHelp**. When the quick help window is dismissed, by hitting closed or envoke help notebook, the object that received **msgQuickHelpHelpShow** will receive **msgQuickHelpHelpDone**. This message will also be sent when tapping on successive objects while in quick help mode. It will not be sent when quick help was initially brought up directly from the object when it posted **msgQuickHelpShow** (such as the **gWin** response to the '?' gesture.

```
#ifndef QHELP_INCLUDED
#define QHELP_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef RESFILE_INCLUDED
#include <resfile.h>
#endif
```

Debugging Flags

Quick Help uses the debugging flag set 'q'. Defined flags are:

0001 General quick help debugging information

Types and Constants

These tags are used for defining three quick help screens: 1) the quick help intro screen that gives directions on quick help, 2) the "No help available" screen, and 3) the help not found screen.

```
#define hlpQuickHelpSignOn              MakeTag(clsQuickHelp, 1)
#define hlpQuickHelpNoHelp              MakeTag(clsQuickHelp, 2)
#define hlpQuickHelpNotFound            MakeTag(clsQuickHelp, 3)
```

Messages

msgQuickHelpShow

Displays the Quick Help associated with the resource ID.

Takes P_QUICK_DATA, returns STATUS.

```
#define msgQuickHelpShow            MakeMsg(clsQuickHelp, 1)
```

Arguments

```
typedef struct QUICK_DATA {
    U32 helpId;         // Help ID of the screen to show
    OBJECT appUID;      // UID of the application. Used to find resources
                        // of application specific help IDs.
    U32 reserved;       // Reserved for future use
} QUICK_DATA, *P_QUICK_DATA;
```

Comments

Gets the quick help resource from either the system resource files or the application specific resource files. If the quick help resource can't be found, will display the "Quick help not found" message in the quick help screen. Typically called from **gWin** in order to display the help screen for a help gesture. Would take the **gWin helpId** and the application uid. Needs the application object in order to reference the resource files of the application to find application specific help IDs. Typically not called directly by applications, but called indirectly through **gWin** inheritence. Will call **msgQuickHelpOpen** to open the quick help window as necessary.

Typically called by objects in response to a ? gesture, or in response to **msgQuickHelpHelpShow**.

See Also

gwin.h

msgQuickHelpHelpShow

Sent to a window to display a quick help request.

Takes P_XY32, returns STATUS.

```
#define msgQuickHelpHelpShow        MakeMsg(clsQuickHelp, 7)
```

Comments

Sent from **theQuickHelp** to a window when it is required to display its quick help. Typically the window will respond by posting **msgQuickHelpShow**. Sent as the user taps on various windows while quick help is being displayed.

See Also

msgQuickHelpHelpDone

msgQuickHelpHelpDone

Sent to a window when quick help is no longer displayed.

Takes **OBJECT**, returns STATUS.

```
#define msgQuickHelpHelpDone        MakeMsg(clsQuickHelp, 8)
```

Comments

Sent to the last object asked to display quick help via **msgQuickHelpHelpShow** when help is no longer needed on said object. Can be sent because the user tapped somewhere else and a new object is about to be sent **msgQuickHelpHelpShow**, quick help has been terminated by the user, or the help notebook has been entered. Takes the new object receiving a **msgQuickHelpHelpShow** if because the user tapped elsewhere, or null if quick help is being terminated or going to the help notebook. Note that this message is only sent to object which previously received **msgQuickHelpHelpShow**, and not those objects generating a help request by posting **msgQuickHelpShow** directly.

See Also

msgQuickHelpHelpShow

msgQuickHelpOpen

Forces the Quick Help window to appear.

Takes nothing, returns STATUS.

```
#define msgQuickHelpOpen            MakeMsg(clsQuickHelp, 2)
```

Comments

Opens the quick help window on the screen. If the quick help window is already on the screen, will simply return **stsOK**. The quick help window is a modal filter that will grab all input till closed via **msgQuickHelpClose**. Self sent to when **msgQuickHelpShow** is posted. Also sent from the help notebook icon to invoke quick help.

Notification Messages

msgQuickHelpOpened

Indicates that the quick help window has been opened.

Takes nothing, returns STATUS. Category: observer notification.

```
#define msgQuickHelpOpened          MakeMsg(clsQuickHelp, 128)
```

Comments

Sent to observers of the quick help that the quick help window has been opened.

msgQuickHelpClosed

Indicates that the quick help window has been closed.

Takes nothing, returns STATUS. Category: observer notification.

```
#define msgQuickHelpClosed          MakeMsg(clsQuickHelp, 129)
```

Comments

Sent to observers of **theQuickHelp** to indicate that the quick help window has been closed.

msgQuickHelpInvokedNB

Indicates that the notebook associated with quick help should be open.

Takes nothing, returns STATUS. Category: observer notification.

```
#define msgQuickHelpInvokedNB       MakeMsg(clsQuickHelp, 130)
```

Comments

Sent to observers when **msgQuickHelpInvokeNB** is recieved. The help note book is an observer, and will bring itself up when this message is recieved.

SEL.H

This file contains the API for **clsSelection**.

clsSelection inherits from **clsObject**.

theSelectionManager provides management of the system-wide selection. **theSelectionManager** is the one and only instance of **clsSelection**.

Introduction

Much of PenPoint's user interface is based on the "selection." The selection is often the center of the user's attention. In general it is very easy for the user to set the selection -- it often just requires a tap.

The precise definition of the selection is application-specific. In text the selection is often a set of characters. In a spreadsheet it might be a range of rows, columns, or cells. In a Table of Contents it might be a set of documents. Typically, an application "highlights" the selection with a grey background, handles, or some other graphic technique.

Because the selection corresponds to the center of the user's attention, many user interface operations are based on the selection. Here are some examples:

- The selection is the source of PenPoint's move and copy operations.
- Typically, the selection is altered by Applying an Option Sheet.
- The selection often determines which menu items are enabled and which are disabled.
- The selection and keyboard input target are often linked together.

Programmatically, other objects can inquire about the selection, get information from the selection and transfer data from the selection.

Road Map

Use the following to take ownership of the selection:

- msgSelSetOwner
- msgSelSetOwnerPreserve
- msgSelSelect (if object has **clsEmbeddedWin** in the object's ancestry)

Selection owners must be prepared to handle the following:

- msgSelDelete
- msgSelYield
- msgSelBeginCopy
- msgSelBeginMove
- msgControlProvideEnable (see section "Control Enabling")

Use the following to inquire about the selection:

- msgSelOwner
- msgSelPrimaryOwner
- msgSelOwners
- msgSelIsSelected (if object has **clsEmbeddedWin** in the object's ancestry)

theSelectionManager sends the following notifications:

- msgSelChangedOwners
- msgSelPromotedOwner

Destinations of PenPoint's Move and Copy mechanism must handle the following:

- msgSelCopySelection
- msgSelMoveSelection

Move and Copy

sel.h defines several messages that are used to implement PenPoint's Move and Copy operations. These messages are used in combination with PenPoint's data transfer messages which are defined in xfer.h. (PenPoint data transfer does not always necessarily involve the selection, but when it does, the messages described here are employed.)

clsEmbeddedWin (see embedwin.h) provides the default response for several of the steps described below.

Here's the typical "flow of control" for moving selected data:

- The source object handles the "Press" gesture (**xgsPressHold** in xgesture.h). The object might receive this gesture if it is a **gWin** (see gwin.h).
- If the Press gesture is not over the selection, the object typically selects what is under the gesture. "Selecting" includes either (1) self sending **msgSelSelect** or (2) sending **msgSelSetOwner** to **theSelectionManager**, whichever is appropriate.
- Next the object self-sends **msgSelBeginMove**.
- msgSelBeginMove is received. Note that **msgSelBeginMove** is sent in other cases than the Press gesture response. For instance, the standard application menu item "Move" (in the "Edit" menu) results in the selection owner receiving **msgSelBeginMove**.
- In response to **msgSelBeginMove**, the receiver should self send **msgEmbeddedWinBeginMove**. **msgEmbeddedWinBeginMove** takes, in its **pArgs**, the hot point of the gesture that kicks off the move, and the bounds of the selection being moved.
- In response to **msgEmbeddedWinBeginMove**, **embeddedWin** creates the floating "move icon." **clsEmbeddedWin** manages the icon.
- The icon takes over at this point and manages the process of moving the selection.
- When the icon is dropped on a destination, the icon sends **msgMoveCopyIconDone** to the source.
- clsEmbeddedWin handles **msgMoveCopyIconDone** and sends **msgSelMoveSelection** to the destination.

- In response to **msgSelMoveSelection**, the destination object retrieves the selection owner from the selection manager (using **msgSelOwner**) and engage in an xfer protocol with the selection. (The xfer protocols are described in xfer.h) The data should be copied to the position contained in **msgSelMoveSelection**'s **pArgs**, which is a P_XY32.
- After the data has been copied from the selection owner, the destination should send **msgSelDelete** to the selection owner.
- The destination object should select the data that it just absorbed.

The "flow of control" for copying selected data is very similar, with the following changes:

- The gesture that kicks off the protocol is "Tap-Press" (**xgsTapHold** in xgesture.h) rather than Press-Hold.
- The source object self sends and handles **msgSelBeginCopy** rather than **msgSelBeginMove**. The source object self sends **msgEmbeddedWinBeginCopy** rather than **msgEmbeddedWinBeginMove**.
- The destination receives **msgSelCopySelection** rather than **msgSelMoveSelection**.
- The destination object should not send **msgSelDelete**.

See Also xfer.h.h

Two Selection Owners

Some objects need to own the selection, but they need to take in a fashion that (1) allows PenPoint to restore the original selection and (2) allows client code to find the original selection. For example, Option Sheets apply to a selection. But the various controls that appear within the option sheet might need to own the selection as well. Both selections need to be maintained.

Therefore **theSelectionManager** actually manages two selection owners: a selection owner and a preserved selection owner.

NOTE: The same object cannot be both the selection owner and preserved selection owner. See the detailed comments with **msgSelSetOwner** and **msgSelSetOwnerPreserve** for details.

When an object needs to take the selection but allow the current selection to be restored, that object should take the selection via **msgSelSetOwnerPreserve**, which "preserves" or "remembers" the original selection. The preserved selection can be restored by sending **msgSelOwnerPreserve** with a **pArgs** of **pNull** to **theSelectionManager**. Hence objects in option sheets take the selection via **msgSelSetOwnerPreserve**.

Essentially all clients should operate on the selection owner. This includes move and copy operations. The only client that should operate on the preserved selection owner, if one exists, is option sheets.

Control Enabling

Some controls, particularly menu items, should be disabled if there is no selection owner. And some controls should be disabled based on application-specific details about the selection state.

For instance, the "Move," "Copy," and "Delete" menu items should not be enabled if there is no selection owner. The "Move" menu item should be enabled if there is a selection and the selection owner is not read-only. The "Delete" menu item should be enabled if there is a selection owner and the contents of the selection are not empty.

To support this, **clsControl** allows control creators to specify that the control should send **msgControlProvideEnable** to the selection owner to get the proper enable/disable state.

Some standard application menus (SAMs) are set up to send **msgControlProvideEnable** to the selection owner. See app.h for details.

Therefore all selection owners should handle **msgControlProvideEnable**.

Relationship of Selection to the Input Target

The input system's "Target" is the object to which keyboard events are sent. See input.h for more information.

Because the selection is normally the center of the user's attention, it often makes sense for the same object to own the selection and to be the input target. For instance, PenPoint's text component always becomes the input target whenever it takes the selection and sets the input target to null when it yields the selection.

There are, however, cases where it makes more sense to NOT link the selection and input target together. For instance, some types of fields take the input target without taking the selection. The decision is quite application-specific.

Implementing a correspondence between the input target and selection ownership is the client's responsibility.

What to Do When the Selection Changes Within an Owner

Some parts of PenPoint's UI depend on knowing when the user's center of attention changes. For instance, each time that an Option Sheet is notified that the selection has changed it checks to be sure that the top card is still applicable.

Therefore, selection owners should set the selection to self EVERY TIME THE SELECTION CHANGES within them, even if they are already the selection owner. This lets observers take any appropriate action.

Only One Instance

There is one and only one instance of **clsSelection**, and that instance is the global well-known **theSelectionManager**.

```
#ifndef SEL_INCLUDED
#define SEL_INCLUDED
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
```

Common #defines and typedefs

Status Codes

theSelectionManager returns **stsSelYieldInProgress** when the selection manager is in the process of sending **msgSelYield** and therefore can't respond to the message.

```
#define stsSelYieldInProgress                  MakeWarning(clsSelection,1)
```

Types

preservedOwner is defined only if **havePreservedOwner** is true. It IS possible to have a null **preservedOwner**.

```
typedef struct SEL_OWNERS {
    OBJECT      owner;
    OBJECT      preservedOwner;
    BOOLEAN     havePreservedOwner;
} SEL_OWNERS, *P_SEL_OWNERS;
```

Messages Sent to theSelectionManager

```
// Next Up: 26, Recycled: 9, 14, 20
```

msgSelSetOwner

Sets the selection owner.

Takes OBJECT, returns STATUS.

```
#define msgSelSetOwner  MakeMsg(clsSelection,2)
```

Comments

Send **msgSelSetOwner** to **theSelectionManager** to set the selection owner. **theSelectionManager** responds in one of the following ways:

If **pArgs** is not a valid selection owner (because it can't be called from other objects or is not a global object):

- theSelectionManager returns **stsScopeViolation.**

If **pArgs** is null, **theSelectionManager:**

- sends **msgSelYield** to the current selection if it exists and sets the current selection to null.
- sends **msgSelYield** the current preserved selection if it exists and sets the current preserved selection to null.
- sends **msgSelChangedOwners** to **theSelectionManager**'s observers.

Otherwise, **theSelectionManager:**

- sends **msgSelYield** to the current preserved selection if it exists and is not equal to **pArgs. theSelectionManager** then sets the preserved selection to null and stops observing the preserved selection.
- sends **msgSelYield** to the current selection if it exists and is not equal to **pArgs.**
- sets the current selection to **pArgs.**
- adds itself as an observer of the new selection.
- sends **msgSelChangedOwners** to **theSelectionManager**'s observers.

Return Value

stsScopeViolation pArgs is not a valid selection owner.

See Also

msgSelYield

msgSelSetOwnerPreserve

Sets the selection owner with the preserve option.

Takes OBJECT, returns STATUS.

```
#define msgSelSetOwnerPreserve  MakeMsg(clsSelection,5)
```

Comments

Send **msgSelSetOwnerPreserve** to **theSelectionManager** to set the selection owner while preserving the current selection owner.

See the section "Two Selection Owners" for more information.

theSelectionManager's response to this message is similar to its response to **msgSelSetOwner**, with only subtle differences.

If **pArgs** is null, and there is no **preservedOwner**:

- theSelectionManager simply returns **stsOK**.

If **pArgs** is null, and a preserved owner exists (even if it is null), **theSelectionManager**:

- sends **msgSelYield** to the current owner if it exists.
- sends **msgSelPromote** to the current preserved owner if non-null.
- sets the current owner to the current preserved owner if non-null.
- sets the current preserved owner to null.
- sets the value for SEL_OWNERS.**havePreservedOwner** to false.
- sends **msgSelPromotedOwner** to **theSelectionManager**'s observers.

If **pArgs** is non-null but is not a valid selection owner (because it can't be called from other objects or is not a global object):

- theSelectionManager returns **stsScopeViolation**.

If **pArgs** is a valid selection owner and there is a no preserved owner:

- sends **msgSelDemote** to the current owner.
- sets the current preserved owner to be the current owner.
- sets the current owner to be **pArgs**.
- adds itself as an observer of the new selection.
- sets the value for SEL_OWNERS.**havePreservedOwner** to true.
- sends **msgSelChangedOwners** to **theSelectionManager**'s observers.

If **pArgs** is a valid selection owner and there is a preserved owner:

- sends **msgSelYield** to the current owner if it exists and is not the same as **pArgs**.
- sets the current owner to **pArgs**.
- adds itself as an observer of the new selection.
- sends **msgSelChangedOwners** to **theSelectionManager**'s observers.

Return Value

stsScopeViolation pArgs is not a valid selection owner.

See Also

msgSelYield

msgSelOwner

Passes back the selection owner.

Takes P_OBJECT, returns STATUS.

```
#define msgSelOwner MakeMsg(clsSelection,1)
```

Comments

theSelectionManager passes back the current selection owner. It does not pass back the preserved selection owner.

Return Value

stsSelYieldInProgress theSelectionManager is currently sending **msgSelYield.**

msgSelPrimaryOwner

Passes back the primary selection owner.

Takes P_OBJECT, returns STATUS.

```
#define msgSelPrimaryOwner  MakeMsg(clsSelection,7)
```

Comments

The "primary owner" is the selection owner which an option sheet applies to. If there is a preserved selection owner, the primary owner is the preserved owner. Otherwise, the primary selection owner is the current owner.

Return Value

stsSelYieldInProgress theSelectionManager is currently sending **msgSelYield.**

See Also

msgSelSetOwner

msgSelOwners

Passes back the selection and preserved owners.

Takes P_SEL_OWNERS, returns STATUS.

```
#define msgSelOwners    MakeMsg(clsSelection,4)
```

Message Arguments

```
typedef struct SEL_OWNERS {
    OBJECT      owner;
    OBJECT      preservedOwner;
    BOOLEAN     havePreservedOwner;
} SEL_OWNERS, *P_SEL_OWNERS;
```

Return Value

stsSelYieldInProgress theSelectionManager is currently sending **msgSelYield.**

See Also

msgSelSetOwner

Notifications Sent to theSelectionManager's Observers

msgSelChangedOwners

Notifies observers when either of the selection owners changes.

Takes P_SEL_OWNERS, returns STATUS.

```
#define msgSelChangedOwners MakeMsg(clsSelection,6)
```

Message Arguments

```
typedef struct SEL_OWNERS {
    OBJECT      owner;
    OBJECT      preservedOwner;
    BOOLEAN     havePreservedOwner;
} SEL_OWNERS, *P_SEL_OWNERS;
```

Comments

theSelectionManager posts **msgSelChangedOwners** to its observers to inform the observers that the selection owner and/or preserved owner has been set. (The notification is sent even if the new owner is null.)

theSelectionManager sends this notification even if the old owner and new owner are the same. Hence if object A is the selection owner, and **msgSelSetOwner** is sent with object A, **msgSelChangedOwners** IS sent to **theSelectionManager**'s observers.

When a preserved selection owner is promoted back to the selection owner, **msgSelPromotedOwner** is sent rather than **msgSelChangedOwners**.

Example of use: In response to this message, option sheets check the applicability of the top card.

See Also **msgSelSetOwner**

msgSelPromotedOwner

Notifies observers when the preserved owner has been promoted back to the selection owner.

Takes P_SEL_OWNERS, returns STATUS.

```
#define msgSelPromotedOwner MakeMsg(clsSelection,8)
```

Message Arguments

```
typedef struct SEL_OWNERS {
    OBJECT      owner;
    OBJECT      preservedOwner;
    BOOLEAN     havePreservedOwner;
} SEL_OWNERS, *P_SEL_OWNERS;
```

Comments **theSelectionManager** posts **msgSelPromotedOwner** to its observers to inform the observers that preserved selection owner has been promoted to the normal selection owner.

This happens as a result of **theSelectionManager** handling **msgSelSetOwnerPreserve** with a **pArgs** of null.

See Also **msgSelSetOwnerPreserve**

Messages Sent by theSelectionManager to Owners

msgSelYield

theSelectionManager requires the release of the selection.

Takes BOOLEAN, returns STATUS.

```
#define msgSelYield MakeMsg(clsSelection,11)
```

Comments **theSelectionManager** sends this message to a selection owner to inform the object that it is no longer the selection owner. **pArgs** is true if object is yielding the primary selection and false when the object is yielding the preserved selection.

This message is not sent when an object takes the selection via **msgSelSetOwner** or **msgSelSetOwnerPreserve** and it already is the selection, or already is the preserved selection. (However, **msgSelChangedOwners** IS sent to **theSelectionManager**'s observers.)

When handling this message, be careful about sending selection manager messages (such as **msgSelSetOwner**) as deadlock can occur.

After sending **msgSelYield**, **theSelectionManager** removes itself as an observer of the object.

See Also **msgSelSetOwner**

msgSelDemote

Informs the owner that it is becoming the preserved owner.

Takes nothing, returns STATUS.

```
#define msgSelDemote    MakeMsg(clsSelection,24)
```

Comments **theSelectionManager** sends this message to a selection owner to tell the owner that it is becoming the preserved owner. (This can happen when **theSelectionManager** receives **msgSelSetOwnerPreserve.**)

Receivers should not do anything in response to this message. (If for some reason receivers chose to handle this message, be careful about sending selection manager messages (such as **msgSelSetOwner**) as deadlock can occur.)

See Also **msgSelPromote**

msgSelPromote

Informs the preserved owner that it is becoming the owner.

Takes nothing, returns STATUS.

```
#define msgSelPromote   MakeMsg(clsSelection,25)
```

Comments **theSelectionManager** sends this message to a preserved selection owner to tell the owner that it is becoming the normal selection owner. (This can happen when **theSelectionManager** receives **msgSelSetOwnerPreserve.**)

Receivers should not do anything in response to this message. (If for some reason receivers chose to handle this message, be careful about sending selection manager messages (such as **msgSelSetOwner**) as deadlock can occur.)

See Also **msgSelSetOwner**

Embedded Window Messages

Most subclasses of **clsEmbeddedWin** should use these messages. See embedwin.h for information about how and why to use them.

The messages are defined here rather than in embedwin.h because they are abstract. Theoretically other classes can respond to these messages to implement behavior analogous to that of **embeddedWin** (although no other PenPoint system class does so).

msgSelSelect

Sets self to be the selection owner.

Takes nothing, returns STATUS.

```
#define msgSelSelect    MakeMsg(clsSelection,19)
```

Comments See the section "Embedded Window Selection Messages" for more information.

Send this message to an object to have that object make itself be the selection owner or the preserved selection owner.

Do not send this message to **theSelectionManager**.

See Also **msgSelSetOwner.h**

msgSelIsSelected

Returns TRUE if self is current selection owner.

Takes nothing, returns BOOLEAN.

```
#define msgSelIsSelected    MakeMsg(clsSelection,21)
```

Comments — See the section "Embedded Window Selection Messages" for more information.

Send this message to an object to inquire if it is the selection owner.

Do not send this message to **theSelectionManager**.

Return Value — true The object is the selection owner.

false The object is not the selection owner. (The object may be the preserved selection owner.)

See Also — embedwin.h

Abstract Messages for Selection Move & Copy

msgSelBeginCopy

Initiate a copy operation.

Takes P_XY32, returns STATUS.

```
#define msgSelBeginCopy     MakeMsg(clsSelection, 23)
```

Comments — See the section "Move and Copy" for information about when this message is sent and how it should be handled.

pArgs will be null if this message is sent from a menu.

msgSelBeginMove

Initiates a move operation.

Takes P_XY32, returns STATUS.

```
#define msgSelBeginMove     MakeMsg(clsSelection, 22)
```

Comments — See the section "Move and Copy" for information about when this message is sent and how it should be handled.

pArgs will be null if this message is sent from a menu.

msgSelCopySelection

The receiver should copy the selection to self at (x, y).

Takes P_XY32, returns STATUS.

```
#define msgSelCopySelection MsgNoError(MakeMsg(clsSelection,16))
```

Comments — See the section "Move and Copy" for information about when this message is sent and how it should be handled.

msgSelMoveSelection

The receiver should move the selection to self at (x, y).

Takes P_XY32, returns STATUS.

```
#define msgSelMoveSelection MsgNoError(MakeMsg(clsSelection,15))
```

Comments

See the section "Move and Copy" for information about when this message is sent and how it should be handled.

msgSelDelete

The selection owner should delete the selection.

Takes U32, returns STATUS.

```
#define msgSelDelete    MakeMsg(clsSelection,3)
#define SelDeleteReselect   0       // Display a selection after delete
#define SelDeleteNoSelect   1       // Don't display a selection after delete
```

Comments

Clients wishing to delete the selection send **msgSelDelete** to the selection owner. Selection owners should respond to this message by deleting the contents of the selection.

msgSelDelete is sent in two situations: (1) the user has hit the "Delete" menu item, or (2) an object has received **msgSelMoveSelection**, has copied the data (see xfer.h), and now wants to delete the original data.

See the section "Move and Copy" for information about how **msgSelDelete** is related to moving data.

pArgs must be one of SelDeleteReselect or SelDeleteNoSelect. This parameter is just a performance enhancement. The sender of **msgSelDelete** should pass SelDeleteNoSelect if it plans on taking the selection after the **msgSelDelete**, and SelDeleteReselect otherwise. The receiver of **msgSelDelete** can use **pArgs** as an optimization, but it is not strictly necessary since **theSelectionManager** will send a **msgSelYield** when the sender takes the selection. (The **pArgs** of **msgSelDelete** exist primarily for historical reasons. The simplest thing to do is for the sender to pass SelDeleteReselect and for the receiver to ignore **pArgs**.)

Abstract Messages For Linking Protocol

msgSelRememberSelection

The receiver should "remember" the selection and place the "remembrance" at (x, y).

Takes P_XY32, returns STATUS.

```
#define msgSelRememberSelection MsgNoError(MakeMsg(clsSelection,17))
```

Comments

Most objects should not send or handle this message. It might be better defined as a **clsEmbeddedWin** message.

msgSelRememberSelection is sent to an object to ask it to "remember" the selection. The response to this message is highly object specific.

This message is not sent to the selection owner; it is sent to any object to ask it remember the selection.

An **embeddedWin** self sends this message in response to the "Create Reference Button" gesture (**xgsDblCircle** in xgesture.h). In response, an **embeddedWin** creates a goto button at the specified (x,y).

See Also

embedwin.h

SPELL.H

Spelling Checking

See Also proof.h, pdict.h

```
#ifndef SPELL_INCLUDED
#define SPELL_INCLUDED
```

/DS0001 Low-level debug messages; LOTS of output
/DS0002 mid-level debug messages
/DS0004 high-level debugs - general information
/DS8000 disable dictionary

```
#ifndef GO_INCLUDED
#include <go.h>
#endif
```

Common Definitions

maxSpellList is the most bytes a list of spelling corrections can use.is the dictionary alphabet size

```
#define maxSpellList            128
#define maxSpellXlateChoices    30
```

Common typedefs

```
typedef struct SPELL_LIST {
    U16 count;              // Number of strings in the list
    CHAR    words[maxSpellList];            // List of concatenated strings
} SPELL_LIST, * P_SPELL_LIST;
typedef struct SPELL_XLATE {
    U16         index;      // Offset within bank
    U8              bits;           // Nibble and bank indicator
    U8              character;  // Out: Character at that location
} SPELL_XLATE, *P_SPELL_XLATE;
typedef struct SPELL_DICT_LIST {
    P_CHAR      pName;      // name of dictionary (e.g. English)
    P_CHAR      pPath;      // path to dictionary (e.g. \\boot\dicts\webf77k)
    U16         bankCount;  // Number of 16K banks the lex is divided into
    P_UNKNOWN   pLangHeader;// Pointer to language specific info
} SPELL_DICT_LIST, *P_SPELL_DICT_LIST;
```

Definitions of different types of word capitalization

```
Enum16(SPELL_CASE) {
    spellCommonCase,    // all letters are in lower case
    spellProperCase,    // The First Letter Of Each Word Is Capitalized
    spellUpperCase, // ALL LETTERS ARE CAPITALIZED
    spellSpecialCase,   // tHere IS a StRANGe Mix of cAPitALizATion
};
typedef struct SPELL_CASE_CONTEXT {
    SPELL_CASE  minCase;        // lowest case allowed for output dictionary words
    SPELL_CASE  unkCase;        // case for non-dictionary words
    BOOLEAN     sentence;       // do end-of-sentence processing
    BOOLEAN     dictionary;     // use the dictionary for capitalization info
    BOOLEAN     allCapsWriter;  // user writes all caps only
    BOOLEAN     firstWord;  // In/Out: This word is first in a sentence
} SPELL_CASE_CONTEXT, * P_SPELL_CASE_CONTEXT;
```

Functions

SpellDictSelect

Sets the active dictionary to the language specified.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED SpellDictSelect(
    S16 dictCode
);
```

dictCode is an index into **spellDictList**; -1 means deselect. Currently, onlyEnglish can be selected, and its code is 0.

SpellSetOptionsX

Turns the dictionary on or off.

Returns void.

```
void EXPORTED SpellSetOptionsX(BOOLEAN mode);
```

Pass it true to turn the dictionary on, false to turn it off.

SpellGetOptionsX

Returns current dictionary status.

Returns BOOLEAN.

```
BOOLEAN EXPORTED SpellGetOptionsX(void);
```

True means spelling is on; false means it's off.

SpellCheck

Checks if a word is in the dictionary or not.

Returns BOOLEAN.

```
BOOLEAN EXPORTED SpellCheck(P_CHAR pWord);
```

Argument may contain punctuation but should not contain spaces. Thisdesigned so higher-level software can parse a line of text intotokens and pass those tokens (with no further) to this routine.

SpellCorrect

Finds all the corrections for a word and adds them to a SPELL_LIST structure.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED SpellCorrect(
    P_CHAR pWord,               // Word to be corrected
    P_SPELL_LIST pSpellList,    // Out: List to add the word to
    BOOLEAN phonetic                // Perform phonetic correction?
);
```

This also takes a space-delimited token, as described above, stripsthe punctuation, and puts it back on the correction candidates.that the count field in the SPELL_LIST structure must beto zero, unless you are deliberately adding to anlist. This routine avoids adding duplicates to theif it already had some words in it.

SpellCorrectWord

Finds the first correction for a word. Returns 0 if none found, else 1.

Returns U16.

Function Prototype
```
U16 EXPORTED SpellCorrectWord(
    P_CHAR pWord,          // Word to be corrected
    P_CHAR pCorrectWord // Out: place to put the correction
);
```

The word is a space-delimited token, as described above. In this, "first" means "first in alphabetical order," this routine issuitable for most applications.

SpellAddToDict

Add a word to **thePersonalDictionary**.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED SpellAddToDict(
    P_CHAR pWord
);
```

Comments The prefered way to add words to the current personal dictionary. As usual, it takes space-delimited tokens and strips off extraneous punctuation.

SpellAddToAnyDict

Add a word to any one of the personal dictionaries.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED SpellAddToAnyDict(
    OBJECT pDict,
    P_CHAR pWord
);
```

Comments The prefered way to add words to a personal dictionary other than the current one. It takes a pdict object (**clsPDict**) that specifies the personal dictionary to add to, and space-delimited tokens. It strips off extraneous punctuation.

SpellWordSetCase

Convert all-upper-case input into a reasonable mix of upper and lower case using dictionary information and other lexical clues.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED SpellWordSetCase(
    P_CHAR  pWord,
    P_SPELL_CASE_CONTEXT pSpellCaseContext
);
```

Call SpellWordSetCase the first time with **pWord** == **pNull** tothe context structure. Then pass it the words to be(in order) with the same context structure each time. Iteach word in place. To modify the default behavior, changeappropriate context parameters (see the definition of the_CASE_CONTEXT structure).

DefaultsminCase: SpellCommonCase **unkCase:** SpellCommonCase sentence: true dictionary: true **allCapsWriter:** false **firstWord:** true

SpellLineSetCase

Convert all-upper-case input into a reasonable mix of upper and lower case using dictionary information and other lexical clues.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED SpellLineSetCase(
    P_CHAR  pLine,
    P_SPELL_CASE_CONTEXT pSpellCaseContext
);
```

Identical to SpellWordSetCase, except it expects the input to beline of text, which it splits into tokens as required.

Miscellaneous

Address of the list of legal dictionaries

```
extern const SPELL_DICT_LIST spellDictList[];
```

SPMGR.H

This file contains the API for the Spell Manager Class and **theSpellManager**.

clsSpellManager inherits from **clsObject**.

theSpellManager is a well-known instance of **clsSpellManager**.

See Also spell.h, pdict.h

```
#ifndef SPMGR_INCLUDED
#define SPMGR_INCLUDED
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef WIN_INCLUDED
#include <win.h>
#endif
#ifndef XLATE_INCLUDED
#include <xlate.h>
#endif
#ifndef GWIN_INCLUDED
#include <gwin.h>
#endif
```

Common typedefs

This structure is passed to **theSpellManager** when the user makes thegesture on a window.

```
typedef struct SP_MGR_GESTURE {
    GWIN_GESTURE   gesture;
} SP_MGR_GESTURE, * P_SP_MGR_GESTURE;
```

Messages

Sent to Traversal Clients

msgSpMgrCreateContext

Piggybacked with **msgTraverseCreate.*Ctx** messages.

Takes VOID, returns STATUS.

```
#define msgSpMgrCreateContext                MakeMsg(clsSpellManager,1)
```

Initiates a spelling traversal.

msgSpMgrFindMisspelling

Asks the recipient to find the next misspelled word (using SpellCheck() on successive space-delimited tokens).

Takes SP_MGR_DIALOG, returns STATUS.

```
#define msgSpMgrFindMisspelling              MakeMsg(clsSpellManager,2)
```

Piggybacked with **msgTraverseFind**.

msgSpMgrCorrectMisspelling

Asks the recipient to correct the misspelled word he previously found in response to a **msgSpMgrFindMisspelling** message.

Takes SP_MGR_DIALOG, returns STATUS.

```
#define msgSpMgrCorrectMisspelling              MakeMsg(clsSpellManager,3)
```

Piggybacked with **msgTraverseApply**. Correction is in the word field.

msgSpMgrAcceptMisspelling

Asks the recipient to accept the misspelled word he previously found in response to a **msgSpMgrFindMisspelling** message.

Takes SP_MGR_DIALOG, returns STATUS.

```
#define msgSpMgrAcceptMisspelling               MakeMsg(clsSpellManager,5)
```

Piggybacked with **msgTraverseApply**. Dialog Struct is copied.

Received From GWin

msgSpMgrGesture

This causes **theSpellManager** to initiate a spell traversal from a gesture, as opposed to from a menu.

Takes P_SP_MGR_GESTURE, returns STATUS.

```
#define msgSpMgrGesture                         MakeMsg(clsSpellManager,4)
```

Message Arguments

```
typedef struct SP_MGR_GESTURE {
    GWIN_GESTURE   gesture;
} SP_MGR_GESTURE, * P_SP_MGR_GESTURE;
```

When a user makes the spelling gesture on an embedded window, thesends **msgSpMgrGesture** to **theSpellManager** with the_MGR_GESTURE structure filled in.

Miscellaneous

Quick Help Tags

```
#define SpMgrReplaceButtonTag   MakeTag(clsSpellManager,1)
#define SpMgrIgnoreButtonTag    MakeTag(clsSpellManager,2)
#define SpMgrCancelButtonTag    MakeTag(clsSpellManager,3)
#define SpMgrInsertionPadTag    MakeTag(clsSpellManager,4)
#define SpMgrTKTableTag         MakeTag(clsSpellManager,5)
#define SpMgrBackgroundTag      MakeTag(clsSpellManager,6)
#define SpMgrClearButtonTag     MakeTag(clsSpellManager,7)
#define SpMgrRememberButtonTag  MakeTag(clsSpellManager,8)
#define SpMgrTitleBarTag        MakeTag(clsSpellManager,9)
#define hlpSpMgrReplaceButton   SpMgrReplaceButtonTag
#define hlpSpMgrIgnoreButton    SpMgrIgnoreButtonTag
#define hlpSpMgrCancelButton    SpMgrCancelButtonTag
#define hlpSpMgrInsertionPad    SpMgrInsertionPadTag
#define hlpSpMgrTKTable         SpMgrTKTableTag
#define hlpSpMgrBackground      SpMgrBackgroundTag
#define hlpSpMgrClearButton     SpMgrClearButtonTag
#define hlpSpMgrRememberButton  SpMgrRememberButtonTag
#define hlpSpMgrTitleBar        SpMgrTitleBarTag
// Different help tags for when this is proof instead of spell
#define hlpProofInsertionPad    MakeTag(clsSpellManager,10)
#define hlpProofTKTable         MakeTag(clsSpellManager,11)
```

SR.H

clsSR inherits from **clsObject**.

clsSR is the class of **theSearchManager**. It defines a protocol which clients can respond to implement Find and Replace. Clients of this protocol must respond to the "mark" protocol defined in mark.h.

Debugging Flags

The Find and Replace mechanism uses the debug flag R10000.

```
#ifndef SR_INCLUDED
#define SR_INCLUDED 1
#ifndef MARK_INCLUDED
#include <mark.h>
#endif
```

Common #defines and typedefs

```
#define srBufSize      80
typedef struct SR_FLAGS {
    BOOLEAN     matchCase       : 1,    // case must match
                matchWord       : 1,    // full word search
                keepOldCase     : 1,    // replace with found case
                findFromEdge    : 1,    // search from edge of doc
                onBigCard       : 1;    // display big card
} SR_FLAGS;
typedef struct SR_METRICS {
    CHAR                findText[srBufSize];
    CHAR                replaceText[srBufSize];
    MARK_MSG_FLAGS      markFlags;
    SR_FLAGS            searchFlags;
} SR_METRICS, * P_SR_METRICS;
```

Statuses

The current match cannot/may not be replaced.

```
#define stsSRCannotReplace      MakeStatus(clsSR, 1)
```

Messages Sent to Clients via clsMark

msgSRNextChars

Asks the client to move the token to the next group of characters.

Takes P_SR_NEXT_CHARS, returns STATUS.

```
#define msgSRNextChars              MakeMsg(clsSR, 1)
```

Arguments

```
typedef struct SR_NEXT_CHARS {
    MARK_MSG_HEADER header;
    U32             maxLen;         // In: maximum size the group can be
    U32             len;            // Out: the size of the group
    BOOLEAN         blockStart;     // Out: the group starts a block
    BOOLEAN         blockEnd;       // Out: the group ends a block
} SR_NEXT_CHARS, * P_SR_NEXT_CHARS;
```

Comments

Important: your handler must have the following as its first statement. Replace "clsYourClassHere" with the uid of your class. See mark.h.

```
MarkHandlerForClass(clsYourClassHere);
```

This group may be up to **maxLen** characters in size. The client sets the len parameter to the actual size of the group, and if the group is the start and/or end of a block of character, sets the respective flags. A block is defined as a logically contiguous group of characters that can be searched.

Any non-text element usually delimits the end of a block. If the element is an embedded window that should be searched, the token should be set to point to the embedded window and **stsMarkEnterChild** (see mark.h) should be returned. If the element is not a child, then it should be simply skipped and the token moved to the next group of characters following it.

Example: If the following text is in the client's data, and **msgSRNextChars** is received with a **maxLen** of 5, the token would should refer to the blocks 1 through 4 in succession. **blockStart** should be true for blocks 1 and 3 and **blockEnd** should be true for blocks 2 and 4. In this way, "SEN" and "MANTLE" can be found, but "GERMAN" which spans some non-text object won't be mistakenly found.

```
 M E S S E N G E R (non-text-thing) M A N T L E
 |         |       |                |         | |
 +----1----+---2---+----------------+----3----+4+
```

msgSRGetChars

The component passes back the characters from the location identified by the token.

Takes P_SR_GET_CHARS, returns STATUS.

```
#define msgSRGetChars                   MakeMsg(clsSR, 2)
```

Arguments

```
typedef struct SR_GET_CHARS {
    MARK_MSG_HEADER header;
    U32             first;          // In: character to start with
    U32             len;            // In: the number of characters to return
    U32             bufLen;         // In: length of the buffer
    P_CHAR          pBuf;           // In: pointer to the buffer to fill
} SR_GET_CHARS, * P_SR_GET_CHARS;
```

Comments

Important: your handler must have the following as its first statement. Replace "clsYourClassHere" with the uid of your class. See mark.h.

```
MarkHandlerForClass(clsYourClassHere);
```

pArgs->first is token-relative and **pArgs**->len is the number of characters to return. Thus (0,2) requests the first two characters, (1,1) requests the second character, and (3,0) requests no characters.

The string returned must be null-terminated. Note that if len is less than **bufLen** then this is always possible without truncation. Otherwise, the number of characters returned should be one less than **bufLen** and they should still be null terminated.

msgSRReplaceChars

Ask the component to replace some of the characters at the location identified by the token.

Takes P_SR_REPLACE_CHARS, returns STATUS.

```
#define msgSRReplaceChars               MakeMsg(clsSR, 3)
```

Arguments

```
typedef struct SR_REPLACE_CHARS {
    MARK_MSG_HEADER header;
    S32             first;          // In: replacement starts here
    U32             len;            // In: ...and is this long
    U32             bufLen;         // In: repl. size in characters
    P_CHAR          pBuf;           // In: the buffer of the characters
} SR_REPLACE_CHARS, * P_SR_REPLACE_CHARS;
```

Comments

Important: your handler must have the following as its first statement. Replace "clsYourClassHere" with the uid of your class. See mark.h.

```
    MarkHandlerForClass(clsYourClassHere);
```

pArgs->first is token-relative, and **pArgs**->len is the number of characters to replace. Thus (0,2) replaces the first two characters, (1,1) replaces the second character, and (3,0) replaces no characters starting between the third and fourth (thus effecting an insertion).

pArgs->first may be negative, indicating replacement of text BEFORE the current token (or large indicating AFTER). However, in no case will **pArgs**->first go beyond the boundaries indicated by the **blockStart** and **blockEnd** flags from previous calls to **msgSRNextChars**.

This message should only affect the token insofar as the replacement makes changes to the data the token refers to. For example: if the token refers to the three characters "cat" and the replace messages changes the substring "c" (0,1) into "womb", then the token should now refer to the six characters "wombat".

msgSRPositionChars

Asks the component to reposition the token to some of the characters in the current group.

Takes P_SR_POSITION_CHARS, returns STATUS.

```
#define msgSRPositionChars          MakeMsg(clsSR, 4)
```

Arguments

```
typedef struct SR_POSITION_CHARS {
    MARK_MSG_HEADER header;
    S32             first;          // In: new position starts here
    U32             len;            // In: ...and is this long
} SR_POSITION_CHARS, * P_SR_POSITION_CHARS;
```

Comments

Important: your handler must have the following as its first statement. Replace "clsYourClassHere" with the uid of your class. See mark.h.

```
    MarkHandlerForClass(clsYourClassHere);
```

pArgs->first is token-relative, and **pArgs**->len is the number of characters to reposition to. Thus (0,2) positions to the first two characters, (1,1) positions to the second character, and (3,0) positions to between the third and fourth characters.

pArgs->first may be negative indicating positioning BEFORE the current token (or large indicating AFTER). However, in no case will **pArgs**->first go beyond the boundaries indicated by the **blockStart** and **blockEnd** flags from previous calls to **msgSRNextChars**.

Messages to theSearchManager

These messages are sent to **theSearchManager** by PenPoint's standard UI elements. Typical clients do not send them.

msgSRInvokeSearch

Starts a Find & Replace option sheet.

Takes P_SR_INVOKE_SEARCH, returns STATUS.

```
#define msgSRInvokeSearch           MakeMsg(clsSR, 10)
```

Arguments

```
typedef struct SR_INVOKE_SEARCH {
    OBJECT          target;             // nil if fromGesture or fromSelection
    BOOLEAN         fromSelection   :1, // start from the selection
                    fromGesture     :1, // start from the gesture given
                    doFind          :1, // do an initial find
                    findBackward    :1, // direction for initial find
                    noUI            :1, // don't open option sheet
                    useWord         :1, // use the word at the gesture or selection
                    useFlags        :1; // use the flags in metrics
    U16             reserved;
    GWIN_GESTURE    gesture;            // the gesture if fromGesture
    SR_METRICS      metrics;            // optional initial text and flags
    U32             reserved2;
} SR_INVOKE_SEARCH, * P_SR_INVOKE_SEARCH;
```

Comments

The target of the search is the target argument. However if **fromSelection** is true then it is the selection; or if **fromGesture** is true then it is from the gesture.

The user's last saved metrics are always used except that

- metrics.**findText** is used if it is not the empty string
- metrics.**replaceText** is used if it is not the empty string
- metrics.**markFlags** & metrics.**searchFlags** are used if **pArgs**->useFlags is true

If **doFind** is true, then an initial find is executed.

If **noUI** is true, then the option sheet isn't created. This is only useful in conjunction with **doFind** (otherwise, nothing has happened!), the result being a "find next" operation.

If **useWord** is true, then the find text will be fetched from the target with **msgSRGetChars**.

msgSRRememberMetrics

Asks **theSearchManager** to remember the current settings of a Find & Replace option sheet

Takes P_SR_METRICS, returns STATUS.

```
#define msgSRRememberMetrics        MakeMsg(clsSR, 12)
```

Message Arguments

```
typedef struct SR_METRICS {
    CHAR                findText[srBufSize];
    CHAR                replaceText[srBufSize];
    MARK_MSG_FLAGS      markFlags;
    SR_FLAGS            searchFlags;
} SR_METRICS, * P_SR_METRICS;
```

Comments

As a result, when **theSearchManager** option sheet next appears it will have the these settings.

STROBJ.H

This file contains the API definition for **clsString**.

clsString inherits from **clsByteBuf**.

clsString provides a facility to store null-terminated ASCII byte strings. Each object of **clsString** stores a single string. This class provides convenient object filing of the string data. Storage for each object's string is allocated out of the creator's shared process heap using OSHeapBlockAlloc.

Clients who want to store uninterpreted byte arrays should use **clsByteBuf** (see bytebuf.h).

clsString and **clsByteBuf** do not share messages. **clsByteBuf** messages cannot be sent to a **clsString** object.

```
#ifndef STROBJ_INCLUDED
#define STROBJ_INCLUDED
#include <go.h>
#include <clsmgr.h>
typedef OBJECT STROBJECT, *P_STROBJECT;
```

Class Messages

msgNew

Creates a new string object.

Takes P_STROBJ_NEW_ONLY, returns STATUS. Category: class message.

Arguments

```
typedef struct STROBJ_NEW_ONLY {
    P_CHAR  pString;
} STROBJ_NEW_ONLY, *P_STROBJ_NEW_ONLY;
#define strObjNewFields         \
    objectNewFields             \
    STROBJ_NEW_ONLY     strobj;
typedef struct STROBJ_NEW {
    strObjNewFields
} STROBJ_NEW, *P_STROBJ_NEW;
```

Comments

This message allocates shared heap storage for the specified string and copies the client string data into it.

msgNewDefaults

Initializes the STROBJ_NEW structure to default values.

Takes P_STROBJ_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct STROBJ_NEW {
    strObjNewFields
} STROBJ_NEW, *P_STROBJ_NEW;
```

Comments

Sets

```
    pNew->strobj.pString    = pNull;
```

Object Messages

msgStrObjGetStr

Passes back the object's string.

Takes PP_CHAR, returns STATUS.

```
#define msgStrObjGetStr                  MakeMsg(clsString, 1)
```

Comments The pointer passed back references the object's global storage. Clients must not modify or free this storage.

msgStrObjSetStr

Copies the specified string data into the object's string buffer.

Takes P_CHAR, returns STATUS.

```
#define msgStrObjSetStr                  MakeMsg(clsString, 2)
```

Comments Previously retrieved string pointers will be invalid after this operation. Clients must call **msgStrObjGetStr** to retrieve a pointer to the valid object buffer.

Observer Messages

msgStrObjChanged

Sent to observers when the string object data changes.

Takes OBJECT, returns nothing. Category: observer notification.

```
#define msgStrObjChanged                 MakeMsg(clsString, 3)
```

Comments The message argument is the UID of the **clsString** object that changed.

TS.H

This file contains the API definition for **clsTable**.

clsTable inherits from **clsObject**.

clsTable provides a general-purpose table mechanism with random and sequential access. The table allows clients to create, destroy, modify, and access the table and its data using a row and column metaphor. Data for the table is stored in a table file, whose lifetime can be independent to that of the table object.

Tables are two dimensional arrays consisting of a fixed number of columns and a variable number of rows. Each column can contain data of a single data type such as a U32, a variable length string, a fixed sized byte field, date and time, etc.

The number of and types of these columns are defined when the table is created. Once that table has been created, these parameters cannot be changed.

Clients access rows in the table using a TBL_ROW_POS data structure. The value for this row position is returned to the client when a row is added to the table. All messages for manipulating data in the table require this value to specify an individual row.

Clients address columns using their position in the TBL_COL_DESC array which the client provides in the TBL_CREATE data structure during **msgNew**.

The table is an observable object and clients choosing to be observers will receive notification when data in the table changes or a row has been added to or removed from the table.

```
#ifndef TS_INCLUDED
#define TS_INCLUDED
#include <clsmgr.h>
#include <fs.h>
#include <resfile.h>
```

Status Codes

Status values return by messages to **clsTable**.

```
#define stsTBLRefCountNotZero       MakeStatus( clsTable, 1 )
#define stsTBLColNameNotFound       MakeStatus( clsTable, 2 )
#define stsTBLStrBufTooSmall        MakeStatus( clsTable, 3 )
#define stsTBLBadNewFlags           MakeStatus( clsTable, 4 )
#define stsTBLEndOfTable            MakeStatus( clsTable, 5 )
#define stsTBLInvalidSortColValue   MakeStatus( clsTable, 7 )
#define stsTBLCorruptedIndex        MakeStatus( clsTable, 8 )
#define stsTBLColNotIndexed         MakeStatus( clsTable, 9 )
#define stsTBLContainsIndexedCols   MakeStatus( clsTable, 10 )
```

Common macros and typedefs

◆ Class Declaration

```
#define clsTable                MakeWKN(2003,1,wknGlobal)
```

◆ Object Declarations

```
typedef OBJECT  TABLE;
typedef OBJECT  TBLOBJ;
typedef TBLOBJ  *P_TBLOBJ;
```

◆ Table Parameter Definitions

```
#define TBL_MAXCOLNAMELEN       nameBufLength
#define TBL_MAXTBLNAMELEN       nameBufLength
#define TBL_MAXROWCOUNT         0x2000              // 8192 entries
```

◆ Table Row Definitions

```
typedef RES_ID  TBL_ROW_POS,        *P_TBL_ROW_POS;     // Absolute TS Row Key
typedef U16     TBL_ROW_NUM,        *P_TBL_ROW_NUM;     // Position relative TS Row Key
typedef U16     TBL_ROW_COUNT,      *P_TBL_ROW_COUNT;
typedef U16     TBL_ROW_LENGTH,     *P_TBL_ROW_LENGTH;
typedef S32     TBL_ROW_OFFSET,     *P_TBL_ROW_OFFSET;
typedef S16     TBL_REF_COUNT,      *P_TBL_REF_COUNT;
```

◆ Table Data Type Definitions

```
typedef P_U8                    P_ROW_BUFFER, *PP_ROW_BUFFER;
typedef P_UNKNOWN               P_TBL_COL_DATA_HOLDER;
```

◆ Column Index Declarations

```
typedef U16 TBL_COL_INX_TYPE,   *P_TBL_COL_INX_TYPE;
typedef U16 TBL_COL_COUNT,      *P_TBL_COL_COUNT;
typedef U16 TBL_COL_LENGTH,     *P_TBL_COL_LENGTH;
typedef U32 TBL_COL_OFFSET,     *P_TBL_COL_OFFSET;
```

◆ Column Descriptor Definitions

```
typedef enum TBL_TYPES {
    tsChar          = 0, // fixed length byte array of case sensitive chars
    tsCaseChar      = 1, // fixed length byte array of case insensitive chars
    tsU16           = 2, // unsigned 16 bit integer
    tsU32           = 3, // unsigned 32 bit integer
    tsFP            = 4, // double precision floating point
    tsDate          = 5, // date field (system compressed time format)
    tsString        = 6, // null-terminated variable length ascii string (case sensitive)
    tsCaseString    = 7, // same as tsString but is case insensitive
    tsByteArray     = 8, // variable length byte array, contained in unsigned chars
    tsUUID          = 9, // UUID struct.
    tsLastType = tsUUID
} TBL_TYPES;
typedef struct TBL_COL_DESC {
    CHAR                name[TBL_MAXCOLNAMELEN];    // Column name
    TBL_TYPES           type;                       // Column type
    TBL_COL_LENGTH      length;                     // Column data length
    TBL_COL_INX_TYPE    repeatFactor;               // # of times to repeat the column
    TBL_COL_OFFSET      offset;                     // Column offset in the row
    BOOLEAN             sorted;                     // Is the column sorted?
} TBL_COL_DESC, *P_TBL_COL_DESC;
```

◆ Variable Length Data Buffer Definition

```
typedef struct TBL_STRING {
    U16     strLen; // In/Out: length of string or byte array column data
    U16     strMax; // In:     length of string or byte array buffer
    P_CHAR  pStr;   // In:     pointer to client buffer.
} TBL_STRING, *P_TBL_STRING;
```

Class Messages

msgNew

Creates a new table object.

Takes P_TBL_NEW, returns STATUS. Category: class message.

Arguments

```
typedef enum TBL_FREE_BEHAVE {
    tsFreeNoDeleteFile      = 0,        // Free only the object, not the file
    tsFreeDeleteFile        = flag0,    // Destroy the file when freed
    tsFreeWhenNoClients     = flag1,    // Free when # clients accessing is 0
    tsFreeNoObservers       = flag2,    // Free when # of observers is 0
    tsFreeNoCompact         = flag3,    // Don't compact the table when freed
    tsFreeDefault           = tsFreeNoDeleteFile
} TBL_FREE_BEHAVE, *P_TBL_FREE_BEHAVE;
typedef enum TBL_EXIST {
    // Same values as FS_EXIST_MODE
    tsExistOpen             = 0,            // Open an existing table
    tsExistGenError         = 1,            // Return error if table exists
    tsExistGenUnique        = 2,            // Create table with a unique name
    tsNoExistCreate         = MakeU16(0,0), // Create a new table
    tsNoExistGenError       = MakeU16(0,1), // Return error if no table exists
    tsExistDefault          = tsExistOpen | tsNoExistCreate
} TBL_EXIST, *P_TBL_EXIST;
typedef struct TBL_CREATE {
    TBL_COL_COUNT   colCount;       // number of columns
    P_TBL_COL_DESC  colDescAry;     // TBL_COL_DESC array
} TBL_CREATE, *P_TBL_CREATE;
typedef struct TBL_NEW_ONLY {
    CHAR                name[TBL_MAXTBLNAMELEN];    // Table name
    FS_LOCATOR          locator;                    // Table file
    TBL_EXIST           exist;                      // Table exist behavior
    TBL_CREATE          create;                     // Column specifications
    TBL_FREE_BEHAVE     freeBehavior;               // Table free behavior
    BOOLEAN             createSemaphore;            // Provide semaphore?
} TBL_NEW_ONLY, *P_TBL_NEW_ONLY;
#define tableNewFields      \
    objectNewFields         \
    TBL_NEW_ONLY    table;
typedef struct TBL_NEW {
    tableNewFields
} TBL_NEW, *P_TBL_NEW;
```

Comments

This message creates a new table file or opens an existing file.

The table name is an optional field. The locator and **colDescAry** fields must be valid and **colCount** must be non zero or this message returns **stsBadParam**.

Return Value

stsTBLBadNewFlags TBL_EXIST flags were invalid.

stsBadParam locator or **colDescAry** fields are invalid. **colCount** is 0.

msgNewDefaults

Initializes the TBL_NEW structure to default values.

Takes P_TBL_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct TBL_NEW {
    tableNewFields
} TBL_NEW, *P_TBL_NEW;
```

Comments

Zeroes out **pNew**->table and sets:

```
pNew->table.name[0]             = '\0';
pNew->table.locator.uid         = objNull;
pNew->table.locator.pPath       = pNull;
pNew->table.exist               = tsExistDefault;
pNew->table.create.colCount     = 0;
pNew->table.create.colDescAry   = pNull;
pNew->table.freeBehavior        = tsFreeDefault;
pNew->table.createSemaphore     = false;
```

msgDestroy

Destroys an existing table object.

Takes OBJ_KEY, returns STATUS. Category: class message.

Comments

This message destroys the table object and frees the table files if the object was created with the **tsFreeDeleteFile** flag specified.

The table file will not be destroyed regardless of whether **tsFreeDeleteFile** was specified if there are still accessors to the table. Only the object will be freed.

Return Value

stsTBLRefCountNotZero The number of accessors of the table is not zero. The table file will not be destroyed.

Object Messages

Table Row Addition and Deletion Messages

msgTBLAddRow

Adds a row/record with no data to the table server object.

Takes P_TBL_ROW_POS, returns STATUS.

```
#define msgTBLAddRow              MakeMsg(clsTable, 1)
```

Comments

The row position (TBL_ROW_POS) for the new row is passed back. The row position is the key to access data in the row or to delete the row.

msgTBLDeleteRow

Deletes the specified row.

Takes P_TBL_ROW_POS, returns STATUS.

```
#define msgTBLDeleteRow           MakeMsg(clsTable, 5)
```

Comments

Rows are deleted from the table at the completion of this call. The row's TBL_ROW_POS is no longer valid after the row has been deleted.

Return Value

stsTBLEndOfTable TBL_ROW_POS value was not found in the table.

Table Data Messages

msgTBLColGetData

Passes back the data for the specified row and column.

Takes P_TBL_COL_GET_SET_DATA, returns STATUS.

```
#define msgTBLColGetData          MakeMsg(clsTable, 13)
```

Arguments

```
typedef struct TBL_COL_GET_SET_DATA {
    TBL_ROW_POS             tblRowPos;      // In: Table row position
    TBL_COL_INX_TYPE        colNumber;      // In: Column number
    P_TBL_COL_DATA_HOLDER   tblColData;     // Out: Column data
} TBL_COL_GET_SET_DATA, *P_TBL_COL_GET_SET_DATA;
```

Comments

tblColData is of type P_TBL_STRING if the column type is **tsString**, **tsCaseString**, or **tsByteArray**.

The client is responsible for allocating storage for the **tblStr.pStr** buffer. If the buffer is too small to accomodate the requested data, the table will return **stsTBLStrBufTooSmall** and pass back the truncated data and the actual length of the data in **tblStr.strLen**.

Return Value

stsTBLStrBufTooSmall Returned if column type is **tsString**, **tsCaseString** or **tsByteArray** and **tblStr.strMax** is less than the actual data length. The data is truncated and the length is returned in **tblStr.strLen**.

stsTBLEndOfTable TBL_ROW_POS value was not found in the table.

msgTBLColSetData

Sets the data for the specified row and column.

Takes P_TBL_COL_GET_SET_DATA, returns STATUS.

```
#define msgTBLColSetData          MakeMsg(clsTable, 14)
```

Message Arguments

```
typedef struct TBL_COL_GET_SET_DATA {
    TBL_ROW_POS             tblRowPos;      // In: Table row position
    TBL_COL_INX_TYPE        colNumber;      // In: Column number
    P_TBL_COL_DATA_HOLDER   tblColData;     // Out: Column data
} TBL_COL_GET_SET_DATA, *P_TBL_COL_GET_SET_DATA;
```

Comments

tblColData is of type P_TBL_STRING if the column type is **tsString**, **tsCaseString**, or **tsByteArray**. Clients are responsible for setting the **strLen** field of the TBL_STRING argument for all column types.

Return Value

stsTBLEndOfTable TBL_ROW_POS value was not found in the table.

msgTBLRowGetData

Gets the contents of an entire row.

Takes P_TBL_GET_SET_ROW, returns STATUS.

```
#define msgTBLRowGetData                    MakeMsg(clsTable, 15)
```

Arguments

```
typedef struct TBL_GET_SET_ROW {
    TBL_ROW_POS     tblRowPos;  // In:  Which row
    P_UNKNOWN       pRowData;   // Out: Row data
} TBL_GET_SET_ROW, *P_TBL_GET_SET_ROW;
```

Comments

Not valid for tables containing variable length columns.

The client is responsible for providing storage for the **pRowData** buffer. The length of a table row can be obtained using **msgTBLGetRowLength**.

Return Value **stsTBLEndOfTable** TBL_ROW_POS value was not found in the table.

stsTBLContainsIndexedCols Table contains variable length columns.

See Also **msgTBLGetRowLength**

msgTBLRowSetData

Sets the contents of an entire row.

Takes P_TBL_GET_SET_ROW, returns STATUS.

```
#define msgTBLRowSetData            MakeMsg(clsTable, 16)
```

Message Arguments

```
typedef struct TBL_GET_SET_ROW {
    TBL_ROW_POS     tblRowPos;  // In:  Which row
    P_UNKNOWN       pRowData;   // Out: Row data
} TBL_GET_SET_ROW, *P_TBL_GET_SET_ROW;
```

Comments Not valid for tables containing variable length columns.

Return Value **stsTBLEndOfTable** TBL_ROW_POS value was not found in the table.

stsTBLContainsIndexedCols Table contains variable length columns.

See Also **msgTBLGetRowLength**

Table Information Messages

msgTBLGetInfo

Gets the table header information.

Takes P_TBL_HEADER, returns STATUS.

```
#define msgTBLGetInfo               MakeMsg(clsTable, 10)
```

Arguments

```
typedef struct TBL_HEADER {
    TBL_COL_COUNT   colCount;                // number of columns in table
    CHAR            name[TBL_MAXTBLNAMELEN];// non-file table reference
    TBL_ROW_COUNT   nRows;                   // how many rows in table
    TBL_ROW_LENGTH  rowLength;               // row buffer length
    TBL_ROW_POS     firstRow;                // position of first row in table
    TBL_ROW_POS     currentRow;              // position of current row in table
    TBL_ROW_POS     lastRow;                 // position of last row in table
    TBL_REF_COUNT   refCount;                // number of active clients.
} TBL_HEADER, *P_TBL_HEADER, **PP_TBL_HEADER;
```

See Also **msgTBLGetColCount,,,**

msgTBLGetColCount

Gets the number of columns in the table.

Takes P_TBL_COL_COUNT, returns STATUS.

```
#define msgTBLGetColCount           MakeMsg(clsTable, 7)
```

msgTBLGetColDesc

Passes back the column description for the specified column.

Takes P_TBL_GET_COL_DESC, returns STATUS.

```
#define msgTBLGetColDesc            MakeMsg(clsTable, 2)
```

Arguments

```
typedef struct TBL_GET_COL_DESC {
    TBL_COL_INX_TYPE    colInx;     // In: column number
    TBL_COL_DESC        colDesc;    // Out: column decription
} TBL_GET_COL_DESC, *P_TBL_GET_COL_DESC;
```

msgTBLGetRowCount

Gets the current number of rows in the table.

Takes P_TBL_ROW_COUNT, returns STATUS.

```
#define msgTBLGetRowCount           MakeMsg(clsTable, 6)
```

msgTBLGetRowLength

Gets the length (in bytes) of the specified row.

Takes P_TBL_ROW_LENGTH, returns STATUS.

```
#define msgTBLGetRowLength          MakeMsg(clsTable, 8)
```

Comments

The row length indicates the total width of all columns for each row in the table. This information is useful when getting and setting row data.

See Also

msgTBLRowGetData

msgTBLGetState

Gets the current state of a specified row.

Takes P_TBL_GET_STATE, returns STATUS.

```
#define msgTBLGetState              MakeMsg(clsTable, 11)
```

Arguments

```
typedef enum TBL_STATE {
    tsBegin     = 0, // rowPos is the first row
    tsEnd       = 1, // rowPos is the last row
    tsPosition  = 2  // rowPos is not first or last
} TBL_STATE, *P_TBL_STATE;
typedef struct TBL_GET_STATE {
    TBL_STATE   tblState;   // Out: State of the specified row
    TBL_ROW_POS tblRowPos;  // In:  Row position of the specified row.
} TBL_GET_STATE, *P_TBL_GET_STATE;
```

Comments

The state of a row in the table indicates its general positioning within the table.

Return Value

stsTBLEndOfTable TBL_ROW_POS value was not found in the table.

Table Access Messages

msgTBLBeginAccess

Initiates table access by a client on this table.

Takes P_TBL_BEGIN_ACCESS, returns STATUS.

```
#define msgTBLBeginAccess           MakeMsg(clsTable, 17)
```

Arguments

```
typedef struct TBL_BEGIN_ACCESS {
    OBJECT          sender;     // In: sender's id IFF wants to be observer
    TBL_ROW_LENGTH  rowLength;  // Out: Length of the first row
} TBL_BEGIN_ACCESS, *P_TBL_BEGIN_ACCESS;
```

Comments

Passes back the row length of the first row. Adds the sender to the table's observer list.

msgTBLEndAccess

Ends client access to the table.

Takes P_TBL_END_ACCESS, returns STATUS.

```
#define msgTBLEndAccess             MakeMsg(clsTable, 18)
```

Arguments

```
typedef struct TBL_END_ACCESS {
        OBJECT  sender;     // In: Sender's uid
} TBL_END_ACCESS, *P_TBL_END_ACCESS;
```

Comments

Removes sender from the observer list.

msgTBLSemaClear

Releases the table's semaphore.

Takes nothing, returns STATUS.

```
#define msgTBLSemaClear             MakeMsg(clsTable, 23)
```

Comments

The next client currently waiting on the table semaphore will unblock when this messages completes.

msgTBLSemaRequest

Requests access to the table's semaphore.

Takes nothing, returns STATUS.

```
#define msgTBLSemaRequest           MakeMsg(clsTable, 22)
```

Comments

Waits on the table semaphore if another client already has access. Provides exclusive access of the table semaphore to the sender when it returns.

Semaphore access has no timeout.

Table Search Messages

msgTBLFindFirst

Finds the first record that meets the search specification.

Takes P_TBL_FIND_ROW, returns STATUS;.

```
#define msgTBLFindFirst             MakeMsg(clsTable, 3)
```

Arguments

```
typedef enum TBL_BOOL_OP {
    tsEql           = 0,    // Match if operands are equal
    tsEqual         = 1,    // Match if operands are equal
    tsLess          = 2,    // Match if opnd1 < opnd2
    tsGreater       = 3,    // Match if opnd1 > opnd2
    tsGreaterEqual  = 4,    // Match if opnd1 <= opnd2
    tsLessEqual     = 5,    // Match if opnd1 >= opnd2
    tsNotEqual      = 6,    // Match if the operands do not match
    tsSubstring     = 7,    // Match if opnd1 is an exact substring of opnd2
    tsStartsWith    = 8,    // Match if opnd1 starts with opnd2
    tsAlwaysTrue    = 9     // Match the first (or next) row
} TBL_BOOL_OP, *P_TBL_BOOL_OP;
typedef struct TBL_SEARCH_SPEC {
    TBL_COL_INX_TYPE            colOperand;     // In: Which column
    TBL_BOOL_OP                 relOp;          // In: Operation
    P_TBL_COL_DATA_HOLDER       pConstOperand;  // In: Value to search against
} TBL_SEARCH_SPEC, *P_TBL_SEARCH_SPEC;
```

```
typedef struct TBL_FIND_ROW {
    TBL_ROW_POS         rowPos;     // In:Out - current table position
    TBL_ROW_NUM         rowNum;     // Out: indexed column row number
    TBL_SEARCH_SPEC     srchSpec;   // In: search query
    TBL_COL_INX_TYPE    sortCol;    // In: which column sort to use (if any)
    P_ROW_BUFFER        pRowBuffer; // In: pointer to client's buffer space
} TBL_FIND_ROW, *P_TBL_FIND_ROW;
```

Comments

Passes back the TBL_ROW_POS and TBL_ROW_NUM of the row.

srchSpec.pConstOperand is of type P_TBL_STRING if the column type is **tsString**, **tsCaseString**, or **tsByteArray**. The length of the string/array used in the search is decalred in the **strLen** field of the TBL_STRING struct. Clients are responsible for setting this field to the appropriate length for columns of type **tsString**, **tsCaseString**, and **tsByteArray**.

srchSpec.pConstOperand is ignored if **srchSpec.relOp** is **tsAlwaysTrue**.

Currently, **tsSubstring** searches are always case sensitive regardless of the column type.

Return Value

stsTBLEndOfTable No data was found matching the search spec.

stsTBLInvalidSortColValue sortCol is not a valid column value.

msgTBLFindNext

Find the next record following the specified TBL_ROW_POS that meets the search specification.

Takes P_TBL_FIND_ROW, returns STATUS.

```
#define msgTBLFindNext              MakeMsg(clsTable, 4)
```

Message Arguments

```
typedef struct TBL_FIND_ROW {
    TBL_ROW_POS         rowPos;     // In:Out - current table position
    TBL_ROW_NUM         rowNum;     // Out: indexed column row number
    TBL_SEARCH_SPEC     srchSpec;   // In: search query
    TBL_COL_INX_TYPE    sortCol;    // In: which column sort to use (if any)
    P_ROW_BUFFER        pRowBuffer; // In: pointer to client's buffer space
} TBL_FIND_ROW, *P_TBL_FIND_ROW;
```

Comments

Passes back the TBL_ROW_POS and TBL_ROW_NUM of the row.

srchSpec.pConstOperand is of type P_TBL_STRING if the column type is **tsString**, **tsCaseString**, or **tsByteArray**. The length of the string/array used in the search is decalred in the **strLen** field of the TBL_STRING struct. Clients are responsible for setting this field to the appropriate length for columns of type **tsString**, **tsCaseString**, and **tsByteArray**.

srchSpec.pConstOperand is ignored if **srchSpec.relOp** is **tsAlwaysTrue**.

If **srchSpec.colOperand** is an unsorted column, then the order of the rows searched is random.

Return Value

stsTBLEndOfTable No data was found matching the search spec, or **rowPos** is was not found in the table.

stsTBLInvalidSortColValue sortCol is not a valid column value.

Table Utility Messages

msgTBLFindColNum

Passes back the column number for the specifed column name.

Takes P_TBL_COL_NUM_FIND, returns STATUS.

```
#define msgTBLFindColNum            MakeMsg(clsTable, 12)
```

Arguments

```
typedef struct TBL_COL_NUM_FIND {
    P_CHAR              name;       // In: Column name
    TBL_COL_INX_TYPE    number;     // Out: Column number
} TBL_COL_NUM_FIND, *P_TBL_COL_NUM_FIND;
```

Return Value

stsTBLColNameNotFound A column with the specified name does not exist.

msgTBLCompact

Compacts the table without closing it.

Takes nothing, returns STATUS.

```
#define msgTBLCompact                MakeMsg(clsTable, 24)
```

Comments

This message allows clients to compact a table on demand. Compaction frees up any storage associated with previously deleted rows and compacts the table to its minimum file size. Ordinarily, a table is compacted automatically when the last client accessing the table closes it unless specifically prevented by specifying **tsFreeNoCompact** during **msgNew**.

msgTBLRowNumToRowPos

Converts a TBL_ROW_NUM to its corresponding TBL_ROW_POS for the specified column.

Takes P_TBL_CONVERT_ROW_NUM, returns STATUS.

```
#define msgTBLRowNumToRowPos         MakeMsg(clsTable, 28)
```

Arguments

```
typedef struct TBL_CONVERT_ROW_NUM {
    TBL_ROW_POS         rowPos;     // Out: - Table row pos.
    TBL_ROW_NUM         rowNum;     // In:  - Index row number.
    TBL_COL_INX_TYPE    colNum;     // In:  - Indexed (sorted) column number.
} TBL_CONVERT_ROW_NUM, *P_TBL_CONVERT_ROW_NUM;
```

Comments

This message is defined only for sorted columns. Unsorted columns do not have a defined order.

Return Value

stsTBLEndOfTable rowNum is larger than the number of rows in the table.

stsTBLColNotIndexed The specified column is not sorted.

Observer Messages

msgTBLRowAdded

Sent to observers indicating that a row has been added.

Takes P_TBL_ROW_POS, returns STATUS. Category: observer notification.

```
#define msgTBLRowAdded               MakeMsg(clsTable, 19)
```

Comments

A pointer to the newly added TBL_ROW_POS is sent as an argument.

msgTBLRowDeleted

Sent to observers indicating that a row has been deleted.

Takes nothing, returns STATUS. Category: observer notification.

```
#define msgTBLRowDeleted             MakeMsg(clsTable, 20)
```

msgTBLRowChanged

Sent to observers indicating that row data has been changed.

Takes P_TBL_ROW_POS, returns STATUS. Category: observer notification.

```
#define msgTBLRowChanged            MakeMsg(clsTable, 21)
```

Comments
A pointer to the changed TBL_ROW_POS is sent as an argument.

UNDO.H

This file contains the API definition for **theUndoManager. theUndoManager** is the **wknProcessGlobal** instance of **clsUndo**.

clsUndo inherits from **clsList.**

The functions described in this file are contained in MISC.LIB.

Introduction

theUndoManager provides a centralized facility for managing undo information. **theUndoManager** supports undo of user interface actions.

An undoable operation, or "undo transaction," is a collection of "undo items." Typically an undoable operation is a small UI action (e.g. deleting some text).

When the user issues an "Undo" command the most recent undo transaction will be undone. A typical scenario goes something like this:

- In response to some user interface action, a message handler begins an undo transaction with **msgUndoBegin** and then sends messages which manipulate the application's data.
- As the data manipulation routines do their work, they add undo items to the undo transaction via **msgUndoAddItem.**
- When the user interface handler regains control, the transaction is closed with **msgUndoEnd.**
- At some later date, the transaction might be undone. **theUndoManager** undoes a transaction by sending **msgUndoItem** to each item in the transaction (in the reverse order in which they were added).
- If the transaction is not undone, but instead falls off the end of the undo transaction queue, then the transaction is freed. (A transaction is also freed if the application is terminated.) **theUndoManager** frees a transaction by sending **msgUndoFreeItemData** to each item in the transaction. (But see the comments near the typedef UNDO_ITEM for some circumstances under which **theUndoManager** doesn't send **msgUndoFreeItemData** but instead frees the item itself.)

Common Messages

Typical application code will send the following messages to **theUndoManager**:

- msgUndoBegin
- msgUndoEnd
- msgUndoAddItem

Typical application code will receive the following messages from **theUndoManager**:

- msgUndoItem
- msgUndoFreeItemData

See the individual descriptions of each of these messages for more information.

Debugging Flags

Undo's debugging flag set is 'U.' Defined flags are:

0001	Show messages sent to **theUndoManager**.
0002	Show **clsUndo** initialization.
0004	Show **msgUndoAddItem**.
0008	Show undoing a undo transaction.
0010	Show creating a undo transaction.
0020	Show destroying an undo transaction.

The Current Transaction

At any time, there is at most one current undo transaction open. The current undo transaction includes:

- a unique id of type UNDO_ID
- the OS_TASK_ID of the task that issued the **msgUndoBegin** that began the transaction
- a nesting count which is the number of **msgUndoBegin**'s minus the number of **msgUndoEnd**'s. (See the section "Nesting of **msgUndoBegin** and **msgUndoEnd.**")
- a heap with local scope from which clients can allocate space for undo information
- a list of undo items added to the transaction so far..

The Undo Queue

theUndoManager maintains a queue of undo transactions. By default **theUndoManager** has a queue length of 2, but an application can set the limit by sending **msgUndoLimit** to **theUndoManager**.

Your code should not depend on any particular queue size.

Nesting of msgUndoBegin and msgUndoEnd

In response to **msgUndoBegin**, **theUndoManager** opens a new transaction if there is no open transaction; otherwise it simply increments a "nesting count." The nesting count is decremented when **theUndoManager** receives **msgUndoEnd**. When the count becomes zero, the transaction is closed.

This allows you to write code that doesn't know whether it there is an open transaction or not. If the code wants to record undo information, it can simply send a **msgUndoBegin / msgUndoEnd** pair. If there was no open transaction, the result is that one will be created. And if there is one open, then the code's items will be added to that one.

It is vital that every **msgUndoBegin** have a matching **msgUndoEnd**!

To guard against erroneous code never terminating the current transaction, and thus having that transaction slowly consume all of system memory, there is a bounds on the depth of nesting permitted. (This bounds is approximately 1000.) If the bounds is exceeded, the open transaction is automatically closed.

Memory Management

Each undo item records the information necessary to undo and/or free itself.

Often this information has to be remembered in allocated memory or objects that must be freed once the item can no longer be undone. For instance, an undoable operation might involve deleting an object. However, you probably don't want to destroy the object until you're sure that the operation can't be undone. But eventually that object has to be destroyed.

Normally **theUndoManager** will send **msgUndoFreeItemData** to the object stored in each UNDO_ITEM. The handler should respond by freeing any resources associated with the item. Typically those resources are pointed to by item.**pData**.

But there are five ways in which you and **theUndoManager** can cooperate so that **theUndoManager** can free the resources for you.

- If **ufDataIsHeapNode** is set in item.flags, then item.**pData** must point to a heap block. **theUndoManager** will free item.**pData** by calling OSHeapBlockFree(item.**pData**).
- If **ufDataInUndoHeap** is set in item.flags, then item.**pData** must point to heap block allocated from the current transaction's heap. **theUndoManager** will free item.pdata when it destroys the transactions's heap.
- If **ufDataIsObject** is set in item.flags, then item.**pData** must be an object UID. **theUndoManager** will free item.pdata by calling ObjectSend(**msgDestroy**, item.**pData**, ...). (See the section "Freeing Undone Items" for one reason NOT to use this variation.)
- If **ufDataIsSimple** is set in item.flags, then item.**pData** is treated as a 32 bit value. There is no need for **theUndoManager** to do anything to free item.**pData**.
- If none of the above flags is set in item.flags, and item.**dataSize** is non-zero, then when the item is added to the transaction (with **msgUndoAddItem**) **theUndoManager** copies item.**dataSize** bytes from item.**pData** into a block allocated from the current transaction's heap. **theUndoManager** then frees item.**pData** when it destroys the transactions's heap.

Freeing Undone Items

Even an item that has been undone will be freed. It might be automatically freed by **theUndoManager**, as described in the section on Memory Management, or it might be freed by sending **msgUndoFreeItemData** to item.object.

Often freeing an item's data is done the same way regardless of whether the item has been undone or not. But there are cases where the difference is very important. Here's an example. Assume that the undoable operation includes deleting an object. If the operation is undone, then the object is "put back" into the application.

If the item IS undone, then the object should NOT be destroyed when the item is freed. But if the operation IS NOT undone, then the object should be destroyed when the object is destroyed.

For items that need to free the item's data differently in these two cases, the fact that the item has been undone should be recorded in the item when **msgUndoItem** is received. Then the code responding to **msgUndoFreeItemData** can check this recorded value. (One convenient place to record this value is in the item's **ufClient** flags.)

Adding Items When No Transaction is Open

When **theUndoManager** is undoing a transaction, there is no current open transaction. But, as described in the typical scenario above, data manipulation routines will attempt to add items anyhow. Therefore it is CRITICAL that your code check the value returned from **msgUndoAddItem** and handle it properly.

There are several ways to do this, but here's one convenient approach. (This approach works ONLY if you DON'T use any of **theUndoManager**'s memory management functionality.)

If you're not using the memory management facilities of **theUndoManager**, then you're most likely allocating memory to hold the client data part of an undo item. That memory has been allocated before calling **msgUndoAddItem** and must be freed if the **msgUndoAddItem** fails. Conveniently, an item's client data can be freed by sending **msgUndoFreeItemData** to the object stored in item.object.

Simply define a utility routine that attempts to add an item, and which frees the item if adding fails. Then always use that routine to add items. The routine will look something like:

```
if (ObjectCall(msgUndoAddItem, theUndoManager, pItem) < stsOK) {
    return ObjCallWarn(msgUndoFreeItemData, pItem->object, pItem);
} else {
    return stsOK;
}
```

Subclass Issues

A class and any number of its ancestors may contribute items to an undo transaction.

Thus, every **msgUndoFreeItemData** handler should first check that item.subclass is the expected value. If it isn't, the message should be passed onto the ancestor. So a **msgUndoFreeItemData** handler should look something like:

```
MsgHandlerWithTypes(RTItemUndoFreeItemData, P_UNDO_ITEM, PP_DATA)
{
    if (pArgs->subclass != clsRTItem) {
        return ObjectCallAncestorCtx(ctx);
    } else {
        ...
    }
}
```

Flushing the Undo Queue

There may be "points of no return" in an application's execution beyond which undoing previous operations is impossible or non-sensical. (For instance, it may not be possible to undo operations if the application's data files are saved via **msgAppSave.**)

You should flush the queue when one of these "points of no return" is encountered. The queue can be flushed by performing the following three steps: (1) get the current undo limit via **msgUndoGetMetrics**, (2) send **msgUndoLimit** with a **pArgs** of 0 (which actually flushes the queue), and (3) send **msgUndoLimit**, but this time with the limited returned by the previous call to **msgUndoGetMetrics.**

Aborting a Transaction

Sometimes it is necessary to abort an operation part way through. (For instance, the user might not confirm the operation.) If this happens, you should abort the then the undo transaction with **msgUndoAbort**. See the comments on **msgUndoAbort** for more information.

```
#ifndef UNDO_INCLUDED
#define UNDO_INCLUDED
#ifndef LIST_INCLUDED
#include <list.h>
#endif
```

Types and Constants

```
typedef STATUS  UNDO_ID;                 // A transaction's id.
#define stsUndoAbortingTransaction MakeStatus(clsUndo, 1)
#define stsUndoDataFreed           MakeWarning(clsUndo, 1)
#define undoStateNil        0
#define undoStateBegun      flag0
#define undoStateUndoing    flag1
#define undoStateRedoing    flag2        // Not implemented
#define undoStateAborting   flag3
```

Exported Functions

```
STATUS PASCAL
InitClsUndo(void);
```

Message Arguments

UNDO_ITEM

```
typedef struct UNDO_ITEM {
    OBJECT          object;     // In:  object that undoes/frees item
    OBJECT          subclass;   // In:  See "Subclass Issues" section
    U16             flags;      // In:  See "Memory Management" section
    P_UNKNOWN       pData;      // In:  See "Memory Management" section
    SIZEOF          dataSize;   // In:  See "Memory Management" section
} UNDO_ITEM, *P_UNDO_ITEM;
```

The following flags are used in the flags field of an UNDO_ITEM.

```
#define ufReserved         (0xff00)
#define ufClient           (flag0|flag1|flag2|flag3)
#define ufDataType         (flag4|flag5|flag6|flag7|ufReserved)
#define ufDataInUndoHeap   flag4
#define ufDataIsHeapNode   flag5
#define ufDataIsObject     (flag5|flag4)
#define ufDataIsSimple     (flag6|flag4)
```

Other Message Arguments

```
typedef struct UNDO_METRICS {
    UNDO_ID         id;                 // In:Out   Nil => get current
    OS_HEAP_ID      heapId;             // Out
    U16             state;              // Out
    U16             transactionCount;   // Out
    U16             itemCount;          // Out
    U32             limit;              // Out
    U32             resId;              // Out
    U32             info;               // Reserved
} UNDO_METRICS, *P_UNDO_METRICS;
```

```
#define undoNewFields       \
    listNewFields           \
    UNDO_NEW_ONLY   undo;
typedef struct UNDO_NEW_ONLY {
    U32             reserved;               // Reserved for expansion
    P_UNKNOWN       pReserved;              // Reserved for expansion
    U32             maxTransactions;
} UNDO_NEW_ONLY, *P_UNDO_NEW_ONLY;
typedef struct UNDO_NEW {
    undoNewFields
} UNDO_NEW, *P_UNDO_NEW;
```

Messages

Next: 11; recycled: none

msgUndoAbort

Aborts the current undo transaction.

Takes **pNull**, returns STATUS.

```
#define msgUndoAbort            MakeMsg(clsUndo, 10)
```

Comments

The current transaction is flagged as being aborted. Until the transaction is closed, any attempted **msgUndoAddItem**, **msgUndoBegin**, and **msgUndoEnd** (including the one that finally closes the transaction) will fail and return **stsUndoAbortingTransaction**. Once the **msgUndoEnd** that closes the transaction is received, any remaining undo items in the aborted transaction are freed.

msgUndoAddItem

Adds a new item to the current undo transaction if and only if it is still open.

Takes P_UNDO_ITEM, returns STATUS.

```
#define msgUndoAddItem          MakeMsg(clsUndo, 0)
```

Message Arguments

```
typedef struct UNDO_ITEM {
    OBJECT          object;      // In:  object that undoes/frees item
    OBJECT          subclass;    // In:  See "Subclass Issues" section
    U16             flags;       // In:  See "Memory Management" section
    P_UNKNOWN       pData;       // In:  See "Memory Management" section
    SIZEOF          dataSize;    // In:  See "Memory Management" section
} UNDO_ITEM, *P_UNDO_ITEM;
```

Comments

theUndoManager returns **stsFailed** if an open transaction does not exist. Any other error status indicates that there are not enough resources available to add the item.

msgUndoBegin

Creates a new undo transaction if there is no current transaction, or increments the nesting count if there is a current transaction.

Takes RES_ID, returns STATUS or UNDO_ID.

```
#define msgUndoBegin            MakeMsg(clsUndo, 1)
```

Comments

See the "Nesting of **msgUndoBegin** and **msgUndoEnd**" section for information about how to send this message.

Return Value

stsFailed Nesting limit exceeded.

stsOK Returned status is actually the id of the new (or currently open) transaction. Cast it to type UNDO_ID.

The RES_ID for a transaction is determined by the first **msgUndoBegin** with a non-null argument. The string identified by the RES_ID of the current undo transaction is used as the string for the "Undo" menu item. The RES_ID should specify a **resGrpTK** string resource list. (This is analogous to the quick help strings that are found in the **resGrpQHelp** string resource list.)

msgUndoCurrent

Undoes the most recent undo transaction.

Takes **pNull**, returns STATUS.

```
#define msgUndoCurrent          MakeMsg(clsUndo, 2)
```

Comments

msgUndoCurrent undoes the most recent transaction. If a transaction is currently open the transaction is closed first, and then undone.

It is unusual for a client to send this message. The only real reason for sending this message is if some piece of client code is implementing an alternative UI mechanism to invoke the undo mechanism.

msgUndoEnd

Decrements the nesting count of (and thus may end) the current transaction.

Takes **pNull**, returns STATUS.

```
#define msgUndoEnd              MakeMsg(clsUndo, 3)
```

Comments

See the "Nesting of **msgUndoBegin** and **msgUndoEnd**" section for information about how to send this message.

Return Value

stsFailed No open transaction.

msgUndoGetMetrics

Passes back the metrics associated with an undo transaction.

Takes P_UNDO_METRICS, returns STATUS.

```
#define msgUndoGetMetrics       MakeMsg(clsUndo, 4)
```

Message Arguments

```
typedef struct UNDO_METRICS {
    UNDO_ID             id;                 // In:Out   Nil => get current
    OS_HEAP_ID          heapId;             // Out
    U16                 state;              // Out
    U16                 transactionCount;   // Out
    U16                 itemCount;          // Out
    U32                 limit;              // Out
    U32                 resId;              // Out
    U32                 info;               // Reserved
} UNDO_METRICS, *P_UNDO_METRICS;
```

Comments

Only an **pArgs**->id of Nil(UNDO_ID), representing the current undo transaction, is supported.

Return Value

stsFailed The specified transaction does not exist or there is in sufficient memory available to manipulate it.

msgUndoLimit

Sets the maximum number of remembered undo transactions.

Takes U32, returns STATUS.

```
#define msgUndoLimit        MakeMsg(clsUndo, 8)
```

Comments

The default undo limit is 2. If your application wants to support a longer undo history, send **msgUndoLimit** to **theUndoManager** with the desired limit.

If there are more transactions in the queue than the new limit, the extra transactions will be freed. Setting the limit to 0 flushes all transactions and effectively disables undo until the limit is set to some non-zero value.

msgUndoLimit always returns **stsOK**.

msgUndoRedo

Not implemented.

Takes **pNull**, returns STATUS.

```
#define msgUndoRedo             MakeMsg(clsUndo, 5)
```

Comments

Not implemented. Do not send this message.

Client Messages

msgUndoItem

Sent to **pArgs**->object to have the item undone.

Takes P_UNDO_ITEM, returns STATUS.

```
#define msgUndoItem             MakeMsg(clsUndo, 6)
```

Message Arguments

```
typedef struct UNDO_ITEM {
    OBJECT              object;     // In:  object that undoes/frees item
    OBJECT              subclass;   // In:  See "Subclass Issues" section
    U16                 flags;      // In:  See "Memory Management" section
    P_UNKNOWN           pData;      // In:  See "Memory Management" section
    SIZEOF              dataSize;   // In:  See "Memory Management" section
} UNDO_ITEM, *P_UNDO_ITEM;
```

Comments

Note that the item will be freed in a separate step later.

msgUndoFreeItemData

Sent to **pArgs**->object to have **pArgs**->pData freed.

Takes P_UNDO_ITEM, returns STATUS.

```
#define msgUndoFreeItemData     MakeMsg(clsUndo, 7)
```

Message Arguments

```
typedef struct UNDO_ITEM {
    OBJECT              object;     // In:  object that undoes/frees item
    OBJECT              subclass;   // In:  See "Subclass Issues" section
    U16                 flags;      // In:  See "Memory Management" section
    P_UNKNOWN           pData;      // In:  See "Memory Management" section
    SIZEOF              dataSize;   // In:  See "Memory Management" section
} UNDO_ITEM, *P_UNDO_ITEM;
```

Comments

See the "Memory Management," "Subclass Issues" and "Freeing Undone Items" sections for information about how to respond to this message.

XFER.H

This file contains the API definition for **clsXfer** and **clsXferList.**

clsXfer inherits from **clsStream.**

clsXfer defines the mechanisms used for transferring data between objects.

clsXferList inherits from **clsList.**

clsXferList is used by the transfer mechanism.

Most clients of PenPoint's data transfer mechanism should use the procedural interfaces defined in this file.

The functions described in this file are contained in XFER.LIB.

Introduction

Key Concepts

This file describes some of PenPoint's support for transferring data.

There are a few central concepts that underlie PenPoint's data transfer mechanism:

- Sender and Receiver. There are two sides to any data transfer. "Sender" refers to the object providing the data and "Receiver" refers to the object receiving the data. These two objects can be in different processes, or in the same process. They can even be the same object!
- Two Stages. Each PenPoint data transfer has two major stages. In the first stage the Sender and Receiver engage in a simple protocol to determine if the data can be transferred, and if so what "type" the data has. In the second stage, the data is actually transferred using a protocol that is specific to the type agreed to during Stage 1.
- Data Transfer Types. A Sender and Receiver need to agree on a data transfer type that they both understand. PenPoint defines several data transfer types and clients can define additional types. See the section "Determining a Data Transfer Type" for more information.
- Data Transfer Protocol. Each data transfer type has an associated data transfer protocol. Once a transfer type has been agreed upon, the Sender and Receiver engage in the type-specific protocol to actually move the data. Note the same Data Transfer Protocol can be employed for multiple Data Transfer Types, but that each Data Transfer Type uses one and only one protocol.

Roadmap

Typical Receivers use the following to determine the desired data transfer type.

- XferMatch()

Typical Senders respond to or use the following to provide a list of data transfer types.

- msgXferList
- XferAddIds()

Typical Senders and Receivers who use data transfer types that use one-shot protocols use the following:

- msgXferGet

Senders and Receivers who use data transfer types that use stream-based protocols use the following:

- msgXferStreamConnect
- msgXferStreamWrite
- msgXferStreamFreed
- XferStreamConnect()
- XferStreamAccept()

Relationship between Data Transfer and PenPoint's UI

PenPoint's data transfer mechanism is intentionally independent of the user interface that might trigger a data transfer. None of the interfaces defined in this file depend or define any part of a PenPoint application's user interface.

However, the examples given in the commentary often use PenPoint's UI as an example of how a data transfer might be started. The file sel.h describes PenPoint's Move and Copy operations in detail.

During a Move or Copy operation, the Sender object is the owner of the selection. The Receiver is the object upon which the move/copy icon was dropped and which receives **msgSelMoveSelection** or **msgSelCopySelection** as a result. The Receiver sends **msgSelOwner** to **theSelectionManager** to get the Sender object and then engages in a data transfer with that object.

A Typical Scenario

A typical data transfer session goes something like this:

- The Receiver decides that it is the receiving end of a data transfer operation. (For instance, the receiver might receive **msgSelMoveSelection** or **msgSelCopySelection**; see sel.h.)
- The Receiver figures out the UID of the Sender object. (For instance, in the case of **msgSelCopySelection** or **msgSelMoveSelection**, the Sender object is the current selection owner, which can retrieved by sending **msgSelOwner** to **theSelectionManager**.)
- The Receiver determines a mutually agreeable data transfer type using the utility routine XferMatch. (See section "Determining a Common Data Transfer Type" for more detailed information about XferMatch and alternatives.)
- The Sender and Receiver use the Data Transfer Protocol associated with the agreed-upon type to actually transfer the data.

Data Transfer Types

A data transfer type is represented by a TAG.

Below is a list of PenPoint's predefined data transfer types and the data transfer protocol associated with each. (The protocols are described in the next section.)

```
-:  xferString:          one-shot using XFER_FIXED_BUF
-:  xferLongString:      one-shot using XFER_BUF
-:  xferName:            one-shot using XFER_FIXED_BUF
-:  xferFullPathName:    one-shot using XFER_FIXED_BUF
-:  xferRTF:             stream
-: xferFlatLocator:   one-shot using XFER_FIXED_BUF
-: xferASCIIMetrics:  one-shot using XFER_ASCII_METRICS
-: xferScribbleObject: one-shot using XFER_OBJECT
-: xferPicSegObject:  one-shot using XFER_OBJECT
```

In addition export.h and embedwin.h each define an additional data transfer type; see these files for more information.

Determining a Common Data Transfer Type

The Sender and Receiver must agree on a data transfer type.

For instance, a note taking application might be willing to provide either **xferScribbleObject** or **xferLongString** data. A text editor might be willing to consume **xferString, xferLongString** or xferRTF data. Somehow the common data type (**xferLongString**) must be found and used.

In PenPoint's data transfer mechanism, the Receiver is ultimately responsible for determining the mutually agreeable data transfer type.

Typical Receivers can use a simply utility function, XferMatch, to compute the data transfer type. Typical Senders must respond to **msgXferList** and add data transfer types to the provided list with the utility function XferAddIds.

(Most clients don't need to know about the inner workings of XferMatch, but they are documented in the section "Details of XferMatch" for sophisticated clients or the merely curious.)

Data Transfer Protocols

Each data transfer type uses a specific data transfer protocol.

There are three types of protocols:

- one-shot protocols
- stream-based protocols
- client-defined protocols

One Shot Protocols

Several data transfer types use a "One-Shot" protocol to transfer data. The protocols are called "one-shot" because all of the data can be transferred via a single message send.

In all one-shot transfers, the Receiver uses ObjectSendUpdate to send **msgXferGet** to the Sender. (ObjectSendUpdate must be used because the Sender and Receiver might be in different processes.)

The type of the **pArgs** to **msgXferGet** depends on the data transfer type -- the specific types are described in the section "Data Transfer Types." However, all legal **pArgs** to **msgXferGet** have one thing in common -- their first field is a data transfer type. The Receiver must fill in at least this field before sending **msgXferGet** so that the Sender can tell which data transfer type is being used.

The Sender responds to **msgXferGet** by filling in **pArgs** as necessary. Some one-shot protocols require the Sender to allocate memory. (For instance, the **xferLongString** data transfer type requires that the sender allocate memory for **pArgs**->pBuf field of an XFER_BUF.)

Some one-shot protocols require that Sender allocate memory. Any Sender-allocated memory must be allocated using OSHeapBlockAlloc and **osProcessSharedHeapId.** The Receiver must free this memory with OSHeapBlockFree.

Stream-Based Protocols

Stream-based protocols make use of a specialized stream that is implemented by **clsXferStream**. **clsXferStream** adds the ability for two streams to be linked through an internal "pipe."

Once a Receiver has decided to engage in a stream-based transfer (as described in the Section "A Typical Scenario" earlier), the steps in stream-based protocol are as follows:

- The Receiver calls XferStreamConnect.
- XferStreamConnect creates the Receiver's stream and then sends **msgXferStreamConnect** to the Sender.
- In response to **msgXferStreamConnect**, the Sender calls XferStreamAccept. Essentially all Senders of stream-based protocols should pass self as the "Producer" parameter when they call XferStreamAccept -- motivation and exceptions are described below.
- XferStreamAccept properly creates the Sender's stream.
- When control returns to it, the Receiver sends **msgStreamReadData** to its stream.
- As a result of the Receiver's **msgStreamReadData**, the Sender receives **msgXferStreamWrite.**
- In response to **msgXferStreamWrite**, the Sender writes data using **msgStreamWriteData.** IMPORTANT NOTE: In order to avoid overflowing internal buffers, Senders should not write huge chunks of data in a single call. Chunks than 64K won't work at all. Memory is used more efficiently if chunk sizes don't exceed 10K, although things will work at any size up to 64K.
- The last two steps can be repeated any number of times. Eventually the Receiver gets **stsEndOfData** returned when sending **msgStreamReadData.**
- The Receiver sends **msgDestroy** to its stream.
- As a result of the Receiver's **msgDestroy**, the Sender receives **msgXferStreamFree.**
- In response to **msgXferStreamFree**, the Sender sends **msgDestroy** to its stream.

The Sender must be prepared to handle **msgXferStreamFreed** at any time. (In addition to normal termination, **msgXferStreamFreed** can indicate that the Receiver has died or otherwise has prematurely destroyed its side of the pipe.)

An Available Simplification

Some Senders may know that they can contain only a limited amount of data. Or they may find the obligation to respond to **msgXferStreamWrite** multiple times and record how much data was actually written each time to be unduly burdensome.

These Senders can pass **objNull** as the "Producer" parameter in their call of XferStreamConnect. As a result of doing this, **msgXferStreamWrite** will only be sent once, and in response these Senders should write all of their data in a single chunk.

Client-Defined Protocols

Clients can define their own data transfer types. There is a wide range of possibilities. Clients can use **msgXferGet** that use a new **pArgs** type. They can use streams but define structure on the data being streamed. Or they define an entirely new transfer protocol.

Other Information

Details of XferMatch

Most clients can simply use XferMatch without understanding how it works, but it's described here for specialized clients or the curious.

- XferMatch creates an instance of **clsXferList**
- It then sends **msgXferList** to the passed-in Sender.
- The Sender responds to **msgXferList** by adding items to the xfer list by calling XferAddIds.
- XferMatch then scans the two lists (one passed in by the Receiver and one filled in by the Sender) using the utility function XferListSearch.
- If no mutually acceptable data transfer type is found, XferMatch returns **stsNoMatch**. Otherwise XferMatch returns **stsOK** and passes back the data transfer type in *pId.
- Just before returning, XferMatch destroys the **xferList**.

As an alternative to calling XferMatch, the Receiver could create the list, send **msgXferList** to the Sender, and then search the list for the best match (perhaps by using XferListSearch).

Also, a sophisticated Sender can use **msgListAddItem** (rather than XferAddIds) to add the types to the list.

Creating Instances of clsXfer and clsXferList

Normal clients of PenPoint's data transfer mechanism have no need to create instances of **clsXfer** and **clsXferList**. Instances are created internally when using the data transfer functions.

```
#ifndef XFER_INCLUDED
#define XFER_INCLUDED
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef STREAM_INCLUDED
#include <stream.h>
#endif
#ifndef STREAM_INCLUDED
#include <list.h>
#endif
```

Common #defines and typedefs

Predefined Data Transfer Types

```
#define xferString           MakeTag(clsXfer, 1)     // XferGet (FixedBuf)
#define xferLongString       MakeTag(clsXfer, 2)     // XferGet (Buf)
#define xferName             MakeTag(clsXfer, 3)     // XferGet (FixedBuf)
#define xferFullPathName     MakeTag(clsXfer, 4)     // XferGet (FixedBuf)
#define xferRTF              MakeTag(clsXfer, 5)     // Stream
#define xferGoRTF            MakeTag(clsXfer, 6)     // Obsolete
#define xferFlatLocator      MakeTag(clsXfer, 7)     // XferGet (FixedBuf)
#define xferASCIIMetrics     MakeTag(clsXfer, 10)    // XferGet (AsciiMetrics)
#define xferScribbleObject   MakeTag(clsXfer, 11)    // XferGet (Object)
#define xferPicSegObject     MakeTag(clsXfer, 12)    // XferGet (Object)
```

XferList

Normal clients need not create **xferLists** since the functions create and destroy **xferLists** as needed.

An **xferList** is a subclass of **clsList** that always allocates globally accessible memory for the list.

```
#define XFER_LIST_NEW   LIST_NEW
#define P_XFER_LIST_NEW P_LIST_NEW
```

Messages

msgXferList

Ask Sender for its list of data transfer types.

Takes OBJECT, returns STATUS.

```
#define msgXferList MakeMsg(clsXfer, 1)
```

Comments

This message is sent to the Sender to have the Sender provide the list of data transfer types it can provide.

The Sender can add types to the passed-in list using either **msgListAddItem** or XferListAddIds.

If the Sender has a preferred data transfer type, it should put this type at the beginning of the list. The Sender can use **clsList** messages to change the ordering of the list (see list.h).

See Also

msgListAddItems

msgXferGet

Sent by a Receiver to get "one-shot" data transfer information.

Takes lots-of-things, returns STATUS.

```
#define msgXferGet  MakeMsg(clsXfer, 8)
```

Comments

msgXferGet is sent by the Receiver to the stream to retrieve the data being transferred.

The type of this message's **pArgs** depends on the data transfer type being used. In all cases, the first field of **pArgs** must be a data transfer type so that the Sender (when it receives this message) knows what type of data to supply and what the true type of **pArgs** really is.

Return Value

stsNoMatch specified data transfer type is inappropriate

Variable Size Buffer

This type is used as the **pArgs** of **msgXferGet** when the data transfer type is **xferLongString**. This type might also be used for client-defined data transfers.

[The rest of this description is complicated by the reversal of names. The Receiver side of the data transfer operation sends **msgXferGet** and the the Sender side of the data transfer operation receives **msgXferGet**.]

The Receiver (which sends **msgXferGet**) must set the "id" field to **xferLongString**. The Sender receives **msgXferGet** and fills in the rest of the structure.

The Sender allocates the memory for **pArgs**->pBuf using OSHeapBlockAlloc from **osProcessSharedHeapId**. The Receiver must free this data using OSHeapBlockFree.

When used for **xferLongString**, the "pBuf" field is a null-terminated string and the "len" field includes the terminating null character. (In other words, upon return, **pArgs**->len must equal (strlen(**pArgs**->pBuf) + 1).)

```
typedef struct XFER_BUF {
    TAG         id;             // In: Data transfer type
    U32         data;           // Unused: future use
    U32         len;            // Out: Length of data in pBuf
    P_UNKNOWN   pBuf;           // Out: Buffer containing data
                                // Must be SHARED and freed by caller
} XFER_BUF, *P_XFER_BUF;
```

Fixed Size Buffer

This type is used as the **pArgs** of **msgXferGet** when the data transfer type is

- xferString
- xferName
- xferFullPathName
- xferFlatLocator

[The rest of this description is complicated by the reversal of names. The Receiver side of the data transfer operation sends **msgXferGet** and the the Sender side of the data transfer operation receives **msgXferGet.**]

The Receiver (which sends **msgXferGet**) must set the "id" field to one of the data transfer types listed above. The Sender receives **msgXferGet** and fills in the rest of the structure.

```
typedef struct XFER_FIXED_BUF {
    TAG         id;             // In: Data transfer type
    U32         data;           // Unused. Reserved for future use
    U32         len;            // Out: Length of data in buf
    U8          buf[300];       // Out: Buffer containing data
} XFER_FIXED_BUF, *P_XFER_FIXED_BUF;
```

Object Transfer

This type is used as the **pArgs** of **msgXferGet** when the data transfer type is:

- xferScribbleObject
- xferPicSegObject.

[The rest of this description is complicated by the reversal of names. The Receiver side of the data transfer operation sends **msgXferGet** and the the Sender side of the data transfer operation receives **msgXferGet.**]

The Receiver (which sends **msgXferGet**) must set the "id" field to one of the data transfer types listed above, and must set the "receiver" field to self (or some other object in the Receiver's task). The Sender receives **msgXferGet** and fills in the rest of the structure.

The Sender makes a copy of the object using **msgCopy** and returns the uid of the object in **pArgs**->uid. When the Sender sends **msgCopy**, it should use **pArgs**->receiver as the value of **msgCopy**'s **pArgs**->requestor.

```
typedef struct XFER_OBJECT {
    TAG         id;             // In: Data transfer type
    OBJECT      receiver;       // In: Receiver
    OBJECT      uid;            // Out: Uid of object
    CLASS       objClass;       // Out: Class of object
    U32         reserved[4];    // Reserved for future use
} XFER_OBJECT, * P_XFER_OBJECT;
```

ASCII Metrics

This type is used as the **pArgs** of **msgXferGet** when the data transfer type is **xferASCIIMetrics.**

[The rest of this description is complicated by the reversal of names. The Receiver side of the data transfer operation sends **msgXferGet** and the the Sender side of the data transfer operation receives **msgXferGet.**]

The Receiver (which sends **msgXferGet**) must set the "id" field to **xferASCIIMetrics**. The Sender receives **msgXferGet** and fills in the rest of the structure.

"ASCII Metrics" include information about the character data that can be transferred from the Sender. In some cases (e.g. PenPoint's text component) it describes the selected text.

(Essentially any Sender that can provide **xferASCIIMetrics** can also provide some type of character data -- typically **xferString, xferLongString** or **xferRTF.**)

The "spare" field is always set to 0. The "first" field is offset of the first selected character. The "length" field is the number of characters in the selection. The "level" field describes which lexical unit the selection "contains."

```
typedef struct XFER_ASCII_METRICS {
    TAG         id;             // In: data transfer type.
    U32         spare;          // Out: always 0
    U32         first;          // Out: character offset w.r.t. entire text
                                //      maxU32 implies a bad request
    U32         length;         // Out: number of chars available to transfer
    U16         level;          // Out: 0: undefined or unknown, 1: chars,
                                //      2: words, 3: sentences, 4: paragraphs
} XFER_ASCII_METRICS, *P_XFER_ASCII_METRICS;
```

Stream Specific Messages

msgXferStreamConnect

Sent to the Sender to ask it to link the Sender's and Receiver's pipe.

Takes XFER_CONNECT, returns STATUS.

```
#define msgXferStreamConnect    MakeMsg(clsXfer, 2)
```

Arguments

```
typedef struct XFER_CONNECT {
    TAG             id;         // In: Id Receiver sent to XferStreamConnect
    OBJECT          stream;     // In: Stream created by Receiver
    P_UNKNOWN       clientData; // In: clientData Receiver sent to
                                // XferStreamConnect
} XFER_CONNECT, *P_XFER_CONNECT;
```

Comments

The Sender responds by calling XferStreamAccept to complete the connection.

In its call to XferStreamAccept, the Sender identifies the object that will generate the actual data, known as the Producer. Essentially all Senders should pass self as the value of Producer.

See the section "Stream-Based Protocols" for more information.

msgXferStreamAuxData

Passes back auxiliary information associated with the pipe.

Takes PP_UNKNOWN, returns STATUS.

```
#define msgXferStreamAuxData    MakeMsg(clsXfer, 4)
```

Comments

The Sender or Receiver can store auxiliary information with the pipe. using **msgXferStreamSetAuxData** and retrieve that information with **msgXferStreamAuxData.**

This information can be used by either the Sender or Receiver to store private information or to or to pass information across the pipe.

Warning: There is only one auxiliary data slot in the pipe. Only one of the Sender or Receiver should write the data, although both can read it. Subclasses must be aware of their ancestor's behavior in this regard.

See Also

msgXferStreamSetAuxData

msgXferStreamSetAuxData

Stores arbitrary client data with the pipe.

Takes P_UNKNOWN, returns STATUS.

```
#define msgXferStreamSetAuxData MakeMsg(clsXfer, 5)
```

See Also

msgXferStreamAuxData

msgXferStreamWrite

Asks the Sender to write more data to the stream.

Takes STREAM, returns STATUS.

```
#define msgXferStreamWrite  MakeMsg(clsXfer, 3)
```

Comments

The Sender responds by writing to its stream using **msgStreamWrite.**

The Sender may need access to its instance data to handle this message. The Sender can either implement its own facility for mapping from the stream to the necessary instance data (perhaps using properties; see clsmgr.h) or it can use **msgXferStreamSetAuxData** and **msgXferStreamAuxData.**

See the section "Stream-Based Protocols" for more information.

msgXferStreamFreed

Sent to the Sender when the Receiver's side of the stream has been freed.

Takes STREAM, returns STATUS.

```
#define msgXferStreamFreed  MakeMsg(clsXfer, 6)
```

Comments

The Sender handles this message by sending **msgDestroy** to the stream passed in as a parameter. This means that both streams (and hence both ends of the "pipe") have been freed.

See the section "Stream-Based Protocols" for more information.

Public Functions

XferMatch

The Receiver calls XferMatch to find a mutually acceptable data transfer type.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED XferMatch(
    OBJECT      Sender,      // In: Sender to find match with
    TAG         ids[],       // In: Array of types the Receiver understands
    SIZEOF      idsLen,      // In: Length of the ids[] array
    P_TAG       pId);        // Out: matching data type
```

Comments See the section "Determining a Common Data Transfer Type" for detailed. information.

Return Value **stsNoMatch** No common data transfer type could be found.

non-error The common data transfer type is passed back in *pId.

See Also XferListSearch

XferListSearch

Searches two sets of data transfer types for a match.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED XferListSearch(
    OBJECT      listObject, // In: List object containing Sender types
    TAG         ids[],      // In: Array of types the Receiver understands
    SIZEOF      idsLen,     // In: Length of the ids[] array
    P_TAG       pId);       // Out: Matching data type
```

Comments Most clients of the data transfer mechanism use XferMatch rather than calling this function.

XferListSearch scans the two sets of transfer types (one in **listObject** and one in the passed-in array) to find the best match.

XferListSearch checks each item in **listObject** against each item in the array in order from 0 to n-1. Hence if the array contains [tagA, **tagB**] and the list contains [tabB, **tagA**], **tagA** is returned. Objects should put data types into the **listObject** or the array in order of most desired to least desired.

Return Value **stsNoMatch** No common data transfer type could be found.

non-error The common data transfer type is passed back in *pId.

See Also XferMatch

XferAddIds

Adds data transfer types to **listObject**.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED XferAddIds(
    OBJECT      listObject,
    TAG         ids[],
    SIZEOF      idsLen);
```

Comments Typical Senders call this function while handling **msgXferList**.

XferAddIds adds each item in the array of data transfer types to the list by sending **msgListAddItem** to **listObject**.

Stream Specific Functions

XferStreamConnect

A Receiver calls this function to create a stream connection to a Sender.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED XferStreamConnect(
    OBJECT      owner,      // In: Sender to connect stream to
    TAG         id,         // In: Desired data transfer type. (This is
                            // passed to Sender via msgXferStreamConnect.)
    P_UNKNOWN   clientData, // In: clientData. (This is passed to Sender
                            // via msgXferStreamConnect.)
    P_OBJECT    pStream);   // Out: Stream to perform msgStreamRead on
```

Comments

See the section "Stream-Based Protocols" for more information.

XferStreamAccept

Called by Sender in response to **msgXferStreamConnect**.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED XferStreamAccept(
    OBJECT      connect,    // In: pArgs->stream from msgXferStreamConnect
    U16         bufSize,    // In: Size of transfer buffer (up to 64k)
    OBJECT      Producer,   // In: Object to receive msgXferStreamWrite
    P_OBJECT    pStream);   // Out: Stream for Sender side of the "pipe"
```

Comments

As part of the Sender's response to **msgXferStreamConnect**, the Sender calls XferStreamAccept to properly create the Sender's side of the stream.

See the section "Stream-Based Protocols" for more information.

Part 10 / Connectivity

ABMGR.H

This file contains the API definition for **theAddressBookMgr**.

theAddressBookMgr is an instance of a private class. It is the only instance of that class in the system.

theAddressBookManager is a well known object that handles registration of and access to "system" address books. Registered address books are primarily responsible for managing the storage and retrieval of service specific addressing information.

Registered address books adhere to the protocol defined in addrbook.h. Information about its functionality and use can be found there.

theAddressBookMgr provides the facility to help other applications to provide a UI for picking the system address book. When an application wants to provide this pick list as an option card, it just needs to pass on **msgOptionAddCards** before it calls its ancestor to **theAddressBookMgr**. TheAddressBookMgr will do the rest.

```
#ifndef ABMGR_INCLUDED
#define ABMGR_INCLUDED
#include <uuid.h>
#include <go.h>
#define tagABMgrABList              MakeTag(theAddressBookMgr, 1)
```

Status Codes

```
#define stsABMgrAddrBookNotActive       MakeStatus(theAddressBookMgr, 1)
#define stsABMgrAddrBookOpen            MakeStatus(theAddressBookMgr, 2)
#define stsABMgrNoneActive              MakeStatus(theAddressBookMgr, 3)
#define stsABMgrAddrBookNotRegistered   MakeStatus(theAddressBookMgr, 4)
#define stsABMgrNoOpenAddrBook          MakeStatus(theAddressBookMgr, 5)
```

Common #defines and typedefs

```
Enum16(AB_MGR_ID_TYPE) {
    abMgrApplication    = 0,        // Client is an application
    abMgrObject         = 1,        // Client is a service/data object
    abMgrNone           = 2,        // abmgr internal use only
};
typedef struct AB_MGR_ID {
    CHAR            name[nameBufLength]; // Name of the address book
    AB_MGR_ID_TYPE  type;                // Address book object type
    union {
        OBJECT      uid;                // UID of the service/object
        UUID        uuid;               // UUID of the application working dir
    } value;
} AB_MGR_ID, *P_AB_MGR_ID;
```

Messages

msgABMgrRegister

Registers an application or a service as an address book instance.

Takes P_AB_MGR_ID, returns STATUS.

```
#define msgABMgrRegister           MakeMsg(theAddressBookMgr, 1)
```

Message Arguments

```
typedef struct AB_MGR_ID {
    CHAR            name[nameBufLength]; // Name of the address book
    AB_MGR_ID_TYPE  type;                // Address book object type
    union {
        OBJECT      uid;                // UID of the service/object
        UUID        uuid;               // UUID of the application working dir
    } value;
} AB_MGR_ID, *P_AB_MGR_ID;
```

Comments

When an instance of an address book is registered with **theAddressBookMgr**, it can later be selected as "the system address book".

Address books send this message to register themselves with **theAddressBookMgr**. Each instance of each address book should be registered with **theAddressBookMgr**. If an address book application is a subclass of **clsAddrBookApplication**(see addrbook.h), then **theAddressBookMgr** automatically registers a newly created instance of this class.

If an address book is an application, **theAddressBookMgr** will automatically re-registers the app on warm boot. If an address book is a service, however, it would have to re-register itself after a warm boot.

msgABMgrUnregister

Unregisters an application or a service as an address book instance.

Takes P_AB_MGR_ID, returns STATUS.

```
#define msgABMgrUnregister         MakeMsg(theAddressBookMgr, 2)
```

Message Arguments

```
typedef struct AB_MGR_ID {
    CHAR            name[nameBufLength]; // Name of the address book
    AB_MGR_ID_TYPE  type;                // Address book object type
    union {
        OBJECT      uid;                // UID of the service/object
        UUID        uuid;               // UUID of the application working dir
    } value;
} AB_MGR_ID, *P_AB_MGR_ID;
```

Comments

Address book send this message to **theAddressBookMgr** to unregister themselves. This is usually done when an application instance is deleted, or when a service is de-installed. If an address book application is a subclass of **clsAddrBookApplication**(see addrbook.h), then **theAddressBookMgr** automatically unregisters a deleted instance of this class.

msgABMgrOpen

Used by address book clients to begin access to address books.

Takes nothing, returns STATUS.

```
#define msgABMgrOpen               MakeMsg(theAddressBookMgr, 3)
```

Comments

Address book clients send **msgABMgrOpen** to **theAddressBookMgr**. If the system address book is an application, then **theAddressBookMgr** activates the application. If the system address book is a service, then **theAddressBookMgr** binds to the service(**msgSMBind**)

Clients must call **msgABMgrClose** when they're finished with the address book.

On warm boots, **theAddressBookMgr** requires that clients reopen the system address book.

msgABMgrClose

Used by address book clients to end access to address books.

Takes nothing, returns STATUS.

```
#define msgABMgrClose              MakeMsg(theAddressBookMgr, 4)
```

Arguments

```
typedef struct {
    BOOLEAN             activated;
    AB_MGR_ID           addressBook;
} AB_MGR_LIST, *P_AB_MGR_LIST;
```

Comments

If the system address book is an application, then **theAddressBookMgr** deactivates the application. If the system address book is a service, then **theAddressBookMgr** binds to the service(**msgSMUnbind**).

The address book is reference counted, so all **msgABMgrOpen** calls must be followed by an **msgABMgrClose**.

msgABMgrList

Creates a list of currently registered address book in **pArgs**.

Takes P_LIST, returns STATUS.

```
#define msgABMgrList               MakeMsg(theAddressBookMgr,5)
```

Comments

Every time **msgABMgrList** is called, a new list object is created. It is up to the client to call **msgListFree**(not **msgDestroy**) to destroy the list and the items in the list. Set the free mode to **listFreeItemsAsData**.

Each element of the list is a P_AB_MGR_LIST.

msgABMgrActivate

Make a registered address book the system address book.

Takes P_AB_MGR_ID, returns STATUS.

```
#define msgABMgrActivate              MakeMsg(theAddressBookMgr, 6)
```

Message Arguments

```
typedef struct AB_MGR_ID {
    CHAR            name[nameBufLength]; // Name of the address book
    AB_MGR_ID_TYPE  type;                // Address book object type
    union {
        OBJECT      uid;                // UID of the service/object
        UUID        uuid;               // UUID of the application working dir
    } value;
} AB_MGR_ID, *P_AB_MGR_ID;
```

Comments

In the current implementation only one address book can be the system address book at a time. If there is currently a system address book, that address book is deactivated first.

Clients that are applications set the type field to 'application' and set the value field to the UUID of their application working directory. Clients that are services or data objects set the type field to 'object' and set the value field to their object UID.

Return Value

stsABMgrAddrBookOpen The current system address book is currently open, therefore it can not be deactivated

stsABMgrAddrBookNotRegistered The address book identified by **pArgs** is not a registered address book.

msgABMgrDeactivate

Deactivates the current system address book.

Takes P_AB_MGR_ID, returns STATUS.

```
#define msgABMgrDeactivate          MakeMsg(theAddressBookMgr, 7)
```

Message Arguments

```
typedef struct AB_MGR_ID {
    CHAR            name[nameBufLength]; // Name of the address book
    AB_MGR_ID_TYPE  type;                 // Address book object type
    union {
        OBJECT      uid;                // UID of the service/object
        UUID        uuid;               // UUID of the application working dir
    } value;
} AB_MGR_ID, *P_AB_MGR_ID;
```

Return Value

stsABMgrAddrBookOpen The current system address book is currently open, therefore it can not be deactivated

msgABMgrIsActive

Indicates if the specified AB_MGR_ID is currently set.

Takes P_AB_MGR_ID, returns STATUS.

```
#define msgABMgrIsActive            MakeMsg(theAddressBookMgr, 8)
```

Message Arguments

```
typedef struct AB_MGR_ID {
    CHAR            name[nameBufLength]; // Name of the address book
    AB_MGR_ID_TYPE  type;                 // Address book object type
    union {
        OBJECT      uid;                // UID of the service/object
        UUID        uuid;               // UUID of the application working dir
    } value;
} AB_MGR_ID, *P_AB_MGR_ID;
```

Return Value

stsOK Specified id is activated.

stsABMgrNotActive Specified id is not activated, but something is active.

stsABMgrNoneActive No address book is currently active.

Observer Messages

msgABMgrChanged

Sent to observers of **theAddressBookMgr** when the system address book changes.

Takes P_AB_MGR_NOTIFY, returns STATUS.

```
#define msgABMgrChanged         MakeMsg(clsAddressBook, 9)
```

Arguments

```
Enum16(AB_MGR_CHANGE_TYPE) {
    abMgrRegister       = 0,            // an ab has been registered
    abMgrUnregister     = 1,
    abMgrActivated      = 2,
    abMgrDeactivated    = 3,
    abMgrOpened         = 4,
    abMgrClosed         = 5,
};
typedef struct {
    AB_MGR_CHANGE_TYPE  type;
    AB_MGR_ID           addressBook;
} AB_MGR_NOTIFY, *P_AB_MGR_NOTIFY;
```

Comments

pArgs->activated is set to TRUE if **pArgs**->addressBook is made the system address book, and to FALSE if **pArgs**->addressBook has been deactivated as the system address book.

ADDRBOOK.H

clsAddressBook inherits from **clsObject.**

This header file defines the address book protocol.

The address book protocol defines what minimal set of information is to be kept by an address book app or service, how information is to be stored, retrieved, queried by an address book client. Please refer to abmgr.h for information on address book manager.

All requests to access address book information is channeled through the address book manager. There can be multiple address book clients at one time. Whether or not address book clients can access information from more than 1 address book application/service simultaneously is completely up to the implementation of the address book manager. The current implementation of **theAddressBookMgr** provided by GO only allows access to one address book at a time.

Because **theAddressBookMgr** uses ObjectSend to relay messages to address books, pointers in **pArgs** in any address book protocol messages should point to some shared memory space.

There are 3 major types of address information defined by the protocol:

- individual personal information(e.g.name, phone number, street address)
- service information(individual's fax phone number, email address, etc)
- distribution list information

All information is kept/retrieved in attribute-value form. The basic entity in an address book is an "entry"; all information is presented relative to an entry. E.g. to access any information in an address book, a "key" to an entry must be presented. Within an entry, a client can set/get entry related information(name, street address, etc.). Service address information is also kept as part of an entry. Because there can be multiple service addresses for each entry(e.g. an individual has 2 fax numbers and 1 email address), a service address is accessed through a "service id" or the name of the service.(e.g. service name = "fax")

The Address Book Protocol specifies a minimum set of attributes and attribute types to be supported by third party address book applicaitons or services. If a developer thinks that some addition attributes or attribute types are common enough that they should be defined in the protocol, please contact GO Corporation Developer Support.

```
#ifndef ADDRBOOK_INCLUDED
#define ADDRBOOK_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef UID_INCLUDED
#include <uid.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef DIALENV_INCLUDED
#include <dialenv.h>
#endif
```

Common #defines and typedefs

All address book apps should be a sub-class of this app. Being a sub-class of **clsAddrBookApplication** frees an address book application from having to register, and unregister itself w/ TheAddressBookMgr. TheAddressBookMgr will notice when an instance of **clsAddrBookApplication** has been created/destroyed, and will automatically register/unregister the instance. Aside from providing this auto registeration/unregisteration, **clsAddrBookApplication** provides no other special behavior to its sub-class.

```
#define clsAddrBookApplication          MakeWKN(3284, 1, wknGlobal)
```

Pre-defined Attribute Types

```
#define abNumber        MakeTag(clsAddressBook, 0)  // 32-bit number
#define abString        MakeTag(clsAddressBook, 1)  // null-terminated string
#define abPhoneNumber   MakeTag(clsAddressBook, 2)  // DIALENV_TELEPHONE_NUMBER
#define abOther         MakeTag(clsAddressBook, 3)  // some encoded byte array
                                                    // interpreted by address
                                                    // books simply as a byte
                                                    // stream
```

Pre-defined attribute ids

```
#define AddrBookGroupNameId MakeTag(clsAddressBook, 0)  // abString
#define AddrBookGivenNameId MakeTag(clsAddressBook, 1)  // abString
#define AddrBookSurNameId   MakeTag(clsAddressBook, 2)  // abString
#define AddrBookHomePhoneId MakeTag(clsAddressBook, 3)  // abPhoneNumber
#define AddrBookBussPhoneId MakeTag(clsAddressBook, 4)  // abPhoneNumber
#define AddrBookCountryId   MakeTag(clsAddressBook, 5)  // country in post
                                                        // addr,abString
#define AddrBookStateId     MakeTag(clsAddressBook, 6)  // state or prefe-
                                                        // cture, abString
#define AddrBookZipId       MakeTag(clsAddressBook, 7)  // zip, abString
#define AddrBookCityId      MakeTag(clsAddressBook, 8)  // city , abString
#define AddrBookDistrictId  MakeTag(clsAddressBook, 9)  // ku in Japanese
                                                        // addr, abString
```

AddrBookStreetId represents street, number, building and other addressing information, the character \012(LF in ASCII) can be used to separate the different parts. E.g. a street address can be 2650 Durant Avenue Deutsch Hall #406 In this case, the address should be stored in AddrBookStreetId as "2650 Durant Avenue\012Deutsch Hall #406"

```
#define AddrBookStreetId    MakeTag(clsAddressBook, 10) // abString
#define AddrBookCompanyId   MakeTag(clsAddressBook, 11) // company name,
                                                        // abString
#define AddrBookTitleId     MakeTag(clsAddressBook, 18) // title of an
                                                        // individual entry
                                                        // abString
#define AddrBookPositionId  MakeTag(clsAddressBook, 19) // position of an
                                                        // individual entry
                                                        // abString
#define AddrBookNickNameId  MakeTag(clsAddressBook, 20) // nickname of an
                                                        // individual entry
                                                        // abString
#define AddrBookBussPhone2Id    MakeTag(clsAddressBook, 21) // 2nd bussiness
                                                        // phone #
                                                        // abPhoneNumber
#define AddrBookFaxId       MakeTag(clsAddressBook, 22) // fax # of an
                                                        // individual entry
                                                        // abPhoneNumber
#define AddrBookSvcNameId   MakeTag(clsAddressBook, 12) // name of svc,
                                                        // abString
```

```
#define AddrBookSvcNoteId   MakeTag(clsAddressBook, 13) // user defined
                                                        // svc nickname
                                                        // abString
#define AddrBookSvcShortId  MakeTag(clsAddressBook, 14) // service short
                                                        // address
```

The following two special id's are used in specifying a query

```
#define AddrBookEntryKeyId  MakeTag(clsAddressBook, 15)
#define AddrBookSvcIdId     MakeTag(clsAddressBook, 16)
```

This is the type for address book transfer protocol. If an address book supports move/copy protocol, then it should transfer an entry in a XFER_BUF structure, where XFER_BUF.pBuf is a pointer to ADDR_BOOK_ENTRY structure.

```
#define AddrBookXferType    MakeTag(clsAddressBook, 17)
#define AddrBookAll                     (maxU16)
#define AddrBookAllSvcSelectAttrs       (maxU16-1)
#define AddrBookSelectSvcSelectAttrs    (maxU16-2)
#define AddrBookSelectSvcAllAttrs       (maxU16-3)
```

If the client wants all attributes(either all entry attributes or all service attributes.), the address book should return the attributes in some well-known order. The next batch of #define's specifies the order for the common fields

```
#define AddrBookSurNameIndex        0
#define AddrBookGivenNameIndex      1
#define AddrBookHomePhoneIndex      2
#define AddrBookBussPhoneIndex      3
#define AddrBookCountryIndex        4
#define AddrBookStateIndex          5
#define AddrBookZipIndex            6
#define AddrBookCityIndex           7
#define AddrBookDistrictIndex       8
#define AddrBookStreetIndex         9
#define AddrBookCompanyIndex        10
#define AddrBookTitleIndex          11
#define AddrBookPositionIndex       12
#define AddrBookNickNameIndex       13
#define AddrBookBussPhone2Index     14
#define AddrBookFaxIndex            15
#define AddrBookSvcNameIndex        0
#define AddrBookSvcNoteIndex        1
#define AddrBookSvcShortIndex       2
typedef P_UNKNOWN   ADDR_BOOK_SERVICE_ID,   *P_ADDR_BOOK_SERVICE_ID;
typedef TAG         ADDR_BOOK_ATTR_ID,      *P_ADDR_BOOK_ATTR_ID;
typedef TAG         ADDR_BOOK_ATTR_TYPE,    *P_ADDR_BOOK_ATTR_TYPE;
typedef U16         ADDR_BOOK_ATTR_LENGTH,  *P_ADDR_BOOK_ATTR_LENGTH;
typedef P_UNKNOWN   ADDR_BOOK_ATTR_VALUE,   *P_ADDR_BOOK_ATTR_VALUE;
typedef P_UNKNOWN   ADDR_BOOK_KEY,          *P_ADDR_BOOK_KEY;
typedef CHAR    ADDR_BOOK_ATTR_LABEL[nameBufLength];
```

ADDR_BOOK_ATTR.length is the length of ADDR_BOOK_ATTR.value. The following table lists what the length field mean, given a certain attribute type:

```
    Attr Type                length
    ======================================================
    abString            length of the string
    abNumber            SizeOf(U32)
    abPhoneNumber       SizeOf(DIALENV_TELEPHONE_NUMBER)
    abOther             length of attribute in bytes
```

The following table lists what the value field should be, given a certain attribute type:

```
Attr Type               value
=======================================================
abString            a ptr to actual storage of the str
abNumber            the number itself
abPhoneNumber       P_DIALENV_TELEPHONE_NUMBER
abOther             a ptr to a byte array that
                    contains the attribute.
```

abString a ptr to actual storage of the str

abNumber the number itself

abPhoneNumber P_DIALENV_TELEPHONE_NUMBER

abOther a ptr to a byte array thatcontains the attribute.

```
typedef struct ADDR_BOOK_ATTR {
    ADDR_BOOK_ATTR_ID        id;
    ADDR_BOOK_ATTR_TYPE      type;
    ADDR_BOOK_ATTR_LENGTH    length;         // length of value, in bytes
    ADDR_BOOK_ATTR_VALUE     value;
    ADDR_BOOK_ATTR_LABEL     label;          // for display purpose
} ADDR_BOOK_ATTR, *P_ADDR_BOOK_ATTR;
typedef struct ADDR_BOOK_ATTR_DESC {
    ADDR_BOOK_ATTR_ID        id;
    ADDR_BOOK_ATTR_TYPE      type;
    ADDR_BOOK_ATTR_LABEL     label;          // for display purpose
} ADDR_BOOK_ATTR_DESC, *P_ADDR_BOOK_ATTR_DESC;
typedef struct ADDR_BOOK_SERVICE {
    ADDR_BOOK_SERVICE_ID     svcId;          // uniquely identify a svc inst
    U16                      numAttrs;
    P_ADDR_BOOK_ATTR         attrs;
} ADDR_BOOK_SERVICE, *P_ADDR_BOOK_SERVICE;
Enum16(ADDR_BOOK_ENTRY_TYPE) {
    abIndividual    = 0,
    abGroup         = 1,
};
#define abMaxSvcNameMatch       5
typedef struct ADDR_BOOK_SERVICE_QUAL {
    U16                      numAttrIds;
    P_ADDR_BOOK_ATTR_ID      svcAttrIds;
    U16                      numSvcNames;
    CHAR                     svcNames[abMaxSvcNameMatch][nameBufLength];
} ADDR_BOOK_SERVICE_QUAL, *P_ADDR_BOOK_SERVICE_QUAL;
```

.heap field is an in-parameter in **msgAddrBookGet** and **msgAddrBookSearch**, it is not applicable for other msgs. A client should specify the heap id of the heap that it would like space allocated. Typically a client would use OSTaskSharedHeapId(**clientsTaskId**). A client should not use **osProcessSharedHeapId** or **osProcessHeapId** because they refer to different heaps in diffferent processes. It is very important that clients free allocated space.

```
typedef struct ADDR_BOOK_ENTRY {
    OS_HEAP_ID                  heap;           // where should the address
                                                // book alloc necessary space
                                                // applicable only for
                                                // msgAddrBookGet and
                                                // msgAddrBookSearch
    ADDR_BOOK_ENTRY_TYPE        type;
    ADDR_BOOK_KEY               key;
    U16                         numAttrs;
    P_ADDR_BOOK_ATTR            attrs;
    U16                         numServices;    // Read only,abIndividual only
    P_ADDR_BOOK_SERVICE         services;       // abIndividual only
    ADDR_BOOK_SERVICE_QUAL      svcQual;        // service qualifier, for Get
} ADDR_BOOK_ENTRY, *P_ADDR_BOOK_ENTRY;
```

Status Codes

Error Status Values

```
#define stsAddrBookBufTooSmall          MakeStatus(clsAddressBook, 1)
#define stsAddrBookEntryExists          MakeStatus(clsAddressBook, 2)
#define stsAddrBookSvcDataExists        MakeStatus(clsAddressBook, 3)
#define stsAddrBookEntryNotFound        MakeStatus(clsAddressBook, 4)
#define stsAddrBookSvcNotFound          MakeStatus(clsAddressBook, 5)
#define stsAddrBookBadKey               MakeStatus(clsAddressBook, 6)
#define stsAddrBookUnknownType          MakeStatus(clsAddressBook, 7)
#define stsAddrBookInvalidAttr          MakeStatus(clsAddressBook, 8)
#define stsAddrBookReadOnlyAttr         MakeStatus(clsAddressBook, 9)
#define stsAddrBookDuplicateAttrId      MakeStatus(clsAddressBook, 10)
```

Non Error Status Values

```
#define stsAddrBookGroupEntry               MakeWarning(clsAddressBook, 7)
#define stsAddrBookNotSupported             MakeWarning(clsAddressBook, 8)
```

Messages

msgAddrBookGet

fills in the specified entry field data, given an address book key for the entry.

Takes **P_ADDR_BOOK_ENTRY**, returns **STATUS**.

```
#define msgAddrBookGet                      MakeMsg(clsAddressBook, 1)
```

Message Arguments

```
typedef struct ADDR_BOOK_ENTRY {
    OS_HEAP_ID                  heap;           // where should the address
                                                // book alloc necessary space
                                                // applicable only for
                                                // msgAddrBookGet and
                                                // msgAddrBookSearch
    ADDR_BOOK_ENTRY_TYPE        type;
    ADDR_BOOK_KEY               key;
    U16                         numAttrs;
    P_ADDR_BOOK_ATTR            attrs;
    U16                         numServices;    // Read only,abIndividual only
    P_ADDR_BOOK_SERVICE         services;       // abIndividual only
    ADDR_BOOK_SERVICE_QUAL      svcQual;        // service qualifier, for Get
} ADDR_BOOK_ENTRY, *P_ADDR_BOOK_ENTRY;
```

Comments

If attribute type is **abString** and the client-provided space is not big enough, **stsAddrBookBufTooSmall** is returned, and as much information as there is room for is filled in(null-terminated). Similarly, if attribute type is **abOther**, **stsAddrBookBufTooSmall** is returned, and the client-provided buffer is filled in(w/o null-termination).

Parameters:

pArgs->key In: specify from which entry to get info

pArgs->type Out: type of the entry

pArgs->numAttrs In: number of elements in **pArgs**->attrs array. Each of **pArgs**->attrs.id specifies the id of the attribute the client wants the address book to return. If the client sets this field to AddrBookAll, then the address book will return all entry attributes(excluding services), and it will allocate the necessary space. The client needs to deallocate the space. If the field is set to 0, then no attributes are returned. Out: number of attributes returned

pArgs->attrs[x].id In: which attributes to get

pArgs->attrs[x].type Out: attribute type

pArgs->attrs[x].length Out: attribute length of each attr specified in **entryAttrIds**. See previous table on attribute type-attribute length.

pArgs->attrs[x].value In: if this field is **pNull**, the address book will allocate space for the value. Out: attribute value. see previous table on attribute value-attribute length.

pArgs->attrs[x].label Out: attribute label, for display.

pArgs->numServices In: number of elements in **pArgs**->services array The client should specify AddrBookAll here if it wants all services and all service attributes for each service. If it wants only selective attributes from all services, then set **numServices** to AddrBookAllSvcSelectAttrs. If it wants all attributes from selective services, then set **numServices** to AddrBookSelectSvcAllAttrs. Lastly, if the client wants selective attrs from selective svcs, then set **numServices** to AddrBookSelectSvcSelectAttrs.In all cases, the address book will allocate the necessary storage for all info, which needs to be freed by the client. If the field is set to 0, then no service information is returned Out: number of services returned.

pArgs->svcQual In: If **numServices** is AddrBookAllSvcSelectAttrs, or AddrBookSelectSvcSelectAttrs, then **numAttrIds** is the number of elements in the **svcAttrIds** array, and **svcAttrIds** contains the ids of the attributes whose values should be retrieved. If **numServices** is AddrBookSelectSvcAllAttrs or AddrBookSelectSvcSelectAttrs,then **numSvcNames** is the number of elements in the **svcNames** array, and **svcNames** contains the names of services whose attribute values should be retrieved. For any other values of **numServices**, this field is irrelevent.

pArgs->services Out: Allocated space if so requested.

pArgs->services[y].**svcId** In: For each services specifically requested (as opposed to using AddrBookAll or AddrBookAllSvcsSelectAttrs, and other such constants in **pArgs**->numServices), there needs to be a **svcId**, telling the address book which service to return

pArgs->services[y].attrs:In/Out: analogous to **pArgs**->attrs

msgAddrBookSet

Sets the specified entry and service data .

Takes P_ADDR_BOOK_ENTRY, returns STATUS.

```
#define msgAddrBookSet                      MakeMsg(clsAddressBook, 2)
```

Message Arguments

```
typedef struct ADDR_BOOK_ENTRY {
    OS_HEAP_ID                  heap;           // where should the address
                                                // book alloc necessary space
                                                // applicable only for
                                                // msgAddrBookGet and
                                                // msgAddrBookSearch
    ADDR_BOOK_ENTRY_TYPE        type;
    ADDR_BOOK_KEY               key;
    U16                         numAttrs;
    P_ADDR_BOOK_ATTR            attrs;
    U16                         numServices;    // Read only,abIndividual only
    P_ADDR_BOOK_SERVICE         services;       // abIndividual only
    ADDR_BOOK_SERVICE_QUAL      svcQual;        // service qualifier, for Get
} ADDR_BOOK_ENTRY, *P_ADDR_BOOK_ENTRY;
```

Comments

Parameters:

pArgs->key In: specify from which entry to get info

pArgs->numAttrs In: how many attributes in the entry to set

pArgs->attr[x].id In: which attributes to set

pArgs->attr[x].type NA: don't need to specify

pArgs->attr[x].length In: client-specified size of the correspond- ing **entryAttrValue** field. mandatory for **abOther**, unnecessary for other types.

pArgs->attr[x].value In: attribute value. see previous table on attribute value-attribute length.

pArgs->numServices In: number of services to set. Set it to 0 if not setting any service info

pArgs->svcAttrIds NA: not applicable

pArgs->services[y].**svcId** In: service id of the service that set applies to

pArgs->services[y].attrs In: analogous to **pArgs**->attrs.

msgAddrBookAdd

Adds the specified entry and service data.

Takes P_ADDR_BOOK_ENTRY, returns STATUS.

```
#define msgAddrBookAdd                    MakeMsg(clsAddressBook, 3)
```

Message Arguments

```
typedef struct ADDR_BOOK_ENTRY {
    OS_HEAP_ID              heap;           // where should the address
                                            // book alloc necessary space
                                            // applicable only for
                                            // msgAddrBookGet and
                                            // msgAddrBookSearch
    ADDR_BOOK_ENTRY_TYPE    type;
    ADDR_BOOK_KEY           key;
    U16                     numAttrs;
    P_ADDR_BOOK_ATTR        attrs;
    U16                     numServices;    // Read only,abIndividual only
    P_ADDR_BOOK_SERVICE     services;       // abIndividual only
    ADDR_BOOK_SERVICE_QUAL  svcQual;        // service qualifier, for Get
} ADDR_BOOK_ENTRY, *P_ADDR_BOOK_ENTRY;
```

Comments

Parameters:

pArgs->key In: If the msg is used to add a service addr then the client specifies the entry key of the entry to which we add the service address. Out: if the msg is used to add an entry, then address book fill this field w/ the key of the entry just added

pArgs->numAttrs In: how many attributes in the entry to have specified initial values.

pArgs->attr[x].id In: which attributes to add. To add a brand new individual entry, then at least AddrBookGivenNameId or AddrBookSurNameId need to be specified. To add a group entry, AddrBookGroupNameId needs to be specified.

pArgs->attr[x].type NA: don't need to specify

pArgs->attr[x].length In: mandatory if attribute type is **abOther**

pArgs->attr[x].value In: attribute value. see previous table on attribute value-attribute length.

pArgs->numServices In: number of services to set. Set it to 0 if not adding any service info

pArgs->svcAttrIds NA: not applicable

pArgs->services[y].**svcId** Out service id of the service just added

pArgs->services[y].attrs In analogous to **pArgs**->attrs.

msgAddrBookDelete

Deletes the specified entry and service data .

Takes P_ADDR_BOOK_ENTRY, returns STATUS.

```
#define msgAddrBookDelete                         MakeMsg(clsAddressBook, 4)
```

Message Arguments

```
typedef struct ADDR_BOOK_ENTRY {
    OS_HEAP_ID                heap;           // where should the address
                                              // book alloc necessary space
                                              // applicable only for
                                              // msgAddrBookGet and
                                              // msgAddrBookSearch
    ADDR_BOOK_ENTRY_TYPE      type;
    ADDR_BOOK_KEY             key;
    U16                       numAttrs;
    P_ADDR_BOOK_ATTR          attrs;
    U16                       numServices;    // Read only,abIndividual only
    P_ADDR_BOOK_SERVICE       services;       // abIndividual only
    ADDR_BOOK_SERVICE_QUAL    svcQual;        // service qualifier, for Get
} ADDR_BOOK_ENTRY, *P_ADDR_BOOK_ENTRY;
```

Comments

Parameters:

pArgs->key In: entry id of the entry to be deleted. If deleting a service, then this field still needs to be specified. Only the specified service is deleted.

pArgs->numServices In: number of services to delete. Set it to 0 if deleting the entire entry.

pArgs->services[x].**svcId** In Id's of the services to be deleted

All other fields in ADDR_BOOK_ENTRY structure are not applicable.

msgAddrBookSearch

Searches for the entry that matches the search spec.

Takes P_ADDR_BOOK_SEARCH, returns STATUS.

```
#define msgAddrBookSearch                         MakeMsg(clsAddressBook, 5)
```

Arguments

```
Enum16(ADDR_BOOK_SEARCH_TYPE) {
    abSearchIndividuals = 0,    // Enumerate address book entries
    abSearchGroups      = 1,    // Enumerate groups
    abSearchAll         = 2,    // Enumerate all entries
};
Enum16(ADDR_BOOK_SEARCH_DIR) {
    abEnumNext          = 0, // Search forward
    abEnumPrevious      = 1  // Search backwards
};
Enum16(ADDR_BOOK_ATTR_OPS) {
    abAnd   = 0,
    abOr    = 1
};
```

```
Enum16(ADDR_BOOK_VALUE_OPS) {
    abEqual          = 0,
    abNotEqual       = 1,
    abGreater        = 2,
    abLess           = 3,
    abGreaterEqual   = 4,
    abLessEqual      = 5,
    abMatchBeginning = 6,       // string matching
    abMatchEnd       = 7,       // string matching
    abMatchPartial   = 8,       // string matching
    abMaxValue = abMatchPartial
};
```

If a client wants to specify a query that says "match an entry whose last name is "Smith" and whose zip code is "94024", then the .query field in **pArgs** for **msgAddrBookSearch** would have 2 elements:

```
    pArgsquery        id                length  value   valueOp   attrOp
    ==================================================================
    attr[0]       AddrBookGivenNameId     N/A    Smith  abEqual    abAnd
    attr[1]       AddrBookZipId           N/A    94024  abEqual    N/A
```

Essentially, the **attrOp** field specifies the operator between attr[x] and attr[x+1]. **valueOp** specifies the relationship between the attribute id and its specified value. e.g. (a == 1) AND (b == 2), the "=="'s are **valueOp**, "AND" is an **attrOp**. By definition, **pArgs**->attrs[pArgs->numAttrs-1].**attrOp** does not need to be specified.

```
typedef struct ADDR_BOOK_QUERY_ATTR {
    ADDR_BOOK_ATTR_ID        id;
    ADDR_BOOK_ATTR_LENGTH    length;
    ADDR_BOOK_VALUE_OPS      valueOp;
    ADDR_BOOK_ATTR_VALUE     value;
    ADDR_BOOK_ATTR_OPS       attrOp;
} ADDR_BOOK_QUERY_ATTR, *P_ADDR_BOOK_QUERY_ATTR;
typedef struct ADDR_BOOK_QUERY {
    U16                          numAttrs;
    P_ADDR_BOOK_QUERY_ATTR       attrs;
} ADDR_BOOK_QUERY, *P_ADDR_BOOK_QUERY;
typedef struct ADDR_BOOK_SEARCH {
    ADDR_BOOK_KEY            key;    // In: Starting Pt. Out: Result
    ADDR_BOOK_SEARCH_TYPE    type;   // In:
    U32                      nth;    // In: look for the nth entry meeting
                                     //     the search criteria. nth = 1
                                     //     if looking for the first entry
                                     //     meeting the search criteria.
    ADDR_BOOK_ATTR_ID        sort;
    ADDR_BOOK_SEARCH_DIR     dir;
    ADDR_BOOK_ENTRY_TYPE     outType;
    ADDR_BOOK_QUERY          query;  // In: what to look for, set query to
                                     //     pNull to enumerate
    ADDR_BOOK_ENTRY          result; // Out: result entry
} ADDR_BOOK_SEARCH, *P_ADDR_BOOK_SEARCH;
```

Comments

pArgs->key is the **pArgs**->nth entry that matches the search spec, sorted by the attribute specified in **pArgs**->sort, the entry is just before/after(depending on the value of **pArgs**->dir) of **pArgs**->key If key is nil, the enumeration starts with the first element if **abEnumNext** is specified, and the last element if **abEnumPrevious** is specified.

Parameters:

pArgs->key	In	Start point of the search Out:Resulting entry id of the match
pArgs->nth	In	Look for the nth enty meeting the search criteria
pArgs->sort	In	Attribute id of the attribute that the result should be sorted by

pArgs->dir In search backwards or forwards.

pArgs->outType Out:type of the matched entry

pArgs->query In an elaborate explanation is available below

pArgs->result In How each field is specified is the same as that for **msgAddrBookGet**. Except for the key field, which will be filled in by **msgAddrBookSearch** Out:same as **msgAddrBookGet**

msgAddrBookGetServiceDesc

Gets the service address description from the address book.

Takes P_ADDR_BOOK_SERVICES, returns STATUS.

```
#define msgAddrBookGetServiceDesc          MakeMsg(clsAddressBook, 9)
#define abServiceDescFields                                  \
    CHAR                    name[nameBufLength];             \
    U16                     maxPerEntry;                     \
    U16                     numAttrs;                        \
    P_ADDR_BOOK_ATTR_DESC   attrs;                           \
```

Arguments

```
typedef struct ADDR_BOOK_SVC_DESC {
    abServiceDescFields
} ADDR_BOOK_SVC_DESC, *P_ADDR_BOOK_SVC_DESC;
typedef struct ADDR_BOOK_SERVICES {
        OS_HEAP_ID              heap;
        U16                     numServices;
        P_ADDR_BOOK_SVC_DESC    services;
} ADDR_BOOK_SERVICES, *P_ADDR_BOOK_SERVICES;
```

Comments

Parameters:

pArgs->numServices Out: number of installed services an array of ADDR_BOOK_SVC_DESC's is allocated and should be freed by the caller.

Return Value

stsOK

msgAddrBookEnumGroupMembers

Enumerates through the members in a group.

Takes P_ADDR_BOOK_ENUM_GROUP_MEMBER, returns STATUS.

```
#define msgAddrBookEnumGroupMembers        MakeMsg(clsAddressBook, 6)
```

Arguments

```
typedef struct ADDR_BOOK_ENUM_GROUP_MEMBER {
    ADDR_BOOK_KEY           groupKey;
    ADDR_BOOK_KEY           startKey;
    BOOLEAN                 recurse;
    ADDR_BOOK_ATTR_ID       sort;
    U32                     count;
    P_ADDR_BOOK_KEY         pKeys;
} ADDR_BOOK_ENUM_GROUP_MEMBER, *P_ADDR_BOOK_ENUM_GROUP_MEMBER;
```

Comments

Parameters:

pArgs->groupKey In: key of the group

pArgs->startKey In: where to start the group enumeration. Use **pNull** to start from the beginning. Out:last entry key returned in **pArgs**->pKeys. Client usually uses the out value to be the next in value of the next **msgAddrBookEnumGroupMembers** call.

pArgs->recurse In: whether to recursively enumerate groups

pArgs->sort In: attr id of the field to sort the returned entry id by

pArgs->count In: number of entries to return, which is also the number of slots in the **pKeys** array. Use AddrBookAll to get every member. In this case address book will allocate the necessary space, and the client should free the space. Out:number of entries actually returned

pArgs->pKeys Out:keys of the members of **pArgs**->groupKey

msgAddrBookIsAMemberOf

Determines if an entry is a member of a group.

Takes P_ADDR_BOOK_IS_A_MEMBER_OF, returns STATUS.

```
#define msgAddrBookIsAMemberOf          MakeMsg(clsAddressBook, 7)
```

Arguments

```
typedef struct ADDR_BOOK_IS_A_MEMBER_OF {
    ADDR_BOOK_KEY       groupKey;
    ADDR_BOOK_KEY       memberKey;
    BOOLEAN             recurse;
} ADDR_BOOK_IS_A_MEMBER_OF, *P_ADDR_BOOK_IS_A_MEMBER_OF;
```

Comments

Parameters:

pArgs->groupKey In: key of the group

pArgs->memberKey In: potential member's key

pArgs->recurse In: whether to recursively test for membership

Return Value

stsOK if **pArgs**->memberKey is a member of **pArgs**->groupKey.

stsNoMatch if **pArgs**->memberKey is not a member of **pArgs**->groupKey

msgAddrBookGetMetrics

Passes back the metrics for the address book.

Takes P_ADDR_BOOK_METRICS, returns STATUS.

```
#define msgAddrBookGetMetrics               MakeMsg(clsAddressBook, 8)
```

Arguments

```
typedef struct ADDR_BOOK_METRICS {
    U32         numEntries;     // Total number of entries
    U32         numGroups;      // Number of groups in the address book
    U16         numServices;    // Number of known services
    U32         spare1;
    U32         spare2;
} ADDR_BOOK_METRICS, *P_ADDR_BOOK_METRICS;
```

msgAddrBookAddAttr

Adds a new attribute to active address books.

Takes P_ADDR_BOOK_ATTR, returns STATUS.

```
#define msgAddrBookAddAttr          MakeMsg(clsAddressBook, 12)
```

Message Arguments

```
typedef struct ADDR_BOOK_ATTR {
    ADDR_BOOK_ATTR_ID       id;
    ADDR_BOOK_ATTR_TYPE     type;
    ADDR_BOOK_ATTR_LENGTH   length;         // length of value, in bytes
    ADDR_BOOK_ATTR_VALUE    value;
    ADDR_BOOK_ATTR_LABEL    label;          // for display purpose
} ADDR_BOOK_ATTR, *P_ADDR_BOOK_ATTR;
```

Comments

This operation will change the address book database schema. If the attribute is of type **abNumber**, the value is initialized to be 0 for all existing address book entries. If the attribute is of type **abPhoneNumber**, then the value is intialized to be 0. If the attribute is of type **abString** or **abOther**, the value is initialized to be 0 length byte array.

After an attribute is added to an address book, clients can then set the attribute value in subsequent **msgAddrBookSet**'s and get the attribute value in the subsequent **msgAddrBookGet**'s. Failure to first make an attribute known to an address book and then try to set or get the attribute value will cause **stsAddrBookInvalidAttr** to be returned.

Parameters:

pArgs->id In: the id(should be a tag) of the new attribute. It has to be different from all other attribute ids in the same address book.

pArgs->type In: one of **abNumber, abString, abOther, abPhoneNumber**

pArgs->label In: a string, for display purpose. The address book will copy the string to its own storage.

Return Value

stsRequestNotSupported if the address book does not allow dynamically changing its database schema.

stsAddrBookDuplicateAttrId There is another attribute in the address book w/ the same id.

msgAddrBookCount

Finds the number of entries that match the search spec

Takes P_ADDR_BOOK_COUNT, returns STATUS.

```
#define msgAddrBookCount                        MakeMsg(clsAddressBook, 13)
```

Arguments

```
typedef struct ADDR_BOOK_COUNT {
    ADDR_BOOK_KEY           key;
    ADDR_BOOK_ATTR_ID       sort;
    ADDR_BOOK_SEARCH_DIR    dir;
    ADDR_BOOK_QUERY         query;
    U16                     count;
} ADDR_BOOK_COUNT, *P_ADDR_BOOK_COUNT;
```

Comments

Parameters:

pArgs->key In where to stop counting, AddrBookAll to count the entire database

pArgs->dir In whether to start counting from the beginning or the end of the address book.

pArgs->query In qualifier. See **msgAddrBookSearch**

Observer Messages

msgAddrBookEntryChanged

Sent to observers when an entry has been changed, added or deleted.

Takes P_ADDR_BOOK_ENTRY_CHANGE, returns STATUS.

```
#define msgAddrBookEntryChanged             MakeMsg(clsAddressBook, 11)
```

Arguments

```
Enum16(ADDR_BOOK_CHANGE_TYPE) {
    abServiceChanged        = 0,
    abServiceDeleted        = 1,
    abServiceAdded          = 2,
    abEntryAdded            = 3,
    abEntryDeleted          = 4,
    abEntryNameChanged      = 5,
    abEntryChanged          = 6,
    abServiceInstalled      = 7,    // svcs have been installed
    abServiceDeinstalled    = 8,    // svcs have been deinstalled
};
typedef struct ADDR_BOOK_ENTRY_CHANGE {
    OBJECT                  addrBook;   // Address book UID
    ADDR_BOOK_CHANGE_TYPE   type;       // Type of change
    ADDR_BOOK_KEY           entryKey;   // Internal address book key of the
                                        // changed entry
    ADDR_BOOK_SERVICE_ID    svcId;      // service id, if applicable
} ADDR_BOOK_ENTRY_CHANGE, *P_ADDR_BOOK_ENTRY_CHANGE;
```

Comments

If **pArgs**->type is **abServiceChanged**, **abServiceDeleted**, **abServiceAdded**, then the address book fills in **pArgs**->svcId to be the id of the service address affected. **pArgs**->entryKey is filled in by the address book except when **pArgs**->type is **abServiceInstalled** or **abServiceDeinstalled**. In that case, the address book is notifying clients that some service has been installed or deinstalled, and the service information returned by the previous **msgAddrBookGetServiceDesc** is no longer up-to-date.

ATALK.H

This file contains the API for **clsATP**.

clsATP inherits from **clsObject**.

Provides remote access to stations using the AppleTalk protocol suite.

```
#ifndef ATALK_INCLUDED
#define ATALK_INCLUDED
```

Common #defines and typedefs

```
typedef  U8  DDP_TYPE,    * P_DDP_TYPE;
typedef  U8  ATP_FLAGS;
typedef struct ATP_ADDRESS {
    U16 network;
    U8  node;
    U8  socket;
} ATP_ADDRESS,    * P_ATP_ADDRESS;
typedef struct USER_BYTES {
    U8  ub1;
    U8  ub2;
    U8  ub3;
    U8  ub4;
} USER_BYTES,    * P_USER_BYTES;
typedef struct ATP_OPTIONS {
    DDP_TYPE     ddpType;
    ATP_FLAGS    flags;
    U16          transactionID;      // In: transaction id when sending a response
                                     // Out: transaction id when receiving a request

    U32          interval;           // timeout value in milliseconds
    U16          retries;            // number of times to retry a request
    U8           numUserByteSets;    // In: number of valid user byte sets to send
                                     // Out: number of valid user byte sets received

    U8           reserved;
    USER_BYTES   userBytes[ 8 ];
} ATP_OPTIONS,    * P_ATP_OPTIONS;
//  ATP flags
#define  ATP_XO_Flag                 0x01
#define  ATP_Checksum_Flag           0x02
#define  ATP_ALONoResponse_Flag      0x04
typedef      U8      NBP_NAME,    * P_NBP_NAME;
#define      NBP_NAME_Size       99
```

Format for an NBP name is:

U8 **objectNameLength;**
U8 **objectName[objectNameLength];**
U8 **typeNameLength;**
U8 **typeName[typeNameLength];**
U8 **zoneNameLength;**
U8 **zoneName[zoneNameLength];**

```
typedef U8  NBP_ENUMERATOR;
typedef struct NBP_TUPLE {
    ATP_ADDRESS     address;
    NBP_ENUMERATOR  enumerator;
    NBP_NAME        name[ NBP_NAME_Size ];
} NBP_TUPLE,    * P_NBP_TUPLE;
typedef     U8      ZONES_BUFFER,     * P_ZONES_BUFFER;
```

Messages

msgNBPRegister

Registers a name with the network.

Takes P_NBP_REGISTER, returns STATUS.

```
#define     msgNBPRegister  MakeMsg( clsATP, 1 )
```

Arguments

```
typedef struct NBP_REGISTER {
    P_NBP_NAME      pName;      // name to register
} NBP_REGISTER,    * P_NBP_REGISTER;
```

msgNBPRemove

Removes a previously registered name from the network.

Takes P_NBP_REMOVE, returns STATUS.

```
#define     msgNBPRemove    MakeMsg( clsATP, 2 )
```

Arguments

```
typedef struct NBP_REMOVE {
    P_NBP_NAME      pName;      // name to remove
} NBP_REMOVE,    * P_NBP_REMOVE;
```

msgNBPLookup

Looks up names registered with the network.

Takes P_NBP_LOOKUP, returns STATUS.

```
#define     msgNBPLookup    MakeMsg( clsATP, 3 )
```

Arguments

```
typedef struct NBP_LOOKUP {
    P_NBP_NAME          pName;          // name spec to lookup
    P_TP_BUFFER         pBuffer;        // ptr to buffer containing names found
    U16                 length;         // size of buffer in bytes
    U16                 numMatches;     // In-Out: number of names wanted/found
} NBP_LOOKUP,    * P_NBP_LOOKUP;
```

msgNBPConfirm

Confirms the network address of a registered name.

Takes P_NBP_CONFIRM, returns STATUS.

```
#define     msgNBPConfirm   MakeMsg( clsATP, 4 )
```

Arguments

```
typedef struct NBP_CONFIRM {
    P_NBP_NAME          pName;      // name to confirm address of
    P_TP_ADDRESS        pAddress;   // ptr to address of name
} NBP_CONFIRM,    * P_NBP_CONFIRM;
```

msgZIPGetZoneList

Obtains a list of zone names.

Takes P_ZIP_GETZONES, returns STATUS.

```
#define     msgZIPGetZoneList   MakeMsg( clsATP, 6 )
```

Arguments

```
typedef struct ZIP_GETZONES {
    P_ZONES_BUFFER          pBuffer;    // ptr to buffer to contain zone names
    U16                     length;     // size of buffer in bytes
    U16                     numZones;   // Out: number of zones found
} ZIP_GETZONES,   * P_ZIP_GETZONES;
```

msgZIPGetMyZone

Obtains my zone name.

Takes P_ZIP_GETZONES, returns STATUS.

```
#define     msgZIPGetMyZone     MakeMsg( clsATP, 7 )
```

Message Arguments

```
typedef struct ZIP_GETZONES {
    P_ZONES_BUFFER          pBuffer;    // ptr to buffer to contain zone names
    U16                     length;     // size of buffer in bytes
    U16                     numZones;   // Out: number of zones found
} ZIP_GETZONES,   * P_ZIP_GETZONES;
```

msgATPRespPktSize

Sets the maximum size of ATP response packets.

Takes P_ATP_RESPPKTSIZE, returns STATUS.

```
#define     msgATPRespPktSize   MakeMsg( clsATP, 8 )
```

Arguments

```
typedef struct ATP_RESPPKTSIZE {
    U16                 size;       // max size of response packets in bytes
} ATP_RESPPKTSIZE,   * P_ATP_RESPPKTSIZE;
```

CNCTIONS.H

This file contains the API definition for the interface between the connections notebook and a generic service.

The connections notebook is, effectively, an option sheet. Because of this implementation choice, it is important to understand the option sheet protocol and messages, as defined in OPTION.H. The terminology chosen herein reflects the close association between the connections notebook and an option sheet.

The two default views that one gets, for disks and printers, in the connections notebook are each option sheets added as cards of the connections notebook option sheet. Other sheets or windows can be added to the connections notebook.

The connections notebook observes the well-known list **theConnections**. If an item is added to the list, the connections notebook calls that item with **msgConnectionsAddSheet**, with the **P_ARGS** being the main option sheet in the connections notebook. By using **msgOptionAddCard** to the object passed in the aforementioned call, a service can add a sheet or just a single window to the connections notebook. Once these items have been added, all responsibility for the user interface and functionality rests solely on the service.

Network disks and printers, however, are handled differently. There are already predefined windows for these two items. A network file-sharing system, for example, would add itself to the well-known list **theVolumeServices**. The connections notebook, which observes this list, would send the object on the list a **msgConnectionsStartConversation** and a **msgConnectionsSetConnectionsApp** to pass along the application context of the connections notebook from this time.

If the network file-sharing service were to remove itself from **theVolumeServices**, the connections notebook would send **msgConnectionsEndConveration** to the object.

The object on the list is expected to be able to respond to the various connections messages. If it has specified that it provides a UI, it will be asked for its network view when appropriate.

```
#ifndef CNCTIONS_INCLUDED
#define CNCTIONS_INCLUDED
#ifndef INSTLMGR_INCLUDED
#include <instlmgr.h>
#endif
```

Common #defines and typedefs

Warnings

```
#define stsConnectionsAlreadyConnected          MakeWarning(clsConnections, 1)
```

Statuses

```
#define stsConnectionsPasswordFailed            MakeStatus(clsConnections, 1)
#define stsConnectionsServiceDeinstalling       MakeStatus(clsConnections, 2)
#define stsConnectionsNotConnected              MakeStatus(clsConnections, 3)
```

Typedefs

```
typedef struct CONNECTIONS_MENU_ITEM {
    P_CHAR          pName;
    OBJECT          netService;
    P_UNKNOWN       netIdentifier;
    U32             reserved[2];
} CONNECTIONS_MENU_ITEM, * P_CONNECTIONS_MENU_ITEM;
typedef struct CONNECTIONS_ITEM {
    struct CONNECTIONS_ITEM     *pNextConnectionsItem;  // Next item
    P_UNKNOWN                   pItemID;        // Service defined identifer
                                                // for this item
    TAG                         itemIconTag;    // Item's icon tag
    TAG                         itemTag;        // Item tag
    P_CHAR                      name;           // Item name
    P_CHAR                      serverName;     // Item's server's name
    P_CHAR                      location;       // Item's location
    P_CHAR                      type;           // Item's type
    BOOLEAN                     connected;      // Connected?
    BOOLEAN                     autoConnect;    // Auto-connect enabled?
    BOOLEAN                     remember;       // Remember (menu) enabled?
    // fill in some more information here
    P_UNKNOWN                   itemSpecificData;   // volume or printer stuff
    U32                         filler[4];          // reserved
} CONNECTIONS_ITEM, * P_CONNECTIONS_ITEM, * * PP_CONNECTIONS_ITEM;
```

Messages

msgConnectionsSetState:

Sets the specified states in the service.

Takes P_CONNECTIONS_STATE, returns STATUS.

Arguments

```
Enum16 ( CONNECTIONS_CONNECT_STATE ) {
    cnctManualConnections,                  // Connect only when asked to
    cnctAutoConnections,                    // Connect auto-connect items
    cnctPromiscuousConnections              // Connect to everything
};
Enum16 ( CONNECTIONS_WARNINGS ) {
    cnctWarningNone                 = 0,        // No warnings
    cnctWarningPermissionsFailure   = flag0,    // On permissions failure
    cnctWarningOnConnection         = flag1,    // On connection
    cnctWarningOnUnconnection       = flag2     // On loss of connection
};
Enum16 ( CONNECTIONS_PASSWORDS ) {
    cnctPasswordNone                = 0,        // Do not save passwords
    cnctPasswordServer              = flag0,    // Save server passwords
    cnctPasswordItem                = flag1,    // Save item passwords
    cnctPasswordServerAndItem       = flag2     // Save server and item
                                                // passwords
};
Enum16 ( CONNECTIONS_PERMISSIONS ) {
    cnctPermissionsReadWrite,                   // Connect Read/Write
    cnctPermissionsReadOnly                     // Connect Read only
};
typedef struct CONNECTIONS_STATE {
    BOOLEAN                     attached;           // Attached
    CONNECTIONS_CONNECT_STATE   connectMores;       // How to attach
    CONNECTIONS_WARNINGS        connectWarning;     // Level of warnings
    CONNECTIONS_PASSWORDS       connectPasswords;   // What passwords
    CONNECTIONS_PERMISSIONS     connectPermissions; // What permissions
    U32                         reserved[4];
} CONNECTIONS_STATE, * P_CONNECTIONS_STATE;
#define msgConnectionsSetState              MakeMsg ( clsConnections, 1 )
```

msgConnectionsGetState:

Gets the specified states in the service.

Takes P_CONNECTIONS_STATE, returns STATUS.

```
#define msgConnectionsGetState          MakeMsg ( clsConnections, 2 )
```

Message Arguments

```
typedef struct CONNECTIONS_STATE {
    BOOLEAN                         attached;           // Attached
    CONNECTIONS_CONNECT_STATE       connectMores;       // How to attach
    CONNECTIONS_WARNINGS            connectWarning;     // Level of warnings
    CONNECTIONS_PASSWORDS           connectPasswords;   // What passwords
    CONNECTIONS_PERMISSIONS         connectPermissions; // What permissions
    U32                             reserved[4];
} CONNECTIONS_STATE, * P_CONNECTIONS_STATE;
```

msgConnectionsEnumerateItems:

Gets a list of the network items, per restrictions.

Takes P_CONNECTIONS_ENUMERATE, returns STATUS.

```
#define cnctAttribMatchLocation     flag0       // Match on location
#define cnctAttribMatchServer       flag1       // Match on server
#define cnctAttribMatchConnect      flag2       // Match on connected state
#define cnctAttribMatchAutoConnect  flag3       // Match on auto-connect state
#define cnctAttribMatchMenu         flag4       // Match on menu
                                                // (remember) state
```

Arguments

```
typedef struct ATTRIB {
    U32             flags;          // various meanings -- complete match
                                    //    match at beginning, match at end
                                    // connected, auto connect, remember
    P_CHAR          restrictName;   // match this string
    // other possible characteristics -- type, characteristics, etc.
    P_UNKNOWN       matchID;        // restrict enumeration to this file
                                    // server
    TAG             tag;            // Tag to match against
} ATTRIB, * P_ATTRIB;
#define cnctFlagLocationsOnly       flag0       // Look only at locations
#define cnctFlagServersOnly         flag1       // Look only at servers
#define cnctFlagOKFreeCIFields      flag14      // Free the CI fields
#define cnctFlagOKFreeCI            flag15      // Free the CI
typedef struct CONNECTIONS_ENUMERATE {
    ATTRIB              attributes;
    U16                 count;  // in   = # of entries to return in list.
                                // out  = # of valid entries in list.
    U16                 next;   // in   = 0 to start at beginning
                                //        OR previous out value to pick up
                                //        where we left off.
    P_CONNECTIONS_ITEM  pEntry; // in   = pNull.
                                // out  = Link list of connections items.
    U16                 flags;  // in   = state flags to filter on.
                                // out  = free state
} CONNECTIONS_ENUMERATE, * P_CONNECTIONS_ENUMERATE;
#define msgConnectionsEnumerateItems        MakeMsg ( clsConnections, 3 )
```

msgConnectionsEnumerateServers:

Gets a list of the network servers, per restrictions.

Takes P_CONNECTIONS_ENUMERATE, returns STATUS.

```
#define msgConnectionsEnumerateServers      MakeMsg ( clsConnections, 4 )
```

Message Arguments

```
typedef struct CONNECTIONS_ENUMERATE {
    ATTRIB              attributes;
    U16                 count;  // in   = # of entries to return in list.
                                // out  = # of valid entries in list.
    U16                 next;   // in   = 0 to start at beginning
                                //        OR previous out value to pick up
                                //        where we left off.
    P_CONNECTIONS_ITEM  pEntry; // in   = pNull.
                                // out  = Link list of connections items.
    U16                 flags;  // in   = state flags to filter on.
                                // out  = free state
} CONNECTIONS_ENUMERATE, * P_CONNECTIONS_ENUMERATE;
```

Use CONNECTIONS_ITEM with restriction of **cnctFlagServersOnly.**

msgConnectionsEnumerateTags:

Gets a list of the known tags, per restrictions.

Takes P_CONNECTIONS_ENUMERATE, returns STATUS.

Arguments

```
typedef struct CONNECTIONS_TAG {
    TAG         tag;
} CONNECTIONS_TAG, * P_CONNECTIONS_TAG;
#define msgConnectionsEnumerateTags           MakeMsg ( clsConnections, 5 )
```

Message Arguments

```
typedef struct CONNECTIONS_ENUMERATE {
    ATTRIB              attributes;
    U16                 count;  // in   = # of entries to return in list.
                                // out  = # of valid entries in list.
    U16                 next;   // in   = 0 to start at beginning
                                //        OR previous out value to pick up
                                //        where we left off.
    P_CONNECTIONS_ITEM  pEntry; // in   = pNull.
                                // out  = Link list of connections items.
    U16                 flags;  // in   = state flags to filter on.
                                // out  = free state
} CONNECTIONS_ENUMERATE, * P_CONNECTIONS_ENUMERATE;
```

msgConnectionsGetNetworkView:

Each service is required to provide a window, which will be a client of a scrollwin, which will be set as the current (active) window when the network view is invoked. This window will be able to make use of **msgConnections** calls to manipulate attachments, et al.

Takes P_WIN, returns STATUS.

```
#define msgConnectionsGetNetworkView          MakeMsg ( clsConnections, 6 )
```

msgConnectionsCompareItems:

Compares two **pItemID** values to see if they refer to the same item.

Takes P_CONNECTIONS_COMPARE, returns STATUS.

Arguments

```
typedef struct CONNECTIONS_COMPARE {
    P_UNKNOWN       item1;          // First item
    P_UNKNOWN       item2;          // Second item
    BOOLEAN         same;           // Out:  Are they the same?
    U32             forPublicUse;   // if any one needs this
} CONNECTIONS_COMPARE, * P_CONNECTIONS_COMPARE;
#define msgConnectionsCompareItems          MakeMsg ( clsConnections, 10 )
```

msgConnectionsTagItem:

Tags the indicated item.

Takes P_CONNECTIONS_TAG_ITEM, returns STATUS.

Arguments

```
typedef struct CONNECTIONS_TAG_ITEM {
    TAG             tag;                // Tag to set
    U32             flags;              // Type
    P_UNKNOWN       netAddress;         // Item's address
    U32             userInformation;
} CONNECTIONS_TAG_ITEM, * P_CONNECTIONS_TAG_ITEM;
#define msgConnectionsTagItem                  MakeMsg ( clsConnections, 11 )
```

msgConnectionsGetServiceInfo:

Gets the service name and other information.

Takes P_CONNECTIONS_SERVICE_INFO, returns STATUS.

Arguments

```
typedef struct CONNECTIONS_SERVICE_INFO {
    CHAR            serviceName[nameBufLength];     // Service name
    U16             reserved:15,
                    uiProvided:1;                   // User interface provided
    U32             filler[2];
} CONNECTIONS_SERVICE_INFO, * P_CONNECTIONS_SERVICE_INFO;
#define msgConnectionsGetServiceInfo           MakeMsg ( clsConnections, 12 )
```

msgConnectionsGetItemInfo:

Gets information for the specified item, specific to the service.

Takes P_UNKNOWN, returns STATUS.

```
#define msgConnectionsGetItemInfo          MakeMsg ( clsConnections, 13 )
```

msgConnectionsSetConnectionsApp:

Passes the connections notebook app object to the service.

Takes OBJECT, returns STATUS.

```
#define msgConnectionsSetConnectionsApp    MakeMsg ( clsConnections, 14 )
```

msgConnectionsUpdate:

Requests an update of the current network state.

Takes nothing, returns STATUS.

```
#define msgConnectionsUpdate       MakeMsg ( clsConnections, 15 )
```

msgConnectionsExpandCollapse:

Requests an expand/collapse (depending on the argument) of the current view of the network.

Takes BOOLEAN, returns STATUS.

```
#define msgConnectionsExpandCollapse    MakeMsg ( clsConnections, 16 )
```

msgConnectionsConnectItem:

Connect the specified item.

Takes P_CONNECTIONS_REQUEST, returns STATUS.

Arguments

```
typedef struct CONNECTIONS_REQUEST {
    P_UNKNOWN           pItemID;            // Item to connect
    U32                 response;
} CONNECTIONS_REQUEST, * P_CONNECTIONS_REQUEST;
#define msgConnectionsConnectItem               MakeMsg ( clsConnections, 17 )
```

msgConnectionsUnconnectItem:

Unconnect the specified item.

Takes P_CONNECTIONS_REQUEST, returns STATUS.

```
#define msgConnectionsUnconnectItem             MakeMsg ( clsConnections, 18 )
```

Message Arguments

```
typedef struct CONNECTIONS_REQUEST {
    P_UNKNOWN           pItemID;            // Item to connect
    U32                 response;
} CONNECTIONS_REQUEST, * P_CONNECTIONS_REQUEST;
```

msgConnectionsRememberItem:

Remember the specified item.

Takes P_CONNECTIONS_REQUEST, returns STATUS.

```
#define msgConnectionsRememberItem              MakeMsg ( clsConnections, 19 )
```

Message Arguments

```
typedef struct CONNECTIONS_REQUEST {
    P_UNKNOWN           pItemID;            // Item to connect
    U32                 response;
} CONNECTIONS_REQUEST, * P_CONNECTIONS_REQUEST;
```

msgConnectionsForgetItem:

Forget the specified item.

Takes P_CONNECTIONS_REQUEST, returns STATUS.

```
#define msgConnectionsForgetItem                MakeMsg ( clsConnections, 20 )
```

Message Arguments

```
typedef struct CONNECTIONS_REQUEST {
    P_UNKNOWN           pItemID;            // Item to connect
    U32                 response;
} CONNECTIONS_REQUEST, * P_CONNECTIONS_REQUEST;
```

msgConnectionsAutoConnectItem:

Sets the auto connect state on for the specified item.

Takes P_CONNECTIONS_REQUEST, returns STATUS.

```
#define msgConnectionsAutoConnectItem           MakeMsg ( clsConnections, 21 )
```

Message Arguments

```
typedef struct CONNECTIONS_REQUEST {
    P_UNKNOWN           pItemID;            // Item to connect
    U32                 response;
} CONNECTIONS_REQUEST, * P_CONNECTIONS_REQUEST;
```

msgConnectionsUnAutoConnectItem:

Sets the auto connect state off for the specified item.

Takes P_CONNECTIONS_REQUEST, returns STATUS.

```
#define msgConnectionsUnAutoConnectItem        MakeMsg ( clsConnections, 22 )
```

Message Arguments

```
typedef struct CONNECTIONS_REQUEST {
   P_UNKNOWN          pItemID;           // Item to connect
   U32                response;
} CONNECTIONS_REQUEST, * P_CONNECTIONS_REQUEST;
```

msgConnectionsAddSheet:

Permits items on the connections to add items to the contents.

Takes OBJECT, returns STATUS.

```
#define msgConnectionsAddSheet                 MakeMsg ( clsConnections, 23 )
```

msgConnectionsAddCards:

Sent to network views, when they are not the foremost view, to run the option protocol.

Takes P_OPTION_TAG, returns STATUS.

```
#define msgConnectionsAddCards                 MakeMsg ( clsConnections, 24 )
```

msgConnectionsSetSelection:

Sent by the connections notebook to the appropriate service, informing the service what the currently selected item is.

Takes P_UNKNOWN, returns STATUS.

```
#define msgConnectionsSetSelection             MakeMsg ( clsConnections, 25 )
```

msgConnectionsGetTopCard:

Sent by the connections notebook to the appropriate service, inquiring of that service what the appropriate top card is to be.

Takes P_TAG, returns STATUS.

```
#define msgConnectionsGetTopCard               MakeMsg ( clsConnections, 26 )
```

msgConnectionsStartConversation:

Sent by the Connections Notebook to the appropriate service, informing that service that the Connections Notebook is planning on conversing with it. This message will be sent at first page turn and at restore (of the Connections Notebook) time.

Takes nothing, returns STATUS.

```
#define msgConnectionsStartConversation        MakeMsg ( clsConnections, 27 )
```

msgConnectionsEndConversation:

Sent by the Connections Notebook to the appropriate service, informing that service that the Connections Notebook is stopping conversing with it. This message will be sent at save (of the Connections Notebook) time.

Takes nothing, returns STATUS.

```
#define msgConnectionsEndConversation          MakeMsg ( clsConnections, 28 )
```

msgConnectionsIsParent:

Compares two **pItemID** values to see if item1 is a parent of item2.

Takes P_CONNECTIONS_COMPARE, returns STATUS.

```
#define msgConnectionsIsParent                 MakeMsg ( clsConnections, 31 )
```

Message Arguments

```
typedef struct CONNECTIONS_COMPARE {
    P_UNKNOWN       item1;          // First item
    P_UNKNOWN       item2;          // Second item
    BOOLEAN         same;           // Out:  Are they the same?
    U32             forPublicUse;   // if any one needs this
} CONNECTIONS_COMPARE, * P_CONNECTIONS_COMPARE;
```

Notification Messages

msgConnectionsConnectedChanged:

Sent by the appropriate service, indicating when an item has been connected to or unconnected from.

Takes P_CONNECTIONS_NOTIFY, returns STATUS.

```
#define msgConnectionsConnectedChanged         MakeMsg ( clsConnections, 7 )
```

Arguments

```
typedef struct CONNECTIONS_NOTIFY {
    OBJECT              manager;        // manager that sent notification
    IM_HANDLE           handle;         // handle to service
    OBJECT              service;        // service that sent notification
    P_UNKNOWN           pItemID;        // pointer to affected item
    U16                 reserved:13,
                        server:1,       // Unused
                        uiProvided:1,   // Unused
                        state:1;        // connected or unconnected
    U16                 notifyLength;   // Length of notify info which follows
} CONNECTIONS_NOTIFY, * P_CONNECTIONS_NOTIFY;
```

msgConnectionsAutoConnectChanged:

Sent by the appropriate service, indicating when an item has had the auto connect state set or turned off for it.

Takes P_CONNECTIONS_NOTIFY, returns STATUS.

```
#define msgConnectionsAutoConnectChanged       MakeMsg ( clsConnections, 8 )
```

Message Arguments

```
typedef struct CONNECTIONS_NOTIFY {
    OBJECT              manager;        // manager that sent notification
    IM_HANDLE           handle;         // handle to service
    OBJECT              service;        // service that sent notification
    P_UNKNOWN           pItemID;        // pointer to affected item
    U16                 reserved:13,
                        server:1,       // Unused
                        uiProvided:1,   // Unused
                        state:1;        // connected or unconnected
    U16                 notifyLength;   // Length of notify info which follows
} CONNECTIONS_NOTIFY, * P_CONNECTIONS_NOTIFY;
```

msgConnectionsRememberChanged:

Sent by the appropriate service, indicating when an item has had the remember state set or turned off for it.

Takes P_CONNECTIONS_NOTIFY, returns STATUS.

```
#define msgConnectionsRememberChanged          MakeMsg ( clsConnections, 9 )
```

Message Arguments

```
typedef struct CONNECTIONS_NOTIFY {
    OBJECT              manager;        // manager that sent notification
    IM_HANDLE           handle;         // handle to service
    OBJECT              service;        // service that sent notification
    P_UNKNOWN           pItemID;        // pointer to affected item
    U16                 reserved:13,
                        server:1,       // Unused
                        uiProvided:1,   // Unused
                        state:1;        // connected or unconnected
    U16                 notifyLength;   // Length of notify info which follows
} CONNECTIONS_NOTIFY, * P_CONNECTIONS_NOTIFY;
```

msgConnectionsItemChanged:

Sent by the appropriate service, indicating when an item has been noticed or lost.

Takes P_CONNECTIONS_NOTIFY, returns STATUS.

```
#define msgConnectionsItemChanged              MakeMsg ( clsConnections, 30 )
```

Message Arguments

```
typedef struct CONNECTIONS_NOTIFY {
    OBJECT              manager;        // manager that sent notification
    IM_HANDLE           handle;         // handle to service
    OBJECT              service;        // service that sent notification
    P_UNKNOWN           pItemID;        // pointer to affected item
    U16                 reserved:13,
                        server:1,       // Unused
                        uiProvided:1,   // Unused
                        state:1;        // connected or unconnected
    U16                 notifyLength;   // Length of notify info which follows
} CONNECTIONS_NOTIFY, * P_CONNECTIONS_NOTIFY;
```

msgConnectionsServiceChanged:

Sent by the appropriate service, indicating when it is available for use or unavailable.

Takes P_CONNECTIONS_NOTIFY, returns STATUS.

```
#define msgConnectionsServiceChanged               MakeMsg ( clsConnections, 32 )
```

Message Arguments

```
typedef struct CONNECTIONS_NOTIFY {
    OBJECT              manager;        // manager that sent notification
    IM_HANDLE           handle;         // handle to service
    OBJECT              service;        // service that sent notification
    P_UNKNOWN           pItemID;        // pointer to affected item
    U16                 reserved:13,
                        server:1,       // Unused
                        uiProvided:1,   // Unused
                        state:1;        // connected or unconnected
    U16                 notifyLength;   // Length of notify info which follows
} CONNECTIONS_NOTIFY, * P_CONNECTIONS_NOTIFY;
```

DIALENV.H

This file contains the API for **clsDialEnv**, **clsDialEnvOptCard**, and **clsDialEnvField**.

clsDialEnv inherits from **clsService.**

clsDialEnv maintains telephone dialing related information pertinent to a specific geographic location/environment.

The intent of **clsDialEnv** is to relieve client data communication programs of having to replicate the code for maintaining their own seperate telephone dialing-related data and logic. **clsDialEnv** is designed to provide the "intelligence" and data needed for dialing from/to a variety of environments (to/from local in-house to/from international).

==

clsDialEnvOptCard inherits from **clsCustomLayout.**

clsDialEnvOptCard provides a default behavior of observing the dialing environment and refreshing dialing environment option cards when the dialing environment changes.

==

clsDialEnvField inherits from **clsField.**

clsDialEnvField alters the a default behavior of ancestor **clsField** by specifying a character list template for coercing its field input.

Dialing environments are a location type service and therefore managed by a service manager called **theLocations.** Each instance of a dialing environment is identified by the name of a location to which the dialing environment pertains (NOTE: for PenPoint 1.0 there is only a single location/dialing environment). Objects wishing to communicate with a dialing environment do so by sending messages to the current location service. The UID of the current location is obtained by querying **theLocations** via standard install manager and service manager messages. The following block of code provides one example of how a client might obtain dialing environment data.

```
{
    OBJECT          handleCurrentLoc,
                    theCurrentLocation;
    SM_QUERY_LOCK   lock;
    SM_QUERY_UNLOCK unlock;
    DIALENV_COUNTRY country;
    IM_GET_SET_NAME getName;
    CHAR            locationName[nameBufLength];
    //
    //  Get the handle and UID of the current location.
    //  Lock the current location to guarantee exclusive access to
    //    location data.
    //  Get the country code for the current location (from the dialing
    //    environment for the current location).
    //  Unlock the current location so that other clients may access it.
    //  Get the name of the current location.
    //
    ObjCallJmp(msgIMGetCurrent, theLocations, &handleCurrentLoc, s, Problem);
    lock.handle = unlock.handle = handleCurrentLoc;
```

```
        ObjCallJmp(msgSMQueryLock, theLocations, &lock, s, Problem);
        theCurrentLocation = lock.service;
        ObjCallJmp(msgDialEnvGetCountry, theCurrentLocation, &country, s, Problem);
        ObjectCall(msgSMQueryUnlock, theLocations, &unlock);
        getName.handle = handleCurrentLoc;
        getName.pName = locationName;
        ObjCallJmp(msgIMGetName, theLocations, &getName, s, Problem);
    }
```

For PenPoint 1.0 an application or service requiring dialing environment services should install the dialing environment dll via a SERVICE.INI file.

**** Future Direction Ideas ****

In a future release of PenPoint, dialing environments will be subsumed by a location service. The location service will manage all of the objects which provide location-dependent behavior to the PenPoint environment/applications. Current plans are for the user to access location services via the configuration notebook. Because dialing environments will be a constituent of a location service it won't be necessary for a dialing environment to be included by an application's or service's SERVICE.INI file.

The location service will maintain the list of locations the user has created (GO may ship pre-configured locations; however a user will be able to create and modify locations). A user will select a location by name, and all of the unique properties regarding that location will take effect.

For each location there may be a dialing environment. Thus, whenever the user selects a new location, a different dialing environment may take effect (it is possible that two different locations will share the same dialing environment, or that a location doesn't have a dialing environment). When a user creates a new location, the user will be given the opportunity to specify a dialing environment for the new location, or to select one of the currently available dialing environments and bind it to the new location.

The dialing environment will be enhanced to provide clients with information regarding valid city/area codes and dialing rules for specific countries. This information can be presented to the user for UI pick-lists, used to coerce input to only valid combinations of codes, and to enforce the rules which national telephone systems impose on computer software which interacts with the public telephone system.

**** End of Future Direction Ideas ****

clsDialEnvOptCard provides a default behavior of observing the dialing environment and refreshing dialing environment option cards when the dialing environment changes. A client needn't provide any special code support to have such option cards track dialing environment changes. Note: A client shouldn't insert a dialing environment option card into an option sheet or any window tree with a modal filter (e.g. option sheet with a style modality set to either **osModalApp** or **osModalSystem**).

The following block of code provides one example of creating a dialing environment option card.

```
    {
        //
        //  Create an option card for dialing environment settings.
        //
        STATUS                  s;
        DIALENV_OPTCARD_NEW     don;
        OBJECT                  handleCurrentLoc;
        IM_GET_SET_NAME         getName;
        CHAR                    locationName[nameBufLength];
        //
        //  Get the handle and name of the current location. Create
        //    a dialing environment option card for the current location.
        //
        ObjCallRet(msgIMGetCurrent, theLocations, &handleCurrentLoc, s);
        getName.handle = handleCurrentLoc;
        getName.pName = locationName;
        ObjCallRet(msgIMGetName, theLocations, &getName, s);
        ObjCallRet(msgNewDefaults, clsDialEnvOptCard, &don, s);
        don.win.tag = tagDialEnvOptionCard;
        strcpy(don.dialenvOptCard.dialEnv.name, locationName);
        ObjCallRet(msgNew, clsDialEnvOptCard, &don, s);
    }
```

clsDialEnvField alters the a default behavior of ancestor **clsField** by specifying a character list template for coercing its field input.

Defined within this header file.

- defines and typedefs for dial environment data. function prototypes. messages & status values.

```
#ifndef DIALENV_INCLUDED
#define DIALENV_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef SERVICE_INCLUDED
#include <service.h>
#endif
#ifndef CLAYOUT_INCLUDED
#include <clayout.h>
#endif
#ifndef FIELD_INCLUDED
#include <field.h>
#endif
```

Defines and typedefs

Class UIDs for:

clsDialEnv	The dialing environment service.
clsDialEnvOptCard	Dialing environment option cards.
clsDialEnvField	Field for entering and coercing dialing codes/numbers.
theLocations	Service manager for dialing environments.

```
#define clsDialEnv                MakeWKN(2576,1,wknGlobal)
#define clsDialEnvOptCard         MakeWKN(2577,1,wknGlobal)
#define clsDialEnvField           MakeWKN(2578,1,wknGlobal)
#define theLocations              MakeWKN(2579,1,wknGlobal)
```

Dialing Environment Quick Help.

- Quick help is stored in **clsDialEnv** resource list 0.
- Each quick help entry is located by its index/positionwithin resource list 0.

```
#define resListDialEnvQHelp       0
#define MakeDialEnvQHelpResId(x)  MakeIndexedResId(clsDialEnv,resListDialEnvQHelp,x)
#define tagDialEnvOptCard         MakeTag(clsDialEnv, 1)
#define hlpDialEnvOptCard         MakeDialEnvQHelpResId(0)
#define tagDialEnvDialEnvTable    MakeTag(clsDialEnv, 17)
#define hlpDialEnvDialEnv         MakeDialEnvQHelpResId(0)
```

```
#define tagDialEnvCurrentLocLabel    MakeTag(clsDialEnv, 18)
#define tagDialEnvCurrentLocTable    MakeTag(clsDialEnv, 19)
#define hlpDialEnvCurrentLoc         MakeDialEnvQHelpResId(6)
#define tagDialEnvDialLabel          MakeTag(clsDialEnv, 24)
#define tagDialEnvDial               MakeTag(clsDialEnv, 25)
#define tagDialEnvDialTone           MakeTag(clsDialEnv, 26)
#define tagDialEnvDialPulse          MakeTag(clsDialEnv, 27)
#define hlpDialEnvDial               MakeDialEnvQHelpResId(7)
#define tagDialEnvAreaCityLabel      MakeTag(clsDialEnv, 32)
#define tagDialEnvAreaCity           MakeTag(clsDialEnv, 33)
#define hlpDialEnvAreaCity           MakeDialEnvQHelpResId(9)
#define tagDialEnvCountryLabel       MakeTag(clsDialEnv, 40)
#define tagDialEnvCountry            MakeTag(clsDialEnv, 41)
#define hlpDialEnvCountry            MakeDialEnvQHelpResId(8)
#define tagDialEnvOutsideLineLabel   MakeTag(clsDialEnv, 48)
#define tagDialEnvOutsideLine        MakeTag(clsDialEnv, 49)
#define hlpDialEnvOutsideLine        MakeDialEnvQHelpResId(1)
#define tagDialEnvLongDistLabel      MakeTag(clsDialEnv, 56)
#define tagDialEnvLongDist           MakeTag(clsDialEnv, 57)
#define hlpDialEnvLongDist           MakeDialEnvQHelpResId(2)
#define tagDialEnvIntlAccessLabel    MakeTag(clsDialEnv, 64)
#define tagDialEnvIntlAccess         MakeTag(clsDialEnv, 65)
#define hlpDialEnvIntlAccess         MakeDialEnvQHelpResId(3)
#define tagDialEnvSuffixLabel        MakeTag(clsDialEnv, 72)
#define tagDialEnvSuffix             MakeTag(clsDialEnv, 73)
#define hlpDialEnvSuffix             MakeDialEnvQHelpResId(4)
#define tagDialEnvMacroCodesLabel    MakeTag(clsDialEnv, 80)
#define tagDialEnvMacroCodes         MakeTag(clsDialEnv, 81)
#define hlpDialEnvMacroCodes         MakeDialEnvQHelpResId(5)
#define tagDialEnvSetCodes           MakeTag(clsDialEnv, 82)
#define tagDialEnvMacroCodeALabel    MakeTag(clsDialEnv, 83)
#define tagDialEnvMacroCodeA         MakeTag(clsDialEnv, 84)
#define tagDialEnvMacroCodeBLabel    MakeTag(clsDialEnv, 85)
#define tagDialEnvMacroCodeB         MakeTag(clsDialEnv, 86)
#define tagDialEnvMacroCodeCLabel    MakeTag(clsDialEnv, 87)
#define tagDialEnvMacroCodeC         MakeTag(clsDialEnv, 88)
#define tagDialEnvMacroCodeDLabel    MakeTag(clsDialEnv, 89)
#define tagDialEnvMacroCodeD         MakeTag(clsDialEnv, 90)
#define tagDialEnvMacroCodesFrame    MakeTag(clsDialEnv, 91)
#define deMaxMacroCodes              4
```

Exported function prototypes from dialenv.dll

None currently defined.

Message definitions

NOTE msg #1 is reserved for private use.

Observer Notification Messages

msgDialEnvChanged

Notification sent to observers to indicate a dialing environment change.

Takes OBJECT, returns STATUS. Category: observer notification.

```
#define msgDialEnvChanged                MakeMsg(clsDialEnv, 2)
```

Comments

The **pArgs** indicates the object which initiated the change to the dialing environment. **pArgs** of **objNull** indicates that the dialing environment is being destroyed.

Observers which receive this message should refresh any local dialing environment information or view of such information.

Error Return Values: N/A.

Action Messages

msgDialEnvGetCountry

Passes back the country code from the current dialing environment.

Takes P_DIALENV_COUNTRY, returns STATUS. Category: service action request.

```
#define msgDialEnvGetCountry                MakeMsg(clsDialEnv, 3)
```

Arguments

```
typedef struct DIALENV_COUNTRY
{
    CHAR    symbols[lenDialEnvCountry+1];
} DIALENV_COUNTRY, *P_DIALENV_COUNTRY;
```

Comments

Error Return Values: none, always returns **stsOK**.

msgDialEnvIsCountryNorthAmerican

Indicates whether or not the specified country code is North American.

Takes P_DIALENV_COUNTRY, returns STATUS. Category: service action request.

```
#define msgDialEnvIsCountryNorthAmerican    MakeMsg(clsDialEnv, 6)
```

Message Arguments

```
typedef struct DIALENV_COUNTRY
{
    CHAR    symbols[lenDialEnvCountry+1];
} DIALENV_COUNTRY, *P_DIALENV_COUNTRY;
```

Comments

NOTES: This message is provided so a client may alter its UI and/or enforce editing rules unique to North American phone numbers.

Returns **stsOK** if the specified country is North American, otherwise **stsDialEnvNoMatch**.

msgDialEnvGetEnvironment

Passes back the current dialing environment settings.

Takes P_DIALENV_ENVIRONMENT, returns STATUS. Category: service action request.

```
#define msgDialEnvGetEnvironment            MakeMsg(clsDialEnv, 4)
typedef TAG             DIALENV_DIAL_MODE;
#define deTone          tagDialEnvDialTone      // Touch tone dialing.
#define dePulse         tagDialEnvDialPulse     // Pulse code dialing.
```

Arguments

```
typedef struct DIALENV_OUTSIDE_LINE
{
    CHAR    symbols[lenDialEnvOutsideLine+1];
} DIALENV_OUTSIDE_LINE, *P_DIALENV_OUTSIDE_LINE;
typedef struct DIALENV_AREA_CITY
{
    CHAR    symbols[lenDialEnvAreaCity+1];
} DIALENV_AREA_CITY, *P_DIALENV_AREA_CITY, **PP_DIALENV_AREA_CITY;
```

```
typedef struct DIALENV_INTL_ACCESS
{
    CHAR    symbols[lenDialEnvIntlAccess+1];
} DIALENV_INTL_ACCESS, *P_DIALENV_INTL_ACCESS;
typedef struct DIALENV_LONG_DIST
{
    CHAR    symbols[lenDialEnvLongDist+1];
} DIALENV_LONG_DIST, *P_DIALENV_LONG_DIST;
```

Symbols appended to a dialing string. Typicallyfor credit card billing/call accounting purposes.

```
typedef struct DIALENV_SUFFIX
{
    CHAR    symbols[lenDialEnvSuffix+1];
} DIALENV_SUFFIX, *P_DIALENV_SUFFIX;
```

Multi-purpose codes for specifying credit card #s, accountbilling codes, or altering environment dependent behavior. When a client requests to build a dial string, the symbols from a macro code get expanded into the resultant dial string.

```
typedef struct DIALENV_MACRO_CODE
{
    CHAR    symbols[lenDialEnvMacroCode+1];
} DIALENV_MACRO_CODE, *P_DIALENV_MACRO_CODE;
typedef struct  DIALENV_ENVIRONMENT
{
    DIALENV_DIAL_MODE   dialMode;       // Dial mode (tone/pulse).
    DIALENV_OUTSIDE_LINE outsideLine;   // Outside line/net access.
    DIALENV_AREA_CITY   areaCity;       // Area/City call originates from.
    DIALENV_COUNTRY     country;        // Country call originates from.
    DIALENV_INTL_ACCESS intlAccess;     // International access code.
    DIALENV_LONG_DIST   longDist;       // Long distance access code.
    DIALENV_SUFFIX      suffix;         // Suffix applied to dial strings.
    DIALENV_MACRO_CODE  macroCode[numDialEnvMacroCodes];// Macro/expand codes.
} DIALENV_ENVIRONMENT, *P_DIALENV_ENVIRONMENT;
```

Comments

Error Return Values: none, always returns **stsOK**.

Symbols prefixed to a dialing string to gainaccess to the general switched telephone network.

msgDialEnvBuildDialString

Construct a dial string based upon the current dialing environment.

Takes **P_DIALENV_BUILD_DIALSTR**, returns **STATUS**. Category: service action request.

```
#define msgDialEnvBuildDialString          MakeMsg(clsDialEnv, 5)
```

Arguments

```
typedef struct  DIALENV_TELEPHONE_NUMBER
{
    CHAR    country[lenDialEnvCountry+1];       // Cntry call originates from.
    CHAR    areaCity[lenDialEnvAreaCity+1];     // Area/City call origs from.
    CHAR    teleNumber[lenDialEnvTeleNumber+1]; // Destination telephone #.
    CHAR    postConnect[lenDialEnvPostConnect+1];//Post connect destination
                                                //   network navigation code.
} DIALENV_TELEPHONE_NUMBER, *P_DIALENV_TELEPHONE_NUMBER;
```

The resultant string of symbols a dialer sends to either **clsModem**,the phone network, or another server which performs the dialing.

```
typedef struct DIALENV_DIAL_STRING
{
    CHAR    symbols[lenDialEnvDialString+1];
} DIALENV_DIAL_STRING, *P_DIALENV_DIAL_STRING;
```

```
typedef struct  DIALENV_BUILD_DIALSTR
{
   P_DIALENV_TELEPHONE_NUMBER  pTeleNumber;     // In:  Raw tele # to dial.
   P_DIALENV_DIAL_STRING       pDialString;     // Out: Resultant dial str.
} DIALENV_BUILD_DIALSTR, *P_DIALENV_BUILD_DIALSTR;
```

Comments

NOTE: The order in which macro codes are processed is significant. All like macro codes are expanded before the next macro code is expanded. Thus if expansion of macro code N results in symbols for a subsequent macro code (e.g. N+1) to be inserted into the dial string, such symbols will be interpretted as and expanded as macro codes.

Error Return Values: **stsDialEnvDialStrTooLarge**

Class Messages

msgNew

Creates an instance of a dialing environment.

Takes P_DIALENV_NEW, returns STATUS. Category: class message.

```
typedef DIALENV_ENVIRONMENT DIALENV_NEW_ONLY, *P_DIALENV_NEW_ONLY;
#define dialenvNewFields    \
        serviceNewFields    \
        DIALENV_NEW_ONLY    dialEnv;
```

Arguments

```
typedef struct DIALENV_NEW
{
   dialenvNewFields
} DIALENV_NEW, *P_DIALENV_NEW;
```

Comments

Error Return Values: percolated up from other classes, none from **clsDialEnv**.

msgNewDefaults

Initializes the DIALENV_NEW structure to default values.

Takes P_DIALENV_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct DIALENV_NEW
{
   dialenvNewFields
} DIALENV_NEW, *P_DIALENV_NEW;
```

Comments

Sets:

```
pArgs->svc.style.waitForTarget  =
pArgs->svc.style.exclusiveOpen  =
pArgs->svc.style.autoOwnTarget  =
pArgs->svc.style.autoOpen       =
pArgs->svc.style.autoMsgPass    =
pArgs->svc.style.checkOwner     = false;
pArgs->svc.pManagerList         = pManagerList; // theLocations
pArgs->svc.numManagers          = 1;
memset(&(pArgs->dialEnv), 0, sizeof(pArgs->dialEnv));
pArgs->dialEnv.dialMode = deTone;       // Tone dialing.
                                        // All remaining struct dialEnv
                                        //  fields are set to zero/null.
```

Error Return Values: percolated up from other classes, none from **clsDialEnv**.

msgDialEnvGetMacroIds

Passes back a string of symbols which identify dialing macro codes.

Takes P_DIALENV_MACRO_IDS, returns STATUS. Category: class message.

```
#define msgDialEnvGetMacroIds              MakeMsg(clsDialEnv, 6)
```

Arguments

```
typedef struct DIALENV_MACRO_IDS
{
    CHAR    symbols[numDialEnvMacroCodes+1];
} DIALENV_MACRO_IDS, *P_DIALENV_MACRO_IDS;
```

Comments

Error return values: percolated up from other classes, none from **clsDialEnv**.

clsDialEnv non-error status values

None currently defined

clsDialEnv error status values

The request sent to the dialing environment has been denied because the request isn't supported by this dialing environment.

```
#define stsDialEnvRequestDenied            MakeStatus(clsDialEnv, 1)
```

The request sent to the dialing environment specified an invalid country code.

```
#define stsDialEnvInvalidCountry           MakeStatus(clsDialEnv, 2)
```

The request sent to the dialing environment contained data which didn't match the specified constraints.

```
#define stsDialEnvNoMatch                  MakeStatus(clsDialEnv, 3)
```

The dial string resulting from **msgDialEnvBuildDialString** is too large to be contained within struct DIALENV_DIAL_STRING.

```
#define stsDialEnvDialStrTooLarge          MakeStatus(clsDialEnv, 4)
```

Message definitions ....

NOTE msg #1 reserved for private use.

Action Messages

msgDialEnvOptCardRefresh

Refreshes a dialing environment option card (self) with the current dialing environment settings.

Takes nothing, returns STATUS. Category: action request.

```
#define msgDialEnvOptCardRefresh           MakeMsg(clsDialEnvOptCard,  2)
```

Comments

A client should send **msgDialEnvOptCardRefresh** to a dialing environment option card when it receives **msgOptionRefreshCard** and the card tag matches that assigned to the dialing environment option card.

Error Return Values: percolated up from other classes, none from **clsDialEnv**.

msgDialEnvOptCardApply

Updates the dialing environment with current settings from a dialing environment option card (self).

Takes nothing, returns STATUS. Category: action request.

```
#define msgDialEnvOptCardApply              MakeMsg(clsDialEnvOptCard,  3)
```

Comments

A client should send **msgDialEnvOptCardApply** to a dialing environment option card when it receives **msgOptionApplyCard** and the card tag matches that assigned to the dialing environment option card.

Error Return Values: percolated up from other classes, none from **clsDialEnv**.

Class Messages

msgNew

Creates an instance of a dialing environment option card.

Takes P_DIALENV_OPTCARD_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct LOCATION_NAME
{
    CHAR            name[nameBufLength];    // Name of a location.
} LOCATION_NAME, *P_LOCATION_NAME;
                                            // Name of a dialing environment.
typedef LOCATION_NAME   DIALENV_NAME, *P_DIALENV_NAME;
typedef struct DIALENV_OPTCARD_NEW_ONLY
{
    DIALENV_NAME    dialEnv;                // Name of DialEnv supplying info.
    U32             spare1;                 // unused (reserved).
    U32             spare2;                 // unused (reserved).
} DIALENV_OPTCARD_NEW_ONLY, *P_DIALENV_OPTCARD_NEW_ONLY;
#define dialenvOptCardNewFields \
    customLayoutNewFields       \
    DIALENV_OPTCARD_NEW_ONLY    dialenvOptCard;
typedef struct DIALENV_OPTCARD_NEW
{
    dialenvOptCardNewFields
} DIALENV_OPTCARD_NEW, *P_DIALENV_OPTCARD_NEW;
```

Comments

A client may add the dialing environment option card to its stack of of option cards, and create it in reponse to **msgOptionProvideCard** via this message. Clients may create multiple cards and insert them into any window. The cards needn't be part of an option card stack.

NOTES: It is possible for one or more clients to create multiple dial environment option cards. Because of this, dialing environment option cards observe the dialing environment. When the dialing environment changes, all dialing environment cards get refreshed with current dialing environment settings.

The requestor must fill in the **pArgs**->dialEnv with the name of the location which will supply the option card with dialing environment settings.

Error Return Values: percolated up from other classes, **stsDialEnvOptCardBadEnvironment**.

msgNewDefaults

Initializes the DIALENV_OPTCARD_NEW structure to default values.

Takes P_DIALENV_OPTCARD_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct DIALENV_OPTCARD_NEW
{
    dialenvOptCardNewFields
} DIALENV_OPTCARD_NEW, *P_DIALENV_OPTCARD_NEW;
```

Comments

Sets:

```
     memset(pArgs->dialenvOptCard.dialEnv.name, Nil(CHAR),
         sizeof(pArgs->dialenvOptCard.dialEnv.name));
```

clsDialEnvOptCard non-error status values

None currently defined

clsDialEnvOptCard error status values

An internal system error was encountered creating an instance of **clsDialEnvOptCard**.

```
#define stsDialEnvOptCardProblem            MakeStatus(clsDialEnvOptCard, 1)
```

The arguments specified via **msgNew** to **clsDialEnvOptCard** didn't specify a dialing environment (from which data for the option card is obtained).

```
#define stsDialEnvOptCardBadEnvironment     MakeStatus(clsDialEnvOptCard, 2)
```

An internal system error was encountered unfiling **clsDialEnvOptCard** from a resource file.

```
#define stsDialEnvOptCardBadResFile         MakeStatus(clsDialEnvOptCard, 3)
```

An internal system error was encountered when attempting to locate a window (containing option data) withing a dialing environment option card.

```
#define stsDialEnvOptCardNoSuchOption       MakeStatus(clsDialEnvOptCard, 4)
```

Message definitions

msgNew

Creates an instance of a dialing environment field.

Takes P_DIALENV_FIELD_NEW, returns STATUS. Category: class message.

```
#define dialenvFieldNewFields    \
    fieldNewFields
```

Arguments

```
typedef struct DIALENV_FIELD_NEW
{
    dialenvFieldNewFields
} DIALENV_FIELD_NEW, *P_DIALENV_FIELD_NEW;
```

Comments

clsDialEnvField logic within its **msgInit** method:

```
    DIALENV_MACRO_IDS   macroIds;
    CHAR                fieldCharList[20+numDialEnvMacroCodes+1];
    XTM_ARGS            template;
    P_STRING            fieldChars = "0123456789()-,*#;!";
```

```
//
//  If the client hasn't modified the default field template value,
//  establish a template to coerce dialing environment field input.
//
//  Query clsDialEnv to obtain the symbols identifying macro
//    codes. Append them to base dialing type characters.
//
if (pArgs->field.xlate.pTemplate == pNull  &&
    pArgs->field.style.xlateType == fstXlateTemplate)
{
    macroIds.symbols[0] = Nil(CHAR);
    ObjCallWarn(msgDialEnvGetMacroIds, clsDialEnv, &macroIds);
    strcpy(fieldCharList, fieldChars);
    strcat(fieldCharList, macroIds.symbols);
    template.xtmType = xtmTypeCharList; //  Char list type template.
    template.xtmMode = xtmModeDefault;  //  No special template mode.
    template.pXtmData = fieldCharList;  //  The character list.
    pArgs->field.xlate.pTemplate    = &template;
}
// Call our ancestor to create the object.
return ObjectCallAncestor(msg, self, pArgs, ctx);
```

Error Return Values: percolated up from other classes,

msgNewDefaults

Initializes the DIALENV_FIELD_NEW structure to default values.

Takes P_DIALENV_FIELD_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct DIALENV_FIELD_NEW
{
    dialenvFieldNewFields
} DIALENV_FIELD_NEW, *P_DIALENV_FIELD_NEW;
```

Comments

Sets:

```
//
//  Establish defaults for an instance of clsDialEnvField.
//
pArgs->field.style.veto         =
pArgs->field.style.noSpace      =
pArgs->field.style.upperCase    = true;
pArgs->field.style.xlateType    = fstXlateTemplate;
pArgs->field.xlate.pTemplate    = &template;
pArgs->label.style.numCols      =
pArgs->label.style.numRows      = lsNumAbsolute;
pArgs->label.cols               = 12;
pArgs->label.rows               = 1;
pArgs->border.style.edge        = bsEdgeBottom;
pArgs->border.style.topMargin   =
pArgs->border.style.bottomMargin= bsMarginMedium;
pArgs->border.style.borderInk   = bsInkGray66;
```

FLAP.H

This file contains the API definition for **clsFLAP**

clsFLAP inherits from **clsMILService**

This mil service provides the interface between the ALAP mil device and the rest of Penpoint. This interface allows for the configuring of the ALAP mil device and for PenTops networking using the ALAP mil device. The flap mil service will typically only be accessed by link level drivers since the mil service is responsible for providing the lowest levels of the PenTops protocol stack.

This mil service responds to the messages defined in the link.h header file. Refer to link.h for message definitions.

You access this mil service by using the standard service access techniques. These techniques are discribed in servmgr.h.

The flap mil service is a member of the 'theLinkHandlers' service manager.

```
#ifndef FLAP_INCLUDED
#define FLAP_INCLUDED
#ifndef MIL_SERVICE_INCLUDED
#include <milserv.h>
#endif
#ifndef LINK_INCLUDED
#include <link.h>
#endif
```

msgNew

creates a new flap object.

Takes P_FLAP_NEW, returns STATUS.

```
#define flapNewFields           \
    milServiceNewFields         \
```

Arguments

```
typedef struct FLAP_NEW {
    flapNewFields
} FLAP_NEW,  *P_FLAP_NEW;
STATUS EXPORTED ClsFLAPInit(void);
```

HSLINK.H

This file contains the definition and methods for **clsALAPHighSpeed**.

clsALAPHighSpeed inherits from **clsLink** (see link.h).

```
#ifndef HSLINK_INCLUDED
#define HSLINK_INCLUDED
#define alapHighSpeedNewFields serviceNewFields
typedef struct ALAP_HSLINK_NEW
{
    alapHighSpeedNewFields
} ALAP_HSLINK_NEW, *P_ALAP_HSLINK_NEW;
STATUS EXPORTED ClsALAPHSLinkInit(void);
```

HSPKT.H

This file contains the API definition for **clsHighSpeedPacket**.

clsHighSpeedPacket inherits from **clsService**.

Provides a high speed packet transfer API.

```
#ifndef HSPKT_INCLUDED
#define HSPKT_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef MILSERV_INCLUDED
#include <milserv.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef DVHSPKT_INCLUDED
#include <dvhspkt.h>
#endif
```

Common #defines and typedefs

```
typedef struct HS_PACKET_METRICS
{
    U16     version;                    // version number
    U16     status;                     // current status
    U32     asyncBaud;                  // baud rate for asynch serial mode
    U16     parConnectChar;             // connect character for connection
                                        // testing (parallel mode only!)
    U16     parConnectAckChar;          // character to return upon reception
                                        // of parConnectChar (parallel mode
                                        // only!)
    U16     leadInChar;                 // default lead in character
    U16     dataAckChar;                // default acknowledgement character
                                        // (return upon reception of 1st data
                                        // byte or of packet lead in character
                                        // if one is defined).
    MIL_HS_PACKET_DEVICE_TYPE deviceType;  // device type (see dvhspkt.h)
} HS_PACKET_METRICS, *P_HS_PACKET_METRICS;
typedef OBJECT                          HS_PACKET, *P_HS_PACKET;
#define stsHSPacketBusy                 MakeStatus(clsHighSpeedPacket, 1)
```

High Speed Packet Class Messages

msgHSPacketStatus

Returns the current status of the high speed packet device.

Takes P_HS_PACKET_STATUS, returns STATUS.

```
#define msgHSPacketStatus               MakeMsg(clsHighSpeedPacket, 3)
#define hsPktStsBusy                    flag0       // status
```

Arguments

```
typedef struct HS_PACKET_STATUS
{
    U16 status;
} HS_PACKET_STATUS, *P_HS_PACKET_STATUS;
```

msgHSPacketSendPacket

Sends one packet through high speed packet device.

Takes P_HS_PACKET_SEND_PACKET, returns STATUS.

```
#define msgHSPacketSendPacket              MakeMsg(clsHighSpeedPacket, 9)
```

Arguments

```
typedef struct HS_PACKET_SEND_PACKET
{
    P_UNKNOWN       pBuf;
    U32             numBytes;
    U16             firstByte;
} HS_PACKET_SEND_PACKET, *P_HS_PACKET_SEND_PACKET;
```

Comments

If **leadInChar** (in metrics) is zero, **firstByte** is used as lead in character. If both are zero, no lead in character is sent.

msgHSPacketSetCharHandler

Installs character receive handler.

Takes P_HS_PACKET_CHAR_HANDLER, returns STATUS.

```
#define msgHSPacketSetCharHandler          MakeMsg(clsHighSpeedPacket,10)
```

Arguments

Function Prototype

```
                                                  U32 userData);
typedef struct HS_PACKET_CHAR_HANDLER
{
    P_HS_PACKET_RX_HANDLER  pRxHandler;
    U32                     userData;
} HS_PACKET_CHAR_HANDLER, *P_HS_PACKET_CHAR_HANDLER;
```

Comments

HSPacket calls the user-defined function when a character is received. The called fucntion must collect the provided character and return either true if the packet is complete, false otherwise.

userData in HS_PACKET_RX_HANDLER is the user-provided **userData** U32 in HS_PACKET_CHAR_HANDLER.

If **leadInChar** (in metrics) is zero, the first character received is contained in both the **firstByte** and the **receivedByte** parameters to P_HS_PACKET_RX_HANDLER().

The received character handler will not be installed if one already is. See **msgHSPacketFreeCharHandler**.

The character handler is automatically freed when the service is closed.

msgHSPacketFreeCharHandler

Deinstalls a previously installed character receive handler.

Takes P_HS_PACKET_CHAR_HANDLER, returns STATUS.

```
#define msgHSPacketFreeCharHandler         MakeMsg(clsHighSpeedPacket,11)
```

Message Arguments

```
typedef struct HS_PACKET_CHAR_HANDLER
{
    P_HS_PACKET_RX_HANDLER  pRxHandler;
    U32                     userData;
} HS_PACKET_CHAR_HANDLER, *P_HS_PACKET_CHAR_HANDLER;
```

msgHSPacketEnable

Starts the continuous function which tests for connection and make ourselves "visible" to others.

Takes nothing, returns STATUS.

```
#define msgHSPacketEnable                    MakeMsg(clsHighSpeedPacket, 12)
```

msgHSPacketDisable

Stops the continuous function (started by **msgHSPacketEnable**) which tests for connection and become "invisible".

Takes nothing, returns STATUS.

```
#define msgHSPacketDisable                   MakeMsg(clsHighSpeedPacket, 13)
```

msgNew

Creates a new hspkt object.

Takes P_HS_PACKET_NEW, returns STATUS.

```
#define hspktNewFields      \
    milServiceNewFields
```

Arguments

```
typedef struct HS_PACKET_NEW {
    hspktNewFields
} HS_PACKET_NEW, *P_HS_PACKET_NEW;
```

Function prototypes

Function Prototype

```
STATUS EXPORTED ClsHSPacketInit(void);
```

INBXSVC.H

This file contains the API definition for **clsINBXService.**

clsINBXService inherits from **clsIOBXService.**

Provides default behavior for Inbox Services.

```
#ifndef INBXSVC_INCLUDED
#define INBXSVC_INCLUDED
#ifndef IOBXSVC_INCLUDED
#include <iobxsvc.h>
#endif
```

Introduction

In PenPoint, input operations are handled by a special class of services known as the "inbox services." While most input operations are triggered by an external event such as an incoming fax image from a remote fax machine, some input operations may require that the PenPoint computer be one that initiates the communication process. For example, a fax input service may wish to periodically "poll" a "store-and-forward" facility in order to receive a fax image. Thus, an inbox service implements the "deferred input" feature in PenPoint: This concept permits a user to specify input operations regardless of the readiness of input devices. If the input device (e.g., a data/fax modem, a LAN connection, etc.) is not available or not connected, the input process is deferred until the input device becomes ready.

Passive vs. Active Inbox Services

The simplest type of inbox services are those who passively wait for an input event to happen. That is, after the input operation is initiated by a remote agent such as a fax machine, the inbox service running on a PenPoint computer detects the input event and then receives the incoming data stream. This type of inbox services do not initiate an input operation by themselves. Typically, when such a service is enabled by the user, it simply becomes the owner of the I/O device. A simple fax inbox service, for example, becomes the owner of the fax modem and sets it up to start receiving fax images whenever a phone call comes in. While the inbox service owns the I/O device, no other services can transmit or receive data through the same device. (For more details on the notion of service ownership, see the service API in service.h.)

Some inbox services may want to actively "solicitate" input from a remote agent. For example, a service that queries a remote database will have to establish the communication link between the PenPoint computer and the remote database server. For this type of services, **clsINBXService** provides default behaviors to manage the state of the I/O device (connected or disconnected), the permission to initiate input operation (whether the service is enabled or disabled), as well as automatic polling behavior similar to that of an outbox service. Thus, the user can "defer" the input operation until it becomes possible to establish a communication link with a remote agent. See the API for **clsOBXService** for a detailed discussion of the deferred input/output protocol. Note, however, that to enable such outbox-like behavior, the polling flag must be turned on when the service is created. I.e., in **msgNewDefaults**, you should set

```
    pArgs->iobxsvc.in.autoPoll          = true;
```

Inbox Documents

Normally, documents can be automatically created in an inbox section as the end result of an input event. For example, a fax inbox section may create a document containing the fax images receieved in the fax modem. Such documents are normal PenPoint documents. Their contents have nothing to do with the input device or where the document came from.

Sometimes an inbox document contains not only data, but also some control information about the input operation to be performed. For example, taking advantage of the "deferred input" feature, the user may construct a specific query statement for an online database and put it into the appropriate inbox section before the PenPoint machine is physically connected to the remote database. When the input service becomes ready, the query statement is sent to the remote database, and the result is put into either another document or the same document containing the query statements. This type of inbox documents is very similar to the outbox document that controls the actual output operation. Again, for more information about the deferred input/output protocol, see obxsvc.h.

Note that the deferred I/O protocol implemented by **clsINBXService** assumes that an input operation is controlled by an inbox document: an assumption that may be too cumbersome and confusing for many services. If such is the case, an inbox service can simply store the input control information (e.g., a database query statement) with the service itself. When the service receives **msgINBXSvcPollDocuments**, it simply handles the input operation directly and bypasses the rest of the protocol.

Services that Handle Input and/or Output

clsINBXService deals only with input operations. For those services that want to handle output operations or both input and output at the same time, two other classes, **clsOBXService** and **clsIOBXService**, are provided by PenPoint. In fact, **clsINBXService** and **clsOBXService** are implemented as a subclass (hence a subset) of **clsIOBXService**.

Class Messages

msgNewDefaults

Initializes the P_INBXSVC_NEW structure to default values.

Takes P_INBXSVC_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct INBXSVC_NEW_ONLY {
    OBJECT  sectionClass;    // class of the inbox section
                             // This must be clsNBToc or a subclass of it.
    U32     unused1;
    U32     unused2;
    U32     unused3;
} INBXSVC_NEW_ONLY, *P_INBXSVC_NEW_ONLY;
#define inbxServiceNewFields \
    ioSvcNewFields          \
    INBXSVC_NEW_ONLY         inbxsvc;
typedef struct INBXSVC_NEW {
    inbxServiceNewFields
} INBXSVC_NEW, *P_INBXSVC_NEW;
```

Zeroes out **pArgs**->inbxsvc and sets...>iobxsvc.in.**autoPoll** = false;>inbxsvc.**sectionClass** = clsNBToc;

msgNew

Creates a new inbox service object.

Takes P_INBXSVC_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct INBXSVC_NEW {
    inbxServiceNewFields
} INBXSVC_NEW, *P_INBXSVC_NEW;
```

msgINBXSvcSwitchIcon

Toggles the inbox icon (to empty or filled) if neccessary.

Takes nothing, returns STATUS. Category: class message.

```
#define msgINBXSvcSwitchIcon                    msgIOBXSvcSwitchIcon
```

Comments

Check the content of the inbox notebook. Show the "filled" icon if any document is found. Show the "emtpy" icon otherwise.

msgINBXDocGetService

Gets the service name.

Takes P_INBX_DOC_GET_SERVICE, returns STATUS. Category: class message.

```
#define msgINBXDocGetService                    msgIOBXDocGetService
```

Arguments

```
typedef struct INBX_DOC_GET_SERVICE {
    OBJECT          document;               // In: document uid
    CHAR            svcName[nameBufLength]; // Out: service name
} INBX_DOC_GET_SERVICE, *P_INBX_DOC_GET_SERVICE;
```

Comments

Get the name of the service associated with an inbox document. If the document has not been placed into an inbox section, **stsFailed** is returned.

Note that the document must be at the top level of an inbox section. That is, if the document is embedded within another document, which is in an inbox section, **stsFailed** will be returned.

msgINBXDocInInbox

Checks if a document is in a section in the Inbox.

Takes P_INBX_DOC_IN_INBOX, returns STATUS. Category: class message.

```
#define msgINBXDocInInbox                       msgIOBXDocInIOBox
```

Arguments

```
typedef struct INBX_DOC_IN_INBOX {
    UUID            uuid;               // In: document uuid
    CLASS           svcClass;           // In: service class to check for
} INBX_DOC_IN_INBOX, *P_INBX_DOC_IN_INBOX;
```

Comments

This message can be sent to **clsINBXService** to check if a PenPoint document represented by **pArgs**->uuid is already in the input queue of an inbox service inheriting from **pArgs**->svcClass. **stsOK** is returned if it is, **stsFailed** otherwise. If **pArgs**->svcClass is **objNull**, **stsOK** is returned if the document is anywhere in the Inbox notebook.

Messages Sent to an Inbox Service Instance

msgINBXSvcMoveInDoc

Moves a document into the inbox section.

Takes P_INBXSVC_MOVE_COPY_DOC, returns STATUS.

```
#define msgINBXSvcMoveInDoc                         msgIOBXSvcMoveInDoc
```

Arguments

```
typedef struct INBXSVC_MOVE_COPY_DOC {
    FS_LOCATOR          source;     // In: Location of source document.
    U16                 sequence;   // In: Sequence number to move/copy
                                    //     in front of.
} INBXSVC_MOVE_COPY_DOC, *P_INBXSVC_MOVE_COPY_DOC;
```

Comments

Superclass behavior is to move the document located at **pArgs**->source into the input queue associated with the inbox service. For example, set **pArgs**->sequence to 1 to move the document to the top of the queue. Set it to **maxU16** to move the document to the bottom of the queue.

After the document is moved (or copied) to the input queue, it is considered to be in a state ready for input, even though the service may not be connected at the time. Client should not alter the document in any way once it has been moved to the input queue.

Subclasses can provide their own behavior if they wish. Remember to use the class message **msgINBXSvcSwitchIcon** to change the inbox icon.

msgINBXSvcCopyInDoc

Copies a document into the Inbox section.

Takes P_INBXSVC_MOVE_COPY_DOC, returns STATUS.

```
#define msgINBXSvcCopyInDoc                         msgIOBXSvcCopyInDoc
```

Message Arguments

```
typedef struct INBXSVC_MOVE_COPY_DOC {
    FS_LOCATOR          source;     // In: Location of source document.
    U16                 sequence;   // In: Sequence number to move/copy
                                    //     in front of.
} INBXSVC_MOVE_COPY_DOC, *P_INBXSVC_MOVE_COPY_DOC;
```

Comments

Same as **msgINBXSvcMoveInDoc**, except that the document is copied to the input queue.

msgINBXSvcGetTempDir

Passes back a handle for a temporary directory.

Takes P_OBJECT, returns STATUS.

```
#define msgINBXSvcGetTempDir                        msgIOBXSvcGetTempDir
```

Comments

This message is provided for clients who may want ot prepare their input document before moving it into the input queue. The handle of an "official" temporary directory is passed back and it can be used as temporary storage for documents, data, etc. Clients are responsible for deleting temporary files when they are done. The directory will be flushed after a warm boot.

msgINBXSvcPollDocuments

Polls all documents in an input queue and input those who are ready.

Takes nothing, returns STATUS.

```
#define msgINBXSvcPollDocuments                     msgIOBXSvcPollDocuments
```

Comments

This message tells the inbox service to look through its input queue and send out the first document ready for input. The service will first make sure that it is enabled and is connected to the designated input port. If these conditions are met, it will then self-send **msgINBXSvcNextDocument** to locate the next document ready for input.

If **msgINBXSvcNextDocument** returns **stsOK**, indicating that a document is ready for input, this message proceeds to self-send **msgINBXSvcLockDocument** to lock the document, and finally **msgINBXSvcInputStart** to initiate the input process.

If **msgINBXSvcNextDocument** returns **stsINBXSvcDocReady**, indicating that the section is not empty but none of the documents are ready for input, this message self-sends **msgINBXSvcScheduleDocument** to schedule the document passed back in **pArgs** at a later time.

Subclasses normally do not process this message.

See Also

msgINBXSvcNextDocument

msgINBXSvcNextDocument

Passes back the next document ready for input.

Takes P_INBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgINBXSvcNextDocument                msgIOBXSvcNextDocument
```

Arguments

```
typedef struct INBXSVC_DOCUMENT {
    OBJECT      uid;                        // uid of the doc
    OBJECT      dir;                        // app dir of the doc
    OBJECT      docClass;                   // class of the doc
    U16         sequence;                   // sequence of the doc
    CHAR        pName[nameBufLength];       // name of this doc
    P_UNKNOWN   pDocData;                   // subclass's private data
} INBXSVC_DOCUMENT, *P_INBXSVC_DOCUMENT;
```

Comments

Superclass behavior is to start from the top of the input queue and locate the first document ready for input. If one is found, information about the document is passed back in **pArgs**. The same **pArgs** will be passed to messages **msgINBXSvcLockDocument** and **msgINBXSvcInputStart**. By default, a document is ready for input when it is closed. If the document is open, it will receive **msgINBXDocInputStartOK** and it should return **stsOK** to indicate that it is ready for input.

Subclasses can provide their own behavior if they wish. Return **stsINBXSvcSectionEmpty** to give the superclass an opportunity to change the inbox icon from filled to empty.

Return Value

stsOK A document is ready for input.

stsINBXSvcSectionEmpty The input queue is empty.

stsINBXSvcDocNotReady No document in the input queue is ready.

Service-Specific Error Returns.

See Also

msgINBXSvcPollDocuments

msgINBXSvcLockDocument

Locks the document in preparation for input.

Takes P_INBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgINBXSvcLockDocument                msgIOBXSvcLockDocument
```

Message Arguments

```
typedef struct INBXSVC_DOCUMENT {
    OBJECT      uid;                        // uid of the doc
    OBJECT      dir;                        // app dir of the doc
    OBJECT      docClass;                   // class of the doc
    U16         sequence;                   // sequence of the doc
    CHAR        pName[nameBufLength];       // name of this doc
    P_UNKNOWN   pDocData;                   // subclass's private data
} INBXSVC_DOCUMENT, *P_INBXSVC_DOCUMENT;
```

Comments

This message is a place holder for subclasses that may require additional preparatory work to be performed on a document before it is ready for input. For example, a document may have to be "locked" so that it can not be opened during the input process. This message may be used for other purposes as well. For example, an inbox service may decide to store a light-weight "shadow" document (e.g., a report designator for a database application) in the input queue until it is chosen for input. The service then handles this message by converting the shadow document to a real one (e.g., the actual report).

The superclass behavior for this message is to stamp the document directory with the filesystem attribute **iobxsvcDocInputInProgress**. This stamp will prevent any gestures over the document from being processed. This means that once a document is locked for input it can not be deleted, renamed, etc. via gestures.

See Also

msgINBXSvcUnlockDocument

msgINBXSvcUnlockDocument

Unlocks a document that was previously locked.

Takes P_INBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgINBXSvcUnlockDocument                msgIOBXSvcUnlockDocument
```

Message Arguments

```
typedef struct INBXSVC_DOCUMENT {
    OBJECT      uid;                        // uid of the doc
    OBJECT      dir;                        // app dir of the doc
    OBJECT      docClass;                   // class of the doc
    U16         sequence;                   // sequence of the doc
    CHAR        pName[nameBufLength];       // name of this doc
    P_UNKNOWN   pDocData;                   // subclass's private data
} INBXSVC_DOCUMENT, *P_INBXSVC_DOCUMENT;
```

Comments

This message is a place holder for subclasses that may require additional "cleanup" work to be performed on a document before it is put back to the input queue.

The superclass behavior for this message is to remove the **iobxsvcDocInputInProgress** stamp on the document directory.

See Also

msgINBXSvcLockDocument

msgINBXSvcScheduleDocument

Schedules a document that is not ready for input

Takes P_INBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgINBXSvcScheduleDocument              msgIOBXSvcScheduleDocument
```

Message Arguments

```
typedef struct INBXSVC_DOCUMENT {
    OBJECT      uid;                        // uid of the doc
    OBJECT      dir;                        // app dir of the doc
    OBJECT      docClass;                   // class of the doc
    U16         sequence;                   // sequence of the doc
    CHAR        pName[nameBufLength];       // name of this doc
    P_UNKNOWN   pDocData;                   // subclass's private data
} INBXSVC_DOCUMENT, *P_INBXSVC_DOCUMENT;
```

Comments

This message is sent when **msgINBXSvcNextDocument** locates a document in the input queue but the document is not ready for input.

Subclasses should provide their own behavior. The default behavior is to release the ownership of the target service (i.e., become disabled), with the expectation that the user must manually schedule the document later on (by re-enabling the section.)

See Also

msgINBXSvcNextDocument

msgINBXSvcInputStart

Starts the input process for a document in the input queue.

Takes P_INBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgINBXSvcInputStart                    msgIOBXSvcIOStart
```

Message Arguments

```
typedef struct INBXSVC_DOCUMENT {
    OBJECT      uid;                        // uid of the doc
    OBJECT      dir;                        // app dir of the doc
    OBJECT      docClass;                   // class of the doc
    U16         sequence;                   // sequence of the doc
    CHAR        pName[nameBufLength];       // name of this doc
    P_UNKNOWN   pDocData;                   // subclass's private data
} INBXSVC_DOCUMENT, *P_INBXSVC_DOCUMENT;
```

Comments

Superclass behavior is to activate the inbox document if it isn't already active, and then send **msgINBXDocInputStart** to the document instance.

Subclasses can provide their own behavior if they wish.

msgINBXSvcInputCancel

Cancels the input process.

Takes nothing, returns STATUS.

```
#define msgINBXSvcInputCancel                   msgIOBXSvcIOCancel
```

Comments

This message is sent to the service when the caller wishes to cancel any input operation in progress. The service responds to this message by sending **msgINBXDocInputCancel** to an active inbox document. After the document is cancelled, the service will post an error note to the user if there are other documents waiting to be processed. The user then decides whether or not the service should proceed to send the remaining documents.

Subclasses do not normally process this message.

msgINBXSvcInputCleanUp

Cleans up after the current input is done.

Takes P_INBX_DOC_INPUT_DONE, returns STATUS. Category: self-post..

```
#define msgINBXSvcInputCleanUp                  msgIOBXSvcIOCleanUp
```

Arguments

```
Enum32(INBX_DOC_EXIT_BEHAVIOR) {
    inbxDocExitDoNothing,
    inbxDocExitDelete,
    inbxDocExitMarkAsFailed,
    inbxDocExitMarkAsCancelled
};
```

```
typedef struct INBX_DOC_INPUT_DONE {
    INBX_DOC_EXIT_BEHAVIOR  behavior;   // exit behavior
    P_UNKNOWN               pDocData;   // Unused: document specific data
} INBX_DOC_INPUT_DONE, *P_INBX_DOC_INPUT_DONE;
```

Comments

This message is posted to self as a result of the service receiving **msgINBXDocInputDone**, which is sent by the inbox document when it finishes the input operation. The inbox document will be either deleted or marked as specified in **pArgs**, and when everything is properly cleaned up the service will post **msgINBXSvcPollDocuments** to self to see if anything else is waiting for input.

Subclasses do not normally process this message.

See Also

msgINBXDocInputDone

msgINBXSvcStateChanged

Tells observers that the service state just changed.

Takes OBJECT, returns STATUS. Category: observer notification..

```
#define msgINBXSvcStateChanged                  msgIOBXSvcStateChanged
```

Comments

Informs observers that the state of a service has just changed. **pArgs** is the UID of the service.

msgINBXSvcQueryState

Passes back the state of the service.

Takes P_INBXSVC_QUERY_STATE, returns STATUS.

```
#define msgINBXSvcQueryState                    msgIOBXSvcQueryState
```

Arguments

```
typedef struct {
    BOOLEAN     enabled;                // true if the service is enabled.
    CHAR        status[nameBufLength];  // text describing the status of
                                        // the service.
    CHAR        docName[nameBufLength]; // document being processed
    P_UNKNOWN   pStateData;             // subclass's private data
} INBXSVC_QUERY_STATE, *P_INBXSVC_QUERY_STATE;
```

Comments

This message is typically used to query what state the service instance is in.

msgINBXSvcGetEnabled

Gets the enabled state of the service.

Takes P_BOOLEAN, returns STATUS.

```
#define msgINBXSvcGetEnabled                    msgIOBXSvcGetEnabled
```

Comments

Subclasses can override this message and redefine the notion of "enabled." The default behavior of the superclass is to equate "enabled" with the ownership of the target service (i.e., input device). That is, the service is "enabled" when it owns the target service. By appending to or replacing the default behavior, a subclass can define additional conditions which must be met before a service is considered enabled.

msgINBXSvcSetEnabled

Sets the enabled state of the service.

Takes BOOLEAN, returns STATUS.

```
#define msgINBXSvcSetEnabled                    msgIOBXSvcSetEnabled
```

Comments — This message is sent to the service in response to service notification messages **msgSvcOwnerAcquired** and **msgSvcOwnerReleased**. Subclasses can provide their own behavior and thereby redefine the notion of "enabled" for the service. If they do, they must pass this message up to the ancestor so that observers of the inbox service will be properly notified.

Inbox Document Messages

msgINBXDocInputStartOK

Asks the inbox document if it is OK to start the input process

Takes nothing, returns STATUS.

```
#define msgINBXDocInputStartOK              msgIOBXDocIOStartOK
```

Comments — When an inbox service finds an opened document in the inbox section, it sends this message to the document instance, asking whether it's OK to start the input operation while the document remains open. When the document receives this message, it should return **stsOK** to give the service permission to begin the input process. An error status, including **stsNotUnderstood**, is taken to mean that the document instance vetos the request and the service will not start the input process.

msgINBXDocInputStart

Tells an inbox document to start the input process.

Takes nothing, returns STATUS.

```
#define msgINBXDocInputStart                msgIOBXDocIOStart
```

Comments — This message is sent by the inbox service to a document. The document should respond to this message by starting the input process.

msgINBXDocInputDone

Tells the inbox service that input is finished.

Takes P_INBX_DOC_INPUT_DONE, returns STATUS. Category: client responsibility.

```
#define msgINBXDocInputDone                 msgIOBXDocIODone
```

Message Arguments

```
typedef struct INBX_DOC_INPUT_DONE {
    INBX_DOC_EXIT_BEHAVIOR  behavior;   // exit behavior
    P_UNKNOWN               pDocData;   // Unused: document specific data
} INBX_DOC_INPUT_DONE, *P_INBX_DOC_INPUT_DONE;
```

Comments — When the input process is finished, the inbox document in charge of the input should send this message to the inbox service. This message must be sent even if the input process has been aborted. The **pArgs** for this message tells the inbox service what to do with the inbox document. If **inbxDocExitDelete** is specified, the document will be removed from the inbox. In all other cases the document will be unlocked and left in the inbox. If either **inbxDocExitMarkAsCancelled** or **inbxDocExitMarkAsFailed** are specified, the name of the document will be altered to provide visual indication for the user that the input process has not completed successfully.

See Also — **msgINBXDocGetService**

msgINBXDocInputCancel

Tells an inbox document to cancel the input process.

Takes nothing, returns STATUS.

```
#define msgINBXDocInputCancel                    msgIOBXDocIOCancel
```

Comments

This message is used by the inbox service to inform a document that it should cancel the input process. The document should handle this message by terminating its input operation and then sending **msgINBXDocInputDone** to the service with **pArgs**->behavior set to **inbxDocExistMarkAsCancelled.**

msgINBXDocStatusChanged

Tells the inbox service that the document status is changed.

Takes P_INBX_DOC_STATUS_CHANGED, returns STATUS. Category: client responsibility.

```
#define msgINBXDocStatusChanged                  msgIOBXDocStatusChanged
```

Arguments

```
typedef struct INBX_DOC_STATUS_CHANGED {
    CHAR        status[nameBufLength];  // Text describing document state
    P_UNKNOWN   pDocData;               // Unused: document-specific data
} INBX_DOC_STATUS_CHANGED, *P_INBX_DOC_STATUS_CHANGED;
```

Comments

This message is sent by the inbox document to the service whenever its status has just changed. This status is displayed on Status column for the inbox section, in the Inbox notebook.

IOBXSVC.H

This file contains the API definition for **clsIOBXService**.

clsIOBXService inherits from **clsService**.

```
#ifndef IOBXSVC_INCLUDED
#define IOBXSVC_INCLUDED
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef SERVICE_INCLUDED
#include <service.h>
#endif
#ifndef AUXNBMGR_INCLUDED
#include <auxnbmgr.h>
#endif
```

Introduction

clsIOBXService implements most of the behavior of its two subclasses: **clsOBXService** (Outbox service class) and **clsINBXService** (Inbox service class). While its subclasses deal with either the system Inbox or the system Outbox, **clsIOBXService** allows a service to access both the Inbox and the Outbox at the same time. For details about the two subclasses of **clsIOBXService**, see inbxsvc.h and obxsvc.h.

Choosing the Appropriate Superclass for Your Service

An Outbox service is assigned a section in the system Outbox. Thus, if a service's primary function is to send data out of a PenPoint computer, it should probably be a subclass of **clsOBXService**. A good example for this type of services is a printer device driver. A very important behavior for an Outbox service is to hold the output data until the physical device is available. This "deferred output" feature allows any documents in an Outbox section to be sent only when the conditions are right for the output operation to commence. This is implemented as a series of messages associated with **msgIOBXSvcPollDocumens**, which basically "polls" the Outbox section looking for documents to be sent out. By default, all Outbox services inherit such auto polling behavior. (See the IOBXSVC_NEW structure defined in this API for inhibiting this behavior.)

Similary, an Inbox service is associated with a section in the system Inbox and concerns itself with transfering data into a PenPoint computer. For example, the device driver for an optical scanner should probably be a subclass of **clsINBXService**. However, the notion of "deferred input" may not apply to most types of Inbox services. Therefore an Inbox service by default does not "poll" the documents in its Inbox section. When "deferred input" does make sense, as in the case of a stock quote service periodically downloading the latest stock prices from a host computer, the auto polling behavior can be easily enabled through the **newArgs**.

Some services may need to transfer data both into and out of the PenPoint computer. (E.g., an electronic mail service.) There are several alternatives to deal with this situation. First, such services can still subclass from either **clsINBXService** or **clsOBXService** and avoid the complexity of dealing with two separte sections in the system Inbox and Outbox. Second, the input and output operations can be divided into two services, one inheriting from **clsINBXService** and one inheriting from **clsOBXService**. Third, the service can inherit directly from **clsIOBXService** and deal with both an Inbox section and an Outbox section at the same time. Both sections will have the same name as the service itself, and enabling one of them will automatically enable the other.

Common #defines and typedefs

Inbox/Outbox Service Status Codes

The inbox/outbox section associated with the service is empty. This status is returned by **msgIOBXSvcNextDocument**.

```
#define stsIOBXSvcSectionEmpty          MakeStatus(clsIOBXService, 101)
```

The outbox section associated with the service is not empty, but none of the document is ready for output. This status is returned by **msgIOBXSvcNextDocument**.

```
#define stsIOBXSvcDocNotReady           MakeStatus(clsIOBXService, 102)
```

Outbox Service Standard Dialog Codes

```
#define tagOBXSvcDocumentExists         MakeDialogTag(clsOBXService, 0)
#define tagOBXSvcOutputPending          MakeDialogTag(clsOBXService, 1)
```

Inbox Service Standard Dialog Codes

```
#define tagINBXSvcDocumentExists        MakeDialogTag(clsINBXService, 0)
#define tagINBXSvcInputPending          MakeDialogTag(clsINBXService, 1)
```

Filesystem Attributes

The state of a document in the inbox/outbox.

```
#define iobxsvcAttrDocState           FSMakeFix32Attr(clsIOBXService, 1)
Enum32(IOBXSVC_ATTR_DOC_STATE) {
    iobxsvcDocNotScheduled      = 0, // Document hasn't been scheduled
                                     // Same as no attribute.
    iobxsvcDocOutputInProgress  = 1, // Output started, not finished yet
    iobxsvcDocUserCancelled     = 2, // Cancelled by user
    iobxsvcDocError             = 3, // Unable to finish due to errors
    iobxsvcDocInputInProgress   = 4, // Input started, not finished yet
    iobxsvcDocReserved5         = 5, // Reserved for future expansion
    iobxsvcDocReserved6         = 6, // Reserved for future expansion
    iobxsvcDocReserved7         = 7, // Reserved for future expansion
    iobxsvcDocReserved8         = 8, // Reserved for future expansion
    iobxsvcDocReserved9         = 9, // Reserved for future expansion
    iobxsvcDocReserved10        = 10, // Reserved for future expansion
    iobxsvcDocReserved11        = 11, // Reserved for future expansion
    iobxsvcDocReserved12        = 12, // Reserved for future expansion
    iobxsvcDocReserved13        = 13, // Reserved for future expansion
    iobxsvcDocReserved14        = 14, // Reserved for future expansion
    iobxsvcDocReserved15        = 15 // Reserved for future expansion
};
```

Class Messages

msgNewDefaults

Initializes the P_IOBXSVC_NEW structure to default values.

Takes P_IOBXSVC_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct IOBXSVC_SECTION_METRICS {
    BOOLEAN     autoPoll;       // True if svc should poll documents when
                                // it's both enabled and connected.
    CLASS       sectionClass;   // Section Class. Must be clsNBToc or
                                // a subclass of it, or objNull for none.
    U32         reserved[2];    // Reserved.
} IOBXSVC_SECTION_METRICS, *P_IOBXSVC_SECTION_METRICS;
typedef struct IOBXSVC_NEW_ONLY {
    IOBXSVC_SECTION_METRICS in;     // Inbox section spec
    IOBXSVC_SECTION_METRICS out;    // Outbox section spec
    U32     reserved[3];
} IOBXSVC_NEW_ONLY, *P_IOBXSVC_NEW_ONLY;
#define ioSvcNewFields      \
    serviceNewFields        \
    IOBXSVC_NEW_ONLY         iobxsvc;
typedef struct IOBXSVC_NEW {
    ioSvcNewFields
} IOBXSVC_NEW, *P_IOBXSVC_NEW;
```

Zeroes out **pArgs**->iobxsvc.

msgNew

Creates a new inbox/outbox service object.

Takes P_IOBXSVC_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct IOBXSVC_NEW {
    ioSvcNewFields
} IOBXSVC_NEW, *P_IOBXSVC_NEW;
```

msgIOBXSvcSwitchIcon

Toggles the inbox or outbox icon (to empty or filled) if neccessary.

Takes nothing, returns STATUS. Category: class message.

```
#define msgIOBXSvcSwitchIcon                MakeMsg(clsIOBXService, 1)
```

Comments

Check the content of the inbox or outbox notebook. For outbox, show the "filled" icon if any document is found. For inbox, show the "filled" icon if there is at least one document that has not been opened.

msgIOBXDocGetService

Gets the service name.

Takes P_IOBX_DOC_GET_SERVICE, returns STATUS. Category: class message.

```
#define msgIOBXDocGetService                MakeMsg(clsIOBXService, 2)
```

Arguments

```
typedef struct IOBX_DOC_GET_SERVICE {
    OBJECT          document;               // In: document uid
    CHAR            svcName[nameBufLength]; // Out: service name
} IOBX_DOC_GET_SERVICE, *P_IOBX_DOC_GET_SERVICE;
```

Comments

Get the name of the service associated with an inbox/outbox document. If the document has not been placed into an inbox/outbox section, **stsFailed** is returned.

Note that the document must be at the top level within an inbox/outbox section. That is, if the document is embedded in another document, **stsFailed** will be returned even if its embeddor is within an inbox/outbox section.

msgIOBXDocInIOBox

Checks if a document is in a section in the Inbox/Outbox notebook.

Takes P_IOBX_DOC_IN_IOBOX, returns STATUS. Category: class message.

```
#define msgIOBXDocInIOBox                  MakeMsg(clsIOBXService, 3)
```

Arguments

```
typedef struct IOBX_DOC_IN_IOBOX {
    ANM_AUX_NOTEBOOK    notebook;       // In: Which notebook?
    UUID                uuid;           // In: document uuid
    CLASS               svcClass;       // In: service class to check for
} IOBX_DOC_IN_IOBOX, *P_IOBX_DOC_IN_IOBOX;
```

Messages Sent to an Outbox Service Instance

msgIOBXSvcMoveInDoc

Moves a document into the outbox section.

Takes P_IOBXSVC_MOVE_COPY_DOC, returns STATUS.

```
#define msgIOBXSvcMoveInDoc                MakeMsg(clsIOBXService, 4)
```

Arguments

```
typedef struct IOBXSVC_MOVE_COPY_DOC {
    ANM_AUX_NOTEBOOK    notebook;   // In: Which notebook?
    FS_LOCATOR          source;     // In: Location of source document.
    U16                 sequence;   // In: Sequence number to move/copy
                                    //     in front of.
} IOBXSVC_MOVE_COPY_DOC, *P_IOBXSVC_MOVE_COPY_DOC;
```

Comments

Superclass behavior is to move the document located at **pArgs**->source into the input/output queue associated with the inbox/outbox service. For example, set **pArgs**->sequence to 1 to move the document to the top of the queue. Set it to **maxU16** to move the document to the bottom of the queue.

After the document is moved (or copied) to the input/output queue, it is considered to be in a state ready for input/output, even though the service may not be connected at the time. Client should not alter the document in any way once it has been moved to the input/output queue.

Subclasses can provide their own behavior if they wish. Remember to use the class message **msgIOBXSvcSwitchIcon** to change the inbox/outbox icon.

msgIOBXSvcCopyInDoc

Copies a document into the Inbox/Outbox section.

Takes P_IOBXSVC_MOVE_COPY_DOC, returns STATUS.

```
#define msgIOBXSvcCopyInDoc                MakeMsg(clsIOBXService, 5)
```

Message Arguments

```
typedef struct IOBXSVC_MOVE_COPY_DOC {
    ANM_AUX_NOTEBOOK    notebook;   // In: Which notebook?
    FS_LOCATOR          source;     // In: Location of source document.
    U16                 sequence;   // In: Sequence number to move/copy
                                    //     in front of.
} IOBXSVC_MOVE_COPY_DOC, *P_IOBXSVC_MOVE_COPY_DOC;
```

Comments

Same as **msgIOBXSvcMoveInDoc**, except that the document is copied to the input/output queue.

msgIOBXSvcGetTempDir

Passes back a handle for a temporary directory.

Takes P_OBJECT, returns STATUS.

```
#define msgIOBXSvcGetTempDir              MakeMsg(clsIOBXService, 6)
```

Comments

This message is provided for clients who may want to prepare their input/output document before moving it into the input/output queue. The handle of an "official" temporary directory is passed back and it can be used as temporary storage for documents, data, etc. Clients are responsible for deleting temporary files they created when done. This temporary directory will be flushed after a warm boot.

msgIOBXSvcPollDocuments

Polls all documents waiting for input/output.

Takes nothing, returns STATUS.

```
#define msgIOBXSvcPollDocuments           MakeMsg(clsIOBXService, 7)
```

Comments

This message tells the inbox/outbox service to look through its queue and initiate the input/output process for the first document ready to do so. The service will first make sure that it is enabled and is connected to the designated input/output port. If these conditions are met, it will then self-send **msgIOBXSvcNextDocument** to locate the next document ready for input/output.

If **msgIOBXSvcNextDocument** returns **stsOK**, indicating that a document is ready, this message proceeds to self-send **msgIOBXSvcLockDocument** to lock the document, and finally **msgIOBXSvcIOStart** to initiate the input/output process.

If **msgIOBXSvcNextDocument** returns **stsOBXSvcDocNotReady**, indicating that the section is not empty but none of the documents are ready for input/output, this message self-sends **msgIOBXSvcScheduleDocument** to schedule the document passed back in **pArgs** at a later time.

Subclasses normally do not process this message.

See Also

msgIOBXSvcNextDocument

msgIOBXSvcNextDocument

Passes back the next document ready for input/output.

Takes P_IOBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgIOBXSvcNextDocument            MakeMsg(clsIOBXService, 8)
```

Arguments

```
typedef struct IOBXSVC_DOCUMENT {
    OBJECT          uid;                    // uid of the doc
    OBJECT          dir;                    // app dir of the doc
    OBJECT          docClass;               // class of the doc
    U16             sequence;               // sequence of the doc
    CHAR            pName[nameBufLength];   // name of this doc
    P_UNKNOWN       pDocData;               // subclass's private data
} IOBXSVC_DOCUMENT, *P_IOBXSVC_DOCUMENT;
```

Comments

Superclass behavior is to start from the top of the queue and locate the first document ready for input/output. If one is found, information about the document is passed back in **pArgs**. The same **pArgs** will be passed to messages **msgIOBXSvcLockDocument** and **msgIOBXSvcIOStart**. By default, a document is ready for input/output when it is closed. If the document is open, it will receive **msgIOBXDocIOStartOK** and it should return **stsOK** to indicate that it is ready for input/output.

Subclasses can provide their own behavior if they wish. Return **stsOBXSvcSectionEmpty** to give the superclass an opportunity to change the inbox/outbox icon from filled to empty. Or refresh the look of the icon by sending **msgIOBXSvcSwitchIcon** to the service class.

Return Value

stsOK A document is ready for input/output.

stsOBXSvcSectionEmpty The input/output queue is empty.

stsOBXSvcDocNotReady No document in the input/output queue is ready.

Service-Specific Error Returns.

See Also

msgIOBXSvcPollDocuments

msgIOBXSvcLockDocument

Locks the document in preparation for input/output.

Takes P_IOBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgIOBXSvcLockDocument              MakeMsg(clsIOBXService, 9)
```

Message Arguments

```
typedef struct IOBXSVC_DOCUMENT {
    OBJECT          uid;                    // uid of the doc
    OBJECT          dir;                    // app dir of the doc
    OBJECT          docClass;               // class of the doc
    U16             sequence;               // sequence of the doc
    CHAR            pName[nameBufLength];   // name of this doc
    P_UNKNOWN       pDocData;               // subclass's private data
} IOBXSVC_DOCUMENT, *P_IOBXSVC_DOCUMENT;
```

Comments

This message is a place holder for subclasses that may require additional preparatory work to be performed on a document before it is ready for input/output. For example, a document may have to be "locked" so that it can not be opened during the input/output process. This message may be used for other purposes as well. For example, an inbox/outbox service may decide to store a light-weight "shadow" document (e.g., a report designator for a database application) in the input/output queue until it is chosen for input/output. The service then handles this message by converting the shadow document to a real one (e.g., the actual report).

The superclass behavior for this message is to stamp the document directory with the filesystem attribute **iobxsvcDocIOInProgress**. This stamp will prevent any gestures over the document from being processed. This means that once a document is locked for input/output it can not be deleted, renamed, etc. via gestures.

See Also

msgIOBXSvcUnlockDocument

msgIOBXSvcUnlockDocument

Unlocks a document that was previously locked.

Takes P_IOBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgIOBXSvcUnlockDocument            MakeMsg(clsIOBXService, 10)
```

Message Arguments

```
typedef struct IOBXSVC_DOCUMENT {
    OBJECT          uid;                    // uid of the doc
    OBJECT          dir;                    // app dir of the doc
    OBJECT          docClass;               // class of the doc
    U16             sequence;               // sequence of the doc
    CHAR            pName[nameBufLength];   // name of this doc
    P_UNKNOWN       pDocData;               // subclass's private data
} IOBXSVC_DOCUMENT, *P_IOBXSVC_DOCUMENT;
```

Comments

This message is a place holder for subclasses that may require additional "cleanup" work to be performed on a document before it is put back to the input/output queue.

The superclass behavior for this message is to remove the **iobxsvcDocIOInProgress** stamp on the document directory.

See Also

msgIOBXSvcLockDocument

msgIOBXSvcScheduleDocument

Schedules a document that is not ready for input/output

Takes P_IOBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgIOBXSvcScheduleDocument          MakeMsg(clsIOBXService, 11)
```

Message Arguments

```
typedef struct IOBXSVC_DOCUMENT {
    OBJECT          uid;                    // uid of the doc
    OBJECT          dir;                    // app dir of the doc
    OBJECT          docClass;               // class of the doc
    U16             sequence;               // sequence of the doc
    CHAR            pName[nameBufLength];   // name of this doc
    P_UNKNOWN       pDocData;               // subclass's private data
} IOBXSVC_DOCUMENT, *P_IOBXSVC_DOCUMENT;
```

Comments

This message is sent when **msgIOBXSvcNextDocument** locates a document in the input/output queue but the document is not ready for input/output.

Subclasses should provide their own behavior. The default behavior is to release the ownership of the target service (i.e., become disabled), with the expectation that the user must manually schedule the document later on (by re-enabling the section.)

See Also

msgIOBXSvcNextDocument

msgIOBXSvcIOStart

Starts the input/output process for a document in the input/output queue.

Takes P_IOBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgIOBXSvcIOStart                   MakeMsg(clsIOBXService, 12)
```

Message Arguments

```
typedef struct IOBXSVC_DOCUMENT {
    OBJECT          uid;                    // uid of the doc
    OBJECT          dir;                    // app dir of the doc
    OBJECT          docClass;               // class of the doc
    U16             sequence;               // sequence of the doc
    CHAR            pName[nameBufLength];   // name of this doc
    P_UNKNOWN       pDocData;               // subclass's private data
} IOBXSVC_DOCUMENT, *P_IOBXSVC_DOCUMENT;
```

Comments

Superclass behavior is to activate the inbox/outbox document if it isn't already active, and then send **msgIOBXDocIOStart** to the document instance.

Subclasses can provide their own behavior if they wish.

msgIOBXSvcIOCancel

Cancels the input/output process.

Takes nothing, returns STATUS.

```
#define msgIOBXSvcIOCancel                    MakeMsg(clsIOBXService, 13)
```

Comments

This message is sent to the service when the caller wishes to cancel any input/output operation in progress. The service responds to this message by sending **msgIOBXDocOutuptCancel** to an active inbox/outbox document. After the document is cancelled, the service will post an error note to the user if there are other documents waiting to be processed. The user then decides whether or not the service should proceed to send the remaining documents.

Subclasses do not normally process this message.

msgIOBXSvcIOCleanUp

Cleans up after the current input/output is done.

Takes P_IOBX_DOC_OUTPUT_DONE, returns STATUS. Category: self-post..

```
#define msgIOBXSvcIOCleanUp                   MakeMsg(clsIOBXService, 14)
```

Arguments

```
Enum32(IOBX_DOC_EXIT_BEHAVIOR) {    // What to do after a document
                                    // is processed
    iobxDocExitDoNothing        = 0,
    iobxDocExitDelete           = 1,
    iobxDocExitMarkAsFailed     = 2,
    iobxDocExitMarkAsCancelled  = 3
};
typedef struct IOBX_DOC_OUTPUT_DONE {
    IOBX_DOC_EXIT_BEHAVIOR  behavior;    // exit behavior
    P_UNKNOWN               pDocData;    // Unused: document specific data
} IOBX_DOC_OUTPUT_DONE, *P_IOBX_DOC_OUTPUT_DONE;
```

Comments

This message is posted to self as a result of the service receiving **msgIOBXDocIODone**, which is sent by the inbox/outbox document when it finishes the input/output operation. The inbox/outbox document will be either deleted or marked as specified in **pArgs**, and when everything is properly cleaned up the service will post **msgIOBXSvcPollDocuments** to self to see if anything else is waiting for input/output.

Subclasses do not normally process this message.

See Also

msgIOBXDocIODone

msgIOBXSvcStateChanged

Tells observers that the service state just changed.

Takes OBJECT, returns STATUS. Category: observer notification..

```
#define msgIOBXSvcStateChanged                MakeMsg(clsIOBXService, 15)
```

Comments

Informs observers that the state of a service has just changed. **pArgs** is the UID of the service.

msgIOBXSvcQueryState

Passes back the state of the service.

Takes P_IOBXSVC_QUERY_STATE, returns STATUS.

```
#define msgIOBXSvcQueryState                  MakeMsg(clsIOBXService, 16)
```

Arguments

```
typedef struct {
    BOOLEAN     enabled;                  // is the service enabled?
    CHAR        status[nameBufLength];    // text describing the status of
                                          // the service.
    CHAR        docName[nameBufLength];   // document being processed
    P_UNKNOWN   pStateData;               // subclass's private data
} IOBXSVC_QUERY_STATE, *P_IOBXSVC_QUERY_STATE;
```

msgIOBXSvcGetEnabled

Gets the enabled state of the service.

Takes P_BOOLEAN, returns STATUS.

```
#define msgIOBXSvcGetEnabled            MakeMsg(clsIOBXService, 17)
```

Comments

Subclasses can override this message and redefine the notion of "enabled." The default behavior of the superclass is to equate "enabled" with the ownership of the target service (i.e., input/output device). That is, the service is "enabled" when it owns the target service. By appending to or replacing the default behavior, a subclass can define additional conditions which must be met before a service is considered enabled.

msgIOBXSvcSetEnabled

Sets the enabled state of the service.

Takes BOOLEAN, returns STATUS.

```
#define msgIOBXSvcSetEnabled            MakeMsg(clsIOBXService, 18)
```

Comments

This message is sent to the service in response to service notification messages **msgSvcOwnerAcquired** and **msgSvcOwnerReleased**. Subclasses can provide their own behavior and thereby redefine the notion of "enabled" for the service. If they do, they must pass this message up to the ancestor so that observers of the inbox/outbox service will be properly notified.

Inbox/Outbox Document Messages

msgIOBXDocIOStartOK

Asks the inbox/outbox document if it is OK to start the input/output process

Takes nothing, returns STATUS.

```
#define msgIOBXDocIOStartOK             MakeMsg(clsIOBXService, 19)
```

Comments

When an inbox/outbox service finds an opened document in the inbox/outbox section, it sends this message to the document instance, asking whether it's OK to start the input/output operation while the document remains open. When the document receives this message, it should return **stsOK** to give the service permission to begin the input/output process. An error status, including **stsNotUnderstood**, is taken to mean that the document instance vetos the request and the service will not start the input/output process.

msgIOBXDocIOStart

Tells an inbox/outbox document to start the input/output process.

Takes nothing, returns STATUS.

```
#define msgIOBXDocIOStart               MakeMsg(clsIOBXService, 20)
```

Comments

This message is sent by the inbox/outbox service to a document. The document should respond to this message by starting the input/output process.

msgIOBXDocIODone

Tells the inbox/outbox service that input/output is finished.

Takes P_IOBX_DOC_OUTPUT_DONE, returns STATUS. Category: client responsibility.

```
#define msgIOBXDocIODone                    MakeMsg(clsIOBXService, 21)
```

Message Arguments

```
typedef struct IOBX_DOC_OUTPUT_DONE {
    IOBX_DOC_EXIT_BEHAVIOR  behavior;   // exit behavior
    P_UNKNOWN               pDocData;   // Unused: document specific data
} IOBX_DOC_OUTPUT_DONE, *P_IOBX_DOC_OUTPUT_DONE;
```

Comments

When the input/output process is finished, the inbox/outbox document in charge of the input/output should send this message to the inbox/outbox service. This message must be sent even if the input/output process has been aborted. The **pArgs** for this message tells the inbox/outbox service what to do with the inbox/outbox document. If **obxDocExitDelete** is specified, the document will be removed from the inbox/outbox. In all other cases the document will be unlocked and left in the inbox/outbox. If either **obxDocExitMarkAsCancelled** or **obxDocExitMarkAsFailed** are specified, the name of the document will be altered to provide visual indication for the user that the input/output process has not completed successfully.

See Also

msgIOBXDocGetService

msgIOBXDocIOCancel

Tells an inbox/outbox document to cancel the input/output process.

Takes nothing, returns STATUS.

```
#define msgIOBXDocIOCancel                  MakeMsg(clsIOBXService, 22)
```

Comments

This message is used by the inbox/outbox service to inform a document that it should cancel the input/output process. The document should handle this message by terminating its input/output operation and then sending **msgIOBXDocIODone** to the service with **pArgs**->behavior set to **obxDocExistMarkAsCancelled.**

msgIOBXDocStatusChanged

Tells the inbox/outbox service that the document status is changed.

Takes P_IOBX_DOC_STATUS_CHANGED, returns STATUS. Category: client responsibility.

```
#define msgIOBXDocStatusChanged             MakeMsg(clsIOBXService, 23)
```

Arguments

```
typedef struct IOBX_DOC_STATUS_CHANGED {
    CHAR        status[nameBufLength];  // Text describing document state
    P_UNKNOWN   pDocData;               // Unused: document-specific data
} IOBX_DOC_STATUS_CHANGED, *P_IOBX_DOC_STATUS_CHANGED;
```

Comments

This message is sent by the inbox/outbox document to the service whenever its status has just changed. This status is displayed on Status column for the inbox/outbox section, in the Inbox/Outbox notebook.

LINK.H

Link layer API definition.

This file contains the interface definition for link layer protocols.

1. Link layer protocols must sub-class **clsLink**.

2. **clsLink** sub-classes **clsService**.

```
#ifndef LINK_INCLUDED
#define LINK_INCLUDED
typedef struct
{
    U16                     addrSize;   // size of address pointed to
    U8                          addr[8];        // address
} ADDRESS, *P_ADDRESS;
```

The **PROTOCOL_ADDRESS** structure contains all the addressing information needed below the transport level. Unspecified addresses have null pointers.

```
typedef struct {
} PROTOCOL_ADDRESS, *   P_PROTOCOL_ADDRESS;
```

The **PROTOCOL_INFO** structures in the transmit and receive descriptors holds the following information.

```
typedef struct {
    PROTOCOL_ADDRESS        src;
    PROTOCOL_ADDRESS        dest;
} PROTOCOL_INFO;
#define sizeRxBuf 608
typedef struct RXBUFDESC {
    PROTOCOL_INFO           info;
} RX_DESC, *P_RX_DESC;
typedef struct {
    U16                     blockLen;
    U8                          *pBlock;
} BLOCK, *P_BLOCK;
#define lnkMaxBlocks 8
#define sizeTxImmedData 32
typedef struct {
    PROTOCOL_INFO           info;
    BLOCK                       txBlockTab[lnkMaxBlocks];
    U8                          immedData[sizeTxImmedData];
} TX_DESC, *P_TX_DESC;
#define stsNoTxBuffer               MakeStatus(clsLink, 1)
#define stsNoRxBuffer               MakeStatus(clsLink, 2)
#define stsTxCollisionOrDefer       MakeStatus(clsLink, 3)
#define stsTxTimeout                MakeStatus(clsLink, 4)
// A power cycle has happened, the link should be closed and reinitialized
#define stsLinkPowerCycle         MakeStatus(clsLink, 5)
// The link cable is not connected.
#define stsLinkNotConnected       MakeStatus(clsLink, 6)
typedef U16        LINK_PROTOCOL_TYPE;
typedef enum
{
    linkMulticast   = flag0,        // multicast transmit and receive
    linkBroadcast   = flag1,        // broadcast transmit and receive
    linkPromiscuous = flag2,        // promiscuous receive mode
    linkLoopback    = flag3         // loopback of transmit to receive
} LINK_SERVICES;
typedef struct
{
    U16         tableSize;
    U8          linkAddress[2];
}  *P_BROADCAST_ADDR,  *P_MULTICAST_ADDR;
typedef struct
{
    U16                 tableSize;      // size of link Attributes table
    U8                  typeName[32];   // ASCIIZ name of LINK type: LocalTalk, Ethernet
                                        // ASYNC, SDLC, etc.
    U16                 linkAddrLen;    // length in bytes of link addresses
    U8                  linkAddr[16];   // current link address of local station
    U32                 linkSpeed;      // link communication speed in bits per second
    U16                 maxDataSize;    // maximum amount of data that will fit in a link frame
    U16                 maxFrameSize;   // maximum size of a link frame (including link header)
    U16                 numBuffers;     // total number of available link buffers for this
device
    LINK_SERVICES       linkServices;   // LINK services supported
    ADDRESS             broadcast;      // broadcast address
    P_MULTICAST_ADDR    pMulticastTable;    // pointer to multicast address table
    // add additional fields here
} LINK_ATTRIBUTES,  *P_LINK_ATTRIBUTES;
typedef enum
{
    linkOperational,
    linkHardwareFailure,
    linkConfigurationFailure,
    linkHardwareNotInstalled
} LINK_OPERATING_STATUS;
typedef struct
{
    LINK_OPERATING_STATUS   linkStatus;
    // additional specific status info goes here
} LINK_STATUS,  *P_LINK_STATUS;
typedef void (EXPORTED * PF_PROTOCOL_HANDLER)(P_RX_DESC);
```

structure of the link header

```
#pragma pack(1)     // byte boundary packing for protocol headers
typedef struct
{
    U8          destLinkAddr;
    U8          srcLinkAddr;
    U8          typeLink;
} LINK_HEADER,  *P_LINK_HEADER;
#pragma pack()   // back to command line stuff
#define maxRxFrameSize sizeRxBuf
typedef struct TX_FRAME
{
    struct TX_FRAME  *   link;
    BOOLEAN                 sent;
    U16                     length;
    U32                     physAddr;
    unsigned char           buf[maxRxFrameSize];
} TX_FRAME,  *P_TX_FRAME;
#define lnkMaxShortFrameSize 10
```

```
typedef struct SHORT_TX_FRAME
{
struct SHORT_TX_FRAME  * link;
    BOOLEAN                 sent;
    U16                     length;
    U32                     physAddr;
    unsigned char           buf[lnkMaxShortFrameSize];
} SHORT_TX_FRAME,  *P_SHORT_TX_FRAME;
```

msgLINKInstallProtocol

Install a link layer protocol handler to receive frames.

Takes P_INSTALL_PROTOCOL, returns STATUS.

```
#define  msgLINKInstallProtocol  MakeMsg( clsLink, 1 )
```

Arguments

```
typedef struct INSTALL_PROTOCOL{
    LINK_PROTOCOL_TYPE      linkProtocolType;
    PF_PROTOCOL_HANDLER     pNewHandler;
} INSTALL_PROTOCOL, * P_INSTALL_PROTOCOL;
```

msgLINKRemoveProtocol

Remove a link layer protocol handler.

Takes P_REMOVE_PROTOCOL, returns STATUS.

```
#define  msgLINKRemoveProtocol  MakeMsg( clsLink, 2 )
```

Arguments

```
typedef struct REMOVE_PROTOCOL{
    LINK_PROTOCOL_TYPE      linkProtocolType;
} REMOVE_PROTOCOL, * P_REMOVE_PROTOCOL;
```

msgLINKTransmit

Transmit a packet.

Takes P_LINK_TRANSMIT, returns STATUS.

```
#define  msgLINKTransmit  MakeMsg( clsLink, 5 )
```

Arguments

```
typedef struct LINK_TRANSMIT {
    P_TX_DESC                   pTD;
} LINK_TRANSMIT, * P_LINK_TRANSMIT;
```

msgLINKBufferReturn

Return receive buffer to the link layer.

Takes P_BUFFER_RETURN, returns STATUS.

```
#define  msgLINKBufferReturn  MakeMsg( clsLink, 6 )
```

Arguments

```
typedef struct BUFFER_RETURN {
    P_RX_DESC                   pRD;
} BUFFER_RETURN, * P_BUFFER_RETURN;
```

msgLINKAttributesGet

Obtain the link layer attributes.

Takes P_ATTRIBUTES_GET, returns STATUS.

```
#define  msgLINKAttributesGet  MakeMsg( clsLink, 7 )
```

Arguments

```
typedef struct ATTRIBUTES_GET {
    P_LINK_ATTRIBUTES           pAttributes;
} ATTRIBUTES_GET, * P_ATTRIBUTES_GET;
```

msgLINKStatusGet

Obtain the link layer statistics.

Takes P_STATUS_GET, returns STATUS.

```
#define  msgLINKStatusGet  MakeMsg( clsLink, 8 )
```

Arguments

```
typedef struct STATUS_GET {
    P_LINK_STATUS               pStatus;
} STATUS_GET, * P_STATUS_GET;
```

msgLINKAddressAcquire

Acquire the link layer address.

Takes P_ADDRESS_ACQUIRE, returns STATUS.

```
#define  msgLINKAddressAcquire  MakeMsg( clsLink, 9 )
```

Arguments

```
typedef struct ADDRESS_ACQUIRE {
    U16                         linkAddrLen;    // length in bytes of link addresses
    U8                              linkAddr[16];   // current link address of local station
    BOOLEAN                     server;         // acquire a server address
} ADDRESS_ACQUIRE, * P_ADDRESS_ACQUIRE;
```

MODEM.H

This file contains the API for **clsModem**.

clsModem inherits from **clsService.**

clsModem provides the interface a client uses to communicate via a modem. The modem service is located, bound to, opened, and closed via standard PenPoint service messages.

The object which opens a modem service becomes its client. After opening a modem service, it is recommened that a client explicitly reset the modem firmware, initialize the modem I/O port settings, and then set the modem firmware to the desired state.

The modem firware is reset by sending **msgModemReset** to an open modem service. Refer to **msgModemReset** below for a description of the state to which the modem firmware is reset.

A client obtains current modem I/O port settings by sending **msgSioGetMetrics** to a modem service. I/O port settings may be altered by sending **msgSioSetMetrics** to the modem service. These messages in addition to **msgSioInit, msgSioBreakSend, msgSioControlInStatus, msgSioInputBufferStatus**, and **msgSioInputBufferFlush** are the only **clsMILAsyncSIODevice** messages which **clsModem** handles. Refer to file "sio.h" for a description of these messages.

After initializing the modem I/O port, a client may then send **clsModem** messages to initialize the modem to a desired state. Such initialization may be accomplished via discrete messages, or via **msgSvcSetMetrics.**

Upon successfully initializing a modem, the client may then establish a connection, transmit data and/or receive data via the connection, and finally terminate the connection. Clients send **clsStream** messages to read/write data from/to the modem. Refer to file "stream.h" for a description of **clsStream** messages.

**** PLEASE NOTE ****

In a future release of PenPoint, the **clsModem** API will be augmented. Compatibility with the **clsModem** API described herein shall be maintained for at least one release.

Defined within this header file for the **clsModem** API

Defines and Typedefs

See Also "service.h", "stream.h".

```
#ifndef MODEM_INCLUDED
#define MODEM_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef SERVICE_INCLUDED
#include <service.h>
#endif
#ifndef UID_INCLUDED
#include <uid.h>
#endif
#ifndef DIALENV_INCLUDED
#include <dialenv.h>
#endif
```

Observer Notification Messages

msgModemActivity

Notification sent to observers signifying changes in modem activity.

Takes MODEM_ACTIVITY, returns N/A. Category: observer notification.

```
#define msgModemActivity            MakeMsg(clsModem, 1)
```

Arguments

```
Enum32(MODEM_ACTIVITY) {          // The current modem activity/state.
    mdmOpened,                    //  Modem service has been opened for use. *
    mdmResetting,                 //  Currently being reset.
    mdmDialing,                   //  Dialing a phone number. *
    mdmAwaitingConnection,        //  Awaiting a connection/answer.
    mdmConnected,                 //  Connected with remote node. *
    mdmNegotiating,               //  Negotiating session/link parms.
    mdmSending,                   //  Sending data.
    mdmReceiving,                 //  Receiving data.
    mdmAnswering,                 //  Answering a call. *
    mdmHangingUp,                 //  Terminating the connection. *
    mdmDisconnected,              //  Connection terminated. *
    mdmClosed                     //  Modem service has been closed. *
};                                //  * = required notifications.
```

Comments

NOTE: A modem service needn't implement all observer notifications listed below. Those marked with an asterik are the required minimum.

Client Notification Messages

msgModemResponse

Provides the modem's response to a command.

Takes MODEM_RESPONSE_INFO, returns N/A. Category: client notification.

```
#define msgModemResponse            MakeMsg(clsModem, 2)
```

Arguments

```
Enum32(MODEM_RESPONSE) {          // Modem response indications.
    mdmResOK,                     //  OK - command accepted.
    mdmResUnrecognized,           //  Error - Unrecognized response from modem.
    mdmResError,                  //  Error - Error response from modem.
    mdmResNoCarrier,              //  Error - No line carrier detected.
    mdmResNoDialTone,             //  Error - No phone dial tone detected.
    mdmResPhoneBusy,              //  Error - Phone line busy signal detected.
    mdmResNoAnswer,               //  Error - No one answered at the other end.
    mdmResInvalidFrame,           //  Error - Invalid frame detected.
    mdmResCRCError,               //  Error - Cyclic redundancy check error.
    mdmResRing,                   //  Ring indication signal detected.
    mdmResConnect,                //  Connection established.
    mdmResConnect300,             //  300 baud connection established.
    mdmResConnect600,             //  600 baud connection established.
    mdmResConnect1200,            //  1200 baud connection established.
    mdmResConnect2400,            //  2400 baud connection established.
    mdmResConnect4800,            //  4800 baud connection established.
    mdmResConnect9600,            //  9600 baud connection established.
    mdmResConnect19200,           //  19200 baud connection established.
    mdmResConnectReserved01,      //  Reserved for future expansion.
    mdmResConnectReserved02,      //  Reserved for future expansion.
    mdmResConnectReserved03,      //  Reserved for future expansion.
    mdmResConnectMNP,             //  MNP connection has been established.
    mdmResConnect1200MNP,         //  1200 baud MNP connection established.
    mdmResConnect2400MNP,         //  2400 baud MNP connection established.
    mdmResConnect1200LAPM,        //  1200 baud LAPM connection established.
    mdmResConnect2400LAPM,        //  2400 baud LAPM connection established.
    mdmResConnectReserved04,      //  Reserved for future expansion.
    mdmResConnectReserved05,      //  Reserved for future expansion.
    mdmResConnectReserved06     //  Reserved for future expansion.
};
#define mdmSizeMaxResponse      63
typedef struct {                // Modem response information.
    U8  symbols[mdmSizeMaxResponse+1];//  Symbols comprising a response.
    MODEM_RESPONSE  response;   //  Response meaning as enumerated above.
    U32             spare;      //  Reserved for future expansion.
} MODEM_RESPONSE_INFO, *P_MODEM_RESPONSE_INFO;
```

Comments

Provides the response to a previous modem request/command. **msgModemReponse** is only sent to the modem service's client if the response behavior has been set to **mdmResponseViaMessage** (RE: **msgModemSetResponseBehavior**).

If a desired response isn't available, then please contact GO Corporation to see that it gets added as a standard modem response. Thank you.

NOTE: The modem service depends upon the order in which the responses are defined.

msgModemConnected

Notification sent to the client indicating the modem has connected with a remote node modem.

Takes nothing, returns N/A. Category: client notification.

```
#define msgModemConnected           MakeMsg(clsModem, 3)
```

Comments

A client may obtain information regarding the connection via **msgModemGetConnectionInfo.**

msgModemDisconnected

Notification sent to the client indicating that the current connection has been terminated.

Takes nothing, returns N/A. Category: client notification.

```
#define msgModemDisconnected        MakeMsg(clsModem, 4)
```

msgModemRingDetected

Notification sent to the client indicating that a ring indication has been received from the modem.

Takes nothing, returns N/A. Category: client notification.

```
#define msgModemRingDetected        MakeMsg(clsModem, 5)
```

msgModemTransmissionError

Notification sent to the client indicating that an error has been detected during transmission (sending or receiving) of data.

Takes nothing, returns N/A. Category: client notification.

```
#define msgModemTransmissionError   MakeMsg(clsModem, 6)
```

Comments

This unsolicited message is typically sent as a result of detecting a data framing error, or other low-level modem link protocol generated error condition.

msgModemErrorDetected

Notification sent to the client indicating that an unexpected error indication has been received from the modem.

Takes nothing, returns N/A. Category: client notification.

```
#define msgModemErrorDetected       MakeMsg(clsModem, 7)
```

Action Messages

msgModemSetResponseBehavior

Set the modem response mode, and command-to-response time-out values.

Takes P_MODEM_RESPONSE_BEHAVIOR, returns STATUS. Category: modem service request.

```
#define msgModemSetResponseBehavior MakeMsg(clsModem, 16)
```

Arguments

```
Enum32(MODEM_RESPONSE_MODE) {   // Mode for conveying modem responses.
    mdmResponseViaStatus,       //  Report via status (Default).
    mdmResponseViaMessage,      //  Report via notification msgModemResponse.
    mdmResponseTransparent      //  Don't intercept and process modem responses.
};
#define mdmDefaultCommandTimeout    2500    // 2 1/2 second command timeout.
#define mdmDefaultConnectTimeout    30000   // 30 second connect timeout.
typedef struct {                            // Command-to-response timeouts.
    OS_MILLISECONDS     timeoutCommand;     //  Timeout for all commands
                                            //    except connect requests
                                            //    (default of 2 1/2 seconds).
    OS_MILLISECONDS     timeoutConnect;     //  Timeout for connect requests
                                            //    (default of 30 seconds).
} MODEM_TIMEOUT, *P_MODEM_TIMEOUT;
typedef struct {                // Modem command-response handling behavior.
    MODEM_RESPONSE_MODE mode;   //  Mode for coveying responses
    MODEM_TIMEOUT       timeout;//  Command-to-response timeouts.
} MODEM_RESPONSE_BEHAVIOR, *P_MODEM_RESPONSE_BEHAVIOR;
```

Comments

Response mode **mdmResponseViaStatus** causes the modem service to block and await a response from the modem. If the modem doesn't return a response within the specified time-out duration, **stsTimeOut** is returned.

Response mode **mdmResponseViaMessage** is useful for clients that wish to ObjectPostAsync their modem service requests, and hence not block until completion (or timeout) of the request. Modem responses are reported to the client via **msgModemResponse**.

Response mode **mdmResponseTransparent** disables the modem service response processing sub-system. Modem command responses are left unaltered within the input data stream. The client assumes responsibility for processing modem responses. All commands successfully sent to the modem return a status of **stsOK**.

NOTE: Once a client switches to transparent mode (or sends modem register altering commands via **msgModemSendCommand**) they are responsible for the integrity of **clsModem**. Therefore, it is the client's responsibility to ensure that the **clsModem** (and the modem) are reset to a known state upon switching from transparent mode to a different response mode.

msgModemGetResponseBehavior

Passes back the current modem response mode, and the current command-to-response time-out values.

Takes P_MODEM_RESPONSE_BEHAVIOR, returns STATUS. Category: modem service request.

```
#define msgModemGetResponseBehavior MakeMsg(clsModem, 17)
```

Message Arguments

```
typedef struct {                // Modem command-response handling behavior.
    MODEM_RESPONSE_MODE mode;   //  Mode for coveying responses
    MODEM_TIMEOUT       timeout;//  Command-to-response timeouts.
} MODEM_RESPONSE_BEHAVIOR, *P_MODEM_RESPONSE_BEHAVIOR;
```

msgModemSendCommand

Sends a specified command to the modem.

Takes P_MODEM_SEND_COMMAND, returns STATUS. Category: modem service request.

```
#define msgModemSendCommand        MakeMsg(clsModem, 18)
#define mdmSizeMaxCommand          80      // Max command size is 80 bytes.
```

Arguments

```
typedef struct {
    P_U8                pCmdStr;            // In:  Ptr to command string
                                            //      (null terminated).
    OS_MILLISECONDS     timeout;            // In:  Timeout for cmd response.
    MODEM_RESPONSE_INFO responseInfo;       // Out: The response to the cmd.
} MODEM_SEND_COMMAND, *P_MODEM_SEND_COMMAND;
```

Comments

The timeout value specified within MODEM_SEND_COMMAND supersedes that specified via **msgModemSetResponseBehavior**.

NOTE: Clients should only use **msgModemSendCommand** to perform modem actions unavailable via the **clsModem** API described herein.

NOTE: Clients that send commands that alter modem registers are responsible for the integrity of **clsModem**. Therefore, it is the client's responsibility to ensure that such commands will not adversely affect **clsModem**.

msgModemGetConnectionInfo

Passes back information about the current connection.

Takes P_MODEM_CONNECTION_INFO, returns STATUS. Category: modem service request.

```
#define msgModemGetConnectionInfo   MakeMsg(clsModem, 19)
```

Arguments

```
Enum32(MODEM_CONNECTION) {          // The type of connection established.
    mdmConnectionNone,              //  None; Disconnected.
    mdmConnectionStandard,          //  Standard data.
    mdmConnectionMNP,               //  MNP.
    mdmConnectionLAPM               //  LAPM.
};
Enum32(MODEM_LINK_CONTROL) {            // Link and error control protocols.
    mdmLinkControlMNPClass1_4 = flag0,  //  MNP Levels 1 through 4.
    mdmLinkControlMNPClass5 = flag1,    //  MNP Level 5 data compression.
    mdmLinkControlMNPClass6 = flag2,    //  MNP Level 6.
    mdmLinkControlMNPClass7 = flag3,    //  MNP Level 7 data compression.
    mdmLinkControlV42       = flag4,    //  Physical level error detection and
                                        //    correction (LAPM link control).
    mdmLinkControlV42bis    = flag5     //  V42 data compression.
};
typedef struct {                    // Information about a connection.
    MODEM_CONNECTION    connection; //  The type of connection.
    MODEM_LINK_CONTROL  linkControl;//  Link control in use, if any/known.
    S32                 baudRate;   //  Baud rate of connection.
    U32                 spare[2];   //  Reserved for future expansion.
} MODEM_CONNECTION_INFO, *P_MODEM_CONNECTION_INFO;
```

msgModemReset

Resets the modem firmware, I/O port, and service state.

Takes nothing, returns STATUS. Category: modem service request.

```
#define msgModemReset              MakeMsg(clsModem, 20)
```

Comments

NOTE: The modem I/O port baud rate is reset to the highest supported data mode baud rate. Therefore not all implementations will reset the baud rate to 2400. The client may elect to subseqently change the baud rate for auto- baud detecting modems.

Reset I/O port state:

```
    baud                 = 2400;
    line.dataBits        = sioEightBits;
    line.stopBits        = sioOneStopBit;
    line.parity          = sioNoParity;
    controlOut.rts       = true;
    controlOut.dtr       = true;
    flowChar.xonChar     = 0x11;
    flowChar.xoffChar    = 0x13;
    flowType.flowControl = sioNoFlowControl;
```

Reset modem firmware state:

Speaker control on until carrier detected (*).volume medium (*).detection enabled (*).detection enabled (*).mode from dialing environment.disabled.on ring zero.character echo disabled.command result codes.verbal result codes (words).carrier upon connect.code + (ASCII 43).termination code carriage return (ASCII 13).

(*) or set as per current modem option card setting.

msgModemOffHook

Picks up the phone line.

Takes nothing, returns STATUS. Category: modem service request.

```
#define msgModemOffHook              MakeMsg(clsModem, 21)
```

msgModemOnline

Forces the modem online into data mode.

Takes nothing, returns STATUS. Category: modem service request.

```
#define msgModemOnline               MakeMsg(clsModem, 22)
```

msgModemSetDialType

Establishes the mode for dialing telephone numbers.

Takes MODEM_DIAL_MODE, returns STATUS. Category: modem service request.

```
#define msgModemSetDialType          MakeMsg(clsModem, 23)
```

Arguments

```
Enum32(MODEM_DIAL_MODE) {        // Mode in which the modem is to dial.
    mdmPulseDialing,             //  Perform pulse dialing.
    mdmTouchtoneDialing,         //  Peform touch-tone dialing.
    mdmDialStringDialing,        //  Client supplies the dialing mode
                                 //    embedded within the dialString.
    mdmDialingEnvironmentDialing//  If available, use the current dialing
                                 //    environment dialing mode, otherwise use
                                 //    current modem firmware dialing mode (Default).
};
```

msgModemDial

Performs dialing and attempts to establish a connection.

Takes P_MODEM_DIAL, returns STATUS. Category: modem service request.

```
#define msgModemDial                MakeMsg(clsModem, 24)
```

Arguments

```
typedef struct {                        // Dialing and connection type.
    DIALENV_DIAL_STRING dialString;     //  In:  Phone number to dial.
    U32                 spare[2];       //  Reserved for future expansion.
} MODEM_DIAL, *P_MODEM_DIAL;
```

msgModemSetAutoAnswer

Disables or enables the modem auto-answer feature.

Takes P_MODEM_SET_AUTO_ANSWER, returns STATUS. Category: modem service request.

```
#define msgModemSetAutoAnswer       MakeMsg(clsModem, 25)
```

Arguments

```
Enum32(MODEM_AUTO_ANSWER) {             // Modem auto-answer capability.
    mdmAutoAnswerDisabled,              //  Disable auto-answer (Default).
    mdmAutoAnswerEnabled                //  Enable auto-answer.
};
typedef struct {                        // Auto-answer settings.
    MODEM_AUTO_ANSWER   autoAnswer;     //  In: Enable/disable auto-answer.
    S32                 rings;          //  In: Number of rings before answer.
} MODEM_SET_AUTO_ANSWER, *P_MODEM_SET_AUTO_ANSWER;
```

Comments

NOTE: For some modems a value of 0 for rings disables auto-answer.

msgModemSetAnswerMode

Filters the type of calls to answer and connection reporting.

Takes MODEM_ANSWER_MODE, returns STATUS. Category: modem service request.

```
#define msgModemSetAnswerMode       MakeMsg(clsModem, 26)
```

Arguments

```
Enum32(MODEM_ANSWER_MODE) {             // Modem answer filter/mode.
    mdmAnswerDataMode       = flag0,    //  Answer in data mode.
    mdmAnswerFaxMode        = flag1,    //  Answer in fax mode.
    mdmAnswerVoiceMode      = flag2     //  Answer in voice mode.
};
```

Comments

NOTE: Not all modems are capable of discriminating between the type of incoming call.

msgModemAnswer

Immediately answers a telephone call.

Takes nothing, returns STATUS. Category: modem service request.

```
#define msgModemAnswer              MakeMsg(clsModem, 27)
```

msgModemHangUp

Hang-ups and disconnects to terminate a connection.

Takes nothing, returns STATUS. Category: modem service request.

```
#define msgModemHangUp              MakeMsg(clsModem, 28)
```

msgModemSetSignallingModes

Establishes/restricts the modem to use specific signalling modes/standards.

Takes P_MODEM_SIGNALLING_MODES, returns STATUS. Category: modem service request.

```
#define msgModemSetSignallingModes  MakeMsg(clsModem, 29)
```

Arguments

```
Enum32(MODEM_SIGNALLING_VOICEBAND) {    // Voice-band signalling standards.
    mdmVoiceBandBell103J    = flag0,    //  300 BPS.
    mdmVoiceBandBell212A    = flag1,    //  1200 BPS.
    mdmVoiceBandV21         = flag2,    //  300 BPS duplex modem on GSTN.
    mdmVoiceBandV22         = flag3,    //  1200 BPS duplex modem on GSTN
                                        //    or P-P leased two-wire circuits.
    mdmVoiceBandV22bis      = flag4,    //  2400 BPS duplex modem on GSTN
                                        //    or P-P two-wire leased circuits.
    mdmVoiceBandV23         = flag5,    //  600/1200 BPS modem on GSTN.
    mdmVoiceBandV26         = flag6,    //  2400 BPS modem on four-wire
                                        //    leased circuits.
    mdmVoiceBandV26bis      = flag7,    //  2400/1200 BPS modem on GSTN.
    mdmVoiceBandV26ter      = flag8,    //  2400 BPS duplex modem on GSTN
                                        //    or P-P two-wire leased circuits.
    mdmVoiceBandV27         = flag9,    //  4800 BPS on leased circuits.
    mdmVoiceBandV27bis      = flag10,   //  2400/4800 BPS on leased circuits.
    mdmVoiceBandV27ter      = flag11,   //  4800/2400 BPS modem on GSTN.
    mdmVoiceBandV29         = flag12,   //  9600 BPS FDX or HDX modem on
                                        //    P-P four-wire leased circuits.
    mdmVoiceBandV32         = flag13,   //  9600/4800 BPS duplex modem on
                                        //    GSTN or leased circuits.
    mdmVoiceBandV33         = flag14    //  14400 BPS modem on P-P
                                        //    four-wire leased circuits.
};
Enum32(MODEM_SIGNALLING_WIDEBAND) {     // Wide-band signalling standards.
    mdmWideBandV35          = flag0,    //  48 KBPS data transmission on
                                        //    60-108 KHz group band circuits.
    mdmWideBandV36          = flag1,    //  48-72 KBPS sync data transmission
                                        //    on 60-108 KHz group band circuits.
    mdmWideBandV37          = flag2     //  72-168 KBPS sync data transmission
                                        //    on 60-108 KHz group band circuits.
};
typedef struct {                        // Modem modulation/signalling modes.
    MODEM_SIGNALLING_VOICEBAND  voiceBand;  //  Voice band signalling.
    MODEM_SIGNALLING_WIDEBAND   wideBand;   //  Wide band signalling.
} MODEM_SIGNALLING_MODES, *P_MODEM_SIGNALLING_MODES;
```

Comments

NOTE: Not all modems provide support for selecting signalling modes.

msgModemSetToneDetection

Enables or disables busy tone and/or dial tone detection.

Takes MODEM_TONE_DETECTION, returns STATUS. Category: modem service request.

```
#define msgModemSetToneDetection    MakeMsg(clsModem, 30)
```

Arguments

```
Enum32(MODEM_TONE_DETECTION) {  // Busy and dial toneCarrier signal on/off.
    mdmToneDetectDisable,       //  Detect neither busy tone or dial tone.
    mdmToneDetectBusyOnly,      //  Detect busy tone, but not dial tone.
    mdmToneDetectDialOnly,      //  Detect dial tone, but not busy tone.
    mdmToneDetectBusyAndDial    //  Detect dial tone and busy tone (Default).
};
```

msgModemSetSpeakerControl

Enables, disables and controls modem speaker behavior.

Takes MODEM_SPEAKER_CONTROL, returns STATUS. Category: modem service request.

```
#define msgModemSetSpeakerControl   MakeMsg(clsModem, 31)
```

Arguments

```
Enum32(MODEM_SPEAKER_CONTROL) { // Specifies the modem speaker behavior.
    mdmSpeakerOn,               //  Speaker is always on.
    mdmSpeakerOff,              //  Speaker is always off.
    mdmSpeakerOnConnectOff      //  Speaker on until carrier detected (Default).
};
```

msgModemSetSpeakerVolume

Sets the volume of the modem speaker.

Takes MODEM_SPEAKER_VOLUME, returns STATUS. Category: modem service request.

```
#define msgModemSetSpeakerVolume    MakeMsg(clsModem, 32)
```

Arguments

```
Enum32(MODEM_SPEAKER_VOLUME) {  // Specifies the modem speaker volume.
    mdmSpeakerVolumeWhisper,    //  Lowest volume level.
    mdmSpeakerVolumeLow,        //  Low/reasonable volume level.
    mdmSpeakerVolumeMedium,     //  Normal/average volume level (Default).
    mdmSpeakerVolumeHigh        //  Highest volume level.
};
```

Comments

NOTE: Not all modems are capable of adjusting modem speaker volume.

msgModemSetCommandState

Sets the modem into command mode.

Takes nothing, returns STATUS. Category: modem service request.

```
#define msgModemSetCommandState     MakeMsg(clsModem, 33)
```

msgModemSetDuplex

Sets the duplex mode for inter-modem communications while on-line.

Takes MODEM_DUPLEX_MODE, returns STATUS. Category: modem service request.

```
#define msgModemSetDuplex           MakeMsg(clsModem, 34)
```

Arguments

```
Enum32(MODEM_DUPLEX_MODE) {     // Indicates data transmission line duplex.
    mdmDuplexHalf,              // Data transmitted in one direction at a
                                //   time ( the line must be turned around).
    mdmDuplexFull               // Data can be transmitted in both
                                //   directions simultaneously (Default).
};
```

Comments

NOTE: Not all modems are capable of setting the duplex once on-line.

msgModemSetMNPMode

Sets the MNP mode of operation.

Takes MODEM_MNP_MODE, returns STATUS. Category: modem service request.

```
#define msgModemSetMNPMode          MakeMsg(clsModem, 35)
```

Arguments

```
Enum32(MODEM_MNP_MODE) {         // MNP mode in which modem is to operate.
    mdmMNPModeDirect,            //  Disable MNP mode (default).
    mdmMNPModeReliable,          //  Both modems must support MNP levels
                                 //   1-4 (5 if enabled) before a connection
                                 //   can be made.
    mdmMNPModeAutoReliable,      //  Attempt to establish an MNP connection; if
                                 //   it fails establish a direct connection.
    mdmMNPModeLAPM               //  LAPM connection.
};
```

Comments

NOTE: Not all modems provide MNP support.

msgModemSetMNPCompression

Sets MNP class 5 compression on or off.

Takes MODEM_MNP_COMPRESSION, returns STATUS. Category: modem service request.

```
#define msgModemSetMNPCompression    MakeMsg(clsModem, 36)
```

Arguments

```
Enum32(MODEM_MNP_COMPRESSION) { // Type of compression to use in MNP mode.
    mdmMNPCompressionOff,       //  Disable MNP level 5 compression (default).
    mdmMNPCompressionOn         //  Enable MNP level 5 compression.
};
```

msgModemSetMNPBreakType

Specify how a break is handled in MNP mode.

Takes MODEM_MNP_BREAK_TYPE, returns STATUS. Category: modem service request.

```
#define msgModemSetMNPBreakType     MakeMsg(clsModem, 37)
```

Arguments

```
Enum32(MODEM_MNP_BREAK_TYPE) {  // How breaks are handled in MNP mode.
    mdmMNPSendNoBreak,          //  Do not send break to remote modem.
    mdmMNPEmptyBuffersThenBreak,//  Empty data buffers before sending break.
    mdmMNPImmediatelySendBreak, //  Send break when received (default).
    mdmMNPSendBreakInSequence   //  Send break relative to data to be sent.
};
```

msgModemSetMNPFlowControl

Specify the flow control to use in MNP mode.

Takes MODEM_MNP_FLOW_CONTROL, returns STATUS. Category: modem service request.

```
#define msgModemSetMNPFlowControl   MakeMsg(clsModem, 38)
```

Arguments

```
Enum32(MODEM_MNP_FLOW_CONTROL) {// Indicates the flow control for MNP mode.
    mdmMNPFlowControlDisable,   //  No flow control used (default).
    mdmMNPFlowControlXonXoff,   //  Use Xon/Xoff flow control.
    mdmMNPFlowControlHardware   //  Use RTS/CTS flow control.
};
```

Superclass Messages

msgSvcGetMetrics

Passes back the current modem metrics.

Takes P_SVC_GET_SET_METRICS, returns STATUS. Category: superclass message.

Arguments

```
typedef struct MODEM_METRICS {
    MODEM_DIAL_MODE         mdmDialMode;
    MODEM_DUPLEX_MODE       mdmDuplexMode;
    MODEM_SPEAKER_CONTROL   mdmSpeakerControl;
    MODEM_SPEAKER_VOLUME    mdmSpeakerVolume;
    MODEM_TONE_DETECTION    mdmToneDetection;
    MODEM_ANSWER_MODE       mdmAnswerMode;
    MODEM_AUTO_ANSWER       mdmAutoAnswer;
    U32                     mdmAutoAnswerRings;
    MODEM_MNP_MODE          mdmMNPMode;
    MODEM_MNP_COMPRESSION   mdmMNPCompression;
    MODEM_MNP_BREAK_TYPE    mdmMNPBreakType;
    MODEM_MNP_FLOW_CONTROL  mdmMNPFlowControl;
} MODEM_METRICS, *P_MODEM_METRICS;
```

Comments

The **pMetrics** field of SVC_GET_SET_METRICS is expected to point to a buffer capable of receiving MODEM_METRICS as described below.

msgSvcSetMetrics

Sets current modem metrics, and re-initializes the modem with specified metrics.

Takes P_SVC_GET_SET_METRICS, returns STATUS. Category: superclass message.

Comments

The **pMetrics** field of SVC_GET_SET_METRICS is expected to point to a buffer containing MODEM_METRICS as described above.

msgSvcCharactersticsRequested

Passes back the characteristics of the modem service.

Takes P_SVC_CHARACTERISTICS, returns STATUS. Category: superclass message.

```
#define mdmHWManufactureNameLength  15
#define mdmHWModelNameLength        15
```

Arguments

```
typedef struct {                        // Modem hardware manufacturer.
    CHAR    name[mdmHWManufactureNameLength+1]; // Name of manufacturer.
} MODEM_HARDWARE_MANUFACTURER, *P_MODEM_HARDWARE_MANUFACTURER;
typedef struct {                        // Model of modem hardware.
    CHAR    name[mdmHWModelNameLength+1];// Name of model.
} MODEM_HARDWARE_MODEL, *P_MODEM_HARDWARE_MODEL;
Enum32(MODEM_HARDWARE_FEATURES) {       // Modem hardware capabilities.
    mdmHWCapAutoDial        =   flag0,  //  Auto dialing.
    mdmHWCapAutoAnswer      =   flag1,  //  Auto answer.
    mdmHWCapAutoBaudDetect  =   flag2,  //  Auto baud detection.
    mdmHWCapCallTypeDiscrimination = flag3, //  Call type discrimination
                                        //   (Fax, Data, Voice).
    mdmHWCapPhoneJackConnectDetect = flag4, //  Phone jack connect and
                                        //   disconnect event reporting.
    mdmHWCapRingSignalMachineWakeUp= flag5  //  Ring signal detection
                                        //   wakes up dormant machines.
};
```

```
typedef struct {                          // Size of internal modem I/O buffers.
    S32         sizeInputBuffer;          //  Input buffer size.
    S32         sizeOutputBuffer;         //  Output buffer size.
} MODEM_HARDWARE_BUFFERS, *P_MODEM_HARDWARE_BUFFERS;
Enum32(MODEM_DCE_CONTROL) {               // Firmware DCE protocol/command sets.
    mdmDCEControlAT          = flag0      //  Hayes 'AT' commands.
};
typedef struct  MODEM_CHARACTERISTICS { // Modem hw & sw characteristics.
    MODEM_HARDWARE_MANUFACTURER hardwareManufacturer;
    MODEM_HARDWARE_MODEL        hardwareModel;
    MODEM_HARDWARE_FEATURES     hardwareFeature;
    MODEM_HARDWARE_BUFFERS      hardwareBuffer;
    MODEM_DCE_CONTROL           dceControl;
    MODEM_SIGNALLING_MODES      signallingMode;
    MODEM_LINK_CONTROL          linkControl;
    U32                         spare[4];
} MODEM_CHARACTERISTICS, *P_MODEM_CHARACTERISTICS;
```

Comments

The **pBuf** field of SVC_CHARACTERISTICS is expected to point to a buffer capable of receiving MODEM_CHARACTERISTICS as described below.

Implementors of **clsModem** services that wish to provide capabilities not described within MODEM_CHARACTERISTICS should contact GO Corporation to ensure such **clsModem** enhancements are standardized and noted within MODEM_CHARACTERISTICS. Thank you.

Class Messages

msgNew

Creates a new instance of a modem service.

Takes P_MODEM_NEW, returns STATUS. Category: class message.

```
#define modemNewFields    serviceNewFields
```

Arguments

```
typedef struct MODEM_NEW
{
    modemNewFields
} MODEM_NEW, *P_MODEM_NEW;
```

Comments

Error Return Values: percolated up from other classes,

msgNewDefaults

Initializes the MODEM_NEW structure to default values.

Takes P_MODEM_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct MODEM_NEW
{
    modemNewFields
} MODEM_NEW, *P_MODEM_NEW;
```

Comments

Sets:

```
    pArgs->svc.style.autoOption     =
    pArgs->svc.style.exclusiveOpen  = true;
    pArgs->svc.style.waitForTarget  = false;
    pArgs->svc.pManagerList         = pManagerList;
    pArgs->svc.numManagers          = sizeof(pManagerList)/sizeof(OBJECT);
    static OBJECT   pManagerList[] =
    {
        theModems                   // clsModem is one of theModems.
    };
```

clsModem error status values

This modem service doesn't (or cannot) support the current request due to hardware or firmware constraints.

```
#define stsModemNotSupported            MakeStatus(clsModem, 1)
```

A request to the modem service contained a parameter that is invalid.

```
#define stsModemBadParameter            MakeStatus(clsModem, 2)
```

The size of the buffer supplied to get/set modem service metrics or characteristics is incorrect.

```
#define stsModemBufferSizeError         MakeStatus(clsModem, 3)
```

The modem service was unable to find and/or open its target service.

```
#define stsModemTargetError             MakeStatus(clsModem, 4)
```

The modem service is not open. The current request requires that it be open.

```
#define stsModemNotOpen                 MakeStatus(clsModem, 5)
```

The modem has responded to a modem command with an error response.

```
#define stsModemErrorResponse           MakeStatus(clsModem, 6)
```

The modem has responded to a modem command with a response that was unrecognized.

```
#define stsModemUnrecognizedResponse    MakeStatus(clsModem, 7)
```

The modem responded with a notification of carrier loss after dialing, attempting to go online, or being online.

```
#define stsModemNoCarrier               MakeStatus(clsModem, 8)
```

The modem didn't detect a dial tone while dialing to establish a connection.

```
#define stsModemNoDialTone              MakeStatus(clsModem, 9)
```

The modem didn't detect an answer tone after dialing to establish a connection.

```
#define stsModemNoAnswer                MakeStatus(clsModem, 10)
```

The modem has been unable to successfully transmit a data frame to the remote node.

```
#define stsModemTransmitError           MakeStatus(clsModem, 11)
```

The modem has been unable to successfully receive a data frame to the remote node.

```
#define stsModemReceiveError            MakeStatus(clsModem, 12)
```

The modem has detected a cyclic redundancy check error within a data frame received from the remote node.

```
#define stsModemCRCError                MakeStatus(clsModem, 13)
```

The modem has detected a busy signal after dialing a telephone number.

```
#define stsModemLineBusy                MakeStatus(clsModem, 14)
```

The modem service could not locate a window within one of its option cards. This is an internal error.

```
#define stsModemNoSuchWindow            MakeStatus(clsModem, 255)
```

clsModem non-error status values

None currently defined

OBXSVC.H

This file contains the API definition for **clsOBXService**.

clsOBXService inherits from **clsIOBXService**.

Provides default behavior for Outbox Services.

```
#ifndef OBXSVC_INCLUDED
#define OBXSVC_INCLUDED
#ifndef IOBXSVC_INCLUDED
#include <iobxsvc.h>
#endif
```

1. Introduction

In PenPoint, output operations are handled by a special class of services known as the "outbox services." An outbox service implements the "deferred output" feature in PenPoint: This concept permits a user to specify output operations regardless of the readiness of output devices. If the output device (e.g., a printer, a phone plug, a LAN connection, etc.) is not available or not connected, documents waiting for output will be placed into an "output queue" associated with the output service. (This output queue is a special section in the system Outbox notebook.) Thus, the actual output process is deferred until the output device becomes ready.

The Target of an Outbox Service

PenPoint expects that the PenPoint computer will not always be attached to most output devices. Therefore, the output process for any PenPoint documents will be deferred until a connection is established. The software controlling an input/output device is often implemented as an I/O service. In most cases, an outbox service will make such an I/O service as its "target." (See service.h for more information about target services in general.) Examples of I/O services include drivers for serial ports, parallel ports, data and/or fax modems, and LAN servers. By making an I/O service its target, an outbox service is notified whenever the physical output device becomes connected or disconnected. When an outbox service is not actively sending out a document, the connection status of the device is displayed in the "Status" column of the Outbox notebook Table of Contents.

Enabling and Disabling an Outbox Service

An outbox service must be "enabled" before its output process can begin. This enabled state is represented by a checkbox in the "Enabled?" column of the Outbox notebook TOC. Typically, an output device permits only exclusive access. If multiple outbox services are connected to the same output device, only one can be enabled at a time. Enabling an outbox service causes it to become the "owner" of its target service. The service remains "enabled" until either it is manually disabled by the user (i.e., by unchecking the "Enabled?" box); or until it willingly releases ownership of the device so that another service can become the new owner. For more details on the notion of service ownership, see the service API in service.h.

The concept of enabling or disabling an outbox service also provides a convenient mechanism for the user to manage an output device that can not automatically determine whether or not it becomes connected or disconnected. Because the outbox service will not be informed when its target service is connected or disconnected, its status will always remain "Connected" regardless of the connection status of the physical device. Such services can be explicitly disabled to prevent documents from being sent to a device that is not ready for output.

Managing the Output Process via the Outbox Service Protocol

Each instance of an outbox service has a corresponding section in the system Outbox notebook. The name of the service and the name of the section are the same. For example, the user may create two instances of an outbox service class named "DotMatrix," say "Engineering Printer" and "Upstairs." Each instance will have its own output queue, implemented as a section called "Engineering Printer" and "Upstairs" in the outbox notebook. The primary function of an outbox service is to manage the output queue for each service instance. This function is implemented by a standard outbox protocol consisting of 8 inter-related messages, as summarized below:

The client of an outbox service first sends **msgOBXSvcMoveInDoc** or **msgOBXSvcCopyInDoc** to the outbox service instance, telling it to add an existing PenPoint document to its output queue. Once a document is added to the outbox, **msgOBXSvcPollDocuments** informs an outbox service that it should check to see if conditions are right to start an output process. Other events may also cause the outbox service to receive **msgOBXSvcPollDocument**. For example, an outbox service will self-send this message when the service has just been enabled. If the service is enabled and the output device is connected, the service sends **msgOBXSvcNextDocument** to self to locate the next document ready for output. If a document exists in the output queue but is not ready for output, the service self-sends **msgOBXSvcScheduleDocument** to reschedule output at a later time. If a document is ready for output, the service will lock the document with **msgOBXSvcLockDocument**, and kick off the output process with **msgOBXSvcOutputStart**. At the end of the output process, the document being sent will send **msgOBXDocOutputDone** to the outbox service. Finally, if the output finished normally, the service self-sends **msgOBXSvcPollDocuments** again to see if anything else is ready for output. If the output didn't finish normally, the service self-sends **msgOBXSvcUnlockDocument** to restore the document to its "pre-output" state.

Outbox Documents

The primary focus of an outbox service is to manage its output queue. An output queue is essentially a collection of documents located in an outbox section. The primary focus of an outbox document is to manage a single output job.

An outbox document can be any PenPoint document, i.e., an instance of an application inheriting from **clsApp**. It can be created, opened, and closed just like a regular page in the notebook. An example of an outbox document would be an "address envelope" for an electronic mail service.

An outbox document is also responsible for interacting with the outbox service and controlling the output process, such as sending out an electronic mail message through a communication link. Thus, in addition to responding to **clsApp** messages, an outbox document also understand the following **clsOBXService** messages:

msgOBXDocOutputStartOK

For details see the description for each message.

Writing Your Own Outbox Service

clsOBXService is an abstract class. You should always create a subclass of it. This is because **clsOBXService** only manages the output queue, it does not actually cause the output to happen. Typically, your outbox service will inherit the output queue management behavior from **clsOBXService**, and add any service-specific behaviors for the communication protocol or devices you need to handle.

The default behavior of the outbox service does not support sophisticated scheduling algorithms that may be required by some services. However, it is not difficult to replace some default behaviors with new ones. The messages you may want to handle on your own include:

msgOBXSvcMoveInDoc

For example, the default behavior of **msgOBXSvcNextDocument** treats the output queue as a simple, Fist-In-First-Out queue. If this is not sufficient for the service you wish to develop, you can provide your own behavior and pass back a document not on the top of the queue, or even a document not located in the Outbox notebook if it makes sense for the service.

Another example would be **msgOBXSvcLockDocument** and **msgOBXSvcUnlockDocument**. Their default behavior is to mark the document so that gestures over the document icon will not be recognized while output is in progress. A **msgOBXSvcUnlockDocument** typically indicates that the output has been aborted for some reason. You may wish to add to the default behavior, such as notifying your observers that some error has just occurred.

For details see the description for each message.

Working with Existing Outbox Services

As explained before, all output operations should be performed through an outbox service in order to take advantage of the "deferred output" feature of PenPoint. An application or a service can "bypass" the standard outbox protocol only if the output device is always present or is rarely detached from the PenPoint computer.

The key to working with an existing outbox service is to conceptually break up the output process into two distinct phases. The first phase is either adding an existing PenPoint document to the output queue, or creating a special document of some sort in temporary storage and and then move it into the output queue. The second phase is the actual output process, during which a device-specific data stream is sent out via some communication link. **clsOBXService** provides a framework for managing the transition from one phase to another.

The separation of these two phases of output operation has an additional benefit. In many cases, an application developer can avoid writing a new outbox service in order to handle application-specific output functions. It is often sufficient to handle only one of the two phases of the output operaton. There are several options, as explained below:

One inexpensive solution is to have the application export the data into a format that is easier to output under an existing outbox service. For example, a database document can generate a report as an ASCII file or a word processor document and move it into a printer, fax or e-mail outbox section. Similarly, a spreadsheet document can export its pie chart into a popular drawing program document and move it to the outbox for output.

Another approach is to allow the database or spreadsheet document itself to be moved or copied into the output queue. When the document receives **msgOBXSvcOutputStart**, it knows that the output device is ready. It then proceeds to perform the output operation the old-fashioned way. This alternative may be an attractive one if we wish to port an existing PC application to PenPoint. Such applications already have sophisticated output capabilities, and we only need to ensure not to start the output process until the device is ready. The obvious disadvantage of this approach is that it requires additional memory if we have to make a copy of the document in order to put it into the outbox.

A third approach represents a compromise between the two. During the first phase of the output operation, a "surrogate" document, rather than the real one, is copied into the output queue. This surrogate document not only understands the outbox output protocol, but also knows how to communicate with the original document. It is effectively a "pointer" back to the original document. When the output process begins, the surrogate document communicates with the original one to cause the device-specific data stream to be sent to the correct output port.

Services that Handle Input and/or Output

clsOBXService deals only with output operations. For those services that want to handle input operations, a similar class **clsINBXService** is provided by PenPoint. If a service (e.g., an electronic mail service) wants to handle both input and output, another abstract class, **clsIOBXService,** is provided. **clsIOBXService** associates the service with both an input queue and an output queue. (The input queue is a section in the system Inbox notebook.) The service, the inbox section, and the outbox section all have the same name. In fact, **clsOBXService** is implemented as a subclass (hence a subset) of clsIOBXService.

Class Messages

msgNewDefaults

Initializes the P_OBXSVC_NEW structure to default values.

Takes P_OBXSVC_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct OBXSVC_NEW_ONLY {
    OBJECT  sectionClass;   // class of the outbox section (for output queue)
                            // This must be clsNBToc or a subclass of it.
    U32     unused1;
    U32     unused2;
    U32     unused3;
} OBXSVC_NEW_ONLY, *P_OBXSVC_NEW_ONLY;
#define obxServiceNewFields \
    ioSvcNewFields        \
    OBXSVC_NEW_ONLY         obxsvc;
typedef struct OBXSVC_NEW {
    obxServiceNewFields
} OBXSVC_NEW, *P_OBXSVC_NEW;
```

Zeroes out **pArgs**->obxsvc and sets...>iobxsvc.out.**autoPoll** = true;>obxsvc.**sectionClass** = clsNBToc;

msgNew

Creates a new outbox service object.

Takes P_OBXSVC_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct OBXSVC_NEW {
    obxServiceNewFields
} OBXSVC_NEW, *P_OBXSVC_NEW;
```

msgOBXSvcSwitchIcon

Toggles the outbox icon (to empty or filled) if neccessary.

Takes nothing, returns STATUS. Category: class message.

```
#define msgOBXSvcSwitchIcon                    msgIOBXSvcSwitchIcon
```

Comments

Check the content of the outbox notebook. Show the "filled" icon if any document is found. Show the "emtpy" icon otherwise.

msgOBXDocGetService

Gets the service name.

Takes P_OBX_DOC_GET_SERVICE, returns STATUS. Category: class message.

```
#define msgOBXDocGetService                    msgIOBXDocGetService
```

Arguments

```
typedef struct OBX_DOC_GET_SERVICE {
    OBJECT  document;                  // In: document uid
    CHAR    svcName[nameBufLength];  // Out: service name
} OBX_DOC_GET_SERVICE, *P_OBX_DOC_GET_SERVICE;
```

Comments

Get the name of the service associated with an outbox document. If the document has not been placed into an outbox section, **stsFailed** is returned.

Note that the document must be at the top level of an outbox section. That is, if the document is embedded within another document which is in an outbox section, **stsFailed** will be returned because the document is not at the top level of an outbox section.

msgOBXDocInOutbox

Checks if a document is in a section in the Outbox.

Takes P_OBX_DOC_IN_OUTBOX, returns STATUS. Category: class message.

```
#define msgOBXDocInOutbox                      msgIOBXDocInIOBox
```

Arguments

```
typedef struct OBX_DOC_IN_OUTBOX {
    UUID    uuid;        // In: document uuid
    CLASS   svcClass;    // In: service class to check for
} OBX_DOC_IN_OUTBOX, *P_OBX_DOC_IN_OUTBOX;
```

Comments

This message can be sent to **clsOBXService** to check if a PenPoint document represented by **pArgs**->uuid is already in the output queue of an outbox service inheriting from **pArgs**->svcClass. **stsOK** is returned if it is, **stsFailed** otherwise. If **pArgs**->svcClass is **objNull**, **stsOK** is returned if the document is anywhere in the Outbox notebook.

Messages Sent to an Outbox Service Instance

msgOBXSvcMoveInDoc

Moves a document into the outbox section.

Takes P_OBXSVC_MOVE_COPY_DOC, returns STATUS.

```
#define msgOBXSvcMoveInDoc                     msgIOBXSvcMoveInDoc
```

Arguments

```
typedef struct OBXSVC_MOVE_COPY_DOC {
    FS_LOCATOR  source;     // In: Location of source document.
    U16         sequence;   // In: Sequence number to move/copy in
                                   //     front of.
} OBXSVC_MOVE_COPY_DOC, *P_OBXSVC_MOVE_COPY_DOC;
```

Comments

Superclass behavior is to move the document located at **pArgs**->source into the output queue associated with the outbox service. For example, set **pArgs**->sequence to 1 to move the document to the top of the queue. Set it to **maxU16** to move the document to the bottom of the queue.

After the document is moved (or copied) to the output queue, it is considered to be in a state ready for output, even though the service may not be connected at the time. Client should not alter the document in any way once it has been moved to the output queue.

Subclasses can provide their own behavior if they wish. Remember to use the class message **msgOBXSvcSwitchIcon** to change the outbox icon.

msgOBXSvcCopyInDoc

Copies a document into the Outbox section.

Takes P_OBXSVC_MOVE_COPY_DOC, returns STATUS.

```
#define msgOBXSvcCopyInDoc                    msgIOBXSvcCopyInDoc
```

Message Arguments

```
typedef struct OBXSVC_MOVE_COPY_DOC {
    FS_LOCATOR  source;     // In: Location of source document.
    U16         sequence;   // In: Sequence number to move/copy in
                                   //     front of.
} OBXSVC_MOVE_COPY_DOC, *P_OBXSVC_MOVE_COPY_DOC;
```

Comments

Same as **msgOBXSvcMoveInDoc**, except that the document is copied to the output queue.

msgOBXSvcGetTempDir

Passes back a handle for a temporary directory.

Takes P_OBJECT, returns STATUS.

```
#define msgOBXSvcGetTempDir                   msgIOBXSvcGetTempDir
```

Comments

This message is provided for clients who may want ot prepare their output document before moving it into the output queue. The handle of an "official" temporary directory is passed back and it can be used as temporary storage for documents, data, etc. Clients are responsible for deleting temporary files when they are done. The directory will be flushed after a warm boot.

msgOBXSvcPollDocuments

Polls all documents in an output queue and output those who are ready.

Takes nothing, returns STATUS.

```
#define msgOBXSvcPollDocuments                msgIOBXSvcPollDocuments
```

Comments

This message tells the outbox service to look through its output queue and send out the first document ready for output. The service will first make sure that it is enabled and is connected to the designated output port. If these conditions are met, it will then self-send **msgOBXSvcNextDocument** to locate the next document ready for output.

If **msgOBXSvcNextDocument** returns **stsOK**, indicating that a document is ready for output, this message proceeds to self-send **msgOBXSvcLockDocument** to lock the document, and finally **msgOBXSvcOutputStart** to initiate the output process.

If **msgOBXSvcNextDocument** returns **stsOBXSvcDocReady**, indicating that the section is not empty but none of the documents are ready for output, this message self-sends **msgOBXSvcScheduleDocument** to schedule the document passed back in **pArgs** at a later time.

Subclasses normally do not process this message.

See Also **msgOBXSvcNextDocument**

msgOBXSvcNextDocument

Passes back the next document ready for output.

Takes P_OBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgOBXSvcNextDocument                    msgIOBXSvcNextDocument
```

Arguments

```
typedef struct OBXSVC_DOCUMENT {
    OBJECT      uid;                    // uid of the doc
    OBJECT      dir;                    // app dir of the doc
    OBJECT      docClass;               // class of the doc
    U16         sequence;               // sequence of the doc
    CHAR        pName[nameBufLength];   // name of this doc
    P_UNKNOWN   pDocData;               // subclass's private data
} OBXSVC_DOCUMENT, *P_OBXSVC_DOCUMENT;
```

Comments

Superclass behavior is to start from the top of the output queue and locate the first document ready for output. If one is found, information about the document is passed back in **pArgs**. The same **pArgs** will be passed to messages **msgOBXSvcLockDocument** and **msgOBXSvcOutputStart**. By default, a document is ready for output when it is closed. If the document is open, it will receive **msgOBXDocOutputStartOK** and it should return **stsOK** to indicate that it is ready for output.

Subclasses can provide their own behavior if they wish. Return **stsOBXSvcSectionEmpty** to give the superclass an opportunity to change the outbox icon from filled to empty.

Return Value

stsOK A document is ready for output.

stsOBXSvcSectionEmpty The output queue is empty.

stsOBXSvcDocNotReady No document in the output queue is ready.

Service-Specific Error Returns.

See Also **msgOBXSvcPollDocuments**

msgOBXSvcLockDocument

Locks the document in preparation for output.

Takes P_OBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgOBXSvcLockDocument                    msgIOBXSvcLockDocument
```

Message Arguments

```
typedef struct OBXSVC_DOCUMENT {
    OBJECT      uid;                    // uid of the doc
    OBJECT      dir;                    // app dir of the doc
    OBJECT      docClass;               // class of the doc
    U16         sequence;               // sequence of the doc
    CHAR        pName[nameBufLength];   // name of this doc
    P_UNKNOWN   pDocData;               // subclass's private data
} OBXSVC_DOCUMENT, *P_OBXSVC_DOCUMENT;
```

Comments

This message is a place holder for subclasses that may require additional preparatory work to be performed on a document before it is ready for output. For example, a document may have to be "locked" so that it can not be opened during the output process. This message may be used for other purposes as well. For example, an outbox service may decide to store a light-weight "shadow" document (e.g., a report designator for a database application) in the output queue until it is chosen for output. The service then handles this message by converting the shadow document to a real one (e.g., the actual report).

The superclass behavior for this message is to stamp the document directory with the filesystem attribute **iobxsvcDocOutputInProgress**. This stamp will prevent any gestures over the document from being processed. This means that once a document is locked for output it can not be deleted, renamed, etc. via gestures.

See Also **msgOBXSvcUnlockDocument**

msgOBXSvcUnlockDocument

Unlocks a document that was previously locked.

Takes P_OBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgOBXSvcUnlockDocument                  msgIOBXSvcUnlockDocument
```

Message Arguments

```
typedef struct OBXSVC_DOCUMENT {
    OBJECT      uid;                    // uid of the doc
    OBJECT      dir;                    // app dir of the doc
    OBJECT      docClass;               // class of the doc
    U16         sequence;               // sequence of the doc
    CHAR        pName[nameBufLength];   // name of this doc
    P_UNKNOWN   pDocData;               // subclass's private data
} OBXSVC_DOCUMENT, *P_OBXSVC_DOCUMENT;
```

Comments

This message is a place holder for subclasses that may require additional "cleanup" work to be performed on a document before it is put back to the output queue.

The superclass behavior for this message is to remove the **iobxsvcDocOutputInProgress** stamp on the document directory.

See Also **msgOBXSvcLockDocument**

msgOBXSvcScheduleDocument

Schedules a document that is not ready for output

Takes P_OBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgOBXSvcScheduleDocument                msgIOBXSvcScheduleDocument
```

Message Arguments

```
typedef struct OBXSVC_DOCUMENT {
    OBJECT      uid;                    // uid of the doc
    OBJECT      dir;                    // app dir of the doc
    OBJECT      docClass;               // class of the doc
    U16         sequence;               // sequence of the doc
    CHAR        pName[nameBufLength];   // name of this doc
    P_UNKNOWN   pDocData;               // subclass's private data
} OBXSVC_DOCUMENT, *P_OBXSVC_DOCUMENT;
```

Comments

This message is sent when **msgOBXSvcNextDocument** locates a document in the output queue but the document is not ready for output.

Subclasses should provide their own behavior. The default behavior is to release the ownership of the target service (i.e., become disabled), with the expectation that the user must manually schedule the document later on (by re-enabling the section.)

See Also **msgOBXSvcNextDocument**

msgOBXSvcOutputStart

Starts the output process for a document in the output queue.

Takes P_OBXSVC_DOCUMENT, returns STATUS. Category: self-sent.

```
#define msgOBXSvcOutputStart                        msgIOBXSvcIOStart
```

Message Arguments

```
typedef struct OBXSVC_DOCUMENT {
    OBJECT      uid;                    // uid of the doc
    OBJECT      dir;                    // app dir of the doc
    OBJECT      docClass;               // class of the doc
    U16         sequence;               // sequence of the doc
    CHAR        pName[nameBufLength];   // name of this doc
    P_UNKNOWN   pDocData;               // subclass's private data
} OBXSVC_DOCUMENT, *P_OBXSVC_DOCUMENT;
```

Comments

Superclass behavior is to activate the outbox document if it isn't already active, and then send **msgOBXDocOutputStart** to the document instance.

Subclasses can provide their own behavior if they wish.

msgOBXSvcOutputCancel

Cancels the output process.

Takes nothing, returns STATUS.

```
#define msgOBXSvcOutputCancel                       msgIOBXSvcIOCancel
```

Comments

This message is sent to the service when the caller wishes to cancel any output operation in progress. The service responds to this message by sending **msgOBXDocOutuptCancel** to an active outbox document. After the document is cancelled, the service will post an error note to the user if there are other documents waiting to be processed. The user then decides whether or not the service should proceed to send the remaining documents.

Subclasses do not normally process this message.

msgOBXSvcOutputCleanUp

Cleans up after the current output is done.

Takes P_OBX_DOC_OUTPUT_DONE, returns STATUS. Category: self-post..

```
#define msgOBXSvcOutputCleanUp                      msgIOBXSvcIOCleanUp
```

Arguments

```
Enum32(OBX_DOC_EXIT_BEHAVIOR) {
    obxDocExitDoNothing         = 0,
    obxDocExitDelete            = 1,
    obxDocExitMarkAsFailed      = 2,
    obxDocExitMarkAsCancelled   = 3
};
typedef struct OBX_DOC_OUTPUT_DONE {
    OBX_DOC_EXIT_BEHAVIOR   behavior;   // exit behavior
    P_UNKNOWN               pDocData;   // Unused: document specific data
} OBX_DOC_OUTPUT_DONE, *P_OBX_DOC_OUTPUT_DONE;
```

Comments

This message is posted to self as a result of the service receiving **msgOBXDocOutputDone**, which is sent by the outbox document when it finishes the output operation. The outbox document will be either deleted or marked as specified in **pArgs**, and when everything is properly cleaned up the service will post **msgOBXSvcPollDocuments** to self to see if anything else is waiting for output.

Subclasses do not normally process this message.

See Also

msgOBXDocOutputDone

msgOBXSvcStateChanged

Tells observers that the service state just changed.

Takes OBJECT, returns STATUS. Category: observer notification..

```
#define msgOBXSvcStateChanged                    msgIOBXSvcStateChanged
```

Comments

Informs observers that the state of a service has just changed. **pArgs** is the UID of the service.

msgOBXSvcQueryState

Passes back the state of the service.

Takes P_OBXSVC_QUERY_STATE, returns STATUS.

```
#define msgOBXSvcQueryState                      msgIOBXSvcQueryState
```

Arguments

```
typedef struct {
    BOOLEAN     enabled;                // true if the service is enabled.
    CHAR        status[nameBufLength];  // text describing the status of
                                        // the service.
    CHAR        docName[nameBufLength]; // document being processed
    P_UNKNOWN   pStateData;             // subclass's private data
} OBXSVC_QUERY_STATE, *P_OBXSVC_QUERY_STATE;
```

Comments

This message is typically used to query what state the service instance is in.

msgOBXSvcGetEnabled

Gets the enabled state of the service.

Takes P_BOOLEAN, returns STATUS.

```
#define msgOBXSvcGetEnabled                      msgIOBXSvcGetEnabled
```

Comments

Subclasses can override this message and redefine the notion of "enabled." The default behavior of the superclass is to equate "enabled" with the ownership of the target service (i.e., output device). That is, the service is "enabled" when it owns the target service. By appending to or replacing the default behavior, a subclass can define additional conditions which must be met before a service is considered enabled.

msgOBXSvcSetEnabled

Sets the enabled state of the service.

Takes BOOLEAN, returns STATUS.

```
#define msgOBXSvcSetEnabled                      msgIOBXSvcSetEnabled
```

Comments

This message is sent to the service in response to service notification messages **msgSvcOwnerAcquired** and **msgSvcOwnerReleased**. Subclasses can provide their own behavior and thereby redefine the notion of "enabled" for the service. If they do, they must pass this message up to the ancestor so that observers of the outbox service will be properly notified.

Outbox Document Messages

msgOBXDocOutputStartOK

Asks the outbox document if it is OK to start the output process

Takes nothing, returns STATUS.

```
#define msgOBXDocOutputStartOK                msgIOBXDocIOStartOK
```

Comments

When an outbox service finds an opened document in the outbox section, it sends this message to the document instance, asking whether it's OK to start the output operation while the document remains open. When the document receives this message, it should return **stsOK** to give the service permission to begin the output process. An error status, including **stsNotUnderstood**, is taken to mean that the document instance vetos the request and the service will not start the output process.

msgOBXDocOutputStart

Tells an outbox document to start the output process.

Takes nothing, returns STATUS.

```
#define msgOBXDocOutputStart                  msgIOBXDocIOStart
```

Comments

This message is sent by the outbox service to a document. The document should respond to this message by starting the output process.

msgOBXDocOutputDone

Tells the outbox service that output is finished.

Takes P_OBX_DOC_OUTPUT_DONE, returns STATUS. Category: client responsibility.

```
#define msgOBXDocOutputDone                   msgIOBXDocIODone
```

Message Arguments

```
typedef struct OBX_DOC_OUTPUT_DONE {
    OBX_DOC_EXIT_BEHAVIOR   behavior;    // exit behavior
    P_UNKNOWN               pDocData;    // Unused: document specific data
} OBX_DOC_OUTPUT_DONE, *P_OBX_DOC_OUTPUT_DONE;
```

Comments

When the output process is finished, the outbox document in charge of the output should send this message to the outbox service. This message must be sent even if the output process has been aborted. The **pArgs** for this message tells the outbox service what to do with the outbox document. If **obxDocExitDelete** is specified, the document will be removed from the outbox. In all other cases the document will be unlocked and left in the outbox. If either **obxDocExitMarkAsCancelled** or **obxDocExitMarkAsFailed** are specified, the name of the document will be altered to provide visual indication for the user that the output process has not completed successfully.

See Also

msgOBXDocGetService

msgOBXDocOutputCancel

Tells an outbox document to cancel the output process.

Takes nothing, returns STATUS.

```
#define msgOBXDocOutputCancel                 msgIOBXDocIOCancel
```

Comments

This message is used by the outbox service to inform a document that it should cancel the output process. The document should handle this message by terminating its output operation and then sending **msgOBXDocOutputDone** to the service with **pArgs**->behavior set to **obxDocExistMarkAsCancelled**.

msgOBXDocStatusChanged

Tells the outbox service that the document status is changed.

Takes P_OBX_DOC_STATUS_CHANGED, returns STATUS. Category: client responsibility.

```
#define msgOBXDocStatusChanged                    msgIOBXDocStatusChanged
```

Arguments

```
typedef struct OBX_DOC_STATUS_CHANGED {
    CHAR        status[nameBufLength];  // Text describing document state
    P_UNKNOWN   pDocData;               // Unused: document-specific data
} OBX_DOC_STATUS_CHANGED, *P_OBX_DOC_STATUS_CHANGED;
```

Comments

This message is sent by the outbox document to the service whenever its status has just changed. This status is displayed on Status column for the outbox section, in the Outbox notebook.

OPENSERV.H

This file contains the API definition for **clsOpenServiceObject**.

clsOpenServiceObject inherits from **clsStream.**

Provides default behavior for open service objects.

All open service object classes must be a subclass of **clsOpenServiceObject**. This superclass forwards all **clsService** messages to the actual service instance. It also allows a subclass to easily get the service instance that it is associated with.

```
#ifndef OPENSERV_INCLUDED
#define OPENSERV_INCLUDED
#ifndef STREAM_INCLUDED
#include <stream.h>
#endif
```

Messages

msgNew

Creates a new service object.

Takes P_OSO_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct OSO_NEW_ONLY {
    OBJECT                  serviceInstance;    // This is filled in by
                                                // clsService at open time.
    U32                     unused1;
    U32                     unused2;
    U32                     unused3;
    U32                     unused4;
} OSO_NEW_ONLY, *P_OSO_NEW_ONLY, OSO_METRICS, *P_OSO_METRICS;
#define openServiceObjectNewFields  \
    streamNewFields                 \
    OSO_NEW_ONLY            openServiceObject;
typedef struct OSO_NEW {
    openServiceObjectNewFields
} OSO_NEW, *P_OSO_NEW;
```

msgOSOGetServiceInstance

Returns the service instance that this object is associated with.

Takes P_OBJECT, returns STATUS.

```
#define msgOSOGetServiceInstance        MakeMsg(clsOpenServiceObject, 1)
```

PPORT.H

This file contains the API definition for **clsParallelPort**.

clsParallelPort inherits from **clsMILService.**

This mil service provides the interface between the parallel printer mil device and the rest of Penpoint. This interface allows for the configuring of the parallel printer mil device and for printing using the parallel printer mil device. The pport mil service will typically only be accessed by printer drivers since they are responsible for rendering an image for printing.

You access this mil service by using the standard service access techniques. These techniques are discribed in servmgr.h.

The pport mil service is a member of the 'theParallelDevices' and 'thePrinterDevices' service managers.

```
#ifndef PPORT_INCLUDED
#define PPORT_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef MIL_SERVICE_INCLUDED
#include <milserv.h>
#endif
```

Common #defines and typedefs

```
typedef OBJECT          PPORT, *P_PPORT;
#define stsPPortBusy          MakeStatus(clsParallelPort, 1)
#define stsPPortOutOfPaper    MakeStatus(clsParallelPort, 2)
#define stsPPortOffLine       MakeStatus(clsParallelPort, 3)
#define stsPPortNoPrinter     MakeStatus(clsParallelPort, 4)
#define stsPPortPrinterErr    MakeStatus(clsParallelPort, 5)
typedef struct PPORT_METRICS
{
    U16    version;            // version number of pport
    U16    devFlags;           // device flags (none defined)
    U16    unitFlags;          // unit flags (see dvparall.h)
    U32    initDelay;          // time in microSeconds init signal
                               // is applied to printer
    U32    interruptTimeOut;   // the printer should be ready to accept
                               // another character within this time
                               // period (in milliseconds)
} PPORT_METRICS, *P_PPORT_METRICS;
```

Parallel Port Class Messages

msgPPortStatus

returns the current hardware status of the printer.

Takes P_PPORT_STATUS, returns STATUS.

```
#define msgPPortStatus                  MakeMsg(clsParallelPort, 3)
#define pportStsBusy                    flag7   // printer is busy
#define pportStsAcknowledge             flag6   // printer acknowledged char.
#define pportStsEndOfPaper              flag5   // printer out of paper
#define pportStsSelected                flag4   // printer on line
#define pportStsIOError                 flag3   // printer error occurred
#define pportStsInterruptHappened       flag2   // printer interrupt occurred
```

Arguments

```
typedef struct PPORT_STATUS
{
    U16 pportStatus;
} PPORT_STATUS, *P_PPORT_STATUS;
```

'pportStatus' is the contents of the parallel port status register.

msgPPortStatus

initializes the printer.

Takes P_NULL, returns STATUS.

```
#define msgPPortInitialize              MakeMsg(clsParallelPort, 4)
```

The printer is initialized by asserting the control"Initialize" to the printer for **initDelay** microseconds.

msgPPortAutoLineFeedOn

inserts a line feed after each carriage return.

Takes P_NULL, returns STATUS.

```
#define msgPPortAutoLineFeedOn      MakeMsg(clsParallelPort, 5)
```

The auto line feed signal to the printer is set active.

msgPPortAutoLineFeedOff

disables inserting a line feed after each carriage return.

Takes P_NULL, returns STATUS.

```
#define msgPPortAutoLineFeedOff     MakeMsg(clsParallelPort, 6)
```

The auto line feed signal to the printer is set inactive.

msgPPortGetTimeDelays

gets the initialization and interrupt time out intervals.

Takes P_PPORT_TIME_DELAYS, returns STATUS.

```
#define msgPPortGetTimeDelays           MakeMsg(clsParallelPort, 7)
```

Arguments

```
typedef struct PPORT_TIME_DELAYS
{
    U32 initDelay;                  // initialization delay
    U32 interruptTimeOut;           // interrupt time out
} PPORT_TIME_DELAYS, *P_PPORT_TIME_DELAYS;
```

The initialization time period is the time the initialization pulseasserted to the printer in microseconds. The interrupt time outis the maximum time the printer will assert busy before beingto accept another character in milliseconds.

msgPPortSetTimeDelays

sets the initialization and interrupt time out intervals.

Takes P_PPORT_TIME_DELAYS, returns STATUS.

```
#define msgPPortSetTimeDelays          MakeMsg(clsParallelPort, 8)
```

Message Arguments

```
typedef struct PPORT_TIME_DELAYS
{
    U32 initDelay;                 // initialization delay
    U32 interruptTimeOut;          // interrupt time out
} PPORT_TIME_DELAYS, *P_PPORT_TIME_DELAYS;
```

Neither value can be zero. It's best to get the presentbefore changing the time intervals.

msgPPortCancelPrint

cancels the printing of the buffer currently being printed.

Takes P_NULL, returns STATUS.

```
#define msgPPortCancelPrint            MakeMsg(clsParallelPort, 9)
```

msgNew

creates a new pport object.

Takes P_PPORT_NEW, returns STATUS.

```
#define pportNewFields       \
    milServiceNewFields
```

Arguments

```
typedef struct PPORT_NEW {
    pportNewFields
} PPORT_NEW, *P_PPORT_NEW;
STATUS EXPORTED ClsParallelPortInit(void);
```

SENDSERV.H

This file contains the class definition and methods for **clsSendableService**.

clsSendableService inherits from **clsService.**

Provides the API for the services which appear on the Document Send menu.

clsSendableService is an abstract superclass which defines the sendable services protocol. This protocol is used by the Send Manager and the address book to interact with services on **theSendableServices** service manager. All services on this list *must* implement this protocol.

```
#ifndef SENDSERV_INCLUDED
#define SENDSERV_INCLUDED
#ifndef ADDRBOOK_INCLUDED
#include    <addrbook.h>
#endif
```

Common #defines and typedefs

Data window fields are empty.

```
#define stsSendServAddrWinEmpty         MakeWarning(clsSendableService, 1)
```

Messages

msgSendServCreateAddrWin

Converts address data into a window displaying the data.

Takes P_SEND_SERV_ADDR_WIN, returns STATUS.

```
#define msgSendServCreateAddrWin            MakeMsg(clsSendableService, 1)
```

Arguments

```
typedef struct SEND_SERV_ADDR_WIN {
    U16                 numAttrs;
    P_ADDR_BOOK_ATTR    attrs;
    P_STRING            addrSummary;
    BOOLEAN             errNote;
    OBJECT              win;
} SEND_SERV_ADDR_WIN, *P_SEND_SERV_ADDR_WIN;
```

Comments

This message is sent to a sendable service by the address book. A sendable service should create a display window(**pArgs**->win). The sendable service should wait for **msgSendServFillAddrWin** before it fills in the fields in the window.

Parameters:

pArgs->numAttrs In: number of attributes in the attrs array.

pArgs->attrs In: an array of size **pArgs**->numAttrs. **pArgs**->attrs[x].value contains what the sendable service needs to display.

pArgs->win Out: sendable-service-created display window.

msgSendServGetAddrSummary

given **pArgs**->attrs, set **pArgs**->addrSummary to be a displayable string that sums up the address.

Takes P_SEND_SERV_ADDR_WIN, returns STATUS.

```
#define msgSendServGetAddrSummary          MakeMsg(clsSendableService, 9)
```

Message Arguments

```
typedef struct SEND_SERV_ADDR_WIN {
    U16                 numAttrs;
    P_ADDR_BOOK_ATTR    attrs;
    P_STRING            addrSummary;
    BOOLEAN             errNote;
    OBJECT              win;
} SEND_SERV_ADDR_WIN, *P_SEND_SERV_ADDR_WIN;
```

Comments

Parameters:

pArgs->numAttrs In: number of attributes in the attrs array.

pArgs->attrs In: an array of size **pArgs**->numAttrs.

pArgs->addrSummary Out: a string that sums up the address information described in attribute-value form in **pArgs**->attrs.

msgSendServFillAddrWin

Sendable service refreshes **pArgs**->win with information in **pArgs**->attrs.

Takes P_SEND_SERV_ADDR_WIN, returns STATUS.

```
#define msgSendServFillAddrWin          MakeMsg(clsSendableService, 8)
```

Message Arguments

```
typedef struct SEND_SERV_ADDR_WIN {
    U16                 numAttrs;
    P_ADDR_BOOK_ATTR    attrs;
    P_STRING            addrSummary;
    BOOLEAN             errNote;
    OBJECT              win;
} SEND_SERV_ADDR_WIN, *P_SEND_SERV_ADDR_WIN;
```

Comments

An address book sends a sendable service this message to refresh the window that contains information described in **pArgs**->attrs.

Parameters:

pArgs->numAttrs In: number of attributes in the attrs array. If 0, then clear all fields.

pArgs->attrs In: an array of size **pArgs**->numAttrs. **pArgs**->attrs[x].value contains what the sendable service needs to display.

pArgs->win In: uid of sendable-service-created display window.

msgSendServEncodeAddrWin

Converts a window which displays address data into data.

Takes P_SEND_SERV_ADDR_WIN, returns STATUS.

```
#define msgSendServEncodeAddrWin          MakeMsg(clsSendableService, 2)
```

Message Arguments

```
typedef struct SEND_SERV_ADDR_WIN {
    U16                 numAttrs;
    P_ADDR_BOOK_ATTR    attrs;
    P_STRING            addrSummary;
    BOOLEAN             errNote;
    OBJECT              win;
} SEND_SERV_ADDR_WIN, *P_SEND_SERV_ADDR_WIN;
```

Comments

The service must convert the window into an array of attribute-values, as described in ADDR_BOOK_SERVICE_DESC. Storage for this array should be created by the sendable service from a global heap. The caller client is responsible for freeing this storage.

Parameters:

pArgs->numAttrs Out: Number of elements in the .attrs array

pArgs->attrs Out: fill in the values of each attribute.

pArgs->errNote In: if TRUE, then the service should display some kind of note on the screen when error occurs during data collection and validation.

pArgs->win In: the window to get the data from. Presumably the sendable service created this window in response to a previous **msgSendServCreateAddrWin**.

Return Value

stsServiceDataWinEmpty All data element fields are empty.

stsFailed Some error occurs during data collection and validation.

msgSendServEncodeAddrData

Converts serrvice-specific data into ASCII byte array.

Takes P_SEND_SERV_CONVERT_ADDR_DATA, returns STATUS.

```
#define msgSendServEncodeAddrData          MakeMsg(clsSendableService, 3)
```

Arguments

```
typedef struct SEND_SERV_CONVERT_ADDR_DATA {
    P_U8              pBuf;   // In/Out:  Encoded addressing data
    U16               bufLen; // In/Out:  Length of pBuf
    U16               numAttrs;
    P_ADDR_BOOK_ATTR  attrs;
} SEND_SERV_CONVERT_ADDR_DATA, *P_SEND_SERV_CONVERT_ADDR_DATA;
```

Comments

*** This message is obsolete ***

The service converts attributes in .attrs into ASCII. Storage for this array should be created by the service from **osProcessSharedHeapId**. The caller is responsible for freeing this storage.

Return Value

stsServiceDataWinEmpty All data element fields are empty.

msgSendServDecodeAddrData

Converts ASCII data into service-specific data.

Takes P_SEND_SERV_CONVERT_ADDR_DATA, returns STATUS.

```
#define msgSendServDecodeAddrData          MakeMsg(clsSendableService, 4)
```

Message Arguments

```
typedef struct SEND_SERV_CONVERT_ADDR_DATA {
    P_U8              pBuf;   // In/Out:  Encoded addressing data
    U16               bufLen; // In/Out:  Length of pBuf
    U16               numAttrs;
    P_ADDR_BOOK_ATTR  attrs;
} SEND_SERV_CONVERT_ADDR_DATA, *P_SEND_SERV_CONVERT_ADDR_DATA;
```

Comments

*** This message is obsolete ***

The resulting data is put into .attrs and update the attribute count in **.numAttrs**.

msgAppExecute

Displays a UI for obtaining addressing info and executing the send.

Takes P_APP_EXECUTE, returns STATUS.

Comments

This message is a standard **clsApp** message which is forwarded to the service the user has selected from the standard "Send" menu. The service should create and display their UI for obtaining addressing information from the user.

Declaration for the APP_EXECUTE data structure can be found in app.h

msgSendServGetAddrDesc

Responsibility of a sendable service to return its service attribute-value pairs that describe its service address

Takes P_ADDR_BOOK_SVC_DESC, returns STATUS.

```
#define msgSendServGetAddrDesc      MakeMsg(clsSendableService, 7)
```

Comments

An address book usually send this message to a sendable service as part of of initialization to find out the service address description.

SERLINK.H

This file contains the definition and methods for **clsALAPSerial**

```
#ifndef SERLINK_INCLUDED
#define SERLINK_INCLUDED
ALAP_SERIAL_NEW_ONLY, *P_ALAP_SERIAL_NEW_ONLY;
#define alapSerialNewFields          \
    serviceNewFields                 \
    ALAP_SERIAL_NEW_ONLY    alapSerial;
ALAP_SERIAL_NEW, *P_ALAP_SERIAL_NEW;
STATUS EXPORTED ClsSerLinkInit(void);
```

SIO.H

This file contains the API for **clsMILAsyncSIODevice.**

clsMILAsyncSIODevice inherits from **clsStream.**

Provides the serial port interface, see also stream.h for the stream messages.

```
#ifndef SIO_INCLUDED
#define SIO_INCLUDED
#include <go.h>
#include <clsmgr.h>
#include <milserv.h>
```

Common #defines and typedefs

```
#define stsSioPortInUse      MakeStatus(clsMILAsyncSIODevice, 1)
#define milDefaultBaudRate       9600
#define milDefaultXonChar        0x11
#define milDefaultXoffChar       0x13
#define milDefaultModemControl   milDataTerminalReady | milRequestToSend
#define milDefaultStopBits       milOneStopBit
#define milDefaultParityType     milNoParity
#define milDefaultWordLength     milEightBitWord
#define milDefaultXonTimeout     (U32)30000
#define milDefaultLineToStop     milRequestToSend
typedef OBJECT      SIO;
typedef SIO *       P_SIO;
Enum16(SIO_EVENT_MASK) {
    sioEventCTS             = flag0,    // CTS line has changed state
    sioEventDSR             = flag1,    // DSR line has changed state
    sioEventDCD             = flag2,    // DCD line has changed state
    sioEventRI              = flag3,    // RI line has changed state
    sioEventRxChar          = flag4,    // Rx buffer has become not empty.
                                        // Note: The receive buffer must be
                                        // empty for a received character
                                        // to generate this event!
    sioEventRxBreak         = flag5,    // Break condition has been received
    sioEventTxBufferEmpty   = flag6,    // Tx buffer has become empty
    sioEventRxError         = flag7,    // parity, framing, or overrun error
    sioAllEvents            = flag0 | flag1 | flag2 | flag3 | flag4
                              | flag5 | flag6 | flag7
};
```

Asynchronous SIO Class Messages

msgSioBaudSet

Sets the serial port baud rate.

Takes U32, returns STATUS.

```
#define msgSioBaudSet        MakeMsg(clsMILAsyncSIODevice,4)
```

Comments

Maximum possible setting 115200. Actual baud rate = (115200/((U32)(115200/baudRate))) Default setting 9600 baud

msgSioLineControlSet

Sets serial port data bits per character, stop bits, and parity.

Takes P_SIO_LINE_CONTROL_SET, returns STATUS.

```
#define msgSioLineControlSet    MakeMsg(clsMILAsyncSIODevice,5)
```

Arguments

```
Enum16(SIO_DATA_BITS) {
    sioSixBits = 6,
    sioSevenBits = 7,
    sioEightBits = 8
};
Enum16(SIO_STOP_BITS) {
    sioOneStopBit = 0,
    sioOneAndAHalfStopBits = 1,
    sioTwoStopBits = 2
};
Enum16(SIO_PARITY) {
    sioNoParity = 0,
    sioOddParity = 1,
    sioEvenParity = 2
};
typedef struct {
    SIO_DATA_BITS   dataBits;
    SIO_STOP_BITS   stopBits;
    SIO_PARITY      parity;
} SIO_LINE_CONTROL_SET, *P_SIO_LINE_CONTROL_SET;
```

Comments

Default setting 8 bits, 1 stop bit, no parity.

msgSioControlOutSet

Controls serial port output lines dtr and rts.

Takes P_SIO_CONTROL_OUT_SET, returns STATUS.

```
#define msgSioControlOutSet     MakeMsg(clsMILAsyncSIODevice,6)
```

Arguments

```
typedef struct {
    BOOLEAN         dtr;        // true activates, false deactivates
    BOOLEAN         rts;        // true activates, false deactivates
    BOOLEAN         out1;       // true activates, false deactivates
    BOOLEAN         out2;       // true activates, false deactivates
} SIO_CONTROL_OUT_SET, *P_SIO_CONTROL_OUT_SET;
```

Comments

Default setting dtr active, rts active.

msgSioControlInStatus

Reads the current state of the serial port input control lines.

Takes P_SIO_CONTROL_IN_STATUS, returns STATUS.

```
#define msgSioControlInStatus   MakeMsg(clsMILAsyncSIODevice,7)
```

Arguments

```
typedef struct {
    BOOLEAN         cts;        // out - true = active (Clear To Send)
    BOOLEAN         dsr;        // out - true = active (Data Set Ready)
    BOOLEAN         dcd;        // out - true = active (Data Carrier Detect)
    BOOLEAN         ri;         // out - true = active (Ring Indicator)
} SIO_CONTROL_IN_STATUS, *P_SIO_CONTROL_IN_STATUS;
#define rlsd    dcd
```

msgSioFlowControlCharSet

Defines serial port XON/XOFF flow control characters.

Takes P_SIO_FLOW_CONTROL_CHAR_SET, returns STATUS.

```
#define msgSioFlowControlCharSet    MakeMsg(clsMILAsyncSIODevice,8)
```

Arguments

```
typedef struct {
    U8              xonChar;        // xon character (default control-Q)
    U8              xoffChar;       // xoff character (default control-S)
} SIO_FLOW_CONTROL_CHAR_SET, *P_SIO_FLOW_CONTROL_CHAR_SET;
```

Comments

Valid only if xon-xoff flow control is enabled.

Default xon character 0x11 (control-q), default xoff character 0x13 (control-s).

msgSioBreakSend

Sends a break for the specified duration.

Takes P_SIO_BREAK_SEND, returns STATUS.

```
#define msgSioBreakSend     MakeMsg(clsMILAsyncSIODevice,11)
```

Arguments

```
typedef struct {
    OS_MILLISECONDS milliseconds;   // break duration
} SIO_BREAK_SEND, *P_SIO_BREAK_SEND;
```

Comments

Constant 0's transmitted on the serial line for the specified duration. Typical durations are around 200-400 milliseconds).

msgSioBreakStatus

Sends back the number of breaks received so far.

Takes P_SIO_BREAK_STATUS, returns STATUS.

```
#define msgSioBreakStatus   MakeMsg(clsMILAsyncSIODevice,13)
```

Arguments

```
typedef struct {
    U32             breaksReceived; // out
} SIO_BREAK_STATUS, *P_SIO_BREAK_STATUS;
```

Comments

Also clears the internal break counter.

msgSioReceiveErrorsStatus

Sends back the number of receive errors and the number of dropped bytes (due to buffer overflows).

Takes P_SIO_RECEIVE_ERRORS_STATUS, returns STATUS.

```
#define msgSioReceiveErrorsStatus   MakeMsg(clsMILAsyncSIODevice,36)
```

Arguments

```
typedef struct {
    U32             droppedBytes;   // out
    U32             receiveErrors;  // out
} SIO_RECEIVE_ERRORS_STATUS, *P_SIO_RECEIVE_ERRORS_STATUS;
```

Comments

Also clears the internal counters.

msgSioInputBufferStatus

Provides input buffer status.

Takes P_SIO_INPUT_BUFFER_STATUS, returns STATUS.

```
#define msgSioInputBufferStatus MakeMsg(clsMILAsyncSIODevice,16)
```

Arguments

```
typedef struct {
    U32             bufferChars;    // out, number of chars in buffer
    S32             bufferRoom;     // out, amount of empty room in buffer
    BOOLEAN         receiverFrozen; // out, is receive frozen?
} SIO_INPUT_BUFFER_STATUS, * P_SIO_INPUT_BUFFER_STATUS;
```

Comments

Sends back the number of characters in the input buffer and the amount of empty room in the input buffer.

msgSioOutputBufferStatus

Provides output buffer status.

Takes P_SIO_OUTPUT_BUFFER_STATUS, returns STATUS.

```
#define msgSioOutputBufferStatus    MakeMsg(clsMILAsyncSIODevice,17)
```

Arguments

```
typedef struct {
    U32             bufferChars;    // out, number of chars in buffer
    S32             bufferRoom;     // out, amount of empty room in buffer
    BOOLEAN         transmitterFrozen;  // out, is transmit frozen?
} SIO_OUTPUT_BUFFER_STATUS, * P_SIO_OUTPUT_BUFFER_STATUS;
```

Comments

Sends back the number of characters in the output buffer and the amount of empty room in the output buffer.

msgSioInputBufferFlush

Flushes the contents of the input buffer.

Takes **pNull**, returns STATUS.

```
#define msgSioInputBufferFlush  MakeMsg(clsMILAsyncSIODevice,18)
```

msgSioOutputBufferFlush

Flushes the contents of the output buffer.

Takes **pNull**, returns STATUS.

```
#define msgSioOutputBufferFlush MakeMsg(clsMILAsyncSIODevice,19)
```

msgSioFlowControlSet

Selects flow control type.

Takes P_SIO_FLOW_CONTROL_SET, returns STATUS.

```
#define msgSioFlowControlSet        MakeMsg(clsMILAsyncSIODevice,20)
```

Arguments

```
Enum16(SIO_FLOW_TYPE) {
    sioNoFlowControl            = 0x11,
    sioXonXoffFlowControl       = 0x22,
    sioHardwareFlowControl      = 0x44,
    // To independently set receive and transmit flow control OR together
    // one from each of the following two sets.
    // i.e.,     .flowControl = sioRxXonXoff | sioTxHardware;
    // YOU MUST SET BOTH THE TX AND RX FLOW CONTROL!
    // Transmit flow control
    sioTxNone                   = 0x01,
    sioTxXonXoff                = 0x02,
    sioTxHardware               = 0x04,
    // Receive flow control
    sioRxNone                   = 0x10,
    sioRxXonXoff                = 0x20,
    sioRxHardware               = 0x40
};
typedef struct {
    SIO_FLOW_TYPE          flowControl;
} SIO_FLOW_CONTROL_SET, *P_SIO_FLOW_CONTROL_SET;
```

Comments

Flow control types: no flow control, XON/XOFF flow control, or hardware flow control. Default: XON/XOFF flow control.

msgSioEventStatus

Sends back current state of event word, and then clears the event word.

Takes P_SIO_EVENT_STATUS, returns STATUS.

```
#define msgSioEventStatus       MakeMsg(clsMILAsyncSIODevice,21)
```

Arguments

```
typedef struct {
    SIO_EVENT_MASK  eventMask;      // out
} SIO_EVENT_STATUS, *P_SIO_EVENT_STATUS;
```

Comments

Bit set indicates an event has occurred. Events do not have to be enabled for **eventMask** to be set.

msgSioEventSet

Enables event notification.

Takes P_SIO_EVENT_SET, returns STATUS.

```
#define msgSioEventSet          MakeMsg(clsMILAsyncSIODevice,22)
```

Arguments

```
typedef struct {
    SIO_EVENT_MASK  eventMask;      // in, events to respond to
    OBJECT          client;         // object to inform when event happens
} SIO_EVENT_SET, *P_SIO_EVENT_SET;
```

Comments

Bits set in the **eventMask** enable **msgSioEventHappened** to be sent to uid. Default: **eventMask** = 0, all event notification disabled.

msgSioEventGet

Gets the current sio event setting.

Takes P_SIO_EVENT_SET, returns STATUS.

```
#define msgSioEventGet          MakeMsg(clsMILAsyncSIODevice,29)
```

Message Arguments

```
typedef struct {
    SIO_EVENT_MASK  eventMask;      // in, events to respond to
    OBJECT          client;         // object to inform when event happens
} SIO_EVENT_SET, *P_SIO_EVENT_SET;
```

msgSioEventHappened

Notifies client of event occurance.

Takes P_SIO_EVENT_HAPPENED, returns STATUS.

```
#define msgSioEventHappened     MakeMsg(clsMILAsyncSIODevice,23)
```

Arguments

```
typedef struct {
    SIO_EVENT_MASK  eventMask;      // out, bits set indicate event happened.
    OBJECT          self;           // object which generated message.
} SIO_EVENT_HAPPENED, *P_SIO_EVENT_HAPPENED;
```

Comments

Message sent to object to notify it of event occurrance. Possibly, more than one bit will be set in the event mask (bits may be set from disabled events, although disabled events never cause this message to be generated. Clears event mask.

msgSioInit

Initializes the serial device to its default state.

Takes P_SIO_INIT, returns STATUS.

```
#define msgSioInit              MakeMsg(clsMILAsyncSIODevice,26)
```

Arguments

```
typedef struct {
    U32             inputSize;      // size of the input buffer
    U32             outputSize;     // size of the output buffer
} SIO_INIT, *P_SIO_INIT;
```

msgSioGetMetrics

Sends back the sio metrics.

Takes P_SIO_METRICS, returns STATUS.

```
#define msgSioGetMetrics        MakeMsg(clsMILAsyncSIODevice,24)
```

Arguments

```
typedef struct {
    U32                         baud;           // out/in
    SIO_LINE_CONTROL_SET        line;           // out/in
    SIO_CONTROL_OUT_SET         controlOut;     // out/in
    SIO_FLOW_CONTROL_CHAR_SET   flowChar;       // out/in
    SIO_FLOW_CONTROL_SET        flowType;       // out/in
    //
    // Changing the bufferSize fields causes reinitialization of serial
    // chip!
    SIO_INIT                    bufferSize;     // out/in
    U8                          spare[12];
} SIO_METRICS, *P_SIO_METRICS;
```

msgSioSetMetrics

Sets the sio metrics.

Takes P_SIO_METRICS, returns STATUS.

```
#define msgSioSetMetrics        MakeMsg(clsMILAsyncSIODevice,25)
```

Message Arguments

```
typedef struct {
    U32                         baud;           // out/in
    SIO_LINE_CONTROL_SET        line;           // out/in
    SIO_CONTROL_OUT_SET         controlOut;     // out/in
    SIO_FLOW_CONTROL_CHAR_SET   flowChar;       // out/in
    SIO_FLOW_CONTROL_SET        flowType;       // out/in
    //
    // Changing the bufferSize fields causes reinitialization of serial
    // chip!
    SIO_INIT                    bufferSize;     // out/in
    U8                          spare[12];
} SIO_METRICS, *P_SIO_METRICS;
```

msgSioSetReplaceCharProc

Replaces the built in receive character interrupt routine.

Takes P_SIO_REPLACE_CHAR, returns STATUS.

```
#define msgSioSetReplaceCharProc    MakeMsg(clsMILAsyncSIODevice,72)
```

Arguments

Function Prototype

```
                                                U32     handle);
typedef struct SIO_REPLACE_CHAR
{
    P_SIO_CHAR_HANDLER  pRxHandler; // address of character handler
    U32                 handle;     // user data (meaningless to
                                    // clsMILAsyncSIO)
} SIO_REPLACE_CHAR, *P_SIO_REPLACE_CHAR;
```

Comments

This message calls the user defined function when a character is received. The procedure has the option to filter the character or to return and have the character processed normally. The user defined fuction returns a BOOLEAN indicating whether the function filtered the character or not.

msgNew

Creates a new **clsMILAsyncSIODevice** object.

Takes P_SIO_NEW, returns STATUS.

Arguments

```
typedef struct SIO_NEW
{
    milServiceNewFields
} SIO_NEW, *P_SIO_NEW;
```

Asynchronous SIO Option Card Tags

```
#define sioTagOptionCard    MakeTag(clsMILAsyncSIODevice, 19) // Card tag
#define sioTagName          MakeTag(clsMILAsyncSIODevice, 20)
#define sioTagBaud          MakeTag(clsMILAsyncSIODevice, 21)
#define sioTagFlowControl   MakeTag(clsMILAsyncSIODevice, 22)
#define sioTagParity        MakeTag(clsMILAsyncSIODevice, 23)
#define sioTagDataBits      MakeTag(clsMILAsyncSIODevice, 24)
#define sioTagStopBits      MakeTag(clsMILAsyncSIODevice, 25)
#define sioTagBaud300       MakeTag(clsMILAsyncSIODevice, 40)
#define sioTagBaud600       MakeTag(clsMILAsyncSIODevice, 41)
#define sioTagBaud1200      MakeTag(clsMILAsyncSIODevice, 42)
#define sioTagBaud2400      MakeTag(clsMILAsyncSIODevice, 43)
#define sioTagBaud4800      MakeTag(clsMILAsyncSIODevice, 44)
#define sioTagBaud9600      MakeTag(clsMILAsyncSIODevice, 45)
#define sioTagBaud19200     MakeTag(clsMILAsyncSIODevice, 46)
#define sioTagBaud38400     MakeTag(clsMILAsyncSIODevice, 47)
#define sioTagBaud57600     MakeTag(clsMILAsyncSIODevice, 48)
#define sioTagBaud115200    MakeTag(clsMILAsyncSIODevice, 49)
```

```
#define sioTagFlowNone      MakeTag(clsMILAsyncSIODevice, 55)
#define sioTagFlowXonXoff   MakeTag(clsMILAsyncSIODevice, 56)
#define sioTagFlowHardware  MakeTag(clsMILAsyncSIODevice, 57)
#define sioTagParityNone    MakeTag(clsMILAsyncSIODevice, 60)
#define sioTagParityOdd     MakeTag(clsMILAsyncSIODevice, 61)
#define sioTagParityEven    MakeTag(clsMILAsyncSIODevice, 62)
#define sioTagBits7         MakeTag(clsMILAsyncSIODevice, 65)
#define sioTagBits8         MakeTag(clsMILAsyncSIODevice, 66)
#define sioTagStopBitsOne   MakeTag(clsMILAsyncSIODevice, 70)
#define sioTagStopBitsTwo   MakeTag(clsMILAsyncSIODevice, 71)
```

Function prototypes

Function Prototype

```
STATUS   EXPORTED ClsSioInit(void);
void     EXPORTED SioSemaClear(P_UNKNOWN pHandle);
```

TP.H

This file contains the class definition and methods for **clsTransport**.

clsTransport inherits from **clsOpenServiceObject**.

Provides the API for replaceable transport layer network protocols.

```
#ifndef TP_INCLUDED
#define TP_INCLUDED
#ifndef OPENSERV_INCLUDED
#include <openserv.h>
#endif
```

Common typedefscodetypedef U8 TP_SERVICE;

```
typedef  U8      TP_QUEUE_SIZE;
typedef  U8      TP_ADDRESS, * P_TP_ADDRESS;
typedef  U8      TP_OPTIONS, * P_TP_OPTIONS;
typedef  U8      TP_BUFFER, * P_TP_BUFFER;
```

Service Types

```
#define tpReliableService   1
#define tpDatagramService   2
#define tpTransactionService    3
```

msgNew

Creates a transport (socket) handle object.

Takes P_TP_NEW, returns STATUS.

Arguments

```
typedef struct TP_NEW_ONLY {
    TP_SERVICE      service;    // service type
} TP_NEW_ONLY, *P_TP_NEW_ONLY;
typedef struct TP_NEW {
    OSO_NEW         oso;
    TP_NEW_ONLY     tp;
} TP_NEW, * P_TP_NEW;
```

msgDestroy

Destroys a transport handle object.

Takes OBJ_KEY, returns STATUS.

msgTPAccept

Accepts a connection request from a remote process.

Takes P_TP_ACCEPT, returns STATUS.

```
#define  msgTPAccept  MakeMsg( clsTransport, 1 )
```

Arguments

```
typedef struct TP_ACCEPT {
    OBJECT          newHandle;  // Out: uid of transport handle
    P_TP_ADDRESS    pAddress;   // ptr to protocol dependent address
} TP_ACCEPT, *P_TP_ACCEPT;
```

msgTPBind

Binds a transport handle to a transport address.

Takes P_TP_BIND, returns STATUS.

```
#define  msgTPBind  MakeMsg( clsTransport, 2 )
```

Arguments

```
typedef struct TP_BIND {
    P_TP_ADDRESS    pAddress;   // ptr to protocol dependent address
} TP_BIND, *P_TP_BIND;
```

msgTPConnect

Establishes a connection with a remote process.

Takes P_TP_CONNECT, returns STATUS.

```
#define  msgTPConnect  MakeMsg( clsTransport, 3 )
```

Arguments

```
typedef struct TP_CONNECT {
    P_TP_ADDRESS    pAddress;   // ptr to protocol dependent address
} TP_CONNECT, *P_TP_CONNECT;
```

msgTPListen

Allocates space for a queue of incoming connection requests.

Takes P_TP_LISTEN, returns STATUS.

```
#define  msgTPListen  MakeMsg( clsTransport, 4 )
```

Arguments

```
typedef struct TP_LISTEN {
    TP_QUEUE_SIZE   queueSize;  // max number of connection requests
} TP_LISTEN, *P_TP_LISTEN;
```

msgTPRecv

Receives a message.

Takes P_TP_RECV, returns STATUS.

```
#define  msgTPRecv  MakeMsg( clsTransport, 5 )
```

Arguments

```
typedef struct TP_RECV {
    P_TP_BUFFER     pBuffer;    // ptr to receive data buffer
    U16             length;     // size of receive buffer in bytes
    U16             count;      // number of bytes received
    P_TP_OPTIONS    pOptions;   // ptr to protocol dependent options
} TP_RECV, *P_TP_RECV;
```

msgTPRecvFrom

Receives a datagram.

Takes P_TP_RECVFROM, returns STATUS.

```
#define  msgTPRecvFrom  MakeMsg( clsTransport, 6 )
```

Arguments

```
typedef struct TP_RECVFROM {
    P_TP_BUFFER     pBuffer;    // ptr to receive data buffer
    U16             length;     // size of receive buffer in bytes
    U16             count;      // number of bytes received
    P_TP_ADDRESS    pAddress;   // ptr to protocol dependent address
    P_TP_OPTIONS    pOptions;   // ptr to protocol dependent options
} TP_RECVFROM, *P_TP_RECVFROM;
```

msgTPSend

Sends a message.

Takes P_TP_SEND, returns STATUS.

```
#define  msgTPSend  MakeMsg( clsTransport, 7 )
```

Arguments

```
typedef struct TP_SEND {
    P_TP_BUFFER     pBuffer;     // ptr to send data buffer
    U16             count;       // number of bytes to send
    P_TP_OPTIONS    pOptions;    // ptr to protocol dependent options
} TP_SEND, *P_TP_SEND;
```

msgTPSendTo

Sends a datagram.

Takes P_TP_SENDTO, returns STATUS.

```
#define  msgTPSendTo  MakeMsg( clsTransport, 8 )
```

Arguments

```
typedef struct TP_SENDTO {
    P_TP_BUFFER     pBuffer;     // ptr to send data buffer
    U16             count;       // number of bytes to send
    P_TP_OPTIONS    pOptions;    // ptr to protocol dependent options
    P_TP_ADDRESS    pAddress;    // ptr to protocol dependent address
} TP_SENDTO, *P_TP_SENDTO;
```

msgTPSendRecvTo

Sends a request and waits for a response. For transaction service only.

Takes P_TP_SENDRECVTO, returns STATUS.

```
#define  msgTPSendRecvTo  MakeMsg( clsTransport, 9 )
```

Arguments

```
typedef struct TP_SENDRECVTO {
    P_TP_BUFFER     pSendBuffer;     // ptr to send data buffer
    U16             sendCount;       // number of bytes to send
    P_TP_BUFFER     pRecvBuffer;     // ptr to receive data buffer
    U16             recvLength;      // size of receive buffer in bytes
    U16             recvCount;       // number of bytes received
    P_TP_OPTIONS    pOptions;        // ptr to protocol dependent options
    P_TP_ADDRESS    pAddress;        // ptr to protocol dependent address
} TP_SENDRECVTO, *P_TP_SENDRECVTO;
```

Status Codes

```
#define stsTPnotSupported   MakeStatus(clsTransport,1)
#define stsTPtooMany        MakeStatus(clsTransport,2)
#define stsTPbadUser        MakeStatus(clsTransport,3)
#define stsTPmaxUsers       MakeStatus(clsTransport,4)
#define stsTPnoUser         MakeStatus(clsTransport,5)
#define stsTPbadService     MakeStatus(clsTransport,6)
#define stsTPnoSocket       MakeStatus(clsTransport,7)
#define stsTPnoMemory       MakeStatus(clsTransport,8)
#define stsTPlength         MakeStatus(clsTransport,9)
#define stsTPnoTransaction  MakeStatus(clsTransport,10)
#define stsTPddpLength      MakeStatus(clsTransport,11)
#define stsTPnoBridge       MakeStatus(clsTransport,12)
#define stsTPbadNetwork     MakeStatus(clsTransport,13)
#define stsTPbadNode        MakeStatus(clsTransport,14)
#define stsTPsocketInUse    MakeStatus(clsTransport,15)
#define stsTPpending        MakeStatus(clsTransport,16)
```

```
#define stsTPddpQ          MakeStatus(clsTransport,17)
#define stsTPoverflow      MakeStatus(clsTransport,18)
#define stsTPbadParm       MakeStatus(clsTransport,19)
#define stsTPfailed        MakeStatus(clsTransport,20)
#define stsTPnameNotFound  MakeStatus(clsTransport,21)
#define stsTPnameInUse     MakeStatus(clsTransport,22)
#define stsTPnewSocket     MakeStatus(clsTransport,23)
#define stsTPnoRoom        MakeStatus(clsTransport,24)
#define stsTPnoLink        MakeStatus(clsTransport,25)
```

Part 11 / Resources

PREFS.H

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This file contains the API definition for **clsPreferences.**

clsPreferences inherits from **clsObject.**

clsPreferences provides a shell to access system preferences.

theSystemPreferences is a well-known instance of **clsPreferences. theSystemPreferences** provides access to read and write system wide preferences.

clsPreferences supports a set of preferences. Preferences are stored as resources in the "current" system preferences resource file. An instance of **clsPreferences**, known as **theSystemPreferences**, is created at boot time. This should be the only instance of **clsPreferences** in the system.

Preferences are named by well known resource id's (RES_ID's). This header file contains some predefined preference id's to simplify things. When defining new preferences, use the class that originated the preferences.

Clients can get and set preferences by accessing the well known object **theSystemPreferences.**

Preferences are stored in a resource file. Any request to read or write a preference will force a read or write to a file. This minimizes the amount of space required to store preferences. **theSystemPreferences** will respond to any resource file messaged defined in resfile.h and process them appropriately.

Remember, to read and write system preferences simply use the messages **msgResReadData** and **msgResWriteData** (or **msgResUpdateData**). **theSystemPreferences** forwards the msg to the current system preferences resource file.

As an example of reading a system preference:

```
U16 lineHeight;
RES_READ_DATA read;

read.resId = prLineHeight;
read.heap = 0;
read.pData = &lineHeight;
read.length = SizeOf(U16);
ObjectCall(msgResReadData, theSystemPreferences, &read);
```

An example of writing a system preference:

```
U16 lineHeight;
RES_WRITE_DATA write;

write.resId = prLineHeight;
write.pData = &lineHeight;
write.length = SizeOf(U16);
write.agent = resDefaultResAgent;
ObjectCall(msgResWriteData, theSystemPreferences, &write);
```

theSystemPreferences "knows" about certain preferences (listed in this file below) and performs whatever interaction is required to activate the new preference. It also handles certain system wide notification and actions when certain preferences change. For example, **clsPreferences** will cause the system to be re-drawn and re-fonted when the system preference for the font changes.

clsPreferences will notify all observers when a preference has (potentially) changed. This will allow various objects to observe **theSystemPreferences**, and react to the preference changes.

Whenever a number of preferences are being changed, clients may wish to send **msgPrefsWritingMany**, followed by the preference writes, and then **msgPrefsWritingDone**. **clsPreferences** will use these messages to delay any layout that may occur as a result of writing preferences that cause layout. **clsPreferences** will also send these messages to observers, allowing them to delay expensive operations until the preference changes are complete. As an example, when the preference set changes, **msgPrefsWritingMany**, followed by **msgPrefsPreferenceChanged** for each preference, followed by **msgPrefsWritingDone** is sent to the observers.

clsPreferences supports the concept of different sets of preferences. A set of preferences is stored in a single resource file in a well-known preferences directory managed by **theInstalledPreferences**. **clsPreferences** supports messages to change the current preference set to another one that is already filed. In addition, **clsPreferences** allows a preference set to start "clean". When PenPoint first starts up (or during a warm boot), **theSystemPreferences** will contain the set of preferences associated with the "current" preference set managed by **theInstalledPreferences**. If no current set exists, **theSystemPreferences** will start with a "clean" preference set. When a preference set changes, **clsPreferences** will notify the observers of the changed preferences. This is because **clsPreferences** is notified via **msgIMCurrentChanged** from the install manager (see instlmgr.h).

To change the set of preference set programmatically, one must communicate with **theIntallManager**. An example code fragment to change a preference set. See instlmgr.h for details:

```
    IM_INSTALL install;
    install.locator.uid = theBootVolume;
    rn.fs.locator.pPath = "\\PenPoint\\prefs\\PREFERENCESET";
    install.exist = imExistReactivate;
    install.listAttrLabel = 0;
    install.listHandle = 0;
    ObjectCall(msgIMInstall, theInstalledPrefs, &install);
    ObjectCall(msgIMSetCurrent, theInstalledPrefs, install.handle);
#ifndef PREFS_INCLUDED
#define PREFS_INCLUDED
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef RESFILE_INCLUDED
#include <resfile.h>
#endif
#ifndef SYSGRAF_INCLUDED
#include <sysgraf.h>
#endif
#ifndef OS_INCLUDED
#include <os.h>
#endif
```

Known Preferences in the System

The following are the predefined resource names, the data that reading and writing will return, and some predefined return values for certain preferences.

System Font

prSystemFont is the resource id for the system font. Reads and writes of this id use a P_PREF_SYSTEM_FONT. This resource will affect the returned value from PrefsSysFontInfo.

Changing this resource (via **msgResWriteData**) will cause the system to layout after notification of observers, which is expensive. This is done by doing an ObjectPost of **msgPrefsLayoutSystem** to self. As a result, **clsPreferences** will compare this resource to the previous value to prevent layout and observer notification if the write did not change the value.

```
#define tagPrSystemFont         MakeWknResId(clsPreferences, 1)
#define prSystemFont            tagPrSystemFont
```

Field Font

prUserFont is the resource id for the field (user) font. Reads and writes of this id use a P_PREF_SYSTEM_FONT. This preference will affect the returned data from PrefsSysFontInfo.

Changing this resource (via **msgResWriteData**) will cause the system to layout after notification of observers, which is expensive. This is done by doing an ObjectPost of **msgPrefsLayoutSystem** to self. As a result, **clsPreferences** will compare this resource to the previous value to prevent layout and observer notification if the write did not change the value.

```
#define tagPrUserFont           MakeWknResId(clsPreferences, 2)
#define prUserFont              tagPrUserFont
```

This data structure is the what is read in and written when reading and writing when the **resId** is **prSystemFont** or **prUserFont**. It contains a font specification, and a font scale to use.

```
typedef struct PREF_SYSTEM_FONT {
  SYSDC_FONT_SPEC       spec;       // Font spec
  SCALE                 scale;      // Scale: same for system and user font
} PREF_SYSTEM_FONT, *P_PREF_SYSTEM_FONT;
```

Orientation

prOrientation is the resource id for the screen orientation. Reads and writes of this id use a a P_U8, whose values are defined below.

Changing this resource (via **msgResWriteData**) will cause the system to layout after notification of observers, which is expensive. This is done by doing an ObjectPost of **msgPrefsLayoutSystem** to self. As a result, **clsPreferences** will compare this resource to the previous value to prevent layout and observer notification if the write did not change the value.

```
#define tagPrOrientation        MakeWknResId(clsPreferences, 3)
#define prOrientation           tagPrOrientation
#define prPortrait              0       // Portrait mode
#define prLandscape             1       // Landscape mode
#define prPortraitReversed      2       // Portrait mode (rotated 180 degrees)
#define prLandscapeReversed     3       // Landscape mode (rotated 180 degrees)
```

Bell

prBell is the resource id for ringing the warning bell. It reads and writes a P_U8, whose values are defined below. **prBell** is

```
#define tagPrBell               MakeWknResId(clsPreferences, 5)
#define prBell                  tagPrBell
#define prBellOn                0       // Ring the bell
#define prBellOff               1       // Don't ring the bell
```

Writing Style

prWritingStyle is the resource id for the handwriting preference style. Reads and writes of this id use a P_U8, whose values are defined below.

```
#define tagPrWritingStyle      MakeWknResId(clsPreferences, 6)
#define tagPrPrintingStyle     MakeWknResId(clsPreferences, 6)
#define prWritingStyle         tagPrWritingStyle
#define prPrintingStyle        tagPrPrintingStyle     // old name
#define prMixedCase            0       // Mixed case writer
#define prCapsOnly             1       // All caps writer
```

Date Format

prDateFormat is the resource id for the desired date format. Reads and writes use a P_U8, whose values are defined below. This preference will affect the format of the string returned from PrefsDateToString.

```
#define tagPrDateFormat        MakeWknResId(clsPreferences, 7)
#define prDateFormat           tagPrDateFormat
#define prDateMDYFull          0   //  January 15, 1990
#define prDateMDYAbbre         1   //  Jan. 15, 1990
#define prDateMDYSlash         2   //  1/15/90
#define prDateMDYHyphe         3   //  1-15-90
#define prDateMDYDot           8   //  1.15.90
#define prDateDMYFull          4   //  15 January 1990
#define prDateDMYAbbre         5   //  15 Jan. 1990
#define prDateDMYSlash         6   //  15/1/90
#define prDateDMYHyphe         7   //  15-1-90
#define prDateDMYDot           9   //  15.1.90
```

Gesture Timeout

prGestureTimeout is the resource id for the gesture timeout, and is measured in 1/100's of a second. Reads and writes of this id use a P_U16 whose meaning is 1/100's of a second.

```
#define tagPrGestureTimeout    MakeWknResId(clsPreferences, 9)
#define prGestureTimeout       tagPrGestureTimeout
```

Line Height

prLineHeight is the resource id for the ruled line writing line height in edit pads. Reads and writes of this id use a P_U16, whose meaning is 1/100th's of an inch. Changing this preference only affects newly created ruled pads.

```
#define tagPrLineHeight        MakeWknResId(clsPreferences, 10)
#define prLineHeight           tagPrLineHeight
```

Auto Suspend

tagPrAutoSuspend is the resource id for auto suspend timeout. Reads and writes of this id use a P_U16, whose units are minutes. If the value is 0, the machine will not be auto suspended.

Machines that do not support auto suspend use the auto suspend preference for the auto shutdown timeout.

```
#define tagPrAutoSuspend    MakeWknResId(clsPreferences, 11)
```

Auto Shutdown

tagPrAutoShutdown is the resource id for auto shutdown timeout. Reads and writes of this id use a P_U16, whose units are hundredths of hours. If the value is 0, the machine will not auto shutdown.

Machines that do not support auto suspend use the auto suspend timeout prefrence for auto shutdown.

```
#define tagPrAutoShutdown   MakeWknResId(clsPreferences, 28)
```

Power Management

prPowerManagement is the resource id that indicates if PenPoint should attempt to limit the computer's power consumption by turning off inactive devices

```
#define tagPrPowerManagement    MakeWknResId(clsPreferences, 27)
#define prPowerManagement       tagPrPowerManagement
#define prPowerManagementOff       0   // power management not attempted
#define prPowerManagementOn        1   // power management attempted
```

Floating Allowed

prDocFloating is the resource id that indicates if documents can be floated. Reads and writes of this id use a P_U8, whose meaning is defined below.

```
#define tagPrDocFloating    MakeWknResId(clsPreferences, 12)
#define prDocFloating       tagPrDocFloating
#define prDocFloatingOff       0       // document floating not allowed
#define prDocFloatingOn        1       // document floating allowed
```

Zooming Allowed

prDocZooming is the resource id that indicates if documents can be zoomed. Reads and writes of this id use a P_U8, whose meaning is defined below.

```
#define tagPrDocZooming     MakeWknResId(clsPreferences, 13)
#define prDocZooming        tagPrDocZooming
#define prDocZoomingOff       0        // document zooming not allowed
#define prDocZoomingOn        1        // document zooming allowed
```

Left/Right Handed

prHandPreference is the resource id that indicates a left handed or right handed user. Reads and writes of this id use a P_U8, whose meaning is defined below.

Changing this resource (via **msgResWriteData**) will cause the system to layout after notification of observers, which is expensive. This is done by doing an ObjectPost of **msgPrefsLayoutSystem** to self. As a result, **clsPreferences** will compare this resource to the previous value to prevent layout and observer notification if the write did not change the value.

```
#define tagPrHandPreference     MakeWknResId(clsPreferences, 14)
#define prHandPreference        tagPrHandPreference
#define prLeftHanded          0        // Left Handed writer
#define prRightHanded         1        // Right Handed writer
```

Scroll Margins Style

prScrollMargins is the resource id that indicates a "full" vs. "light" scroll bars. Reads and writes of this id use a P_U8, whose meaning is defined below.

Changing this resource (via **msgResWriteData**) will cause the system to layout after notification of observers, which is expensive. This is done by doing an ObjectPost of **msgPrefsLayoutSystem** to self. As a result, **clsPreferences** will compare this resource to the previous value to prevent layout and observer notification if the write did not change the value.

```
#define tagPrScrollMargins      MakeWknResId(clsPreferences, 26)
#define prScrollMargins         tagPrScrollMargins
#define prScrollMarginsFull     0
#define prScrollMarginsLight    1
```

Character Box Width

prCharBoxWidth is the resource indicating the width of char boxes for boxed writing fields. Reads and writes of this id use a P_U8, whose meaning is the width of the box in points. This preference only affects newly created character boxes.

```
#define tagPrCharBoxWidth       MakeWknResId(clsPreferences, 15)
#define prCharBoxWidth          tagPrCharBoxWidth
```

Character Box Height

prCharBoxHeight is the resource id indicating the height of char boxes for boxed writing fields. Reads and writes of this id use a P_U8, whose meaning is the height of the char box in points. This preference only affects newly created character boxes.

```
#define tagPrCharBoxHeight      MakeWknResId(clsPreferences, 16)
#define prCharBoxHeight         tagPrCharBoxHeight
```

Hand Writing Timeout

prHWXTimeout is the resource id indicating the handwriting timeout. Reads and writes of this id use a P_U16 whose meaning is 1/100's of a second.

```
#define tagPrHWXTimeout     MakeWknResId(clsPreferences, 17)
#define prHWXTimeout        tagPrHWXTimeout
```

Input Pad Style

prInputPadStyle is the resource id indicating the preferred style of handwriting pads. Reads and writes of this id use a P_U8, whose meaning is defined below.

```
#define tagPrInputPadStyle      MakeWknResId(clsPreferences, 18)
#define prInputPadStyle         tagPrInputPadStyle
#define prInputPadStyleBoxed            0   // Pad styles are boxed
#define prInputPadStyleRuled            1   // Pad styles are Ruled
#define prInputPadStyleRuledAndBoxed    2   // Pad styles are boxed-->ruled
#define prInputPadStyleSegmented        0   // Obsolete
```

Hold Timeout

prPenHoldTimeout is the resource id for the press hold timeout. Reads and writes of this id use a P_U16 whose meaning is 1/100's of a second.

```
#define tagPrPenHoldTimeout     MakeWknResId(clsPreferences, 19)
#define prPenHoldTimeout        tagPrPenHoldTimeout
```

Pen Cursor

prPenCursor is the resource id for whether the cursor is off or on. Reads and writes of this id use a P_U8, whose meaning is defined below.

```
#define tagPrPenCursor          MakeWknResId(clsPreferences, 20)
#define prPenCursor             tagPrPenCursor
#define prPenCursorOff              0       // Pen cursor should be off
#define prPenCursorOn               1       // Pen cursor should be on
```

Time Format

prTimeFormat is the resource id for the preferred time format (military or civilian). Reads and writes of this id use a P_U8, whose meaning is defined below. This preference will affect the returned string from PrefsTimeToString.

```
#define tagPrTimeFormat         MakeWknResId(clsPreferences, 21)
#define prTimeFormat            tagPrTimeFormat
#define prTime12Hour                0       // Display 12 hour times
#define prTime24Hour                1       // Display 24 hour times
```

Display Seconds

prTimeSeconds is the resource id indicating if seconds should be displayed or not. Reads and writes of this id use a P_U8, whose meaning is defined below. This preference will affect the returned string from PrefsTimeToString.

```
#define tagPrTimeSeconds        MakeWknResId(clsPreferences, 22)
#define prTimeSeconds           tagPrTimeSeconds
#define prTimeSecondsDisplay        0       // Display seconds in time
#define prTimeSecondsOff            1       // Don't display seconds in time
```

Time

prTime is the resource id for the system time. Reads and writes of this ID use a P_PREF_TIME_INFO, containing the current time information.

```
#define tagPrTime               MakeWknResId(clsPreferences, 23)
#define prTime                  tagPrTime
typedef union PREF_TIME_MODE {
    OS_SET_TIME_MODE writeMode;     // In: which attributes to set (for write only)
} PREF_TIME_MODE;
typedef struct PREF_TIME_INFO {
    PREF_TIME_MODE  mode;           // In: read or write mode
    OS_DATE_TIME    dateTime;       // In/Out: date and time information
} PREF_TIME_INFO, *P_PREF_TIME_INFO;
```

Primary Input

prPrimaryInput is the resource id defining the primary input device. Reads and writes of this id use a P_U8, whose meaning is defined below.

```
#define tagPrPrimaryInput       MakeWknResId(clsPreferences, 24)
#define prPrimaryInput          tagPrPrimaryInput
#define prPrimaryInputPen           0   // Primary input is with the pen
#define prPrimaryInputKbd           1   // Primary input is with a keyboard
```

Unrecognized Character

prUnrecCharacter is the resource id used for the unrecognized character glyph. Reads and writes of this id use a P_U8, whose meaning is defined below.

```
#define tagPrUnrecCharacter     MakeWknResId(clsPreferences, 25)
#define prUnrecCharacter        tagPrUnrecCharacter
#define prUnrecCharacterQuestion    0
#define prUnrecCharacterUnder       1
```

Messages

msgNew

Creates a new preferences object.

Takes P_PREFS_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct PREFS_NEW_ONLY {
    P_CHAR        pPrefSet;   // Preference set name
} PREFS_NEW_ONLY, *P_PREFS_NEW_ONLY;
#define prefsNewFields        \
    objectNewFields           \
    PREFS_NEW_ONLY            prefs;
typedef struct PREFS_NEW {
    prefsNewFields
} PREFS_NEW, *P_PREFS_NEW;
```

Comments

This message should not be called by clients. Creates a preferences object. If **pPrefSet** is **pNull**, the list will start out empty. Otherwise, **pPrefSet** is expected to be an already installed file title in the preferences directory.

msgPrefsPreferenceChanged

Sent to observers when a preference has changed.

Takes P_PREF_CHANGED, returns STATUS. Category: observer notification.

```
#define msgPrefsPreferenceChanged   MsgNoError(MakeMsg(clsPreferences, 1))
```

Arguments

```
typedef struct PREF_CHANGED {
  OBJECT          manager;        // Sender of the notification (theSystemPreferences)
  RES_ID          prefId;         // resId of preference that changed
} PREF_CHANGED, *P_PREF_CHANGED;
```

Comments

Sent to observers. Notifies observers that a given preference has changed. Notifies with the manager (usually **theSystemPreferences**, as there are no other pre-defined instances of **clsPreferences**), and the RES_ID of the preference that has changed.

msgPrefsLayoutSystem

Causes the system to re-layout and re-paint.

Takes NULL, returns STATUS.

```
#define msgPrefsLayoutSystem                    MakeMsg(clsPreferences, 5)
```

Comments

Causes the entire system to layout. If **msgPrefsWritingMany** has not been called, posted to self when **clsPreferences** receives **msgResWriteData** and a new value has been written for **prSystemFont**, **prUserFont**, **prOrientation**, **prHandPreference**, or **prScrollMargins**. If **msgPrefsWritingMany** has been called, the layout will occur when **msgPrefsWritingDone** is called. Will be sent to observers when immediately before a layout of the system occurs due to a preference change.

See Also **msgPrefsWritingMany**

msgPrefsWritingMany

Indicates several preferences are to be written in succession.

Takes NULL, returns STATUS.

```
#define msgPrefsWritingMany                MakeMsg(clsPreferences, 6)
```

Comments Causes **clsPreferences** to delay the self-posting of **msgPrefsLayoutSystem** until it receives **msgPrefsWritingDone**. Useful when writing several preference changes at once, and the client does not want the system laying out several times. If, after this message is received, a **msgResWrite** of **prSystemFont**, **prUserFont**, **prOrientation**, **prHandPreference**, or **prScrollMargins** is received, **clsPreferences** will self-post **msgPrefsLayoutSystem** when **msgPrefsWritingDone** is received. After **msgPrefsWritingDone** is received, any other **msgResWrite** of these preferences will cause an immediate layout unless this message is sent again. Will be sent to observers to allow them to be aware that several preferences are being written.

See Also **msgPrefsWritingDone**

msgPrefsWritingDone

Indicates completion of writing several preferences.

Takes NULL, returns STATUS.

```
#define msgPrefsWritingDone                    MakeMsg(clsPreferences, 7)
```

Comments Causes the system to layout if necessary by self-posting **msgPrefsLayoutSystem**. You should send this message in conjunction with **msgPrefsWritingMany** to indicate that writing of successive preferences is complete. If a **msgResWrite** of **prSystemFont**, **prUserFont**, **prOrientation**, **prHandPreference**, or **prScrollMargins** with a new value has been done, layout will occur at this time. Will be sent to observers to indicate that a series of preferences writes have been completed.

See Also **msgPrefsWritingMany**

Public Functions

PrefsSysFontInfo

Passes back the system and user font information.

Returns void.

Arguments

```
typedef struct PREF_SYSTEM_FONT_INFO {
  U8                    scale;
  U16                   sysFontId;
  U16                   userFontId;
} PREF_SYSTEM_FONT_INFO, *P_PREF_SYSTEM_FONT_INFO;
```

Function Prototype

```
void EXPORTED PrefsSysFontInfo (
  P_PREF_SYSTEM_FONT_INFO pFontInfo);
```

Comments This function can be used to read all font information stored in the preferences file at one time. Equivalent functionality exists with **msgResRead**. This function is provided for convenience.

PrefsDateToString

Returns a pointer to the string containing a formatted date.

Returns P_CHAR.

```
#define prefsMaxDate    19
```

Function Prototype

```
P_CHAR EXPORTED PrefsDateToString (
  P_OS_DATE_TIME pTime,
  P_CHAR pStr);
```

Comments

This function will return a string containing the ASCII representation of the formatted date based on the current user-preference for date. Puts the date into the string passed in. The longest possible string is 18 characters (19 including the terminating 0) given the CURRENT formats. If additional formats are added, this may increase.

PrefsTimeToString

Returns a pointer to the string containing a formatted time.

Returns P_CHAR.

```
#define prefsMaxTime    11
```

Function Prototype

```
P_CHAR EXPORTED PrefsTimeToString (
  P_OS_DATE_TIME pTime,
  P_CHAR pStr);
```

Comments

This function will return a string containing the ASCII representation of the time based on the current user preferences for time. Puts the time into the string passed in, and returns the string pointer. The longest possible string is 10 characters (11 including the terminating 0) given the current time formats. If additional formats are added, this may increase.

RESCMPLR.H

This file contains definitions for input to the resource compiler.

The resource compiler is a program which runs under MS-DOS. In conjunction with your resource compiler input and the C compiler it will create a PenPoint resource file.

NOTE: THIS IS A MSDOS INCLUDE FILE, DO NOT CHANGE IT TO BE PENPOINT COMPATIBLE.

```
#ifndef RESCMPLR_INCLUDED
#define RESCMPLR_INCLUDED
#ifndef RESFILE_INCLUDED
#include <resfile.h>
#endif
```

Common #defines and typedefs

Types

Prototype for the client-supplied agent writing routine. If you wish to supply your own agent writing routine then write a routine of type P_AGENT_TYPE and supply the address to the routine in the field **pAgentWriteProc** of RC_INPUT. Your routine should write out (using fwrite to file) its representation of the data described by **pResInput** (and optionally also by **pAgentData**).

Function Prototype
```
typedef void (PASCAL * P_AGENT_WRITE) (
    P_UNKNOWN              file,           // DOS file handle
    struct RC_INPUT        * pResInput,    // Data described below
    P_UNKNOWN              pAgentData,     // Res Agent specific data
    U32                    spare1,         // For future
    U32                    spare2          // For future
);
```

The resource compiler uses the information supplied by RC_INPUT to create resources. Typically only the first four or five fields of RC_INPUT are used. At a minimum you should set **resId**, **pData** and **dataLen**. You do not need to set **dataLen** if you set agent to **resStringResAgent** or **resStringArrayResAgent** (the resource compiler will infer **dataLen** from **pData**). You should set agent if you do not want the default resource data agent. You should set **minSysVersion** if it has a non-zero value. You may set **objectData** to true in the rare case that an object resource is being created by the resource compiler. You should set **pAgentWriteProc** and optionally **pAgentWriteData** if you are providing your own routine to write the resource data to the resource file.

```
typedef struct RC_INPUT {
    RES_ID            resId;              // the resource ID
    P_UNKNOWN         pData;              // points to data
    U16               dataLen;            // length of data
    UID               agent;              // usually resDefaultResAgent
    U16               minSysVersion;      // min sys version for resource
    U16               reserved;
    BOOLEAN           objectData;         // usually false
    P_AGENT_WRITE     pAgentWriteProc;    // pNull, unless supplying routine
    P_UNKNOWN         pAgentWriteData;    // usually pNull
} RC_INPUT, *P_RC_INPUT, **PP_RC_INPUT;
```

If you use **resTaggedStringArrayResAgent** as the agent for a resource. Then the data must be a list of RC_TAGGED_STRINGs. This is converted into a linear string array and the filed using the **resStringArrayResAgent** agent.

```
#define resTaggedStringArrayResAgent     ((UID)MakeTag(clsResFile, 0xff))
typedef struct RC_TAGGED_STRING {
    TAG                 tag;
    P_STRING            pString;
} RC_TAGGED_STRING, *P_RC_TAGGED_STRING;
```

Public variable

resInput is an exported variable that the resource compiler expects. Each element in the **resInput** array is a pointer to a structure describing the next resource. The list must be terminated with a null pointer.

```
extern  P_RC_INPUT  resInput [];    // Resource compiler input
```

Example

Here is example input for rescmplr (or rc):

```
    // Resource ids
    #define resIdRfANumber               MakeWknResId(clsExample, 1)
    #define resIdRfAString               MakeWknResId(clsExample, 2)
    #define resIdRfAStringArray          MakeWknResId(clsExample, 3)
    #define resIdRfATaggedStringArray    MakeWknResId(clsExample, 4)

    #define tagExampleErrorBogus         MakeTag(clsExample, 0)
    #define tagExampleErrorWrong         MakeTag(clsExample, 1)
    #define tagExampleErrorAgain         MakeTag(clsExample, 2)

    // A number.
    static U16      aNumber = 1;

    // A string array.
    static P_CHAR errorTextData [] = {
        "This is bogus.",
        "You got it wrong.",
        "I think you need to try again.",

        pNull                       // Define end of string array.
    };

    // A tagged string array.
    // This is equivalent to the above string array even thought the
    // elements are in a different order.
    static P_RC_TAGGED_STRING errorTextTaggedData [] = {

        tagExampleErrorWrong,    "You got it wrong.",
        tagExampleErrorAgain,    "I think you need to try again.",
        tagExampleErrorBogus,    "This is bogus.",

        pNull
    };

    // Res compiler input for aNumber.
    static RC_INPUT aNumberRes = {
        resIdRfANumber,
        &aNumber,
        sizeof(aNumber)
    };
```

```
// Res compiler input for aString.
static RC_INPUT aStringRes = {
    resIdRfAString,
    "Sample string",
    0,                  // Size inferred by res compiler.
    resStringResAgent
};

// Res compiler input for aStringArray.
static RC_INPUT aStringArrayRes = {
    resIdRfAStringArray,
    errorTextData,
    0,                  // Size inferred by res compiler.
    resStringArrayResAgent
};

// Res compiler input for aTaggedStringArray.
static RC_INPUT aTaggedStringArrayRes = {
    resIdRfATaggedStringArray,
    errorTextTaggedData,
    0,                  // Size inferred by res compiler.
    resTaggedStringArrayResAgent
};

// Input for resource compiler.
P_RC_INPUT  resInput [] = {
    &aNumberRes,
    &aStringRes,
    &aStringArrayRes,
    &aTaggedStringArrayRes,
    pNull
};
```

RESFILE.H

This file contains the API definition for **clsResFile**.

clsResFile inherits from **clsFileHandle.**

Provides resource and object filing support.

theSystemResFile is a well known instance of **clsResFile.**

clsResList inherits from **clsList.**

ResLists are lists of resource files that act like a single resource file for reading and searching (but not writing).

theProcessResList is a process well known instance of **clsResList.**

A resource file maintains a collection of 'resources' each identified by a 'resource ID'. A resource is filed data or a filed object. The types of data supported are: byte array, string, and array of strings. It is also possible to create an 'agent' that reads and writes other kinds of data.

A resource ID is a 32 bit TAG used as a unique (per file) key to identify and select a desired resource.

Overview

Resource files are used in three general ways: filing & unfiling objects, reading **theProcessResList** for configuration and customization information, and application specific data storage.

- The most common case of filing & unfiling objects is a page turn, which needs to save the state of a running process on the disk, and restore the state of another process from the disk. This is done by (un)filing the application framework, which (if everything is set up correctly) (un)files directly or indirectly all the objects that make up the state of the process.

  Filling of an object is initiated with **msgResWriteObject** which ends up sending **msgSave** to the object. The save procedure uses **msgStreamWrite** (everything except objects) and **msgResPutObject** (objects) to write out its instance data. Unfiling of the object is initiated with **msgResReadObject** which sends **msgRestore** to the (newly created) object. The restore procedure uses **msgStreamRead** and **msgResGetObject** to read its instance data back in.

- theProcessResList is used for several reasons: to allow text to be stored separately from the code, to store pre-built UI objects, to allow applications to override system provided items, to provide a central set of system wide preferences, etc. To do this it normally (inside an application) contains four resource files: DOC.RES (specific to the document), APP.RES (specific to the application), current system preferences file, and PENPOINT.RES (system wide resource file). They are searched in the order listed above. There are some utility functions to access **theProcessResList**, see RESUTIL.H for more information on them.

- There are many other ways to use resource files, but they are application specific. If you think you have a use for resource files, it is worth checking out, but do be careful, resource files are designed and optimized for the first two uses, and do not work well for everything that it at first seems like they should.

How a Resource ID is put together

The fields in a Resource ID:

TagNum (which resource object) = 8 bits

Flags (see below) = 2 bits

Admin (as usual) = 20 or 19 bits

Scope (as usual) = 1 or 2 bits

They are laid out this way:

```
         --------------------------------
Name:    0|tagNum |F|     Admin+Scope
         +-------+-------+-------+-------+
Size:    1| 8     |2|    20+1 or 19+2
         --------------------------------
```

The flags are interpreted as follows:

0 Well-Known Resource ID

1 Dynamic Resource ID

2 Well-Known List Resource ID

3 RESERVED

The Well-Knowns used here are the same ones used in other tags. This gives us three possible scopes: global, process and local. Because resource files are not tied to a process context, there is no difference between the global and process Well-Knowns. System and service classes should only use there own well known. Applications can not only use the well knowns for there own classes, they can also use all local well known values.

Well-Known Resource Ids (flag == 0) can be used to store any kind of resource.

The Dynamic Resource IDs (flag == 1) are used by the resource file in **msgResPutObject** to file nested objects. It is also possible for other code to allocate them using **msgResNextDynResId**. They may be used to file any kind of resource. We get 29 bits worth of Dynamic Resource IDs by combining the **tagNum**, admin and scope fields.

Well-Known List Resource IDs (flag == 2) must be used with list resources to allow the Indexed Resource IDs (see below) to work. The only list resource defined by GO is the string array, but it is possible to define others. The **tagNum** field is split into two fields for List Resource IDs.

The fields in a List Resource ID:

Group of lists	= 6 bits
List in group	= 2 bits
Flags (always set to 0x2)	= 2 bits
Admin (as usual)	= 20 or 19 bits
Scope (as usual)	= 1 or 2 bits

They are laid out this way:

```
         --------------------------------
Name:    0| Grp |L|2|     Admin+Scope
         +-------+-------+-------+-------+
Size:    1|  6  |2|2|     20+1 or 19+2
         --------------------------------
```

The Groups are allocated as follows:

00 - 1F AVAILABLE TO DEVELOPERS
TK Table Lists
Standard Message Lists
Quick Help Lists
3F RESERVED FOR GO

What an Indexed Resource ID is

Indexed Resource IDs are used to access list resources. They are NOT Resource IDs. Each must be converted into the List Resource ID of the desired list plus an index into the list to fetch the desired data.

The fields in a Indexed Resource ID:

TagNum (index into list)	= 8 bits
Flags (which list)	= 2 bits
Admin (as usual)	= 20 or 19 bits
Scope (as usual)	= 1 or 2 bits

They are laid out this way:

```
        --------------------------------
Name:   0|tagNum |F|     Admin+Scope
        +-------+-------+-------+-------+
Size:   1| 8     |2|     20+1 or 19+2
        --------------------------------
```

You will note that this provides eight bits not provided by a List Resource ID (the index) and is missing eight bits needed by it (the flags and group).

The eight bits of index allow each list to contain up to 256 items. Actually they can have more, but only the first 256 can be accessed this way. Since there are four lists for each Well-Known, it is possible to access up to 1,024 items per group per Well-Known.

We provide the missing bits as follows. Since we always map to a List Resource ID we know that the flags will be set to 0x2. Which group to use is determined by which API it is used with. Thus, the passing the same Indexed Resource ID to both Quick help and a TK table will result in different data items being used.

Warnings to those going off the beaten path.

The description above gives the standard way of allocating resource IDs. While there is special support for using them this way, and some other parts of the system in fact require this usage, the resource file itself does not care. The only time it puts a special interpretation on a resource ID is for well-known-object resource IDs. They have the top (sign) bit set to one. These are automatically created by the resource file, and to avoid trouble, should never be created by anything else.

Dynamic resource IDs are based off of a 29-bit count, and gaps are not reused. Because of this it is possible to run out. While this will not happen in 'normal' use, it is possible for uses that seem reasonable. So if you use them for anything other than normal object filing, or are repeatedly filing objects, make sure you do not run into this.

When an object resource is deleted from a resource file, the other objects it filed are NOT deleted, and there is no easy way of finding them to delete them. Because of this, repeatedly filing objects will result in the file growing without bound unless you work very hard to prevent it.

Opening multiple handles on the same resource file has some limitations. It is possible to have as many read-only handles as desired, as long as there are no writable handles. If there is a writable handle, no other handles may be opened. This is do to a limitation of the current implementation. It maintains index information into the file on a per handle basis. If writing was allowed with multiple handles open, these tables would become invalid resulting in fatal errors of many kinds.

While it is possible to use a resource file as a kind of mini-database, it was not designed or optimized for such a use. So, don't be surprised if you find it is not up to the task you would like to use it for.

ResFile Debugging Flags (Shared with Penpoint kernel & fs)

ResFile flag is 'G', values are:

1-80 = Used by PenPoint Kernel (see os.h)
-800 = Used by File System (see fs.h)

1000 = Turns on debugging info for reading and writing resources.
= Turns on timing stats
= Turns on debugging info for intercepted Stream & FS messages.
= TBD

```
#ifndef RESFILE_INCLUDED
#define RESFILE_INCLUDED
#ifndef UUID_INCLUDED
#include <uuid.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef OSHEAP_INCLUDED
#include <osheap.h>
#endif
#ifndef LIST_INCLUDED
#include <list.h>
#endif
#ifndef FS_INCLUDED
#include <fs.h>
#endif
```

Common #defines and typedefs

These are used to define resource IDs, both well known (client-defined) and dynamic (See uuid.h for comparison). Note that the count used for the dynamic resource ID's is managed internal to the resource file, and no attempt should be made to create them elsewhere.

```
#define resFlagsWkn      0x0
#define resFlagsDyn      0x1
#define resFlagsLists    0x2
#define resFlagsSpare    0x3
#define resFlagWknObj    ((RES_ID)0x80000000)
```

```
#define MakeWknResId(wkn,i)         \
    MakeTagWithFlags(wkn, i, resFlagsWkn)
#define MakeDynResId(count)         \
    MakeTagWithFlags(((U32)(count))>>8, ((count)&0xFF), resFlagsDyn)
#define MakeListResId(wkn,grp,lst)  \
    MakeTagWithFlags(wkn, ((((U32)(grp))<<2)+((lst)&0x03)), resFlagsLists)
#define MakeWknObjResId(obj)        ((RES_ID)(obj) | resFlagWknObj)
```

Extract the pieces from resource IDs.

```
#define ResWknObjResId(resId)       ((OBJECT)((resId) & ~resFlagWknObj))
#define ResDynIdCount(resId)        (WKNValue(resId)<<8 | Tag(resId))
#define ResListGroup(resId)         (Tag(resId) >> 2)
#define ResListList(resId)          (Tag(resId) & 0x3)
```

Tests on resource ID's

```
#define WknObjResId(resId)  ((resId) & resFlagWknObj)
#define WknResId(resId)     \
                (!WknObjResId(resId) && TagFlags(resId) != resFlagsDyn)
#define WknItemResId(resId) \
                (!WknObjResId(resId) && TagFlags(resId) == resFlagsWkn)
#define WknListResId(resId) \
                (!WknObjResId(resId) && TagFlags(resId) == resFlagsLists)
#define DynResId(resId)     \
                (!WknObjResId(resId) && TagFlags(resId) == resFlagsDyn)
```

Constants

```
#define resNilResId     Nil(RES_ID)
```

OBOLETE Resource IDs do NOT use.

```
#define residRfSystemVersion          MakeWknResId(clsResFile, 1)
#define residRfApplicationVersion     MakeWknResId(clsResFile, 2)
```

How to make a Indexed resource ID.

```
#define MakeIndexedResId(wkn,list,index)\
   MakeTagWithFlags(wkn,index,list)
```

The group identifiers used to convert from Indexed resource IDs to normal resource IDs. Values from 0x00 to 0x1F are available for use by applications. Values from 0x20 to 0x3F are reserved to the system.

```
#define resGrpTK        0x20
#define resGrpStdMsg    0x21
#define resGrpQhelp     0x22
```

Predefined Resource Agents

These are used by both the resource compiler to define data resources and by **msgResWriteData** to dynamically write a resource.

```
// Don't use these definitions, use the derived values below
#define resDefaultObjAgent          3   // Use resObjectResAgent
#define resDefaultDataAgent     4   // Use resDataResAgent
#define resStringAgent          5   // Use resStringResAgent
#define resStringArrayAgent     6   // Use resStringArrayResAgent
#define MakePrivateResAgent(x) \
      ((UID)MakeTag(clsResFile, x))
// These are the pre-defined resource types
#define resDefaultResAgent      objNull
#define resObjectResAgent       MakePrivateResAgent(resDefaultObjAgent)
#define resDataResAgent         MakePrivateResAgent(resDefaultDataAgent)
#define resStringResAgent       MakePrivateResAgent(resStringAgent)
#define resStringArrayResAgent  MakePrivateResAgent(resStringArrayAgent)
```

Status Codes

```
#define stsResResourceNotFound         MakeStatus(clsResFile, 1)
#define stsResNotDataResource          MakeStatus(clsResFile, 2)
#define stsResNotObjectResource        MakeStatus(clsResFile, 3)
#define stsResBufferTooSmall           MakeStatus(clsResFile, 4)
#define stsResNotFullyRead             MakeStatus(clsResFile, 5)
#define stsResGetNotFromRestore        MakeStatus(clsResFile, 6)
#define stsResPutNotFromSave           MakeStatus(clsResFile, 7)
// removed unused              MakeStatus(clsResFile, 8)
#define stsResWriteObjDynamicClass     MakeStatus(clsResFile, 9)
// removed unused              MakeStatus(clsResFile, 10)
#define stsResCompactInReadOrWrite     MakeStatus(clsResFile, 11)
#define stsResIncorrectFileType        MakeStatus(clsResFile, 12)
#define stsResFileCorrupt              MakeStatus(clsResFile, 13)
#define stsResResourceTooBig           MakeStatus(clsResFile, 14)
#define stsResOutOfDynResIds           MakeStatus(clsResFile, 15)
```

Types

```
// Object types.
typedef OBJECT RES_FILE, *P_RES_FILE;
typedef OBJECT RES_LIST, *P_RES_LIST;
```

NOTE: That **RES_ID** is already defined in clsmgr.h because it is referenced by **msgSave** & **msgRestore**:

```
    typedef TAG     RES_ID, *P_RES_ID;          // Resource ID
// Modes used in msgNew to control the creation of the resource file.
Enum16(RES_NEW_MODE) {
    // Will the file handle be shared?  Also guarantees concurrence
    resSharedResFile        = flag0,
    // Remove "deleted" fields on close
    resCompactOnClose       = flag1,
    // Compact file when ratio of deleted to non-deleted reaches compactRatio.
    resCompactAuto          = flag2,
    // Check to see that system version is new enough for resources.
    resVerifyVersions       = flag3,
    // Allow unsafe opens, internal use only.
    resUnsafeOpen           = flag4,
    // Default - No Concurrence, compact on close, verify versions.
    resNewDefault           = resCompactOnClose | resVerifyVersions
};
// Duplicate object checking flag for reading objects.
Enum16(RES_READ_OBJ_MODE) {
    resReadObjectOnce    = 0,   // Should object resource be read once?
    resReadObjectMany    = 1    // Should object resource be read many times?
};
// Duplicate object checking flag for writing objects.
Enum16(RES_WRITE_OBJ_MODE) {
    resWriteObjectOnce    = 0,  // Should object resource be written once?
    resWriteObjectMany    = 1   // Should object resource be written many?
};
// Mode used to control msgResEnumResources.
Enum16(RES_ENUM_MODE) {
    resEnumAll           = 0,   // Enumerate all resource entries?
    resEnumByResIdClass  = 1,   // Enumerate by wkn resource ID admin field?
    resEnumByObjectClass = 2,   // Enumerate by object resource's class?
    resEnumByObjectUID   = 3,   // Enumerate by object resource's uid?
    resEnumByAgent       = 4,   // Enumerate by resource's agent?
    resEnumNext          = flag14,  // Or in to enumerate the next item.
    resEnumDefault       = resEnumAll   // Default - all resources.
};
```

```
// Internal flag used to enumerate across resource lists.
#define resEnumNextFile     0x8000
// Indexed resource IDs.
typedef TAG     IX_RES_ID, *P_IX_RES_ID;
```

Class ResFile Messages

msgNew

Creates a resource file object.

Takes P_RES_FILE_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct RES_FILE_NEW_ONLY {
    RES_NEW_MODE        mode;
    U16                 compactMinimum;
    U16                 compactRatio;
    U32                 spare1;
    U32                 spare2;
} RES_FILE_NEW_ONLY, *P_RES_FILE_NEW_ONLY;
#define resFileNewFields    \
    fsNewFields             \
    RES_FILE_NEW_ONLY   resFile;
typedef struct RES_FILE_NEW {
    resFileNewFields
} RES_FILE_NEW, *P_RES_FILE_NEW;
```

Return Value

stsIncompatibleVersion Filed data is incompatible with system.

stsResIncorrectFileType File is not a resource file.

stsResFileCorrupt Size or contents of the file are not valid.

stsFSAccessDenied Incompatible with existing handles(*)

(*) Note that there can be only one open handle to a writable resource file. The file mode is automatically set to enforce this.

A resource file compacts itself at close time if the **resCompactOnClose** flag was set in **pNew**->resFile.mode.

If the **resCompactAuto** flag is set in **pArgs**->res.mode then it compacts itself when a resource is written or deleted, if the number of records is greater than **compactMinimum** and the number of deleted records is greater than **compactRatio** percent of the records in the file.

For example, a value of 10 for **compactMinimum** and 50 for **compactRatio** implies that compaction should happen whenever there are more than 10 resources in the resource file and 50% of them have been marked as deleted.

msgNewDefaults

Initializes the RES_FILE_NEW structure to default values.

Takes P_RES_FILE_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct RES_FILE_NEW {
    resFileNewFields
} RES_FILE_NEW, *P_RES_FILE_NEW;
```

Zeroes out **pArgs**->resFile and sets....mode = **resNewDefault**;.**compactRatio** = 33;.**compactMinimum** = 50;

msgResFindResource

Finds a resource in a resource file or a resource list.

Takes P_RES_FIND, returns STATUS.

```
#define msgResFindResource          MakeMsg(clsResFile, 1)
```

Arguments

```
typedef struct RES_FIND {
    RES_ID              resId;          // In: Resource to find
    RES_FILE            file;           // Out: File location of resource
    UID                 agent;          // Out: Agent of the resource
    U32                 offset;         // Out: Offset in file (Careful!)
    U16                 minSysVersion;  // Out: Min sys vers for the resource
    U16                 reserved;
} RES_FIND, *P_RES_FIND;
```

Comments

*** This message is obsolete, you should use **msgResGetInfo** instead.

This message may be used to determine if a resource exists and to get information about that resource. You must use it before writing or deleting a resource if you do not know which resource file (out of a resource list) contains the resource (Resource lists only act upon non-destructive messages).

Return Value

stsBadParam resId is a nil resource ID.

stsResResourceNotFound No resource with the given **resId** exists.

msgResGetInfo

Gets information on a resource in a resource file or a resource list.

Takes P_RES_INFO, returns STATUS.

```
#define msgResGetInfo           MakeMsg(clsResFile, 17)
```

Arguments

```
typedef struct RES_INFO {
    RES_ID              resId;          // In: Resource to find
    RES_FILE            file;           // Out: File location of resource
    UID                 agent;          // Out: Agent of the resource
    UID                 objClass;       // Out: Class of object (if is object)
    U32                 offset;         // Out: Offset in file (Careful!)
    U32                 size;           // Out: Size in file (Careful!)
    U16                 minSysVersion;  // Out: Min sys vers for the resource
    U16                 reserved1;
    U32                 reserved;
} RES_INFO, *P_RES_INFO;
```

Comments

This message may be used to determine if a resource exists and to get information about that resource. You must use it before writing or deleting a resource if you do not know which resource file (out of a resource list) contains the resource (Resource lists only act upon non-destructive messages). This is an improved version of **msgResFindResource.** It gives a more useful set of values for agent (as in exactly what is in the file), and it returns the size of the resource in the file.

Return Value

stsBadParam resId is a nil resource ID.

stsResResourceNotFound No resource with the given **resId** exists.

msgResReadData

Reads resource data from a resource file or resource list.

Takes P_RES_READ_DATA, returns STATUS.

```
#define msgResReadData              MakeMsg(clsResFile, 2)
```

Arguments

```
typedef struct RES_READ_DATA {
    RES_ID              resId;          //
    OS_HEAP_ID          heap;           // Nil if pData is user supplied buf
    P_UNKNOWN           pData;          // I/O: In: user buffer, Out: res data
    U32                 length;         // I/O: In: user buf len, Out: res len
    P_UNKNOWN           pAgentData;     // Agent-specific data
    U32                 spare1;
} RES_READ_DATA, *P_RES_READ_DATA;
```

Comments

This message requires a destination for the read data. There are two choices. You can specify a pointer and a length for the data passed back (heap = null, **pData** = ptr, length = xx) or you can specify a valid heap from which the resource file will allocate memory for the data (heap = heap ID, **pData** = doesn't matter, length = doesn't matter). Typically if the size of the data is already known and it is small and short lived, then the data is "allocated" on the stack. Otherwise, the data is allocated on behalf of a heap.

Some resources require additional data to identify the actual data to be passed back. For example, a string arrays resource requires additional information (the index into the array) to find the string to pass back. You specify an index in **pAgentData** (**pAgentData** = (P_UNKNOWN)index).

Return Value

stsBadParam resId is a nil resource ID or reading a string from a string array resource and the index specified in **pAgentData** is out of range.

stsResResourceNotFound No resource with the given **resId** exists.

stsResNotDataResource The found resource was an object resource.

stsResBufferTooSmall Supplied buffer isn't big enough to hold data.

See Also

msgResWriteData To write data to resource file.

msgResReadObject To read an object from a resource file.

msgResWriteData

Writes resource data to a file.

Takes P_RES_WRITE_DATA, returns STATUS.

```
#define msgResWriteData              MakeMsg(clsResFile, 3)
```

Arguments

```
typedef struct RES_WRITE_DATA {
    RES_ID              resId;          //
    P_UNKNOWN           pData;          // Data to be written
    U32                 length;         // Optional if agent can compute size
    UID                 agent;          // Not used by msgResUpdateData
    P_UNKNOWN           pAgentData;     // Agent-specific data
    U32                 spare1;
} RES_WRITE_DATA, *P_RES_WRITE_DATA;
```

Comments

This message writes data to the resource file. If the resource already exists it is marked as deleted and the new data is written to the end of the file.

Return Value

stsBadParam resId is a nil resource ID.

stsResResourceTooBig Tried to write resource bigger than resource file can handle (16Meg).

See Also

msgResReadData To read data from resource file.

msgResUpdateData To re-write data in a resource file.

msgResWriteObject To write an object to a resource file.

msgResUpdateData

Updates existing data resource data.

Takes P_RES_WRITE_DATA, returns STATUS.

```
#define msgResUpdateData                   MakeMsg(clsResFile, 4)
```

Message Arguments

```
typedef struct RES_WRITE_DATA {
    RES_ID            resId;           //
    P_UNKNOWN         pData;           // Data to be written
    U32               length;          // Optional if agent can compute size
    UID               agent;           // Not used by msgResUpdateData
    P_UNKNOWN         pAgentData;      // Agent-specific data
    U32               spare1;
} RES_WRITE_DATA, *P_RES_WRITE_DATA;
```

Comments

Use this message if you know that a resource already exists and is only being updated. The only advantage of this message over **msgWriteData** is that you don't have to specify the agent.

Return Value

stsBadParam resId is a nil resource ID.

stsResResourceNotFound No resource with the given **resId** exists.

stsResNotDataResource The found resource was an object resource.

stsResResourceTooBig Tried to write resource bigger than resource file can handle (16Meg).

See Also

msgResReadData To read data from resource file.

msgResWriteData To write data to a resource file.

msgResReadObject

Reads a resource object from a resource file or resource list.

Takes P_RES_READ_OBJECT, returns STATUS.

```
#define msgResReadObject                   MakeMsg(clsResFile, 5)
```

Arguments

```
typedef struct RES_READ_OBJECT {
    RES_READ_OBJ_MODE   mode;          // Duplicate checking mode
    RES_ID            resId;           //
    OBJECT_NEW        objectNew;       // Object passed back in new.uid
    RES_SAVE_RESTORE_FLAGS  sysFlags;  // Only for msgResReadObjectWithFlags
    U16               appFlags;        // Only for msgResReadObjectWithFlags
    U32               spare1;
} RES_READ_OBJECT, *P_RES_READ_OBJECT;
```

Comments

An object must be initialized before it can be read. You must send **msgNewDefault** to **clsObject**.

There are two modes that can be applied to reading an object resource, **resReadObjectOnce** and **resReadObjectMany**.

Setting mode to **resReadObjectOnce**, passed back the object that is associated with the resource stored in the resource file (per open). This guarantees that all filed references to a given object refer to the same object. This is the mode to use if you are unfiling data in a **msgRestore** procedure. There are other uses of it, but they can be very tricky, so make sure you read all of the documentation and understand it thoroughly before you try to use this any place other than a **msgSave** procedure.

Setting mode to **resReadObjectMany**, passes back a new copy of the object without regard as to whether the object has already been read in before or not. This guarantees that each reader gets his own unique instance of the object. This is the mode to use if you are reading an object resource "template" (the normal case).

Return Value

stsBadParam resId is a nil resource ID.

stsResResourceNotFound No resource with the given **resId** exists.

stsResNotObjectResource The found resource was a data resource.

stsResNotFullyRead The **msgRestore** routine did not read the same amount of data as the **msgSave** wrote.

See Also

msgResWriteObject To write an object to a resource file.

msgResReadData To read data from a resource file.

Pseudo code for reading an object resource:

```
    #define sampleResId     MakeWknResId(clsXXX, 17)
    readObj.resId = sampleResId;
    readObj.mode  = resReadObjectMany;
    ObjCallRet(msgNewDefaults, clsObject, &readObj.objectNew, status);
    status = ObjCallWarn(msgResReadObject, file, &readObj);
    object = readObj.objectNew.uid;
```

msgResWriteObject

Writes a resource object to a file.

Takes P_RES_WRITE_OBJECT, returns STATUS.

```
#define msgResWriteObject          MakeMsg(clsResFile, 6)
```

Arguments

```
typedef struct RES_WRITE_OBJECT {
    RES_WRITE_OBJ_MODE  mode;          // Duplicate checking mode
    RES_ID              resId;         //
    OBJECT              object;        // Object to write
    RES_SAVE_RESTORE_FLAGS  sysFlags;  // Only for msgResWriteObjectWithFlags
    U16                 appFlags;      // Only for msgResWriteObjectWithFlags
    U32                 spare1;
} RES_WRITE_OBJECT, *P_RES_WRITE_OBJECT;
```

Comments

There are two modes that can be applied to writing an object resource, **resWriteObjectOnce** and **resWriteObjectMany**.

Setting mode to **resWriteObjectOnce**, will only write the object to the resource file once (per open). This guarantees that all filed references to a given object refer to the same object. This is the mode is used by **msgResPutObject**, and should be used by you if you bypass it and use **msgResWriteObject** directly in a **msgSave** procedure. There are other uses of it, but they can be very tricky, so make sure you read all of the documentation and understand it thoroughly before you try to use this any place other than a **msgSave** procedure.

Setting mode to **resWriteObjectMany**, will write a new copy of the object to the resource file whether the object has already been written before or not. This is the mode to use if you are writing an object resource "template" (the normal case).

Return Value

stsBadParam resId is a nil resource ID.

stsResWriteObjDynamicClass Class of object cannot be dynamic.

stsResResourceTooBig Tried to write resource bigger than resource file can handle (16Meg).

See Also

msgResReadObject To read an object from resource file.

msgResWriteData To write data to a resource file.

msgResGetObject

Reads the filed object resource from the current file position.

Takes P_OBJECT, returns STATUS.

```
#define msgResGetObject              MakeMsg(clsResFile, 8)
```

Comments

This should only be called by routines responding to **msgRestore**. This message is provided as a convenience. It eliminates the need for everyone to duplicate the same code and guarantees that the parallel operation (**msgResPutObject**) will work.

Return Value

stsResGetNotFromRestore This was sent in a context other than in response to a **msgRestore**.

This message is equivalent to this pseudo code:

```
    STREAM_READ_WRITE   fsRead;
    RES_READ_OBJECT     resRead;
    STATUS              status;
    // Read the object's resource ID from the file.
    fsRead.numBytes = SizeOf(resRead.resId);
    fsRead.pBuf     = &resRead.resId;
    ObjCallRet(msgStreamRead, pArgs->file, &fsRead, status);
    // Set up the read resource object request.
    resRead.mode = resReadObjectOnce;
    ObjCallRet(msgNewDefaults, clsObject, &resRead.new, status);
    // Read the object if one was filed.
    if (resRead.resId != resNilResId) {
        ObjCallRet(msgResReadObject, pArgs->file, &resRead, status);
    }
```

msgResPutObject

Writes the object as a filed object resource to the current file position.

Takes OBJECT, returns STATUS.

```
#define msgResPutObject              MakeMsg(clsResFile, 9)
```

Comments

This should only be called by routines responding to **msgSave**. This message is provided as a convenience. It eliminates the need for everyone to duplicate the same code and guarantees that the parallel operation (**msgResGetObject**) is done in the correct order.

Return Value

stsResPutNotFromSave This was sent in a context other than in response to a **msgSave**.

This message is equivalent to this pseudo code:

```
    STREAM_READ_WRITE   fsWrite;
    RES_WRITE_OBJECT    resWrite;
    STATUS              status;
    if (object != Nil(OBJECT)) {
        // Assign an appropriate resource ID to the object.
        if (!ObjectIsDynamic(object)) {
            resWrite.resId  = MakeWknObjResId(object);
        } else {
            ObjCallRet(
                msgResNextDynResId, pArgs->file, &resWrite.resId, status
            );
        }
        // Write the object.
        resWrite.mode   = resWriteObjectOnce;
        resWrite.object = object;
        ObjCallRet(msgResWriteObject, pArgs->file, &resWrite, status);
```

```
} else {
    // No object.
    resWrite.resId  = resNilResId;
}
// Write the object's resId.
fsWrite.numBytes = SizeOf(resWrite.resId);
fsWrite.pBuf     = &resWrite.resId;
ObjCallRet(msgStreamWrite, pArgs->file, &fsWrite, status);
```

msgResReadObjectWithFlags

Reads a resource object, passing the supplied flags.

Takes P_RES_READ_OBJECT, returns STATUS.

```
#define msgResReadObjectWithFlags        MakeMsg(clsResFile, 15)
```

Message Arguments

```
typedef struct RES_READ_OBJECT {
    RES_READ_OBJ_MODE   mode;            // Duplicate checking mode
    RES_ID              resId;           //
    OBJECT_NEW          objectNew;       // Object passed back in new.uid
    RES_SAVE_RESTORE_FLAGS  sysFlags;    // Only for msgResReadObjectWithFlags
    U16                 appFlags;        // Only for msgResReadObjectWithFlags
    U32                 spare1;
} RES_READ_OBJECT, *P_RES_READ_OBJECT;
```

Comments

This is identical to **msgResReadObject** except that it copies the flag values supplied into all **msgRestore** calls done by this or any object reads that are done recursively from this.

The values for the **sysFlags** field are defined by GO and should be examined by any object that needs special behavior for any of the defined cases (currently only on copy).

The values for the **appFlags** field are defined by an application writer. Great care must be used with setting or testing these flags. If the flags from one application are used with a class of a second application, disaster can result. E.g. set this field to 0 unless you are very sure you know what you are doing.

Return Value

stsBadParam resId is a nil resource ID.

stsResResourceNotFound No resource with the given **resId** exists.

stsResNotObjectResource The found resource was a data resource.

stsResNotFullyRead The **msgRestore** routine did not read the same amount of data as the **msgSave** wrote.

See Also

msgResReadObject Normal message to read an object

msgResWriteObjectWithFlags The matching write call.

msgResWriteObjectWithFlags

Writes a resource object, passing the supplied flags.

Takes P_RES_WRITE_OBJECT, returns STATUS.

```
#define msgResWriteObjectWithFlags       MakeMsg(clsResFile, 16)
```

Message Arguments

```
typedef struct RES_WRITE_OBJECT {
    RES_WRITE_OBJ_MODE  mode;            // Duplicate checking mode
    RES_ID              resId;           //
    OBJECT              object;          // Object to write
    RES_SAVE_RESTORE_FLAGS  sysFlags;    // Only for msgResWriteObjectWithFlags
    U16                 appFlags;        // Only for msgResWriteObjectWithFlags
    U32                 spare1;
} RES_WRITE_OBJECT, *P_RES_WRITE_OBJECT;
```

Comments

This is identical to **msgResWriteObject** except that it copies the flag values supplied into all **msgSave** calls done by this or any object writes that are done recursively from this.

The values for the **sysFlags** field are defined by GO and should be examined by any object that needs special behavior for any of the defined cases (currently only on copy).

The values for the **appFlags** field are defined by an application writer. Great care must be used with setting or testing these flags. If the flags from one application are used with a class of a second application, disaster can result. E.g. set this field to 0 unless you are very sure you know what you are doing.

Return Value

stsBadParam resId is a nil resource ID.

stsResWriteObjDynamicClass Class of object cannot be dynamic.

stsResResourceTooBig Tried to write resource bigger than resource file can handle (16Meg).

See Also

msgResWriteObject Normal message to write an object.

msgResReadObjectWithFlags The matching Read call.

---

msgResDeleteResource

Deletes the resource identified by RES_ID.

Takes RES_ID, returns STATUS.

```
#define msgResDeleteResource           MakeMsg(clsResFile, 10)
```

Comments

This marks the resource deleted in the resource file index. The space taken by the resource is reclaimed whenever the resource file is compacted. Auto compaction may happen after a resource is deleted.

Note that this may NOT be called during **msgSave** or **msgRestore**. It will appear to work, but the read or write will fail.

Return Value

stsBadParam resId is a nil resource ID.

stsResResourceNotFound No resource with the given **resId** exists.

---

msgResCompact

Compacts the resource file.

Takes void, returns STATUS.

```
#define msgResCompact                  MakeMsg(clsResFile, 11)
```

Comments

This message removes all deleted entries from the file and frees any unused space that results. This can be called automatically in a couple of ways. See **msgNew** for an explanation of them.

Return Value

stsResCompactInReadOrWrite Can not compact during read or write. This only happens if **msgCompact** is sent during **msgSave** or **msgRestore**.

---

msgResFlush

Flushes the resource file index.

Takes void, returns STATUS.

```
#define msgResFlush                    MakeMsg(clsResFile, 12)
```

Comments

The resource file keeps track of all objects that have filed themselves in the resource file. It needs this information to implement the **resReadObjectOnce / resWriteObjectOnce** behavior. If you wish to override the **resReadObjectOnce / resWriteObjectOnce** behavior, then flush the resource file.

Clients rarely use this message. Instead, use the **resReadObjectMany / resWriteObjectMany** modes with **msgResReadObject / msgResWriteObject.**

This also sends a **msgFSFlush** to the file. If all you want to do is flush the file then use **msgFSFlush** instead of **msgResFlush.**

See Also

msgResReadObject To get info on read once / read many.

msgResWriteObject To get info on write once / write many.

msgResEnumResources

Enumerates resources in a resource file or resource list.

Takes RES_ENUM, returns STATUS.

```
#define msgResEnumResources        MakeMsg(clsResFile, 13)
```

Arguments

```
typedef struct RES_ENUM {
    U16             max;        // size of pResId[] and pResFile[] arrays
    U16             count;      // # to pass back in arrays
                                // if count > max then memory may be allocated
                                // Out: # of valid entries in arrays
    RES_ENUM_MODE   mode;       // Enumerate based on what and first/next.
    UID             match;      // key to match on (i.e. class; agent; etc)
    P_RES_ID        pResId;     // Out: ptr to array of resource IDs
    P_RES_FILE      pResFile;   // Out: ptr to array of resource file handles
                                // Note: if memory was alloc'd for previous 2
                                // fields, client should heap free the memory
} RES_ENUM, *P_RES_ENUM;
```

Comments

This message will enumerate all resources of a given category (based on mode and match) in either a single resource file or a resource list. The max and count fields behave as all other enum messages. This passes back the resource IDs and files that contain the resources in the **pResId** and **pResFile** arrays. Mode must always have **resEnumNext** clear the first time this is called and set subsequent times. Other mode flags selectively filter what is being enumerated.

Return Value

stsBadParam resEnumNext was specified first time.

Here is some pseudo-code for enumerating:

```
    #define resMaxEnums 12
    STATUS              status;
    RES_ENUM            rEnum;
    RES_ID              enumResIds[resMaxEnums];
    RES_FILE            enumResFiles[resMaxEnums];
    // Enumerate only objects belonging to clsString of the resources.
    rEnum.max       = resMaxEnums;
    rEnum.count     = resMaxEnums;
    rEnum.mode      = resEnumByObjectClass;
    rEnum.match     = clsString;
    rEnum.pResId    = enumResIds;
    rEnum.pResFile  = enumResFiles;
    for (status = stsOK; status == stsOK; ) {
        status = ObjectCall(msgResEnumResources, resFile, &rEnum);
        for (index = 0; index < rEnum.count; index++) {
            // Process the data, etc, etc
        }
        rEnum.mode |= resEnumNext;
    }
```

msgResNextDynResId

Allocates the next available dynamic resource ID.

Takes P_RES_ID, returns STATUS.

```
#define msgResNextDynResId          MakeMsg(clsResFile, 14)
```

Comments

This message may be used to allocate the next dynamic resource ID available, so that the caller can write dynamic items without using **msgResPutObject**. WARNING: dynamic IDs are based on a 29 bit count, and the values are not recycled. If you run out of available counts, this will fail.

Return Value

stsResOutOfDynResIds ran out of dynamic **resIDs**

ResFile Agent Message

msgResAgent

Message sent by resource file to resource agent when forwarding messages.

Takes P_RES_AGENT, returns STATUS.

```
#define msgResAgent                 MakeMsg(clsResFile, 20)
```

Arguments

```
typedef struct RES_AGENT {
    RES_FILE            file;           // File containing the resource
    U32                 length;         // Length of resource entry
    MESSAGE             msg;            // message passed on to agent
    P_UNKNOWN           pArgs;          // In-Out: message specific args
    U16                 sysVersion;     // Min sys version if write
    U16                 spare;
    U32                 spare1;
    U32                 spare2;
} RES_AGENT, *P_RES_AGENT;
```

Comments

Messages forwarded are **msgResReadData**, **msgResReadObject**, **msgResWriteData**, **msgResUpdateData**, **msgResWriteObject** and **msgResUpdateObject**.

For reads, current file pointer will be positioned at resource entry and length of the entry will be passed in length field. For writes, current file pointer will be positioned where write should begin.

Class ResList Messages

msgNew

Creates a resource file (search) list object.

Takes P_RES_LIST_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct RES_LIST_NEW_ONLY {
    U16             resvd1;
    U16             resvd2;
} RES_LIST_NEW_ONLY, *P_RES_LIST_NEW_ONLY;
#define resListNewFields    \
    listNewFields           \
    RES_LIST_NEW_ONLY       resList;
typedef struct RES_LIST_NEW {
    resListNewFields
} RES_LIST_NEW, *P_RES_LIST_NEW;
```

Comments

clsResList adds no additional **msgNew** parameters to **clsList**. There are no messages specific to **clsResList**. It adds additional behavior.

msgResXxx

Non-destructive resource file messages.

Takes P_RES_XXX, returns STATUS.

Comments

Resource lists accept only non-destructive resource file messages (**msgResReadData**, **msgResReadObject**, **msgResReadObjectWithFlags**, **msgResGetObject**, **msgResFindResource** and **msgResEnumResources**) and forwards the message to each resource file in the list. Resource files that are null are skipped and are not considered an error. The resource list stops forwarding the message when either all resource files in the list have been exhausted or when one of them responds with a status greater than or equal to **stsOK**.

Sending **msgResEnumResource** to a resource file list is special, because it forwards the message to all resource files in the list until the list is exhausted. Thus the enumerated data is representative of the entire resource list.

Return Value

stsRequestNotSupported Msg was not read, find or enum.

stsListEmpty No valid resource files in the list.

See Also

stsXXX Return values from the resource file messages that are sent to the resource list.

RESUTIL.H

This file contains the API definition for the Resource Utility procedures. The functions described in this file are contained in RESFILE.LIB.

```
#ifndef RESUTIL_INCLUDED
#define RESUTIL_INCLUDED
#ifndef RESFILE_INCLUDED
#include <resfile.h>
#endif
```

Public functions

ResUtilLoadObject

Loads an object from **theProcessResList**.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED ResUtilLoadObject(
    RES_ID      resId,      // the resource ID of the object
    P_OBJECT    pObject     // Out: the object
);
```

Comments

This is a short cut to using **msgResReadObject** to read on object in from **theProcessResList**.

ResUtilLoadString

Loads a string item from **theProcessResList**.

Returns STATUS.

Function Prototype
```
STATUS EXPORTED ResUtilLoadString(
    PP_CHAR     ppString,   // In/Out: the pointer to the buffer/string
    P_U32       pLength,    // In/Out: the length of the buffer/string
    OS_HEAP_ID  heap,       // Heap to allocate from.
    RES_ID      resId       // resId for a string
);
```

Comments

This is a short cut to using **msgResReadData** to read a string in from **theProcessResList**.

There are two ways of supplying space to load the string into. You can specify a pointer and a length for the data passed back (heap = null, *ppString = ptr, *pLength = xx) or you can specify a valid heap from which the resource file will allocate memory for the data (heap = heap ID, *ppString = doesn't matter, **pLength** = null or *pLength = doesn't matter). Typically if the size of the data is already known and it is small and short lived, then the data is "allocated" on the stack. Otherwise, the data is allocated on behalf of a heap.

ResUtilLoadListString

Loads an item from a string list in the application resource list.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED ResUtilLoadListString(
    PP_CHAR     ppString,   // In/Out: the pointer to the buffer/string
    P_U32       pLength,    // In/Out: the length of the buffer/string
    OS_HEAP_ID  heap,       // Heap to allocate from.
    U32         listGroup,  // The list group to select from
    IX_RES_ID   listResId   // Indexed resId for a string
);
```

Comments

This is a short cut to using **msgResReadData** to read a single string form a string array that is in **theProcessResList**.

Works just like ResUtilLoadString, except it uses the group and indexed resource ID to construct the resource ID of a string list and the index into it.

SETTINGS.H

clsSettingsNB inherits from **clsApp**.

This class defines the Settings Notebook.

There is only one instance of the Settings Notebook in the system, on the bookshelf.

The Settings Notebook is an option book. It contains a System Preferences sheet, an Installer sheet, and a Status sheet.

The Preferences sheet contains a group of Preferences cards. These update the system preferences resource file (penpoint.res).

The Installer sheet contains one card for each installation category (apps, preferences, services, etc). Each category has an underlying install manager (see instlmgr.h). A card is automatically created when a new install manager is created, and deleted when an install manger is destroyed.

The Installer sheet allows a client to display a particular card and select an item within that card. Here's example code which activates the Settings Notebook from the Bookshelf, turns it to the Installer sheet, displays a particular card, selects an item within that card, and finally opens the Settings Notebook:

```
#include <auxnbmgr.h>
#include <instlsht.h>

{
    ANM_OPEN_NOTEBOOK   openNotebook;
    APP_METRICS         am;
    IUI_SELECT_ITEM     selectItem;
    OPTION_CARD         oc;
    IUI_SHOW_CARD       showCard;
    STATUS              s;

    ObjectCall(msgBusySetState, theBusyManager, (P_ARGS) true);
    openNotebook.notebook = anmSettings;
    openNotebook.activateOnly = true;
    ObjCallRet(msgANMOpenNotebook, theAuxNotebookMgr, &openNotebook, s);
    ObjSendUpdateRet(msgAppGetMetrics, openNotebook.uid, &am, SizeOf(am), s);
    oc.tag = tagIUIInstallerSheet;
    ObjSendUpdateRet(msgOptionShowCard, am.mainWin, &oc, SizeOf(oc), s);
    ObjSendUpdateRet(msgOptionGetTopCard, am.mainWin, &oc, SizeOf(oc), s);
    strcpy(showCard.pCardName, "Applications");
    ObjSendRet(msgIUIShowCard, oc.win, &showCard, SizeOf(showCard), s);
    strcpy(selectItem.pItemName, appMgrMetrics.name);
    ObjSendRet(msgIUISelectItem, oc.win, &selectItem, SizeOf(selectItem), s);
    openNotebook.notebook = anmSettings;
    openNotebook.activateOnly = false;
    ObjCallRet(msgANMOpenNotebook, theAuxNotebookMgr, &openNotebook, s);
    ObjectCall(msgBusySetState, theBusyManager, (P_ARGS) false);
}
#ifndef SETTINGS_INCLUDED
#define SETTINGS_INCLUDED
#ifndef APPTAG_INCLUDED
#include <apptag.h>
#endif
```

Common #defines and typedefs

```
#define tagSettingsPrefSheet                     MakeTag(clsInstallUISheet, 29)
#define tagSettingsInstallerSheet                MakeTag(clsInstallUISheet, 30)
#define tagSettingsStatusSheet                   MakeTag(clsInstallUISheet, 31)
#define tagSettingsNBPeripheralsOnIconResId          tagAppIconBitmap
#define tagSettingsNBPeripheralsOnSmallIconResId     tagAppSmallIconBitmap
#define tagSettingsNBPeripheralsOffSmallIconResId \
                                    MakeTag(clsSettingsNBAppWin, 1)
#define tagSettingsNBPeripheralsOffIconResId \
                                    MakeTag(clsSettingsNBAppWin, 2)
#define tagSettingsPrefCmdBar                    MakeTag(clsSettingsNB, 100)
```

Error status codes

```
#define stsSettingsValueOutOfRange               MakeStatus(clsSettingsNB, 1)
#define stsSettingsFixedValueOutOfRange          MakeStatus(clsSettingsNB, 2)
```

Part 12 / Installation API

APPIMGR.H

This file contains the API definition for **clsAppInstallMgr**.

clsAppInstallMgr inherits from **clsCodeInstallMgr**.

Manages installation and deinstallation of applications.

There is a single instance of **clsAppInstallMgr** in the system; the well-known uid **theInstalledApps**.

theInstalledApps performs installation and deinstallation of applications and allows you to enumerate all of the applications that are currently installed.

An application is a directory, usually located under \penpoint\app on a given filesystem volume. The name of the directory is the name of the application. Within this directory is a .exe and zero or more .dlls that make up the application. If a application includes .dlls there must also be a .dlc file which lists all the .dlls and the .exe. The name of the .dlc file (or the name of the .exe file if there are no .dlls) must be the same as the name of the application. If a application is called MAIL, for example, its .dlc file must be named MAIL.DLC. You can use the STAMP.EXE utility to give an application an extended name. Be sure to stamp the .dlc file as well.

There can also be a service.ini and app.ini file in the application's directory. These specify any additional services and applications that should be installed when this application is installed. These services and applications are deinstalled when the application is deinstalled. If one of these services or applications is already installed it is reference counted, not installed again.

This directory also contains subdirectories which hold entries in the Help notebook (HELP), stationery (STATNRY), tools (ACCESSRY), and any app-specific files that should be copied in when the app is installed (MISC). The application's resource file, app.res, is also in this directory.

The application monitor is responsible for managing the installation of these items. When an app is installed its code is loaded and app.res is copied in. The application monitor object is then created and completes the installation. You can subclass the application monitor if you need control over the installation process. See appmon.h for details.

An application is installed by sending **msgIMInstall** to **theInstalledApps**. Applications are installed under user control from the Applications card of the Settings Notebook. \\boot\penpoint\boot\app.ini specifies applications that are automatically loaded when the system cold-boots.

Each installed application has an application directory in the RAM filesystem under \penpoint\sys\app. For example, MAIL be in \penpoint\sys\app\MAIL. The application resource file and the MISC directory are copied to this directory.

Each installed application is represented by a handle, in a fashion similar to other install managers (see instlmgr.h). This handle is a directory handle onto the application's directory in the RAM filesystem.

NOTE: THE MESSAGES IN THIS CLASS ARE SENT TO THE MANAGER, NOT TO THE HANDLES.

An application can be deinstalled. Deinstallation removes all traces of an application.

An application can be deinstalled even if there are running or filed instances of that application in the machine. All running instances are shut down (saved, then terminated) when an application is removed.

The application framework will use the Placeholder (MaskApp) class if it tries to start up document with a missing application.

The following superclass messages are not understood by **clsAppInstallMgr**:

- msgIMGetCurrent
- msgIMSetCurrent
- msgIMSetName
- msgIMDup

The following notification messages are not sent by **clsAppInstallMgr**:

- msgIMNameChanged
- msgIMCurrentChanged

See Also

- instlmgr.h
- appmon.h

```
#ifndef APPIMGR_INCLUDED
#define APPIMGR_INCLUDED
#ifndef CODEMGR_INCLUDED
#include <codemgr.h>
#endif
```

Common #defines and typedefs

msgNew

Creates a new application installation manager.

Takes P_AIM_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct AIM_NEW {
    installMgrNewFields
} AIM_NEW, *P_AIM_NEW;
```

Comments

There is only one instance of this class, **theInstalledApps**, in the system. Clients should never send **msgNew**.

msgAIMGetMaskClass

Passes back the mask class.

Takes P_CLASS, returns STATUS.

```
#define msgAIMGetMaskClass                    MakeMsg(clsAppInstallMgr, 6)
```

Comments

The mask application class is used by the application framework when it tries to start up a document with an unavailable application.

msgAIMSetMaskClass

Sets the mask class.

Takes CLASS, returns STATUS.

```
#define msgAIMSetMaskClass                    MakeMsg(clsAppInstallMgr, 7)
```

Comments

The mask application class is used by the application framework when it tries to start up a document with an unavailable application.

This message can be sent at any time; however, the new mask class will only be used for subsequent switches.

AUXNBMGR.H

This file contains the class definition and methods for **clsAuxNotebookMgr**.

clsAuxNotebookMgr inherits from **clsObject.**

Manages the system notebooks and documents on the bookshelf.

There is a single instance of **clsAuxNotebookMgr** in the system; the well-known uid **theAuxNotebookMgr**.

The auxiliary notebook manager creates the following items on the bookshelf:

The Help NotebookSettings NotebookAccessories PalleteStationery NotebookKeyboard InstanceConnections Notebook InstanceInbox NotebookOutbox Notebook

It provides access to those items that are guaranteed to always be on the bookshelf:

The Help NotebookSettings NotebookAccessories PalleteStationery NotebookInbox NotebookOutbox Notebook

It allows documents and sections to be created in the Notebooks it manages, and copies documents into the Notebooks. It also provides several Stationery-specific functions.

theAuxNotebookMgr is usually not used by applications, other than to activate and open one of system items on the bookshelf.

The document/section creation and copy facilities are used by application installation.

```
#ifndef AUXNBMGR_INCLUDED
#define AUXNBMGR_INCLUDED
#ifndef GEO_INCLUDED
#include <geo.h>
#endif
#ifndef FS_INCLUDED
#include <fs.h>
#endif
```

Common #defines and typedefs

Which bookshelf item? Used in most messages to **theAuxNotebookMgr**. Also used as part of the definition of the well-known uuids for these items.

```
typedef enum ANM_AUX_NOTEBOOK {
    anmReserved                  = 0,  // Never use this value! See
                                       // anmAttrWhichAuxNB below.
    anmSettingsNotebook          = 1,  // Settings Notebook.
    anmHelpNotebook              = 3,  // Help Notebook.
    anmStationeryNotebook        = 4,  // Stationery Notebook.
    anmInboxNotebook             = 5,  // Inbox.
    anmOutboxNotebook            = 6,  // Outbox.
    anmAccessories               = 7,  // Accessories Pallette.
} ANM_AUX_NOTEBOOK, *P_ANM_AUX_NOTEBOOK;
```

Exist behavior for creating sections and docs.

```
typedef enum ANM_EXIST_BEHAVIOR {
    anmExistGenError,
    anmExistDoNothing,
    anmExistTruncate,
    anmExistGenUnique
} ANM_EXIST_BEHAVIOR, *P_ANM_EXIST_BEHAVIOR;
```

Should a section and/or a notebook entry be added to the stationery menu?

```
typedef struct STAT_MENU_STYLE {
    U16 section         : 2,    // Add a section entry.
        notebook        : 2,    // Add a notebook entry.
        unused1         : 12;   // reserved
} STAT_MENU_STYLE, *P_STAT_MENU_STYLE;
```

Filesystem Attributes

Should a given piece of stationery be on the stationery menu?

```
#define anmAttrStationeryMenu       FSMakeFix32Attr(clsAuxNotebookMgr, 1)
typedef enum ANM_ATTR_STATIONERY_MENU {
    anmNotOnMenu            = 0,    // Same as no attribute.
    anmOnMenu               = 1
} ANM_ATTR_STATIONERY_MENU;
```

Should a stationery or tool document not be loaded at install time? This attribute is on the the document on the external filesystem.

```
#define anmAttrNoLoad               FSMakeFix32Attr(clsAuxNotebookMgr, 2)
typedef enum ANM_ATTR_NO_LOAD {
    anmLoad                 = 0,    // Same as no attribute.
    anmNoLoad               = 1
} ANM_ATTR_NO_LOAD;
```

Id tag; used to designate stationery or accessory documents.

```
#define anmAttrId                   FSMakeFix32Attr(clsAuxNotebookMgr, 3)
```

Attribute used to tell the difference between an auxiliary notebooks and a data notebooks. Backup programs take note. Never backup an auxilary notebook!

```
#define anmAttrAuxNB                FSMakeFix32Attr(clsAuxNotebookMgr, 4)
typedef enum ANM_ATTR_AUX_NB {
    anmDataNB               = 0,    // Same as no attribute.
    anmAuxNB                = 1
} ANM_ATTR_AUX_NB;
```

Attribute used by **clsNBToc** to perform special behavior for each auxnb. This attribute is stamped on the auxnb's TOC at initialization time. The attribute values are specified in the ANM_AUX_NOTEBOOK enum. Note: ANM_AUX_NOTEBOOK must never have a 0 value; 0 indicates no **anmAttrWhichAuxNB** attribute.

```
#define anmAttrWhichAuxNB           FSMakeFix32Attr(clsAuxNotebookMgr, 5)
```

Used to get auto-expand behavior of stationery sections.

```
#define anmAttrExpandStationerySection  FSMakeFix32Attr(clsAuxNotebookMgr, 6)
```

Messages

msgNew

Creates a new auxiliary notebook manager.

Takes P_ANM_NEW, returns STATUS. Category: class message.

```
#define auxNotebookMgrNewFields             \
    objectNewFields
```

Arguments

```
typedef struct ANM_NEW {
    auxNotebookMgrNewFields
} ANM_NEW, *P_ANM_NEW;
```

Comments

Note: this is done once and only once in the init routine of this dll to create **theAuxNotebookMgr**. This message must never be called by anyone else!

msgANMCreateDoc

Create a document in one of the auxiliary notebooks.

Takes P_ANM_CREATE_DOC, returns STATUS.

```
#define msgANMCreateDoc                     MakeMsg(clsAuxNotebookMgr, 1)
```

Arguments

```
typedef struct ANM_CREATE_DOC {
    ANM_AUX_NOTEBOOK    notebook;    // Which auxiliary notebook?
    CLASS               docClass;    // Document class.
    P_STRING            pPath;       // Path to create doc in, relative to
                                     // base of the aux notebook. pNull
                                     // says to create at top level.
    P_STRING            pName;       // Name of doc.
    U32                 sequence;    // Sequence number to create in front of.
    P_STRING            pBookmarkLabel; // pNull for no bookmark.
    ANM_EXIST_BEHAVIOR  exist;       // What to do if the doc exists/doesn't
                                     // exist. Note: doc might exist due to
                                     // warm boot.
    BOOLEAN             putInMenu;   // If type is stationery, should the doc
                                     // initially be in the stationery menu?
    P_FS_FLAT_LOCATOR   pDestPath;   // Out: Location of created doc.
                                     // if pDestPath is pNull then nothing is
                                     // returned.
    U32                 id;          // Id to tag everything with. 0 is no tag.
} ANM_CREATE_DOC, *P_ANM_CREATE_DOC;
```

msgANMCreateSect

Create a section in one of the auxiliary notebooks.

Takes P_ANM_CREATE_SECT, returns STATUS.

```
#define msgANMCreateSect                    MakeMsg(clsAuxNotebookMgr, 2)
```

Arguments

```
typedef struct ANM_CREATE_SECT {
    ANM_AUX_NOTEBOOK    notebook;    // Which auxiliary notebook?
    CLASS               sectClass;   // Section class.
    P_STRING            pPath;       // Path to create section in, relative to
                                     // base of the aux notebook. pNull
                                     // says to create at top level.
    P_STRING            pName;       // Name of section.
    U32                 sequence;    // Sequence number to create in front of.
    P_STRING            pBookmarkLabel; // pNull for no bookmark.
    ANM_EXIST_BEHAVIOR  exist;       // What to do if the sect exists/doesn't
                                     // exist. Note: sect might exist due to
```

```
                                          // warm boot.
    P_FS_FLAT_LOCATOR   pDestPath;  // Out: Location of created section.
                                          // if pDestPath is pNull then nothing is
                                          // returned.
    U32                 id;         // Id to tag everything with. 0 is no tag.
} ANM_CREATE_SECT, *P_ANM_CREATE_SECT;
```

msgANMMoveInDoc

Move a document into an auxiliary notebook.

Takes P_ANM_MOVE_COPY_DOC, returns STATUS.

```
#define msgANMMoveInDoc                     MakeMsg(clsAuxNotebookMgr, 3)
```

Arguments

```
typedef struct ANM_MOVE_COPY_DOC {
    ANM_AUX_NOTEBOOK    notebook;   // Which auxiliary notebook?
    FS_LOCATOR          source;     // Source document.
    P_STRING            pPath;      // Path to move/copy doc to, relative to
                                    // base of the aux notebook. pNull
                                    // says to create at top level.
    CLASS               defaultClass;// Class to use if source isn't stamped.
    U32                 sequence;   // Sequence number to move/copy in front
                                    // of.
    P_STRING            pBookmarkLabel; // pNull for no bookmark.
    ANM_EXIST_BEHAVIOR  exist;      // What to do if the doc exists/doesn't
                                    // exist. Note: doc might exist due to
                                    // warm boot.
    BOOLEAN             forceInMenu;// If this is stationery, override
                                    // any local attribute and put it in
                                    // the stationery menu.
    P_FS_FLAT_LOCATOR   pDestPath;  // Out: Location of destination doc.
                                    // if pDestPath is pNull then nothing is
                                    // returned.
    U32                 id;         // Id to tag everything with. 0 is no tag.
} ANM_MOVE_COPY_DOC, *P_ANM_MOVE_COPY_DOC;
```

msgANMCopyInDoc

Copy a document into an auxiliary notebook.

Takes P_ANM_MOVE_COPY_DOC, returns STATUS.

```
#define msgANMCopyInDoc                     MakeMsg(clsAuxNotebookMgr, 4)
```

Message Arguments

```
typedef struct ANM_MOVE_COPY_DOC {
    ANM_AUX_NOTEBOOK    notebook;   // Which auxiliary notebook?
    FS_LOCATOR          source;     // Source document.
    P_STRING            pPath;      // Path to move/copy doc to, relative to
                                    // base of the aux notebook. pNull
                                    // says to create at top level.
    CLASS               defaultClass;// Class to use if source isn't stamped.
    U32                 sequence;   // Sequence number to move/copy in front
                                    // of.
    P_STRING            pBookmarkLabel; // pNull for no bookmark.
    ANM_EXIST_BEHAVIOR  exist;      // What to do if the doc exists/doesn't
                                    // exist. Note: doc might exist due to
                                    // warm boot.
    BOOLEAN             forceInMenu;// If this is stationery, override
                                    // any local attribute and put it in
                                    // the stationery menu.
    P_FS_FLAT_LOCATOR   pDestPath;  // Out: Location of destination doc.
                                    // if pDestPath is pNull then nothing is
                                    // returned.
    U32                 id;         // Id to tag everything with. 0 is no tag.
} ANM_MOVE_COPY_DOC, *P_ANM_MOVE_COPY_DOC;
```

msgANMDelete

Delete a section or document in one of the auxiliary notebooks.

Takes P_ANM_DELETE, returns STATUS.

```
#define msgANMDelete                          MakeMsg(clsAuxNotebookMgr, 7)
```

Arguments

```
typedef struct ANM_DELETE {
    ANM_AUX_NOTEBOOK    notebook;    // Which auxiliary notebook?
    P_STRING            pPath;       // Path of item to delete.
} ANM_DELETE, *P_ANM_DELETE;
```

msgANMDeleteAll

Delete all the nodes that are identified by 'id'.

Takes P_ANM_DELETE_ALL, returns STATUS.

```
#define msgANMDeleteAll                       MakeMsg(clsAuxNotebookMgr, 8)
```

Arguments

```
typedef struct ANM_DELETE_ALL {
    ANM_AUX_NOTEBOOK    notebook;    // Which auxiliary notebook?
    U32                 id;          // Id.
} ANM_DELETE_ALL, *P_ANM_DELETE_ALL;
```

Comments

If a node's id attribute or its app class is 'id' then delete it.

msgANMGetNotebookPath

Returns the base path of one of the auxiliary notebooks.

Takes P_ANM_GET_NOTEBOOK_PATH, returns STATUS.

```
#define msgANMGetNotebookPath                 MakeMsg(clsAuxNotebookMgr, 9)
```

Arguments

```
typedef struct ANM_GET_NOTEBOOK_PATH {
    ANM_AUX_NOTEBOOK    notebook;    // Which auxiliary notebook?
    P_FS_FLAT_LOCATOR   pLocator;    // Out: base location of notebook.
                                     // pNull is returned if the
                                     // notebook does not exist yet.
} ANM_GET_NOTEBOOK_PATH, *P_ANM_GET_NOTEBOOK_PATH;
```

Comments

Note: This will return a path to the table of contents of the notebook. See **msgANMGetNotebookUUID** if you want the actual notebook itself.

msgANMGetNotebookUUID

Returns the uuid of one of the auxiliary notebooks.

Takes P_ANM_GET_NOTEBOOK_UUID, returns STATUS.

```
#define msgANMGetNotebookUUID                 MakeMsg(clsAuxNotebookMgr, 10)
```

Arguments

```
typedef struct ANM_GET_NOTEBOOK_UUID {
    ANM_AUX_NOTEBOOK    notebook;    // Which auxiliary notebook?
    UUID                uuid;        // Out: uuid of auxiliary notebook.
} ANM_GET_NOTEBOOK_UUID, *P_ANM_GET_NOTEBOOK_UUID;
```

Comments

Note: This is the UUID of the actual notebook. Use **msgANMGetNotebookPath** to get to the table of contents of the notebook.

msgANMOpenNotebook

Activate and optionally open an auxiliary notebook.

Takes P_ANM_OPEN_NOTEBOOK, returns STATUS.

```
#define msgANMOpenNotebook                    MakeMsg(clsAuxNotebookMgr, 11)
```

Arguments

```
typedef struct ANM_OPEN_NOTEBOOK {
    ANM_AUX_NOTEBOOK            notebook;     // Which notebook.
    BOOLEAN                     activateOnly; // Only activate; don't open
    OBJECT                      uid;          // Out: uid of activated or
                                              // opened auxnb.
} ANM_OPEN_NOTEBOOK, *P_ANM_OPEN_NOTEBOOK;
```

Private

msgANMPopUpStationeryMenu

Pop up the stationery menu at the specified location.

Takes P_ANM_POP_UP_MENU, returns STATUS.

```
#define msgANMPopUpStationeryMenu             MakeMsg(clsAuxNotebookMgr, 5)
```

Arguments

```
typedef struct ANM_POP_UP_MENU {
    XY32                hotSpot;      // Where to pop up menu. Coords are
                                      // relative to destObj.
    OBJECT              destObj;      // Object to create stationery in front
                                      // of.
    STAT_MENU_STYLE     style;        // Menu style.
} ANM_POP_UP_MENU, *P_ANM_POP_UP_MENU;
```

Comments

If the user hits one of the menu items create a stationery document in the destination object at the **hotSpot**.

msgANMGetStationeryMenu

Passes back the stationery menu.

Takes P_ANM_GET_MENU, returns STATUS.

```
#define msgANMGetStationeryMenu               MakeMsg(clsAuxNotebookMgr, 6)
```

Arguments

```
typedef struct ANM_GET_MENU {
    XY32                hotSpot;      // Where to pop up menu. Coords are
                                      // relative to destObj.
    OBJECT              destObj;      // Object to create stationery in front
                                      // of.
    STAT_MENU_STYLE     style;        // Menu style.
    OBJECT              menu;         // Out: Stationery menu.
} ANM_GET_MENU, *P_ANM_GET_MENU;
```

Comments

This message allows the app framework to add the stationery menu to an existing menu bar. When the stationery menu is invoked, stationery is created in **destObj** at the **hotSpot**.

msgANMAddToStationeryMenu

Add a stationery notebook doc to the stationery menu.

Takes P_ANM_MENU_ADD_REMOVE, returns STATUS.

```
#define msgANMAddToStationeryMenu             MakeMsg(clsAuxNotebookMgr, 12)
```

Arguments

```
typedef struct ANM_MENU_ADD_REMOVE {
    UUID                        document;  // Dir Index of document to remove.
} ANM_MENU_ADD_REMOVE, *P_ANM_MENU_ADD_REMOVE;
```

msgANMRemoveFromStationeryMenu

Remove a document from the stationery menu

Takes P_ANM_MENU_ADD_REMOVE, returns STATUS.

```
#define msgANMRemoveFromStationeryMenu      MakeMsg(clsAuxNotebookMgr, 13)
```

Message Arguments

```
typedef struct ANM_MENU_ADD_REMOVE {
    UUID                        document;  // Dir Index of document to remove.
} ANM_MENU_ADD_REMOVE, *P_ANM_MENU_ADD_REMOVE;
```

msgANMStationeryMenuNameChanged

Informs the stationery menu that one of its documents has changed name.

Takes P_ANM_MENU_NAME_CHANGED, returns STATUS.

```
#define msgANMStationeryMenuNameChanged     MakeMsg(clsAuxNotebookMgr, 17)
```

Arguments

```
typedef struct ANM_MENU_NAME_CHANGED {
    UUID                        document;  // Dir Index of document whose name
                                           // changed.
} ANM_MENU_NAME_CHANGED, *P_ANM_MENU_NAME_CHANGED;
```

Obsolete

```
#define anmAttrPermanent            FSMakeFix32Attr(clsAuxNotebookMgr, 0)
typedef enum ANM_ATTR_PERMANENT {
    anmNotPermanent       = 0,    // Same as no attribute.
    anmPermanent          = 1
} ANM_ATTR_PERMANENT;
// Next available messsage number: 18
```

CODEMGR.H

This file contains the API definition for **clsCodeInstallMgr.**

clsCodeInstallMgr inherits from **clsInstallMgr.**

Manages installation and deinstallation of code: applications and services.

clsAppInstallMgr and **clsServiceInstallMgr** inherit from this class.

The following superclass messages are not understood by **clsCodeInstallMgr**:

- msgIMGetCurrent
- msgIMSetCurrent
- msgIMSetName
- msgIMDup

The following notification messages are not sent by **clsCodeInstallMgr**:

- msgIMNameChanged
- msgIMCurrentChanged

See Also instlmgr.h

```
#ifndef CODEMGR_INCLUDED
#define CODEMGR_INCLUDED
#ifndef INSTLMGR_INCLUDED
#include <instlmgr.h>
#endif
```

Common #defines and typedefs

Status Codes

An application or service's name can be a max of **nameBufLength** - 4 chars.

```
#define  stsCIMNameTooLong              MakeStatus(clsCodeInstallMgr, 0)
```

Filesystem Attribute Definitions

Note: Most clients do not deal with attributes directly.

Application or service class

```
#define cimAttrClass                FSMakeFix32Attr(clsCodeInstallMgr, 0)
```

Application or service program handle

```
#define cimAttrProgHandle           FSMakeFix32Attr(clsCodeInstallMgr, 1)
```

Application or service program well-known name

```
#define cimAttrProgramName          FSMakeStrAttr(clsCodeInstallMgr, 2)
```

Should this app or service be seen in the installer? This determines whether the user can configure and deinstall it.

```
#define cimAttrDeinstallable       FSMakeFix32Attr(clsCodeInstallMgr, 4)
typedef enum CIM_ATTR_DEINSTALLABLE {
    cimDeinstallable      = 0,   // Same as no attribute
    cimNotDeinstallable   = 1
} CIM_ATTR_DEINSTALLABLE;
```

Dependent application list

```
#define cimAttrAppList             FSMakeVarAttr(clsCodeInstallMgr, 6)
```

Dependent services list

```
#define cimAttrServiceList         FSMakeVarAttr(clsCodeInstallMgr, 7)
```

Common data structure used by **msgCIMTerminateVetoed** and **msgCIMGetTerminateStatus.**

```
typedef struct CIM_TERMINATE_VETOED {
    IM_HANDLE           handle;
    OBJECT              vetoer; // Object that vetoed the terminate.
    STATUS              status; // Veto status.
} CIM_TERMINATE_VETOED, *P_CIM_TERMINATE_VETOED;
```

Messages

msgCIMGetClassList

Passes back a list of the classes of the installed applications or services.

Takes P_LIST, returns STATUS.

```
#define msgCIMGetClassList                MakeMsg(clsCodeInstallMgr, 1)
```

Comments — CAUTION: The caller must destroy the list object when it is finished using it.

See Also — **msgIMGetList** (instlmgr.h) Returns a list of handles.

msgCIMGetClass

Given a handle, passes back the class.

Takes P_CIM_GET_CLASS, returns STATUS.

```
#define msgCIMGetClass                    MakeMsg(clsCodeInstallMgr, 2)
```

Arguments

```
typedef struct CIM_GET_CLASS {
    IM_HANDLE           handle;  // Handle to get class on.
    CLASS               classId; // Out: class.
} CIM_GET_CLASS, *P_CIM_GET_CLASS;
```

msgCIMFindClass

Returns the handle which references the specified class.

Takes P_CIM_FIND_CLASS, returns STATUS.

```
#define msgCIMFindClass                   MakeMsg(clsCodeInstallMgr, 3)
```

Arguments

```
typedef struct CIM_FIND_CLASS {
    CLASS               classId;     // Class to search for.
    IM_HANDLE           handle;      // Out: Resulting handle.
} CIM_FIND_CLASS, *P_CIM_FIND_CLASS;
```

Return Value — **stsNoMatch** No handle for this class was found.

msgCIMFindProgram

Finds a item's handle, given its program name.

Takes P_CIM_FIND_PROGRAM, returns STATUS.

```
#define msgCIMFindProgram                    MakeMsg(clsCodeInstallMgr, 22)
```

Arguments

```
typedef struct CIM_FIND_PROGRAM {
    P_STRING            pName;      // Program name to search for
    IM_HANDLE           handle;     // Out: Resulting handle
} CIM_FIND_PROGRAM, * P_CIM_FIND_PROGRAM;
```

Return Value

stsNoMatch Item not found.

msgCIMLoad

Installs code for the item specified.

Takes P_CIM_LOAD, returns STATUS. Category: descendant responsibility.

```
#define msgCIMLoad                          MakeMsg(clsCodeInstallMgr, 4)
```

Arguments

```
typedef struct CIM_LOAD {
    IM_HANDLE           handle;  // Handle of item to load.
} CIM_LOAD, *P_CIM_LOAD;
```

Comments

This message is sent to subclasses to do the actual work of installing the item. The working directory is set to the source. **pArgs**->handle references the deactivated item to load.

msgCIMTerminateOK

Is this item willing to be terminated?

Takes P_CIM_TERMINATE_OK, returns STATUS. Category: descendant responsibility.

```
#define msgCIMTerminateOK                   MakeMsg(clsCodeInstallMgr, 5)
```

Arguments

```
typedef struct CIM_TERMINATE_OK {
    IM_HANDLE           handle; // Item to ask.
    OBJECT              vetoer; // Out: Object which vetoed the terminate.
} CIM_TERMINATE_OK, *P_CIM_TERMINATE_OK;
```

msgCIMTerminate

Unconditionally terminate this item.

Takes P_CIM_TERMINATE, returns STATUS. Category: descendant responsibility.

```
#define msgCIMTerminate                     MakeMsg(clsCodeInstallMgr, 6)
```

Arguments

```
typedef struct CIM_TERMINATE {
    IM_HANDLE           handle;
} CIM_TERMINATE, *P_CIM_TERMINATE;
```

msgCIMTerminateVetoed

Somebody vetoed the termination sequence.

Takes P_CIM_TERMINATE, returns STATUS. Category: descendant responsibility.

```
#define msgCIMTerminateVetoed               MakeMsg(clsCodeInstallMgr, 7)
```

Message Arguments

```
typedef struct CIM_TERMINATE {
    IM_HANDLE           handle;
} CIM_TERMINATE, *P_CIM_TERMINATE;
```

msgCIMGetTerminateStatus

Gets termination status of last item deinstalled.

Takes P_CIM_TERMINATE_VETOED, returns STATUS.

```
#define msgCIMGetTerminateStatus           MakeMsg(clsCodeInstallMgr, 8)
```

Message Arguments

```
typedef struct CIM_TERMINATE_VETOED {
    IM_HANDLE           handle;
    OBJECT              vetoer; // Object that vetoed the terminate.
    STATUS              status; // Veto status.
} CIM_TERMINATE_VETOED, *P_CIM_TERMINATE_VETOED;
```

Comments

If there was and error then **pArgs**->vetoer is the object which caused the error; an application instance in the case of applications and a service instance in the case of services. **pArgs**->status is the termination status.

DYNTABLE.H

This file contains the API definition for **clsDynamicTableMgr**.

clsDynamicTableMgr inherits from **clsObject**.

It allows a tk table to track the comings and goings of installable items.

Overview

tkTables (see tktable.h) are typically used to display static tables. However, there are times when clients wish to build a **tkTable** that views a dynamic structure, such as the installed fonts or the currently connected filesystem volumes. **clsDynamicTableMgr** allows a tk table to be dynamically updated as one of these things changes. Specifically, **clsDynamicTableMgr** supports viewing the contents of an install manager (see instlmgr.h) and filesystem volumes (see fs.h).

When the dynamic table manager is first created it generates a **tkTable** entry for each item in the dynamic structure. The label of the **tkTable** entry is set to the name of the item. The **tkTable** entry is tagged with the uid of the Install Manager handle or the uid of a volume's root directory handle.

If the specified Install Manager is **theInstalledFonts** and the entry class inherits from **clsButton** then the short font id is also stored in the entry's data field.

clsDynamicTKTableMgr also supports an optional write-in field that is added to the end of the tk table.

```
#ifndef DYNTABLE_INCLUDED
#define DYNTABLE_INCLUDED
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef FONT_INSTALL_INCLUDED
#include <fontmgr.h>
#endif
```

Common #defines and typedefs

Object property tag for entries managed by this class.

```
#define propDTEntry                    MakeTag(clsDynamicTableMgr, 1)
```

Tag on the fill-in field button, if style.**addFillInField** is true.

```
#define tagDTFillInField               MakeTag(clsDynamicTableMgr, 2)
```

Activated/Deactivated display styles

```
#define dtNoShowDeactivated         0   // Don't show any deactivated items.
#define dtShowDeactivated           1   // Show deactivated items same as
                                        // normal items.
#define dtShowDeactivatedAsInactive 2   // Show deactivated with
                                        // bsLookInactive.
typedef struct DYN_TABLE_STYLE {
    U16 showDeactivated : 2,    // How to deal with deactivated elements.
        autoDestroy     : 1,    // Destroy self when tkTable is freed.
        ignoreRamVolume : 1,    // Don't show the RAM filesystem volume.
        putFontIdInData : 1,    // Put short font id in entry's data field.
        addFillInField  : 1,    // Add a blank write-in field. This is a
                                // text field inside of a button.
        unused          : 10;
    U16 spare1;
} DYN_TABLE_STYLE, *P_DYN_TABLE_STYLE;
```

```
typedef struct DYN_TABLE_NEW_ONLY {
    DYN_TABLE_STYLE     style;
    OBJECT              installMgr;    // Install Mgr, ie. theInstalledFonts.
                                       // can also be theFileSystem.
    OBJECT              tkTable;       // Table to manage. Must be updated
                                       // after msgRestore via
                                       // msgDynTableSetTable.
    CLASS               entryClass;    // Class of tktable entries.
    P_UNKNOWN           pNewArgs;      // msgNewDefaulted newArgs for
                                       // entryClass.
    SIZEOF              newArgsSize;   // Size of newArgs.
    FIM_PRUNE_CONTROL   pruneControl;  // Prune control if theInstalledFonts.
    U8                  spare[24];
} DYN_TABLE_NEW_ONLY, *P_DYN_TABLE_NEW_ONLY;
#define dynTableNewFields   \
    objectNewFields         \
    DYN_TABLE_NEW_ONLY  dynTable;
typedef struct DYN_TABLE_NEW {
    dynTableNewFields
} DYN_TABLE_NEW, *P_DYN_TABLE_NEW;
```

Messages

msgNew

Creates a new dynamic table manager.

Takes P_DYN_TABLE_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct DYN_TABLE_NEW {
    dynTableNewFields
} DYN_TABLE_NEW, *P_DYN_TABLE_NEW;
```

msgNewDefaults

Initializes the DYN_TABLE_NEW structure to default values.

Takes P_DYN_TABLE_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct DYN_TABLE_NEW {
    dynTableNewFields
} DYN_TABLE_NEW, *P_DYN_TABLE_NEW;
```

Comments

Sets

```
    dynTable.style.showDeactivated = noShowDeactivated;
    dynTable.style.autoDestroy = true;
    dynTable.style.ignoreRamVolume = true;
    dynTable.style.putFontIdInData = true;
    dynTable.style.addFillInField = false;
```

msgDynTableGetTable

Gets the **tkTable** we are associated with.

Takes P_OBJECT, returns STATUS.

```
#define msgDynTableGetTable            MakeMsg(clsDynamicTableMgr, 1)
```

msgDynTableSetTable

Sets our **tkTable**.

Takes OBJECT, returns STATUS.

```
#define msgDynTableSetTable              MakeMsg(clsDynamicTableMgr, 2)
```

Comments

This must be done whenever this object is restored. It is the client's responsiblity to relink the **tkTable** with the dynamic table manager.

msgDynTableFindButton

Finds a button in the table which has the specified label.

Takes P_DYN_TABLE_FIND_BUTTON, returns STATUS.

```
#define msgDynTableFindButton            MakeMsg(clsDynamicTableMgr, 3)
```

Arguments

```
typedef struct DYN_TABLE_FIND_BUTTON {
    P_STRING            pName;      // Label name of field to find.
    OBJECT              button;     // Out: Found button.
} DYN_TABLE_FIND_BUTTON, *P_DYN_TABLE_FIND_BUTTON;
```

Return Value

stsNoMatch Label not found.

msgDynTableSetFillInField

Sets the fill-in field to a text string.

Takes P_STRING, returns STATUS.

```
#define msgDynTableSetFillInField        MakeMsg(clsDynamicTableMgr, 4)
```

Return Value

stsBadParam There is no fill-in field in the table.

FONTMGR.H

This file contains the API definition for **clsFontInstallMgr**.

clsFontInstallMgr inherits from **clsInstallMgr**.

It performs font installation and maintenance.

There is a single instance of **clsFontInstallMgr** in the system; the well-known uid **theInstalledFonts**.

The font manager maintains the installed and deinstalled fonts on the system. The font manager differs from a generic install manager in the area of font identification and the system font.

A font is a structured file. The system comes with several pre-defined font files that are loaded at cold boot time.

Font files typically reside in the \penpoint\font directory on a given filesystem volume. This is not a requirement, however.

Fonts are identified in four ways:

- a font file handle
- a short font ID
- a string font ID
- the name of a font file

Font file handles are open file handles on to the font files. Much of the install manager interface uses these handles. A short font ID is a pre-defined, 16 bit value that identifies a specific font. It is a compact, specific reference for a particular font. The window system API uses short font IDs. A string font ID is a 4 character string version of a short font ID. The font file name is the user-visible name for the font. Given a handle, you can get the font file name by sending **msgIMGetName**. Given a short font ID, you can get the font file name by sending **msgFIMGetNameFromId**.

NOTE: THE MESSAGES IN THIS CLASS ARE SENT TO THE MANAGER, NOT TO THE HANDLES.

A list of all the font handles in the system is available via superclass message **msgIMGetList**. A pruned list of the fonts that is appropriate for end-user display is available via **msgFIMGetInstalledIDList**.

The following messages are not understood by **clsFontInstallMgr**:

- msgIMGetCurrent
- msgIMSetCurrent
- msgIMDup

The following notification messages are not sent by **clsFontInstallMgr**:

- msgIMCurrentChanged

See Also instlmgr.h

```
#ifndef FONTMGR_INCLUDED
#define FONTMGR_INCLUDED
#ifndef INSTLMGR_INCLUDED
#include <instlmgr.h>
#endif
```

Common #defines and typedefs

Filesystem attribute definitions

Note: Most clients do not deal with attributes directly.

Font ID

```
#define fimAttrId                         FSMakeStrAttr(clsFontInstallMgr, 0)
```

Font ID definitions

```
typedef U16     FIM_SHORT_ID, *P_FIM_SHORT_ID;
typedef struct FIM_LONG_ID {
    U8          pId[5];
} FIM_LONG_ID, *P_FIM_LONG_ID;
```

FIM_GET_SET_ID is used by **msgFIMGetId** and **msgFIMSetId**.

```
typedef struct FIM_GET_SET_ID {
    IM_HANDLE          handle;         // Font handle to get IDs on.
    FIM_SHORT_ID       id;             // Out: short version of ID.
    FIM_LONG_ID        longId;         // Out: long ID version.
} FIM_GET_SET_ID, *P_FIM_GET_SET_ID;
```

Messages

msgNew

Creates a new font install manager.

Takes P_FIM_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct FIM_NEW {
    installMgrNewFields
} FIM_NEW, *P_FIM_NEW;
```

Comments

There is only one instance of this class, **theInstalledFonts**, in the system. Clients should never send **msgNew**.

msgNewDefaults

Initializes the FIM_NEW structure to default values.

Takes P_FIM_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct FIM_NEW {
    installMgrNewFields
} FIM_NEW, *P_FIM_NEW;
```

Comments

Sets

installMgr.fileMode |= fsReadOnly | fsSystemFile;

msgFIMGetId

Gets the short and long font IDs, given a handle.

Takes P_FIM_GET_SET_ID, returns STATUS.

```
#define msgFIMGetId                         MakeMsg(clsFontInstallMgr, 3)
```

Message Arguments

```
typedef struct FIM_GET_SET_ID {
    IM_HANDLE           handle;         // Font handle to get IDs on.
    FIM_SHORT_ID        id;             // Out: short version of ID.
    FIM_LONG_ID         longId;         // Out: long ID version.
} FIM_GET_SET_ID, *P_FIM_GET_SET_ID;
```

msgFIMSetId

Set the font file's ID.

Takes P_FIM_GET_SET_ID, returns STATUS.

```
#define msgFIMSetId                         MakeMsg(clsFontInstallMgr, 4)
```

Message Arguments

```
typedef struct FIM_GET_SET_ID {
    IM_HANDLE           handle;         // Font handle to get IDs on.
    FIM_SHORT_ID        id;             // Out: short version of ID.
    FIM_LONG_ID         longId;         // Out: long ID version.
} FIM_GET_SET_ID, *P_FIM_GET_SET_ID;
```

Comments

If the short version of the ID is 0 then the long version of the ID is used.

Note: A font ID is not normally changed. This message is here to allow a tool that edits font IDs to be written.

msgFIMFindId

Finds a font handle given a short ID.

Takes P_FIM_FIND_ID, returns STATUS.

```
#define msgFIMFindId                        MakeMsg(clsFontInstallMgr, 5)
```

Arguments

```
typedef struct FIM_FIND_ID {
    FIM_SHORT_ID        id;         // ID, short form
    IM_HANDLE           handle;     // Out: resulting handle
} FIM_FIND_ID, *P_FIM_FIND_ID;
```

Return Value

stsNoMatch font handle not found.

msgFIMGetNameFromId

Passes back font name given an short ID.

Takes P_FIM_GET_NAME_FROM_ID, returns STATUS.

```
#define msgFIMGetNameFromId                 MakeMsg(clsFontInstallMgr, 6)
```

Arguments

```
typedef struct FIM_GET_NAME_FROM_ID {
    FIM_SHORT_ID        id;
    P_STRING            pName;  // Out: name, max size is nameBufLength
} FIM_GET_NAME_FROM_ID, *P_FIM_GET_NAME_FROM_ID;
```

Return Value

stsNoMatch short ID not found.

See Also

msgIMGetName Gets the name given a handle.

msgFIMGetInstalledIdList

Passes back a list of the short IDs of all installed fonts.

Takes P_FIM_GET_INSTALLED_ID_LIST, returns STATUS.

```
#define msgFIMGetInstalledIdList            MakeMsg(clsFontInstallMgr, 7)
```

Arguments

```
typedef enum FIM_PRUNE_CONTROL {
    fimNoPruning        = 0,
    fimPruneDupFamilies = flag1,
    fimPruneSymbolFonts = flag2
} FIM_PRUNE_CONTROL, *P_FIM_PRUNE_CONTROL;
typedef struct FIM_GET_INSTALLED_ID_LIST {
    FIM_PRUNE_CONTROL   prune;      // What sort of pruning should be done
    OBJECT              list;       // Out: list
} FIM_GET_INSTALLED_ID_LIST, *P_FIM_GET_INSTALLED_ID_LIST;
```

Comments

This list is pruned so that it is useable as a user pick list. For example, if both Helvetica and Helvetica Bold are in the system, only Helvetica is on this list.

THE CALLER MUST DESTROY THE LIST OBJECT WHEN IT IS FINISHED USING IT.

See Also

msgIMGetList Gets a list of all handles.

HWXMGR.H

This file contains the API definition for **clsHWXProtoInstallMgr**.

clsHWXProtoInstallMgr inherits from **clsInstallMgr**.

It performs handwriting prototype installation and maintenance.

There is a single instance of **clsHWXProtoInstallMgr** in the system; the well-known uid **theInstalledHWXProtos**.

The hwxproto manager maintains the installed and deinstalled handwriting prototype sets on the system, and their relation to the installable handwriting translation engines, which are kept on **theHWXEngines** service manager. The hwxproto manager differs from a generic install manager in the area of hwx engine identification and its tie-in with **theHWXEngines** service manager.

A handwriting prototype set is a directory which contains engine-specific information. Each installed engine on the system must have at least one hwxproto set in **theInstalledHWXProtos** in order for it to be used.

See Also instlmgr.h

```
#ifndef HWXMGR_INCLUDED
#define HWXMGR_INCLUDED
#ifndef INSTLMGR_INCLUDED
#include <instlmgr.h>
#endif
```

Common #defines and typedefs

Status Codes

The hwx engine for this prototype set is not available

```
#define  stsHIMEngineUnavailable        MakeStatus(clsHWXProtoInstallMgr, 0)
```

Can't change current hwx prototype; hwx engine is in use with it

```
#define  stsHIMCurrentEngineInUse       MakeStatus(clsHWXProtoInstallMgr, 1)
```

No training for this handwriting set.

```
#define  stsHIMNoTraining               MakeStatus(clsHWXProtoInstallMgr, 2)
```

No practice for this handwriting set.

```
#define  stsHIMNoPractice               MakeStatus(clsHWXProtoInstallMgr, 2)
```

Filesystem attribute definitions

HWX Engine name

```
#define himAttrEngineName          FSMakeStrAttr(clsHWXProtoInstallMgr, 0)
```

Is the engine for this hwxproto available?

```
#define himAttrEngineAvailable      FSMakeFix32Attr(clsHWXProtoInstallMgr, 1)
typedef enum HIM_ATTR_ENGINE_AVAILABLE {
    himEngineAvailable        = 0,    // Same as no attribute
    himEngineUnavailable      = 1
} HIM_ATTR_ENGINE_AVAILABLE;
```

HWX Training window class. This is stamped on the HWX Engine Service class directory.

```
#define himAttrTrainingWinClass     FSMakeFix32Attr(clsHWXProtoInstallMgr, 3)
```

HWX Practice window class. This is stamped on the HWX Engine Service's class directory.

```
#define himAttrPracticeWinClass     FSMakeFix32Attr(clsHWXProtoInstallMgr, 4)
```

Gesture Training window class. This is stamped on the Gesture Engine Service's class directory.

```
#define himAttrGestTrainingWinClass FSMakeFix32Attr(clsHWXProtoInstallMgr, 5)
```

Gesture Practice window class. This is stamped on the Gesture Engine Service's class directory.

```
#define himAttrGestPracticeWinClass FSMakeFix32Attr(clsHWXProtoInstallMgr, 6)
```

Popup Training and Practice tags

```
#define msgHIMPopUpTraining             MakeMsg(clsHWXProtoInstallMgr, 100)
#define msgHIMPopUpPractice             MakeMsg(clsHWXProtoInstallMgr, 101)
#define msgHIMPopUpGestureTraining      MakeMsg(clsHWXProtoInstallMgr, 102)
#define msgHIMPopUpGesturePractice      MakeMsg(clsHWXProtoInstallMgr, 103)
#define tagHIMPopUpTraining             MakeTag(clsHWXProtoInstallMgr, 1)
#define tagHIMPopUpPractice             MakeTag(clsHWXProtoInstallMgr, 2)
#define tagHIMPopUpGestureTraining      MakeTag(clsHWXProtoInstallMgr, 3)
#define tagHIMPopUpGesturePractice      MakeTag(clsHWXProtoInstallMgr, 4)
#define hlpHIMTrainingButton            MakeTag(clsHWXProtoInstallMgr, 100)
#define hlpHIMPracticeButton            MakeTag(clsHWXProtoInstallMgr, 101)
#define hlpHIMGestureTrainingButton     MakeTag(clsHWXProtoInstallMgr, 102)
#define hlpHIMGesturePracticeButton     MakeTag(clsHWXProtoInstallMgr, 103)
```

Messages

msgNew

Creates a new handwriting prototype install manager.

Takes P_HIM_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct HIM_NEW {
    installMgrNewFields
} HIM_NEW, *P_HIM_NEW;
```

Comments

There is only one instance of this class, **theInstalledHWXProtos**, in the system. Clients should never send **msgNew**.

msgHIMGetEngine

Gets the name and availability of the engine associated with this hwxprot.

Takes P_HIM_GET_SET_ENGINE, returns STATUS.

```
#define msgHIMGetEngine                 MakeMsg(clsHWXProtoInstallMgr, 1)
```

Arguments

```
typedef struct HIM_GET_SET_ENGINE {
    IM_HANDLE           handle;     // hwxproto handle to get engine name of.
    P_STRING            pEngineName;// Out: Name. Must have at least
                                    //   nameBufLength bytes allocated.
    BOOLEAN             available;  // Out: Is the engine available?
} HIM_GET_SET_ENGINE, *P_HIM_GET_SET_ENGINE;
```

Comments

Engine names can be up to **nameLength** characters long.

msgHIMSetEngine

Set the hwxproto's engine name.

Takes P_HIM_GET_SET_ENGINE, returns STATUS.

```
#define msgHIMSetEngine                  MakeMsg(clsHWXProtoInstallMgr, 2)
```

Message Arguments

```
typedef struct HIM_GET_SET_ENGINE {
    IM_HANDLE           handle;     // hwxproto handle to get engine name of.
    P_STRING            pEngineName;// Out: Name. Must have at least
                                    //   nameBufLength bytes allocated.
    BOOLEAN             available;  // Out: Is the engine available?
} HIM_GET_SET_ENGINE, *P_HIM_GET_SET_ENGINE;
```

Comments

Note: This message is rarely used. Typically, handwriting prototype sets have the engine attribute stamped on them when they are created, and it is never changed.

msgHIMAvailabilityChanged

An hwx proto's engine availability has changed.

Takes P_HIM_AVAILABILITY_NOTIFY, returns STATUS. Category: observer notification.

```
#define msgHIMAvailabilityChanged        MakeMsg(clsHWXProtoInstallMgr, 20)
```

Arguments

```
typedef struct HIM_AVAILABILITY_NOTIFY {
    OBJECT              manager;    // manager that sent notification
    IM_HANDLE           handle;     // handle that changed
    BOOLEAN             available;  // new engine availability state
} HIM_AVAILABILITY_NOTIFY, *P_HIM_AVAILABILITY_NOTIFY;
```

INIFILE.H

This file contains the API definition for **clsIniFileHandler**.

clsIniFileHandler inherits from **clsObject**.

Reads and processes a .ini file.

.ini files are used to ask the system to install multiple applications, services, or any installable entity. A .ini file is an ASCII file that contains the path of each item to be installed on a seperate line. Examples of .ini files include app.ini (applications) and service.ini (services).

To process a .ini file, simply create an instance of **clsIniFileHandler**. The **newArgs** specify the location of the .ini file. The .ini file will be completely processed as part of the **msgNew**. Free the ini file handler immediately after creating it.

```
#ifndef INIFILE_INCLUDED
#define INIFILE_INCLUDED
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef INSTLMGR_INCLUDED
#include <instlmgr.h>
#endif
```

Messages

msgNew

Creates a new ini file processor.

Takes P_INI_FILE_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct INI_FILE_STYLE {
    U16 deleteFileWhenDone  : 1,    // Delete file after processing it.
        returnInstallErrors : 1,    // Aborts the install and returns error
                                    // status if true. Keeps going if false.
        spare               : 11;   // unused (reserved)
} INI_FILE_STYLE, *P_INI_FILE_STYLE;
typedef struct INI_FILE_NEW_ONLY {
    INI_FILE_STYLE     style;
    IM_INSTALL_EXIST   exist;          // What to do if the item already
                                       // exists.
    FS_LOCATOR         locator;        // .ini file location.
    OBJECT             manager;        // Install manager to send
                                       // msgIMInstalls to.
    FS_ATTR_LABEL      listAttrLabel;  // List attr; 0 if not needed.
    OBJECT             listHandle;     // FS handle for list attr; objNull
                                       // if not needed.
    OBJECT             relDir;         // Relative dir for ini file paths.
    U8                 spare[8];
} INI_FILE_NEW_ONLY, *P_INI_FILE_NEW_ONLY;
#define iniFileNewFields        \
    objectNewFields             \
    INI_FILE_NEW_ONLY           iniFile;
```

```
typedef struct INI_FILE_NEW {
    iniFileNewFields
} INI_FILE_NEW, *P_INI_FILE_NEW;
```

Comments

This message will return after the entire file has been processed. The file is processed by sending **msgIMInstall** to the specified install manager for each path in the .ini file.

pArgs->iniFile.**listAttrLabel** and **pArgs**->iniFile.**listHandle** are passed through to **msgIMInstall**. See instlmgr.h for details on **msgIMInstall**.

msgNewDefaults

Initializes the INI_FILE_NEW structure to default values.

Takes P_INI_FILE_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct INI_FILE_NEW {
    iniFileNewFields
} INI_FILE_NEW, *P_INI_FILE_NEW;
```

Comments

Sets

iniFile.style.returnInstallErrors = true;

iniFile.style.deleteFileWhenDone = false;

iniFile.listAttrLabel = 0;

iniFile.listHandle = **objNull**;

iniFile.exist = **imExistReactivate**;

INSTALL.H

This file contains definitions for IMProgramInstall and IMModuleLoad. The functions described in this file are contained in INSTALL.LIB.

APPLICATION DEVELOPERS MUST USE THESE FUNCTIONS INSTEAD OF OSProgramInstall AND OSModuleLoad.

OSProgramInstall and OSModuleLoad do not dispatch messages, because they are Ring 0 routines. This will cause the system to lock up if the code being loaded needs to send messages to the process that installed it, as all applications and services do.

```
#ifndef INSTALL_INCLUDED
#define INSTALL_INCLUDED
```

IMProgramInstall

Low-level .exe installation routine.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED IMProgramInstall(
    P_STRING                pPath,       // WorkingDir relative path of
                                         //   .exe or .dlc file
    P_STRING                pWorkingDir,// WorkingDir relative path of where
                                         //   to set the WorkingDir of the
                                         //   instance 0's process
    P_OS_PROG_HANDLE        pProgHandle,// Out: program handle
    P_STRING                pBadName,    // Out: if error, dll/exe that was bad
                                         //   Buffer must be nameBufLength
    P_STRING                pBadRef      // Out: If error, reference that was bad
);                                       //   Buffer must be nameBufLength
```

IMModuleLoad

Low-level .dll installation routine.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED IMModuleLoad(
    P_STRING                pPath,       // WorkingDir relative path of
                                         //   .dll or .dlc file
    P_STRING                pWorkingDir,// WorkingDir relative path of where
                                         //   to set the WorkingDir of the
                                         //   DLLMain() process
    P_OS_PROG_HANDLE        pProgHandle,// Out: program handle
    P_STRING                pBadName,    // Out: if error, dll that was bad
                                         //   Buffer must be nameBufLength
    P_STRING                pBadRef      // Out: If error, reference that was bad
);                                       //   Buffer must be nameBufLength
```

INSTLMGR.H

This file contains the class definition and methods for **clsInstallMgr**.

clsInstallMgr inherits from **clsObject**.

Provides the basic facilities for installing items.

NOTE: THE MESSAGES IN THIS CLASS ARE SENT TO THE INSTALL MANAGER, NOT TO THE HANDLES.

clsInstallMgr provides almost everything needed to manage installable items. An installable item is anything that can be installed and deinstalled on a Penpoint machine, such as fonts, applications, services, handwriting prototype sets, etc. You create an instance of **clsInstallMgr** for each category of installable item. Penpoint creates well-known install managers for the following categories at cold boot time:

- theInstalledHWXProtos: Handwriting prototype sets
- theInstalledPrefs: Preference sets
- theInstalledPDicts: Personal dictionaries

In addition there are several well-known install managers that are created from subclasses of **clsInstallMgr**:

- theInstalledApps: Applications (appimgr.h)
- theInstalledServices: Services (servimgr.h)
- theInstalledFonts: Fonts (fontmgr.h)

clsInstallMgr makes use of the filesystem to keep a database of the installed items. Each item is represented by a file or directory handle. This is a big win for items which *are* files or directories; the InstallMgr's handle is a handle onto the actual item. There is an extra level of indirection for items which are not files. The item's ID (whatever that means for a particular type of item) is stored as an attribute of the handle. An item's name is the name of that item's filesystem node. This means that items on a given install manager must have unique names.

An install manager has a base directory in which it keeps its items' filesystem nodes. The **createInitial** style bit determines whether the install manager creates an initial set of item handles from whatever is in this directory when the install manager is first created.

clsInstallMgr provides an API for installing new items and deinstalling existing items. An item is installed from a location on an external filesystem.

An item can be deinstalled, which removes all traces of the item from the system.

The install manager maintains a bit which specifies if an item has changed. It is the client's responsibility to maintain this bit by sending **msgIMSetModified** when it modifies an item. The install manager will remember the time and date that the item was modified.

Install managers also maintains a "current" item, and provide an API for getting and setting the current item. This is used by **theInstalledHWXProtos, theInstalledPrefs** and **theInstalledPDicts** to specify which handwriting prototype set, preferences, or personal dictionary the system is actively using. A current item is optional; some install managers (**theInstalledApps**, **theInstalledServices**) do not make use of a current item.

An item can be marked as being "in use". This means that the item cannot be deinstalled. The current item is considered to be in use.

Each install manager can have a verifier object, which it queries whenever installation takes place. The verifier object makes sure that the item being installed is valid for this install manager.

An InstallMgr sends notification to its observers whenever an item is installed, deinstalled, the current item changed, etc. Subclasses of **clsInstallMgr** can turn notification generation on and off with **msgIMSetNotify**. Notification is on by default.

A subset of the notification messages are also sent to any observers of an item's handle. This allows clients who are only interested in a particular item to monitor just that item. The messages sent are:

- msgIMNameChanged
- msgIMInUseChanged
- msgIMModifiedChanged
- msgIMDeinstalled
- msgIMCurrentChanged (sent to both old and new current handles)

Clients access installable managers via an ObjectCall interface. **clsInstallMgr** can accommodate simultaneous access by multiple clients if the "shared" style bit is set true (the default). This causes it to semaphore all of its operations. This semaphore is available to subclasses via **msgIMGetSema**, and should be used to protect all subclass messages if multiple clients will be accommodated. **clsInstallMgr** also sets **objCapCall** on by default.

There is a well-known, shared list object (see list.h) that is a list of all the install managers in the system. This object is called **theInstallManagers**. You can observe this list and get notification when an install manager is added and removed. See **msgListNotifyAddition** and **msgListNotifyDeletion.**

clsFontInstallMgr, **clsAppInstallMgr**, and **clsServiceMgr** inherit from **clsInstallMgr**. See fontmgr.h, appimgr.h and servmgr.h for these classes.

```
#ifndef INSTLMGR_INCLUDED
#define INSTLMGR_INCLUDED
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
#ifndef FS_INCLUDED
#include <fs.h>
#endif
#ifndef LIST_INCLUDED
#include <list.h>
#endif
#ifndef TKTABLE_INCLUDED
#include <tktable.h>
#endif
#ifndef OPTION_INCLUDED
#include <option.h>
#endif
```

Common #defines and typedefs

Handle type

```
typedef OBJECT          IM_HANDLE, * P_IM_HANDLE;
```

Warning Codes

Some install manager request has been user cancelled

```
#define stsIMRequestCancelled       MakeWarning(clsInstallMgr, 0)
```

Quick Help Tags

```
#define  appQHInstallMgr            MakeTag(clsInstallUISheet, 32)
#define  svcQHInstallMgr         MakeTag(clsInstallUISheet, 33)
#define  hwxQHInstallMgr            MakeTag(clsInstallUISheet, 34)
#define  gestQHInstallMgr        MakeTag(clsInstallUISheet, 35)
#define  dictQHInstallMgr           MakeTag(clsInstallUISheet, 36)
#define  fontsQHInstallMgr       MakeTag(clsInstallUISheet, 37)
#define  userPfleQHInstallMgr    MakeTag(clsInstallUISheet, 38)
```

Status Codes

The item is current, so cannot be removed.

```
#define  stsIMCurrent               MakeStatus(clsInstallMgr, 1)
```

An item to be installed failed verification.

```
#define  stsIMInvalidItem           MakeStatus(clsInstallMgr, 2)
```

A new name cannot be created for this item.

```
#define stsIMUniqueNameFailed       MakeStatus(clsInstallMgr, 3)
```

The item is in use, so cannot be removed.

```
#define  stsIMInUse                 MakeStatus(clsInstallMgr, 6)
```

The item to be installed is already installed.

```
#define  stsIMAlreadyInstalled      MakeStatus(clsInstallMgr, 8)
```

An invalid handle was passed in.

```
#define  stsIMBadHandle             MakeStatus(clsInstallMgr, 20)
```

File System Attribute Definitions

Note: Most clients do not deal with attributes directly.

Node's home on an external volume. Absolute path.

This attribute is used only during installation.

```
#define imAttrHome                  FSMakeStrAttr(clsInstallMgr, 0)
```

Is this node the current node? Use IM_ATTR_CURRENT values.

```
#define imAttrCurrent               FSMakeFix32Attr(clsInstallMgr, 2)
typedef enum IM_ATTR_CURRENT {
    imNotCurrent          = 0,   // Same as no attribute
    imCurrent             = 1
} IM_ATTR_CURRENT;
```

Is this node in use? Use **IM_ATTR_INUSE** values.

```
#define imAttrInUse                  FSMakeFix32Attr(clsInstallMgr, 3)
typedef enum IM_ATTR_INUSE {
    imNotInUse            = 0,    // Same as no attribute
    imInUse               = 1
} IM_ATTR_INUSE;
```

Has this node been modified? Use **IM_ATTR_MODIFIED** values.

```
#define imAttrModified               FSMakeFix32Attr(clsInstallMgr, 4)
typedef enum IM_ATTR_MODIFIED {
    imNotModified         = 0,    // Same as no attribute
    imModified            = 1
} IM_ATTR_MODIFIED;
```

Ref count. When an item is installed the installer can choose to maintain a reference count if the item is already installed.

```
#define imAttrRefCount               FSMakeFix32Attr(clsInstallMgr, 5)
```

Is this item on some other item's dependency list? Use **IM_ATTR_DEPENDENT** values.

```
#define imAttrDependent              FSMakeFix32Attr(clsInstallMgr, 7)
typedef enum IM_ATTR_DEPENDENT {
    imNotDependent        = 0,    // Same as no attribute
    imDependent           = 1
} IM_ATTR_DEPENDENT;
```

Is this item a system inviolate item? Use **IM_ATTR_SYSTEM** values.

```
#define imAttrSystem                 FSMakeFix32Attr(clsInstallMgr, 8)
typedef enum IM_ATTR_SYSTEM {
    imNotSystem             = 0,      // Same as no attribute
    imSystemInviolate       = flag0,
    imSystemNotRenameable   = flag1
} IM_ATTR_SYSTEM;
```

Version string

```
#define imAttrVersion                FSMakeStrAttr(clsAppInstallMgr, 3)
```

Debug Flags

```
#define installDebugFlag    'I'
```

Messages

msgNew

Creates a new install manager.

Takes **P_IM_NEW**, returns **STATUS**. Category: class message.

Arguments

```
typedef struct IM_STYLE {
    U16 shared            : 1,  // Provide concurrency protection.
        createInitial     : 1,  // Create initial list of handles from
                                //   contents of base directory.
        autoSetCurrent    : 1,  // Choose any item as the initial current
                                //   setting if no one has current attr set.
        copyOnInstall     : 1,  // Copy nodes to manager's dir or create
                                //   handles directly on Install locator.
        addToGlobalList   : 1,  // Add this instlmgr to theInstallManagers.
        createIcon        : 1,  // Create an icon for this install manager.
        private1          : 1,  // Always set this to false.
        duplicatable      : 1,  // Items in this installmgr can be duplicated.
        usesVersions      : 1,  // Items in this installmgr have versions.
        reserved          : 7;
    U16 sizeCol           : 1,  // Show size column in Settings NB card.
        hwxTypeCol        : 1,  // Show hwx engine type column.
        svcTypeCol        : 1,  // Show service type column.
        modifiedCol       : 1,  // Show modified column.
        currentCol        : 1,  // Show current column.
        inUseCol          : 1,  // Show inUse column.
        reserved1         : 10;
    U32 helpId;                 // Help tag for installmgr's Settings NB card.
    U16 spare1;
    U16 spare2;
} IM_STYLE, *P_IM_STYLE;
typedef struct IM_NEW_ONLY {
    IM_STYLE            style;
    FS_DIR_NEW_MODE     dirMode;        // Default mode for dir handles.
    FS_FILE_NEW_MODE    fileMode;       // Default mode for file handles.
    FS_LOCATOR          locator;        // Base directory. InstallMgr will
                                        // create it if it doesn't exist.
    P_STRING            pSingularName;  // Singular name of installer. Must be
                                        // <= nameLength in size.
    P_STRING            pName;          // Plural name of installer. Must be
                                        // <= nameLength in size.
    P_STRING            pInstallPath;   // Base path for installable items,
                                        // (i.e. \penpoint\app).
    OBJECT              verifier;       // Verifier object. Can be null.
    OS_HEAP_ID          heap;           // Installmgr heap. Must be global.
                                        // Can be osInvalidHeapId; instlmgr
                                        // will use global heap of the task
                                        // that this object is created in.
    P_TK_TABLE_ENTRY    pSettingsMenu;  // Additional controls for this
                                        // installmgr's Settings NB card.
    U32                 settingsMenuSize;// Size (in bytes) of pSettingsMenu.
    U32                 unused1;
    U32                 unused2;
    U32                 unused3;
    U32                 unused4;
} IM_NEW_ONLY, *P_IM_NEW_ONLY;
#define installMgrNewFields                 \
    objectNewFields                         \
    IM_NEW_ONLY         installMgr;
typedef struct IM_NEW {
    installMgrNewFields
} IM_NEW, *P_IM_NEW;
```

Comments

The locator field specifies the directory where the managed items live. If this directory does not exist it will be created.

msgNewDefaults

Initializes the IM_NEW structure to default values.

Takes P_IM_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct IM_NEW {
    installMgrNewFields
} IM_NEW, *P_IM_NEW;
```

Comments

Clients do not normally change the defaults.

Zeroes out **installMgr** and sets

```
object.cap |= objCapCall;
installMgr.style.shared = true;
installMgr.style.createInitial = true;
installMgr.style.updateOK = true;
installMgr.style.copyOnInstall = true;
installMgr.style.addToGlobalList = true;
installMgr.style.private1 = false;
installMgr.style.duplicatable = false;
installMgr.style.createIcon = true;
installMgr.style.duplicatable = false;
installMgr.style.usesVersions = false;
installMgr.style.sizeCol = true;
installMgr.dirMode = fsUnchangeable;
installMgr.fileMode = fsSharedMemoryMap;
installMgr.pInstallPath = pNull;
installMgr.verifier = objNull;
installMgr.heap = osInvalidHeapId;
installMgr.pSettingsMenu = objNull;
installMgr.settingsMenuSize = 0;
```

msgDestroy

Frees the install manager.

Takes OBJ_KEY, returns STATUS.

Comments

Note: This message does not destroy the install manager's directory, nor any files/directories in that directory.

msgDump

Prints out the items in the install manager and their state.

Takes OBJ_KEY, returns STATUS.

msgIMGetStyle

Passes back the current style settings.

Takes P_IM_STYLE, returns STATUS.

```
#define msgIMGetStyle                          MakeMsg(clsInstallMgr, 1)
```

Message Arguments

```
typedef struct IM_STYLE {
    U16 shared            : 1,  // Provide concurrency protection.
        createInitial     : 1,  // Create initial list of handles from
                                //   contents of base directory.
        autoSetCurrent    : 1,  // Choose any item as the initial current
                                //   setting if no one has current attr set.
        copyOnInstall     : 1,  // Copy nodes to manager's dir or create
                                //   handles directly on Install locator.
        addToGlobalList   : 1,  // Add this instlmgr to theInstallManagers.
        createIcon        : 1,  // Create an icon for this install manager.
        private1          : 1,  // Always set this to false.
        duplicatable      : 1,  // Items in this installmgr can be duplicated.
        usesVersions      : 1,  // Items in this installmgr have versions.
        reserved          : 7;
    U16 sizeCol           : 1,  // Show size column in Settings NB card.
        hwxTypeCol        : 1,  // Show hwx engine type column.
        svcTypeCol        : 1,  // Show service type column.
        modifiedCol       : 1,  // Show modified column.
        currentCol        : 1,  // Show current column.
        inUseCol          : 1,  // Show inUse column.
        reserved1         : 10;
    U32 helpId;                 // Help tag for installmgr's Settings NB card.
    U16 spare1;
    U16 spare2;
} IM_STYLE, *P_IM_STYLE;
```

msgIMSetStyle

Sets the current style.

Takes P_IM_STYLE, returns STATUS.

```
#define msgIMSetStyle                       MakeMsg(clsInstallMgr, 2)
```

Message Arguments

```
typedef struct IM_STYLE {
    U16 shared            : 1,  // Provide concurrency protection.
        createInitial     : 1,  // Create initial list of handles from
                                //   contents of base directory.
        autoSetCurrent    : 1,  // Choose any item as the initial current
                                //   setting if no one has current attr set.
        copyOnInstall     : 1,  // Copy nodes to manager's dir or create
                                //   handles directly on Install locator.
        addToGlobalList   : 1,  // Add this instlmgr to theInstallManagers.
        createIcon        : 1,  // Create an icon for this install manager.
        private1          : 1,  // Always set this to false.
        duplicatable      : 1,  // Items in this installmgr can be duplicated.
        usesVersions      : 1,  // Items in this installmgr have versions.
        reserved          : 7;
    U16 sizeCol           : 1,  // Show size column in Settings NB card.
        hwxTypeCol        : 1,  // Show hwx engine type column.
        svcTypeCol        : 1,  // Show service type column.
        modifiedCol       : 1,  // Show modified column.
        currentCol        : 1,  // Show current column.
        inUseCol          : 1,  // Show inUse column.
        reserved1         : 10;
    U32 helpId;                 // Help tag for installmgr's Settings NB card.
    U16 spare1;
    U16 spare2;
} IM_STYLE, *P_IM_STYLE;
```

msgIMGetInstallerName

Passes back the install manager's name.

Takes P_STRING, returns STATUS.

```
#define msgIMGetInstallerName               MakeMsg(clsInstallMgr, 3)
```

Comments

pArgs must point to a **nameBufLength** buffer.

The install manager's name was set at **msgNew** time in **installMgr**->pName.

msgIMGetInstallerSingularName

Passes back the install manager's singular name.

Takes P_STRING, returns STATUS.

```
#define msgIMGetInstallerSingularName       MakeMsg(clsInstallMgr, 51)
```

Comments

pArgs must point to a **nameBufLength** buffer.

The install manager's name was set at **msgNew** time in **installMgr**->pName.

msgIMGetCurrent

Passes back the current item's handle.

Takes P_IM_HANDLE, returns STATUS.

```
#define msgIMGetCurrent                     MakeMsg(clsInstallMgr, 4)
```

Comments

Passes back **objNull** if there is no current handle.

msgIMSetCurrent

Sets the current item.

Takes IM_HANDLE, returns STATUS.

```
#define msgIMSetCurrent                     MakeMsg(clsInstallMgr, 5)
```

Comments

The argument is the handle to be made current. It can be **objNull** to indicate that no handle is the current one.

If the handle specified in the argument is already current then nothing is done (no observer message is generated).

Causes the install manager to notify observers with **msgIMCurrentChanged**.

msgIMSetInUse

Changes an item's in use setting.

Takes P_IM_SET_INUSE, returns STATUS.

```
#define msgIMSetInUse                       MakeMsg(clsInstallMgr, 6)
```

Arguments

```
typedef struct IM_SET_INUSE {
    IM_HANDLE           handle;     // Handle of item to set inUse on.
    BOOLEAN             inUse;      // InUse value.
} IM_SET_INUSE, *P_IM_SET_INUSE;
```

Comments

Setting **inUse** to true means that the item cannot be deinstalled.

Use **msgIMGetState** to query the value of this field.

Causes the install manager to notify observers with **msgIMInUseChanged**.

msgIMSetModified

Changes an item's modified setting.

Takes P_IM_SET_MODIFIED, returns STATUS.

```
#define msgIMSetModified                    MakeMsg(clsInstallMgr, 7)
```

Arguments

```
typedef struct IM_SET_MODIFIED {
    IM_HANDLE           handle;     // Handle of item to set modified on.
    BOOLEAN             modified;   // Modified value.
} IM_SET_MODIFIED, *P_IM_SET_MODIFIED;
```

Comments

Use **msgIMGetState** to query the value of this field.

Causes the install manager to notify observers with **msgIMModifiedChanged**.

msgIMGetName

Get the name of a item.

Takes P_IM_GET_SET_NAME, returns STATUS.

```
#define msgIMGetName                        MakeMsg(clsInstallMgr, 8)
```

Arguments

```
typedef struct IM_GET_SET_NAME {
    IM_HANDLE           handle;     // Handle of item to get/set name on.
    P_STRING            pName;      // In: (Set) Out: (Get) name. This
                                    // pointer must reference a nameBufLength
                                    // size buffer.
} IM_GET_SET_NAME, *P_IM_GET_SET_NAME;
```

msgIMSetName

Sets the name of a item.

Takes P_IM_GET_SET_NAME, returns STATUS.

```
#define msgIMSetName                        MakeMsg(clsInstallMgr, 9)
```

Message Arguments

```
typedef struct IM_GET_SET_NAME {
    IM_HANDLE           handle;     // Handle of item to get/set name on.
    P_STRING            pName;      // In: (Set) Out: (Get) name. This
                                    // pointer must reference a nameBufLength
                                    // size buffer.
} IM_GET_SET_NAME, *P_IM_GET_SET_NAME;
```

Comments

The name must be a legitimate file name and unique amoung all the items on this install manager.

Causes the install manager to notify observers with **msgIMNameChanged**.

Return Value

stsFSNodeExists An item with this name already exists.

msgIMGetVersion

Get the version string for this item.

Takes P_IM_GET_VERSION, returns STATUS.

```
#define msgIMGetVersion                     MakeMsg(clsInstallMgr, 37)
```

Arguments

```
typedef struct IM_GET_VERSION {
    IM_HANDLE           handle;     // Handle of item to get version of.
    P_STRING            pVersion;   // Out: Version string. Pointer must
                                    // reference a nameBufLength
                                    // size buffer.
} IM_GET_VERSION, *P_IM_GET_VERSION;
```

Comments

Not all install managers have a version string. **pVersion** is set to **pNull** if there is no version.

msgIMGetList

Passes back a list of all the items on this install manager.

Takes P_LIST, returns STATUS.

```
#define msgIMGetList                        MakeMsg(clsInstallMgr, 14)
```

Comments

The memory for the list object is allocated out of the caller's local process heap.

CAUTION: Caller must destroy the list object when it is finished using it.

msgIMGetState

Gets the state of a item.

Takes P_IM_GET_STATE, returns STATUS.

```
#define msgIMGetState                          MakeMsg(clsInstallMgr, 16)
```

Arguments

```
typedef struct IM_GET_STATE {
    IM_HANDLE           handle;     // Handle of item to get state on.
    BOOLEAN             current;    // Out: Is it the current item?
    BOOLEAN             reserved;   // Reserved.
    BOOLEAN             modified;   // Out: Is it modified?
    BOOLEAN             inUse;      // Out: Is it in use?
} IM_GET_STATE, *P_IM_GET_STATE;
```

msgIMGetSize

Returns the size of an item.

Takes P_IM_GET_SIZE, returns STATUS.

```
#define msgIMGetSize                           MakeMsg(clsInstallMgr, 17)
```

Arguments

```
typedef struct IM_GET_SIZE {
    IM_HANDLE           handle;     // Handle of item to get size of.
    U32                 size;       // Out: size.
} IM_GET_SIZE, *P_IM_GET_SIZE;
```

msgIMInstall

Installs a new item.

Takes P_IM_INSTALL, returns STATUS.

```
#define msgIMInstall                           MakeMsg(clsInstallMgr, 18)
```

Arguments

```
typedef enum IM_INSTALL_EXIST {
    imExistUpdate       = 0, // Copy new over existing.
    imExistReactivate   = 1, // Deactivate existing, then activate new.
    imExistGenError     = 2, // Return stsIMAlreadyInstalled.
    imExistGenUnique    = 3, // Generate a unique name for the new item.
    imExistIncRefCount  = 4  // Just increment ref count of existing item.
} IM_INSTALL_EXIST, *P_IM_INSTALL_EXIST;
typedef struct IM_INSTALL {
    FS_LOCATOR          locator;        // Location of item on external
                                        // filesystem.
    IM_INSTALL_EXIST    exist;          // What to do if item already exists.
    FS_ATTR_LABEL       listAttrLabel;  // Attr list to add install handle to.
    OBJECT              listHandle;     // filesystem handle to put attr on.
    IM_HANDLE           handle;         // Out: Handle of installed item.
} IM_INSTALL, *P_IM_INSTALL;
```

Comments

The install manager derives the item's name from the filesystem location specified in **pArgs**->locator. **pArgs**->exist controls what happens if an item of the same name as the item to be installed already exists.

pArgs->listAttrLabel and **pArgs**->listHandle are used to specify an attr list to which the install handle is added. This is used to keep track of sub-apps and sub-services. Set these arguments to 0 if this should not be done.

Causes the install manager to notify observers with **msgIMInstalled**. The install manager also sends **msgIMModifiedChanged** if the modified states changed due to the install.

Return Value

stsIMInvalid Item to be installed does not pass verification.

stsIMAlreadyInstalled Item already installed and **pArgs**->exist == **imExistGenError**.

stsBadParam pArgs->exist is set to an invalid value.

msgIMDeinstall

Deinstalls an item.

Takes P_IM_DEINSTALL, returns STATUS.

```
#define msgIMDeinstall                      MakeMsg(clsInstallMgr, 19)
```

Arguments

```
typedef struct IM_DEINSTALL {
    IM_HANDLE           handle;     // Item to delete.
} IM_DEINSTALL, *P_IM_DEINSTALL;
```

Comments

All traces of the item are removed, including the item's handle.

Return Value

stsIMInUse Item is in use; cannot be deinstalled.

msgIMDup

Creates a new item that is a duplicate of an existing one.

Takes P_IM_DUP, returns STATUS.

```
#define msgIMDup                            MakeMsg(clsInstallMgr, 23)
```

Arguments

```
typedef struct IM_DUP {
    IM_HANDLE           handle;     // item to duplicate.
    P_STRING            pName;      // new name. If pNull then a unique name
                                    // is generated.
    IM_HANDLE           newHandle;  // Out: Handle to the new item.
} IM_DUP, *P_IM_DUP;
```

Comments

Causes the install manager to notify observers with **msgIMInstalled**.

Return Value

stsIMAlreadyInstalled An item with **pArgs**->name already exists.

msgIMFind

Finds a item's handle, given its name.

Takes P_IM_FIND, returns STATUS.

```
#define msgIMFind                           MakeMsg(clsInstallMgr, 24)
```

Arguments

```
typedef struct IM_FIND {
    P_STRING            pName;      // Resource name to search for
    IM_HANDLE           handle;     // Out: Resulting handle
} IM_FIND, *P_IM_FIND;
```

Return Value

stsNoMatch Item not found.

msgIMGetSema

Gets the concurrency protection semaphore.

Takes P_OS_FAST_SEMA, returns STATUS.

```
#define msgIMGetSema                        MakeMsg(clsInstallMgr, 25)
```

Comments

This message is for subclasses that need to do concurrency protection to their messages. Subclasses should get this semaphore and aquire and release it at the beginning and end of their messages. Subclasses should use this semaphore instead of creating one of their own in order to avoid race conditions.

msgIMGetDir

Passes back a directory handle on the install manager's directory.

Takes **P_OBJECT**, returns **STATUS**.

```
#define msgIMGetDir                          MakeMsg(clsInstallMgr, 26)
```

Comments

This dir handle is owned by the install manager; clients must not destroy it!

msgIMGetInstallPath

Passes back the install base path.

Takes **P_STRING**, returns **STATUS**.

```
#define msgIMGetInstallPath                  MakeMsg(clsInstallMgr, 27)
```

Comments

The install base path is an absolute path to the install manager's directory.

pArgs must point to an **fsPathBufLength** sized buffer.

msgIMGetVerifier

Passes back the current verifier object.

Takes **P_OBJECT**, returns **STATUS**.

```
#define msgIMGetVerifier                     MakeMsg(clsInstallMgr, 33)
```

Comments

This object is sent **msgIMVerify** whenever an item is attempted to be installed. The verifier should return **stsOK** if the item is valid, **stsFailed** if it isn't.

msgIMSetVerifier

Sets the current verifier object.

Takes **OBJECT**, returns **STATUS**.

```
#define msgIMSetVerifier                     MakeMsg(clsInstallMgr, 34)
```

Comments

This object is sent **msgIMVerify** whenever an item is attempted to be installed. The verifier should return **stsOK** if the item is valid, **stsFailed** if it isn't.

msgIMVerify

Verify the validity of an item that is being installed.

Takes **OBJECT**, returns **STATUS**.

```
#define msgIMVerify                          MakeMsg(clsInstallMgr, 35)
```

Comments

This message is sent to an install manager's verifier object whenever an installation is attempted.

pArgs specifies the node being installed. It is either a file handle or a dir handle. The verifier object should determine if the item to be installed is valid, and return **stsOK** if so, **stsFailed** if not.

msgIMExists

Verify the existance of an item that is being installed.

Takes **P_IM_EXISTS**, returns **STATUS**.

```
#define msgIMExists                  MakeMsg(clsInstallMgr, 61)
```

Arguments

```
typedef struct IM_EXISTS {
    OBJECT      source;     // In: {File|Dir} handle of item to be installed.
    IM_HANDLE   handle;     // Out: Handle of item if found.
} IM_EXISTS, * P_IM_EXISTS;
```

Comments

This message is self sent whenever an installation is attempted.

pArgs specifies the node being installed. It is either a file handle or a dir handle. The handler should determine if the item to be installed already exists. Returns **stsOK** if the item is found; **stsFailed** otherwise.

UI Messages

msgIMUIInstall

Installs a new item with a user interface.

Takes P_IM_UI_INSTALL, returns STATUS.

```
#define msgIMUIInstall                          MakeMsg(clsInstallMgr, 38)
```

Arguments

```
typedef struct IM_UI_INSTALL {
    FS_LOCATOR          locator;        // Location of item on external
                                        // filesystem.
    IM_HANDLE           handle;         // Out: Handle of installed item.
} IM_UI_INSTALL, *P_IM_UI_INSTALL;
```

Comments

Performs **msgIMInstall**, but lets the user decide exist behavior. Pops up a progress note which allows the user to cancel the install. Informs the user of successful or unsucessful completion.

Return Value

Returns **msgIMInstall** statuses.

msgIMUIDeinstall

Deinstalls an item with a user interface.

Takes P_IM_UI_DEINSTALL, returns STATUS.

```
#define msgIMUIDeinstall                          MakeMsg(clsInstallMgr, 58)
```

Arguments

```
typedef struct IM_UI_DEINSTALL {
    IM_HANDLE           handle;         // Item to deinstall.
} IM_UI_DEINSTALL, *P_IM_UI_DEINSTALL;
```

Return Value

Returns **msgIMDeinstall** statuses.

msgIMUIDup

Duplicates and item with a UI.

Takes P_IM_UI_DUP, returns STATUS.

```
#define msgIMUIDup                                MakeMsg(clsInstallMgr, 39)
```

Arguments

```
typedef struct IM_UI_DUP {
    IM_HANDLE           handle;     // item to duplicate.
    P_STRING            pName;      // new name. If pNull then a unique name
                                    // is generated.
    IM_HANDLE           newHandle;  // Out: Handle to the new item.
} IM_UI_DUP, *P_IM_UI_DUP;
```

Return Value

Returns **msgIMDup** statuses.

Notification Messages

msgIMNameChanged

The name of a item has changed.

Takes P_IM_NOTIFY, returns STATUS. Category: observer notification.

```
#define msgIMNameChanged                    MakeMsg(clsInstallMgr, 40)
```

Arguments

```
typedef struct IM_NOTIFY {
    OBJECT              manager;    // manager that sent notification.
    IM_HANDLE           handle;     // handle that changed.
    U8                  reserved[40];
} IM_NOTIFY, *P_IM_NOTIFY;
```

msgIMCurrentChanged

The current item has changed.

Takes P_IM_CURRENT_NOTIFY, returns STATUS. Category: observer notification.

```
#define msgIMCurrentChanged                 MakeMsg(clsInstallMgr, 42)
```

Arguments

```
typedef struct IM_CURRENT_NOTIFY {
    OBJECT              manager;    // manager that sent notification
    IM_HANDLE           newHandle;  // the new current handle
    IM_HANDLE           oldHandle;  // the previous current handle
    U8                  reserved[40];
} IM_CURRENT_NOTIFY, *P_IM_CURRENT_NOTIFY;
```

msgIMInUseChanged

An item's **inUse** attribute has changed.

Takes P_IM_INUSE_NOTIFY, returns STATUS. Category: observer notification.

```
#define msgIMInUseChanged                   MakeMsg(clsInstallMgr, 43)
```

Arguments

```
typedef struct IM_INUSE_NOTIFY {
    OBJECT              manager;    // manager that sent notification
    IM_HANDLE           handle;     // handle that changed
    BOOLEAN             inUse;      // new inUse state
    U8                  reserved[40];
} IM_INUSE_NOTIFY, *P_IM_INUSE_NOTIFY;
```

msgIMModifiedChanged

An item's modified attribute has changed.

Takes P_IM_MODIFIED_NOTIFY, returns STATUS. Category: observer notification.

```
#define msgIMModifiedChanged                MakeMsg(clsInstallMgr, 44)
```

Arguments

```
typedef struct IM_MODIFIED_NOTIFY {
    OBJECT              manager;    // manager that sent notification
    IM_HANDLE           handle;     // handle that changed
    BOOLEAN             modified;   // new modified state
    U8                  reserved[40];
} IM_MODIFIED_NOTIFY, *P_IM_MODIFIED_NOTIFY;
```

msgIMInstalled

A new item was installed.

Takes P_IM_NOTIFY, returns STATUS. Category: observer notification.

```
#define msgIMInstalled                    MakeMsg(clsInstallMgr, 45)
```

Message Arguments

```
typedef struct IM_NOTIFY {
    OBJECT              manager;    // manager that sent notification.
    IM_HANDLE           handle;     // handle that changed.
    U8                  reserved[40];
} IM_NOTIFY, *P_IM_NOTIFY;
```

msgIMDeinstalled

An item has been deinstalled.

Takes P_IM_DEINSTALL_NOTIFY, returns STATUS. Category: observer notification.

```
#define msgIMDeinstalled                  MakeMsg(clsInstallMgr, 46)
```

Arguments

```
typedef struct IM_DEINSTALL_NOTIFY {
    OBJECT              manager;            // manager that sent notification.
    IM_HANDLE           handle;             // handle of item that was deinstalled.
    U8                  pName[nameBufLength];   // item name.
    U8                  pVersion[nameBufLength];// item version.
    U8                  reserved[40];
} IM_DEINSTALL_NOTIFY, *P_IM_DEINSTALL_NOTIFY;
```

Comments

Since the handle is no longer valid when this message is recieved, the **pArgs** includes all information about the item.

Private

msgIMDeactivate

Deactivate an item.

Takes P_IM_DEACTIVATE, returns STATUS.

```
#define msgIMDeactivate                   MakeMsg(clsInstallMgr, 20)
```

Arguments

```
typedef struct IM_DEACTIVATE {
    IM_HANDLE           handle;     // item to deactivate.
} IM_DEACTIVATE, *P_IM_DEACTIVATE;
```

Comments

This removes everything but an empty filesytem node with attributes which represents the item. The item's handle and attributes remain intact.

Returns

stsRequestNotSupported style.copyOnInstall is false. Install mgrs of this style don't support deactivation.

msgIMActivate

Activate an item by copying it in from disk.

Takes P_IM_ACTIVATE, returns STATUS.

```
#define msgIMActivate                     MakeMsg(clsInstallMgr, 21)
```

Arguments

```
typedef struct IM_ACTIVATE {
    IM_HANDLE           handle;     // Item to activate.
} IM_ACTIVATE, *P_IM_ACTIVATE;
```

Comments

The install manager also sends **msgIMModifiedChanged** if the modified state changed due to the activate.

Return Value

stsIMAlreadyActive Item is already active.

stsIMInvalidItem There is nothing valid out on disk.

msgAppMgrGetMetrics

Returns generic icon for this installer.

Takes P_APP_MGR_METRICS, returns STATUS.

Comments

Install managers understand this message so they can present an icon for use by the disk manager. Install managers look for their icons in the system resource file.

Only the **iconBitmap**, **smallIconBitmap**, and name fields of **pArgs** are filled in.

msgIMAddCards

Asks the install manager to add option cards for the specified item.

Takes P_IM_ADD_CARDS, returns STATUS.

```
#define msgIMAddCards                       MakeMsg(clsInstallMgr, 56)
```

Arguments

```
typedef struct IM_ADD_CARDS {
    IM_HANDLE           handle;     // Item to add cards for. Can be objNull.
    OPTION_TAG          optionTag;  // msgOptionAddCards argument.
} IM_ADD_CARDS, *P_IM_ADD_CARDS;
```

Comments

The handle argument specifies the currently selected item. It may be **objNull** if there is no selection.

This message is a superset of **msgOptionAddCards**. The **optionTag** argument is exactly the same as that for **msgOptionAddCards**.

msgIMSetNotify

Turns notification generation on or off.

Takes BOOLEAN, returns STATUS.

```
#define msgIMSetNotify                      MakeMsg(clsInstallMgr, 28)
```

msgIMGetNotify

Returns notification generation state.

Takes P_BOOLEAN, returns STATUS.

```
#define msgIMGetNotify                      MakeMsg(clsInstallMgr, 29)
```

msgIMRemoveHandle

Removes and frees a handle from our internal list.

Takes OBJECT, returns STATUS.

```
#define msgIMRemoveHandle                   MakeMsg(clsInstallMgr, 30)
```

msgIMRenameUninstalledItem

Renames an item on disk.

Takes P_IM_RENAME_UNINSTALLED, returns STATUS.

```
#define msgIMRenameUninstalledItem           MakeMsg(clsInstallMgr, 53)
```

Arguments

```
typedef struct IM_RENAME_UNINSTALLED {
    FS_LOCATOR          locator;    // Location of item to rename. Must not
                                    // be an absolute path!
    P_STRING            pOldName;   // Old name.
    P_STRING            pNewName;   // New name.
} IM_RENAME_UNINSTALLED, *P_IM_RENAME_UNINSTALLED;
```

msgIMGetSettingsMenu

Sets a pointer to the **tkTable** entries for the Settings NB menu.

Takes PP_TK_TABLE_ENTRY, returns STATUS.

```
#define msgIMGetSettingsMenu                 MakeMsg(clsInstallMgr, 54)
```

Comments

pArgs must be the address of a P_TK_TABLE_ENTRY pointer.

msgIMGetItemIcon

Gets the icons for a given item.

Takes P_IM_GET_ITEM_ICON, returns STATUS.

```
#define msgIMGetItemIcon                 MakeMsg(clsInstallMgr, 57)
```

Arguments

```
typedef struct IM_GET_ITEM_ICON {
    IM_HANDLE       handle;             // Handle of item.
    OBJECT          iconBitmap;         // Out: Icon bitmap.
    TAG             iconTag;            // Out: Icon's tag in resfile.
    BOOLEAN         iconInSystemRes;    // Out: Is this icon in system
                                        //      resource file?
    OBJECT          smallIconBitmap;    // Out: Small icon bitmap.
    TAG             smallIconTag;       // Out: Icon's tag in resfile.
    BOOLEAN         smallIconInSystemRes;// Out: Is this icon in system
                                        //       resource file?
    U32             reserved;
} IM_GET_ITEM_ICON, *P_IM_GET_ITEM_ICON;
```

INSTLSHT.H

This file contains the API definition for **clsInstallUISheet**.

clsSettingsNB inherits from **clsOption.**

This class defines the Installer sheet in the Settings Notebook.

The Installer sheet contains one card for each installation category (apps, preferences, services, etc). Each category has an underlying install manager (see instlmgr.h). A card is automatically created when a new install manager is created, and deleted when an install manger is destroyed.

The Installer sheet allows a client to display a particular card and select an item within that card. Here's example code which activates the Settings Notebook from the Bookshelf, turns it to the Installer sheet, displays a particular card, selects an item within that card, and finally opens the Settings Notebook:

```
#include <auxnbmgr.h>
#include <instlsht.h>

{
    ANM_OPEN_NOTEBOOK    openNotebook;
    APP_METRICS          am;
    IUI_SELECT_ITEM      selectItem;
    OPTION_CARD          oc;
    IUI_SHOW_CARD        showCard;
    STATUS               s;

    ObjectCall(msgBusySetState, theBusyManager, (P_ARGS) true);
    openNotebook.notebook = anmSettings;
    openNotebook.activateOnly = true;
    ObjCallRet(msgANMOpenNotebook, theAuxNotebookMgr, &openNotebook, s);
    ObjSendUpdateRet(msgAppGetMetrics, openNotebook.uid, &am, SizeOf(am), s);
    oc.tag = tagSettingsInstallerSheet;
    ObjSendUpdateRet(msgOptionShowCard, am.mainWin, &oc, SizeOf(oc), s);
    ObjSendUpdateRet(msgOptionGetTopCard, am.mainWin, &oc, SizeOf(oc), s);
    strcpy(showCard.pCardName, "Applications");
    ObjSendRet(msgIUIShowCard, oc.win, &showCard, SizeOf(showCard), s);
    strcpy(selectItem.pItemName, appMgrMetrics.name);
    ObjSendRet(msgIUISelectItem, oc.win, &selectItem, SizeOf(selectItem), s);
    openNotebook.notebook = anmSettings;
    openNotebook.activateOnly = false;
    ObjCallRet(msgANMOpenNotebook, theAuxNotebookMgr, &openNotebook, s);
    ObjectCall(msgBusySetState, theBusyManager, (P_ARGS) false);
}
#ifndef INSTLSHT_INCLUDED
#define INSTLSHT_INCLUDED
#ifndef TKTABLE_INCLUDED
#include <tktable.h>
#endif
#ifndef FS_INCLUDED
#include <fs.h>
#endif
#ifndef OPTION_INCLUDED
#include <option.h>
#endif
```

Messages

msgIUIShowCard

Show the specified Installer category card.

Takes P_IUI_SHOW_CARD, returns STATUS.

```
#define msgIUIShowCard                    MakeMsg(clsInstallUISheet, 1)
```

Arguments

```
typedef struct IUI_SHOW_CARD {
    CHAR                pCardName[nameBufLength]; // Card Name. These names
                                                  // correspond to installmgr
                                                  // names; ie. Applications,
                                                  // Services, Fonts. See
                                                  // instlmgr.h.
    TAG                 itemTag;                  // If name is of zero length
                                                  // use the tag
} IUI_SHOW_CARD, * P_IUI_SHOW_CARD;
```

Return Value

stsFailed The specified card was not found.

msgIUISelectItem

Set the selection to an item on the current card.

Takes P_IUI_SELECT_ITEM, returns STATUS.

```
#define msgIUISelectItem                  MakeMsg(clsInstallUISheet, 2)
```

Arguments

```
typedef struct IUI_SELECT_ITEM {
    CHAR                pItemName[nameBufLength]; // Name of item to select.
    TAG                 itemTag;                  // If name is of zero length
                                                  // use the tag
} IUI_SELECT_ITEM, * P_IUI_SELECT_ITEM;
```

Return Value

stsFailed The specified item was not found.

msgIUIGetSelectionUID

Gets the UID of the selection on the current card.

Takes P_UID, returns STATUS.

```
#define msgIUIGetSelectionUID                 MakeMsg(clsInstallUISheet, 5)
```

Return Value

stsFailed There is no selection.

msgIUIGetSelectionName

Gets the name of the selection on the current card.

Takes P_CHAR, returns STATUS.

```
#define msgIUIGetSelectionName                MakeMsg(clsInstallUISheet, 6)
```

Return Value

stsFailed There is no selection.

msgIUIGetMetrics

Get **installUI** metrics.

Takes P_IUI_METRICS, returns STATUS.

```
#define msgIUIGetMetrics                  MakeMsg(clsInstallUISheet, 3)
```

Arguments

```
typedef struct IUI_METRICS {
    OBJECT          currentCard;                    // Card displayed.
    CHAR            pCurrentCardName[nameBufLength]; // Name of displayed
                                                    // card.
    TAG             currentCardTag;                 // Tag of card.
    CHAR            spare[24];
} IUI_METRICS, * P_IUI_METRICS;
```

PDICTMGR.H

This file contains the API definition for **clsPDictProtoInstallMgr**.

clsPDictProtoInstallMgr inherits from **clsInstallMgr**.

It performs personal dictionary installation and maintenance.

See Also instlmgr.h

```
#ifndef PDICTMGR_INCLUDED
#define PDICTMGR_INCLUDED
#ifndef INSTLMGR_INCLUDED
#include <instlmgr.h>
#endif
```

Common #defines and typedefs

Popup Editor messages and tags

```
#define msgPIMPopUpEditor          MakeMsg(clsPDictInstallMgr, 100)
#define tagPIMPopUpEditor          MakeTag(clsPDictInstallMgr, 1)
#define hlpPIMEditorButton         MakeTag(clsPDictInstallMgr, 100)
```

Messages

msgNew

Creates a new personal dictionary install manager.

Takes P_PIM_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct PIM_NEW {
    installMgrNewFields
} PIM_NEW, *P_PIM_NEW;
```

Comments There is only one instance of this class, **theInstalledPDicts**, in the system. Clients should never send msgNew.

SERVIMGR.H

This file contains the API definition for **clsServiceInstallMgr**.

clsServiceInstallMgr inherits from **clsCodeInstallMgr.**

Manages installation and deinstallation of services.

There is a single instance of **clsServiceInstallMgr** in the system; the well-known uid **theInstalledServices.**

theInstalledServices performs installation and deinstallation of services, allows you to enumerate all of the services that are currently installed, and find out their classes.

See service.h for the messages that a service implementor needs. See servmgr.h for the messages that a service client uses to find and open a particular service.

Services provide non-application functionality under PenPoint; typically some form of background server or device driver. Examples of services include: device drivers, inbox/outbox transfer agents such as fax and e-mail, network protocol stacks, and databases.

A service is a directory, usually located under \penpoint\service on a given filesystem volume. The name of the directory is the name of the service. Within this directory are one or more .dlls that make up the service.

If a service includes more than one .dll there must also be a .dlc file which lists all the .dlls. The name of the .dlc file (or the name of the .dll file if there is only one .dll) must be the same as the name of the service. If a service is called MAIL, for example, its .dlc file must be named MAIL.DLC. You can use the STAMP.EXE utility to give a service an extended name. Be sure to stamp the .dlc file as well.

A service can contain an init.dll. This .dll will be loaded, run, and unloaded during service loading. This can be used to set up or modify the service's resource file programmatically. A handle to the service's resource file is available to init.dll via **msgSvcGetClassMetrics.**

When a service is installed, a service directory is created in the RAM filesystem. All of the state for that service lives in this directory.

A service can have an optional MISC directory. This is very similar to an application's MISC directory. MISC is used to store static data files that are common to all service instances. The MISC directory will be copied into the service directory when the service is installed. You can get to the MISC directory from a service instance by getting class metrics, then specifying a path of "MISC" relative to the service's directory.

A service can have a resource file, called service.res. This is similar to an application's app.res file. The resource file is automatically copied to the service directory in RAM when the service is installed, and a resource file handle is opened on it and stored in the service class metrics. This resource file should contain the service's UI components and quick-help resources. Each service's resource file handle is added to the well-known **resList theServiceResList.** Quick-help searches **theServiceResList** as part of its normal operation. Note that **theServiceResList** is not callable; you must ObjectSend to it.

There is an optional INST directory in a service directory, which contains saved service instance state nodes. Pre-configured service instances will be created from the nodes in this directory when the service is loaded (see service.h for details).

There can also be a service.ini and app.ini file in the service directory. These specify any additional services and applications that should be installed when this service is installed. These services and applications are deinstalled when the service is deinstalled. If one of these services or applications is already installed it is reference counted, not installed again.

A service is installed by sending **msgIMInstall** to **theInstalledServices**. Services are installed under user control from the Services card of the Settings Notebook, or via the pop-up quick installer (see qckinstl.h). \\boot\penpoint\boot\service.ini specifies services that are automatically loaded when the system cold-boots.

Each installed service has a service directory in the RAM filesystem, under \penpoint\sys\service. For example, service MAIL would have \penpoint\sys\service\mail. The instance state nodes for the service are kept in a directory called INST, under this directory. If the service has preconfigured instances then they are copied to the INST directory when the service is first installed.

Each installed service is represented by a handle, in a fashion similar to other install managers (see instlmgr.h). This handle is a directory handle onto the service's directory in the RAM filesystem.

NOTE: THE MESSAGES IN THIS CLASS ARE SENT TO THE MANAGER, NOT TO THE HANDLES.

A service can be deinstalled. Deinstallation removes all traces of a service and decrements the reference count for any dependent services or applications. All service instances are removed from their service managers and freed when a service is deinstalled.

Deinstallation only occurs if the main service and all dependent applications and services agree to deinstall. A service or application can veto the deinstallation if it chooses. The default behavior for services is to veto if any service instance is open (in use).

The following superclass messages are not understood by **clsServiceInstallMgr**:

- msgIMGetCurrent
- msgIMSetCurrent
- msgIMSetName
- msgIMDup

The following notification messages are not sent by **clsServiceInstallMgr**:

- msgIMNameChanged
- msgIMCurrentChanged

NOTE: Each service must contain one and only one service class. Don't try and define more than one service class in a single service.

See Also instlmgr.h

```
#ifndef SERVIMGR_INCLUDED
#define SERVIMGR_INCLUDED
#ifndef SERVICE_INCLUDED
#include <service.h>
#endif
#ifndef CODEMGR_INCLUDED
#include <codemgr.h>
#endif
```

Common #defines and typedefs

Well-known filenames

These are the files created by **clsServiceInstallMgr** in a service's directory.

```
#define svcResFileName          "service.res"
```

Messages

msgNew

Creates a new service installation manager.

Takes P_SIM_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct SIM_NEW {
    installMgrNewFields
} SIM_NEW, *P_SIM_NEW;
```

Comments

There is only one instance of this class, **theInstalledServices**, in the system. Clients should never send msgNew.

msgSIMGetMetrics

Gets the specified service class's metrics.

Takes P_SIM_GET_METRICS, returns STATUS.

```
#define msgSIMGetMetrics                MakeMsg(clsServiceInstallMgr, 1)
```

Arguments

```
typedef struct SIM_GET_METRICS {
    IM_HANDLE           handle;     // Handle of service class to get metrics
                                    // on.
    SVC_CLASS_METRICS   metrics;    // Out: metrics.
} SIM_GET_METRICS, *P_SIM_GET_METRICS;
```

Comments

See service.h for SVC_CLASS_METRICS.

SYSTEM.H

This file contains the API definition for **clsSystem**.

clsSystem inherits from **clsObject.**

Provides information about the system.

There is a single instance of **clsSystem**, **theSystem**. You send all **clsSystem** messages to **theSystem.**

theSystem manages PenPoint booting. If you need to know when PenPoint booting reaches a certain stage or is complete then you can observe **theSystem** and recieve **msgBootStateChanged**. You can also send **msgSysGetBootState** to find out what stage booting is currently at.

```
    PenPoint Booting Sequence

    Cold Boot                                  Warm Boot
    ----------------------------------         ---------
    Kernel                                     Kernel
    System Dlls Loaded (boot.dlc)              System Dll Upgrade
    System Apps Installed (sysapp.ini)         System Dlls reinitialized
    Initial App Installed                      Instance 0's/DLLMain()s rerun
    Bookshelf Created                          App Upgrade
    Services Installed (service.ini)           Services Upgrade
    Apps Installed (app.ini)                   Run Initial App
    Run Initial App                            Boot Complete
    Boot Complete
```

This header file defines constants for all the interesting PenPoint filesystem locations that you might be tempted to hard-code. Use these defines instead; for example, to set a string to the location where PenPoint applications live, use:

```
    strcpy(pFoo, sysBaseDir "\\" sysInstallableAppDir);
```

PenPoint defines "live" areas for documents on volumes. The live area is where the volume's bookshelf is. Use **msgSysGetLiveRoot** to access the live area on a volume.

```
#ifndef SYSTEM_INCLUDED
#define SYSTEM_INCLUDED
#ifndef APPDIR_INCLUDED
#include <appdir.h>
#endif
#ifndef APPMGR_INCLUDED
#include <appmgr.h>
#endif
#ifndef UUID_INCLUDED
#include <uuid.h>
#endif
```

System Debugging Flags

System debug flag is 'B', values are:

```
1    = Enable active doc cache tracing
2    = Install items from theSelectedVolume at warm boot
4    = Go into debugger when stdmsg functions are called
8    = Enable serial port option sheet testing
800  = Enable showing of the RAM (theSelectedVolume) Volume
```

Common #defines and typedefs

penpoint.res is invalid. This is checked during cold and warm boot.

```
#define  stsSysInvalidSystemResFile        MakeStatus(clsSystem, 1)
```

Penpoint base directory.

```
#define sysBaseDir                  "PENPOINT"
```

Filesystem locations off the base Penpoint directory.

```
#define sysInstallableFontDir       "FONT"
#define sysInstallablePrefDir       "PREFS"
#define sysInstallableHWXProtDir    "HWXPROT"
#define sysInstallableGestureDir    "GESTURE"
#define sysInstallablePDictDir      "PDICT"
#define sysInstallableAppDir        "APP"
#define sysInstallableServiceDir    "SERVICE"
#define sysBootDir                  "BOOT"
#define sysQuickInstall             "QINSTALL"
#define sysRuntimeRootDir           "SYS"
```

Filesystem locations off the runtime root.

```
#define sysSysAppFile               "SYSAPP.INI"
#define sysAppFile                  "APP.INI"
#define sysSysServiceFile           "SYSSERV.INI"
#define sysServiceFile              "SERVICE.INI"
#define sysCopyFile                 "SYSCOPY.INI"
#define sysResFile                  "PENPOINT.RES"
#define sysMILResFile               "MIL.RES"
#define sysLiveRoot                 "Bookshelf"
#define sysLoaderDir                "LOADER"
```

Default initial app (in penpoint\boot\app).

```
#define sysDefaultInitialApp        "Bookshelf"
```

Boot type.

```
typedef enum SYS_BOOT_TYPE {
    sysWarmBoot                 = 1,
    sysColdBoot                 = 2
} SYS_BOOT_TYPE, *P_SYS_BOOT_TYPE;
```

Boot progess.

```
typedef enum SYS_BOOT_PROGRESS {
    sysKernelComplete           = 1,
    sysSystemDllsComplete       = 2,
    sysSystemAppsInstalled      = 3,
    sysInitialAppInstalled      = 4,
    sysBookshelfItemsCreated    = 5,
    sysServicesInstalled        = 6,
    sysAppsInstalled            = 7,
    sysInitialAppRunning        = 8,
    sysBootComplete             = 9
} SYS_BOOT_PROGRESS, *P_SYS_BOOT_PROGRESS;
```

Boot state.

```
typedef struct SYS_BOOT_STATE {
    BOOLEAN            booted;              // Has booting totally completed?
    SYS_BOOT_PROGRESS  progress;            // Where are we in the boot cycle?
    SYS_BOOT_TYPE      type;                // Boot type; warm or cold.
    CLASS              initialAppClass;     // Class of the initial app.
} SYS_BOOT_STATE, *P_SYS_BOOT_STATE;
```

Messages

msgNew

Used by PenPoint to create well-known uid **theSystem**.

Takes P_SYS_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct SYS_NEW_ONLY {
    U32                unused1;
    U32                unused2;
    U32                unused3;
    U32                unused4;
} SYS_NEW_ONLY, *P_SYS_NEW_ONLY;
#define systemNewFields                     \
    objectNewFields                         \
    SYS_NEW_ONLY       system;
typedef struct SYS_NEW {
    systemNewFields
} SYS_NEW, *P_SYS_NEW;
```

Comments This message should never be called by anybody else.

msgSysGetBootState

What stage of booting is the system in?

Takes P_SYS_BOOT_STATE, returns STATUS.

```
#define msgSysGetBootState                    MakeMsg(clsSystem, 1)
```

Message Arguments

```
typedef struct SYS_BOOT_STATE {
    BOOLEAN            booted;              // Has booting totally completed?
    SYS_BOOT_PROGRESS  progress;            // Where are we in the boot cycle?
    SYS_BOOT_TYPE      type;                // Boot type; warm or cold.
    CLASS              initialAppClass;     // Class of the initial app.
} SYS_BOOT_STATE, *P_SYS_BOOT_STATE;
```

Comments This message allows callers to determine the current state of system booting.

See Also **msgSysBootStateChanged** Observer message sent at each stage.

msgSysGetRuntimeRoot

Returns a dir handle onto the root of the Penpoint runtime area.

Takes P_OBJECT, returns STATUS.

```
#define msgSysGetRuntimeRoot                  MakeMsg(clsSystem, 2)
```

Comments Penpoint maintains all of its runtime information in one area of the filesystem on the "selected" volume (**theSelectedVolume**). This message returns a directory handle onto the root of this area.

NOTE: Caller must free the handle when finished.

msgSysGetLiveRoot

Returns an **appDir** handle onto the root of a volume's live document area.

Takes P_SYS_GET_LIVE_ROOT, returns STATUS.

```
#define msgSysGetLiveRoot                        MakeMsg(clsSystem, 3)
```

Arguments

```
typedef struct SYS_GET_LIVE_ROOT {
    OBJECT              volHandle;  // Handle onto volume in question.
    OBJECT              liveRoot;   // Out: appDir handle to live root on
                                    //  the volume.
} SYS_GET_LIVE_ROOT, *P_SYS_GET_LIVE_ROOT;
```

Comments

Live Penpoint documents (those that can be activated) are stored within the live area of a volume. This message returns the root of the live area for a given volume.

pArgs->volHandle is a filesystem handle onto the volume in question. This handle can be on any location of the volume. You can also use the root directory handle for a volume. Use **theSelectedVolume** if you want to get the live area within the filesystem that Penpoint stores its on-machine documents in.

NOTE: Caller must free the **pArgs**->liveHandle when finished.

Return Value

stsFSNodeNotFound No live root on this volume.

msgSysIsHandleLive

Determines if a filesystem handle is within the live document area.

Takes P_SYS_IS_HANDLE_LIVE, returns STATUS.

```
#define msgSysIsHandleLive                       MakeMsg(clsSystem, 4)
```

Arguments

```
typedef struct SYS_IS_HANDLE_LIVE {
    OBJECT              handle;     // Handle onto the node in question.
    BOOLEAN             live;       // Out: Is it in the live area?
} SYS_IS_HANDLE_LIVE, *P_SYS_IS_HANDLE_LIVE;
```

Comments

Penpoint maintains live documents within a particular point in the directory heirarchy of each volume. This message determines whether a filesystem handle is within the live area of its volume.

Return Value

stsFSNodeNotFound No live root on the handle's volume.

msgSysCreateLiveRoot

Create a new live root on a volume.

Takes P_SYS_CREATE_LIVE_ROOT, returns STATUS.

```
#define msgSysCreateLiveRoot                     MakeMsg(clsSystem, 5)
```

Arguments

```
typedef struct SYS_CREATE_LIVE_ROOT {
    OBJECT              volHandle;  // Handle onto volume in question.
    CLASS               rootClass;  // Class of app which should run on the
                                    // live root directory.
} SYS_CREATE_LIVE_ROOT, *P_SYS_CREATE_LIVE_ROOT;
```

Comments

Penpoint maintains live documents within a particular point in the directory heirarchy of each volume. This message creates a new live root on a volume if one doesn't already exist. If the live root already exists it creates an instance of the app over whatever is there currently. Use **msgSysGetLiveRoot** if you want to check for an existing live root.

msgSysGetVersion

Returns the system version number.

Takes P_U16, returns STATUS.

```
#define msgSysGetVersion                        MakeMsg(clsSystem, 6)
```

Comments

This message allows callers to determine the current PenPoint system version number.

msgSysGetSecurityObject

Gets the current security object.

Takes P_OBJECT, returns STATUS.

```
#define msgSysGetSecurityObject                 MakeMsg(clsSystem, 31)
```

Comments

Returns **objNull** if there is no current security object.

msgSysSetSecurityObject

Sets the current security object.

Takes P_SYS_SET_SECURITY_OBJECT, returns STATUS.

```
#define msgSysSetSecurityObject                 MakeMsg(clsSystem, 32)
```

Arguments

```
typedef struct SYS_SET_SECURITY_OBJECT {
    OBJECT              securityObject; // New security object.
    OBJ_KEY             oldKey;         // Object key for old security
                                        // object.
} SYS_SET_SECURITY_OBJECT, *P_SYS_SET_SECURITY_OBJECT;
```

Comments

If a security object already exists then it is destroyed, using the key specified in the arguments. If it refuses to be destroyed then the new security object will not be set.

The security object will be sent **msgSysPowerOn** and **msgSysPowerOff** when the power goes on and off. At shutdown, **msgSysPowerOff** is sent to the security object after **msgSysPowerOff** is sent to power button observers and after **msgAppSave** is sent to applications. At power up, **msgSysPowerOn** is sent to the security object before **msgSysPowerOn** is sent to power button observers.

msgSysPowerOn and **msgSysPowerOff** are sent when the machine is suspended/ resumed, or shutdown and swap-booted. However, these messages are not sent when a warm-boot occurs. A warm-boot destroys all processes and objects. The service or application that owns the security object will be restarted in the warm-boot case. Security objects must handle the warm-boot case. For example, if the security object is created by the app monitor, the app monitor will receive **msgAppInit** when the application is first installed and **msgRestore** on all warm-boots.

At power down, anything painted on the screen by the security object will not appear immediately, but will appear on the screen when it is restored at power on time. If the security object wishes to display a window on top of all other windows, it should observe **theSystem** for **msgBootStateChanged** to determine when booting is complete.

At power on, the security object may choose to veto the powering on of the system by sending **msgPMSetPowerState** to **thePowerMgr** to turn off power.

Return Value

stsProtectionViolation old security object refused to be destroyed.

msgSysGetCorrectiveServiceLevel

Gets the corrective service level.

Takes P_STRING, returns STATUS.

```
#define msgSysGetCorrectiveServiceLevel        MakeMsg(clsSystem, 33)
```

Comments

The corrective service level is a string of up to **maxNameLength** characters.

msgSysSetCorrectiveServiceLevel

Sets the corrective service level.

Takes P_STRING, returns STATUS.

```
#define msgSysSetCorrectiveServiceLevel        MakeMsg(clsSystem, 34)
```

Comments

The corrective service level is a string of up to **maxNameLength** characters.

Notification Messages

msgSysBootStateChanged

The system has reached another stage of booting.

Takes P_SYS_BOOT_STATE, returns STATUS. Category: observer notification.

```
#define msgSysBootStateChanged                 MakeMsg(clsSystem, 10)
```

Message Arguments

```
typedef struct SYS_BOOT_STATE {
    BOOLEAN             booted;             // Has booting totally completed?
    SYS_BOOT_PROGRESS   progress;           // Where are we in the boot cycle?
    SYS_BOOT_TYPE       type;               // Boot type; warm or cold.
    CLASS               initialAppClass;    // Class of the initial app.
} SYS_BOOT_STATE, *P_SYS_BOOT_STATE;
```

Comments

This message is sent to all observers of **theSystem** whenever another stage of booting is attained. If you are just interested in whether the system has completed booting or not, look at the **pArgs**->booted boolean.

Part 13 / Writing PenPoint Services

HWXSERV.H

This file contains the API definition for **clsHWXEngineService.**

clsHWXEngineService inherits from **clsService.**

Provides default behavior for handwriting engine services.

```
#ifndef HWXSERV_INCLUDED
#define HWXSERV_INCLUDED
#ifndef SERVICE_INCLUDED
#include <service.h>
#endif
```

Messages

msgNew

Creates a new service object.

Takes P_HWX_SVC_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct HWX_SVC_NEW_ONLY {
    U32                     unused1;
    U32                     unused2;
    U32                     unused3;
    U32                     unused4;
} HWX_SVC_NEW_ONLY, *P_HWX_SVC_NEW_ONLY;
#define hwxServiceNewFields \
    serviceNewFields        \
    HWX_SVC_NEW_ONLY        hwxService;
typedef struct HWX_SVC_NEW {
    hwxServiceNewFields
} HWX_SVC_NEW, *P_HWX_SVC_NEW;
```

msgHWXSvcCurrentChanged

The current handwriting prototype set has changed.

Takes P_HWX_SVC_CURRENT_CHANGED, returns STATUS.

```
#define msgHWXSvcCurrentChanged             MakeMsg(clsHWXEngineService, 1)
```

Arguments

```
typedef struct HWX_SVC_CURRENT_CHANGED {
    OBJECT                  newHandle;
    OBJECT                  oldHandle;
} HWX_SVC_CURRENT_CHANGED, *P_HWX_SVC_CURRENT_CHANGED;
```

Comments

The user has switched to or from a handwriting prototype set that uses this engine. See hwxmgr.h and instlmgr.h for details on handwriting prototype set management.

pArgs->newHandle and **pArgs**->oldHandle provide the handles of the new and old prototype sets. **objNull** means that the new/former prototype set used some other engine.

MILSERV.H

This file contains the API definition for **clsMILService**. The functions described in this file are contained in milserv.lib.

clsMILService inherits from **clsService**.

Provides default behavior for MIL services.

MIL services are PenPoint device drivers. They represent a MIL device, which represents a piece of hardware. A MIL service sits between a MIL device and the rest of PenPoint.

A MIL service is typically composed of a Ring 0 part, which interfaces to the MIL, and a Ring 3 part, which interfaces to the rest of PenPoint.

MIL service instances are created automatically by PenPoint. Never send **msgNew** to a MIL Service class yourself! Each MIL device contains a **deviceId**, which is the class of the MIL service that should be created for it. PenPoint scans the MIL at power-up time and whenever a MIL service installed, and creates one MIL service for each unit of each device.

The MIL service writer can find out the logical id of the device it represents by self-sending **msgMILSvcGetDevice**.

A MIL service can install a MIL extension if necessary. The new MIL device is installed into the MIL when the MIL service is installed, and removed from the MIL when the MIL service is deinstalled. Use the InstallMILDevice() function in your DLLMain() to do this.

You must also let the service framework know about a service by sending **msgSvcClassInitService** to your service class in DLLMain(). Here's an example:

```
STATUS EXPORTED DLLMain(void)
{
    SVC_INIT_SERVICE    initService;
    STATUS              s;
    // Initalize classes.
    StsRet(ClsMILServiceInit(), s);
    // Include if it is necessary to install MIL extensions.
    InstallMILDevice(&deviceInfo);
    // Initialize service. This creates MIL service instances.
    memset(initService.spare, 0, sizeof(initService.spare));
    initService.autoCreate = true;
    initService.serviceType = 0;
    initService.initServiceFlags = 0;
    ObjCallRet(msgSvcClassInitService, clsTestService, &initService, s);
    return stsOK;
} // DllMain
```

See project MILSVC for a template for creating MIL services.

```
#ifndef MIL_SERVICE_INCLUDED
#define MIL_SERVICE_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
```

```
#ifndef SERVICE_INCLUDED
#include <service.h>
#endif
#ifndef MIL_INCLUDED
#include <mil.h>
#endif
```

Common #defines and typedefs

Did this service install MIL devices?

```
#define svcMILAttrInstalledDevice       FSMakeFix32Attr(clsMILService, 1)
```

The MIL device that this mil service is associated with.

```
typedef struct MIL_SVC_DEVICE {
        TAG     unitResourceTag;        // resource tag into mil.res
        UID     conflictGroup;          // conflict group mil svc is on
        U16     logicalId;              // mil device logical id to use
        U16     unit;                   // mil device unit number to use
        U8      reserved[12];
} MIL_SVC_DEVICE, *P_MIL_SVC_DEVICE;
```

Functions

InstallMILDevice

Install a MIL device.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED InstallMILDevice(
    P_MIL_DEVICE_INFO       pDeviceInfo, // Installable MIL device info.
    U32                     reserved1,   // Set this to 0
    U32                     reserved2);  // Set this to 0
```

Comments

This routine should used to install one or more MIL devices. These devices will be automatically deinstalled when the MIL service is deinstalled.

This routine *must* be called in the service's DLLMain(), after the classes are created but before **msgSvcClassInitService** is sent.

Class Messages

msgNew

Creates a new MIL service object.

Takes P_MIL_SVC_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct MIL_SVC_NEW_ONLY {
    MIL_SVC_DEVICE          device;
    U32                     unused1;
    U32                     unused2;
    U32                     unused3;
    U32                     unused4;
} MIL_SVC_NEW_ONLY, *P_MIL_SVC_NEW_ONLY;
#define milServiceNewFields \
    serviceNewFields        \
    MIL_SVC_NEW_ONLY        milSvc;
```

```
typedef struct MIL_SVC_NEW {
    milServiceNewFields
} MIL_SVC_NEW, *P_MIL_SVC_NEW;
```

Comments

This message should never be sent by clients. PenPoint automatically creates all MIL service instances by scanning the MIL.

msgNewDefaults

Initializes the MIL_SVC_NEW structure to default values.

Takes P_MIL_SVC_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct MIL_SVC_NEW {
    milServiceNewFields
} MIL_SVC_NEW, *P_MIL_SVC_NEW;
```

Comments

Sets

pArgs->svc.style.**exclusiveOpen** = true;

pArgs->svc.style.**checkOwner** = true;

Note pArgs->svc.style.**connectStyle** will be set automatically to

reflect underlying MIL device's auto-detection facilities. It will

be set to **svcAutoDetect** if **milDevFlagDetachable** is true,

svcNoAutoDetect if **milDevFlagDetachable** is false.

Note pArgs->milSvc.device will be set automatically from the MIL.

msgSvcSetConnected

Sets connection state of self.

Takes P_SVC_GET_SET_CONNECTED, returns STATUS.

Comments

'P_SVC_GET_SET_CONNECTED' structure is defined in service.h.

This message is self-sent whenever a MIL service thinks that it's connection state has changed. This message should be sent even when a mil service isn't sure if it is connected (due to possible interference from other mil services in its conflict group).

If the mil service isn't in a conflict group then the message is sent to ancestor. If it is in a conflict group then the following will occur:

if (**pArgs**->connected == true) {

1. **msgCGPollConnected** is sent to the conflict group manager.
2. The conflict group manager sends **msgMILSvcAreYouConnected** to allservices in the conflict group (including the one that self-sent **msgSvcSetConnected**).
3. The conflict group manager decides which service really shouldbe connected and sends **msgMILSvcConnectionStateResolved** to all services. This tells which service (if any) has been chosen to be the connected one. MIL services should restart their connection detection logic if nobody is currently connected.
4. Default behavior for **msgMILSvcConnectionStateResolved** is to **sendmsgSvcSetConnected** to ancestor if a change of state is indicated. MIL services must *always* send **msgMILSvcConnectionStateResolved** to ancestor.

} else {

1. **msgSvcSetConnected** is sent to ancestor.
2. **msgCGInformDisconnected** is sent to the conflict group manager.
3. The conflict group manager sends **msgMILSvcConnectionStateResolvedto** all mil services except the mil service that sent the **msgSvcSetConnected** message. MIL services should restart their connection detection logic.

}

See Also

msgSMConnectedChanged (servmgr.h)

clsMILService Functionality Available to Subclasses

msgMILSvcGetDevice

Returns MIL device associated with this service.

Takes P_MIL_SVC_DEVICE, returns STATUS.

```
#define msgMILSvcGetDevice                    MakeMsg(clsMILService, 1)
```

Message Arguments

```
typedef struct MIL_SVC_DEVICE {
        TAG     unitResourceTag;         // resource tag into mil.res
        UID     conflictGroup;           // conflict group mil svc is on
        U16     logicalId;               // mil device logical id to use
        U16     unit;                    // mil device unit number to use
        U8      reserved[12];
} MIL_SVC_DEVICE, *P_MIL_SVC_DEVICE;
```

msgMILSvcSetDevice

Sets MIL device associated with this service.

Takes P_MIL_SVC_DEVICE, returns STATUS.

```
#define msgMILSvcSetDevice                    MakeMsg(clsMILService, 2)
```

Message Arguments

```
typedef struct MIL_SVC_DEVICE {
        TAG     unitResourceTag;         // resource tag into mil.res
        UID     conflictGroup;           // conflict group mil svc is on
        U16     logicalId;               // mil device logical id to use
        U16     unit;                    // mil device unit number to use
        U8      reserved[12];
} MIL_SVC_DEVICE, *P_MIL_SVC_DEVICE;
```

Comments

Note: This message is almost never used. Usually a MIL service is associated with the device that is set at **msgNew** time, and never changed. This message is included for completeness and very special circumstances.

msgMILSvcInstalledMILDevice

Is this MIL service targeting an installed MIL device?

Takes **pNull**, returns STATUS.

```
#define msgMILSvcInstalledMILDevice           MakeMsg(clsMILService, 3)
```

Comments

Returns **stsOK** if it is, **stsFailed** if it is not.

msgMILSvcAddToConflictManager

Add this service instance to a conflict group manager.

Takes P_MIL_SVC_ADD_TO_CONFLICT_MANAGER, returns STATUS.

```
#define msgMILSvcAddToConflictManager       MakeMsg(clsMILService, 8)
```

Arguments

```
typedef struct MIL_SVC_ADD_TO_CONFLICT_MANAGER {
    OBJECT                  manager;
} MIL_SVC_ADD_TO_CONFLICT_MANAGER, *P_MIL_SVC_ADD_TO_CONFLICT_MANAGER;
```

Comments

This message is used to add a MIL service to a conflict group manager.

Descendant Responsibility Messages

msgMILSvcPowerOff

The power is about to be turned off.

Takes **pNull**, returns STATUS.

```
#define msgMILSvcPowerOff                   MakeMsg(clsMILService, 4)
```

Comments

This message is sent after all other power off messages are sent. MIL services must *not* observe the power button to get power notification.

MIL services should save any hardware-specific state that must be restored when the power is applied.

msgMILSvcPowerOn

The power has just come on.

Takes **pNull**, returns STATUS.

```
#define msgMILSvcPowerOn                    MakeMsg(clsMILService, 5)
```

Comments

This message is sent before all other power on messages are sent. MIL services must *not* observe the power button to get power notification.

MIL services should restore any hardware-specific state that was saved when the power was disconnected.

msgMILSvcAreYouConnected

Do you think you are connected?

Takes P_MIL_SVC_ARE_YOU_CONNECTED, returns STATUS.

```
#define msgMILSvcAreYouConnected            MakeMsg(clsMILService, 6)
```

Arguments

```
Enum16(MIL_SVC_ARE_YOU_CONNECTED) {
    msYes           = 0,
    msMaybe         = 1,
    msNo            = 2
};
```

Comments

This message is sent to all members of a conflict group whenever any service thinks it has become connected. It allows all members of the conflict group to participate in deciding who is really connected.

Default superclass behavior is to return **msMaybe**.

msgMILSvcConnectionStateResolved

Tells a MIL service who was chosen to be connected.

Takes U16, returns STATUS.

```
#define msgMILSvcConnectionStateResolved    MakeMsg(clsMILService, 7)
```

Comments The **pArgs** is the logical id of the service that was chosen to be connected. It is set to **maxU16** if nobody is connected.

Default superclass behavior is to send **msgSvcSetConnected** to ancestor if a change of state is indicated.

MIL services must always send **msgMILSvcConnectionStateResolved** to ancestor.

msgMILSvcStartConnectionProcessing

It is ok to start connection processing.

Takes **pNull**, returns STATUS.

```
#define msgMILSvcStartConnectionProcessing  \
                                        MsgNoError(MakeMsg(clsMILService, 9))
```

Comments This message is sent after booting is complete. MIL services should not start their connection processing until they receive this message.

SERVCONF.H

This file contains the API definition for **clsMILConflictGroupMgr**.

clsMILConflictGroupMgr inherits from **clsServiceMgr**.

Provides definition of conflict group managers.

A conflict group manager is automatically created for each conflict group in the MIL when one or more MIL service instances are created for the MIL devices which are part of that conflict group. The uid of the conflict group manager is that of the conflict group itself. In other words, if there is a conflict group identified with the tag **theMILConflictGroup4**, then the conflict group manager will have a well-known uid of MILConflictGroup4.

A conflict group manager is very much like a service manager. All of the MIL service instances that represent devices in the conflict group are on the conflict group manager. Each service instance is also made an observer of the conflict group manager.

The conflict group manager keeps track of which MIL service owns the conflict group. The owning service is the only one that is permitted to actually use one of the devices in the conflict group.

```
#ifndef SERVCONF_INCLUDED
#define SERVCONF_INCLUDED
#ifndef SERVICE_MANAGER_INCLUDED
#include <servmgr.h>
#endif
```

Messages

msgNew

Creates a new conflict group manager.

Takes P_SM_NEW, returns STATUS. Category: class message.

Comments

This message should *never* be called by clients. Conflict group managers are automatically created. The new args must always be the same as for a service manager.

msgCGGetOwner

Gets the current owner of the conflict group.

Takes P_CG_GET_OWNER, returns STATUS.

```
#define msgCGGetOwner                    MakeMsg(clsMILConflictGroupMgr, 1)
```

Arguments

```
typedef struct CG_GET_OWNER {
    OBJECT              owner;          // Out: owner.
    U8                  reserved[16];
} CG_GET_OWNER, *P_CG_GET_OWNER;
```

Comments

If no one owns the conflict group, 'objNull' will be returned in the owner field.

msgCGSetOwner

Sets a new conflict group owner.

Takes P_CG_SET_OWNER, returns STATUS.

```
#define msgCGSetOwner                    MakeMsg(clsMILConflictGroupMgr, 2)
```

Arguments

```
typedef struct CG_SET_OWNER {
    OBJECT             owner;      // New owner.
} CG_SET_OWNER, *P_CG_SET_OWNER;
```

Comments

"owner" can be **objNull** to specify that this conflict group has no owner.

Old and new owners will recieve service messages which allow them to veto the ownership change and informs them that the change has taken effect. The message sequence is as follows:

1. msgSvcOwnerAquireRequested is sent to the new owner. **pArgs**->ownedService is set to the conflict group. The new owner can veto the owner change by returning a status of anything other than **stsOK** or **stsNotUnderstood**. **msgCGSetOwner** returns with the abort status.
2. msgSvcOwnerReleaseRequested is sent to the old owner. **pArgs**->ownedService is set to the conflict group. The old owner can can veto the owner change by returning a status of anything other than **stsOK** or **stsNotUnderstood**. **msgCGSetOwner** returns with the abort status.
3. msgSvcOwnerReleased is sent to the old owner.
4. msgSvcOwnerAquired is sent to the new owner.
5. msgCGOwnerChanged is sent to all observers of this conflict group manager, includding all of the service instances on this manager.

Return Value

stsBadObject New owner is not an object.

stsBadAncestor New owner has invalid ancestor.

See Also

service.h, for definition of **msgSvc...** messages.

msgCGPollConnected

Polls all the services in the conflict group to see who is connected.

Takes **pNull**, returns STATUS.

```
#define msgCGPollConnected               MakeMsg(clsMILConflictGroupMgr, 3)
```

Comments

A conflict group manager recieves this message when any service within the conflict group thinks it might be connected. The conflict group manager sends **msgMILSvcAreYouConnected** to each service. It then sends **msgSvcConnectionStateResolved** to each service, choosing one of the services as the connected one.

msgCGInformDisconnected

Tells all the services in the conflict group that a disconnect happened.

Takes **pNull**, returns STATUS.

```
#define msgCGInformDisconnected          MakeMsg(clsMILConflictGroupMgr, 4)
```

Comments

A conflict group manager recieves this message when the connected service within the conflict group decides it is disconnected. The conflict group manager sends **msgSvcConnectionStateResolved** to each service, specifying that nobody is connected.

Notification Messages

msgCGOwnerChanged

A conflict group's owner has changed.

Takes P_CG_OWNER_NOTIFY, returns STATUS. Category: observer notification.

```
#define msgCGOwnerChanged             MakeMsg(clsMILConflictGroupMgr, 10)
```

Arguments

```
typedef struct CG_OWNER_NOTIFY {
    OBJECT              conflictGroup;  // conflict group whose owner changed.
    OBJECT              oldOwner;       // old owner.
    OBJECT              owner;          // new owner.
} CG_OWNER_NOTIFY, *P_CG_OWNER_NOTIFY;
```

Tags

```
#define tagConflictChoice          MakeTag(clsMILConflictGroupMgr, 1)
```

SERVICE.H

This file contains the API definition for **clsService**.

clsService inherits from **clsStream**.

Provides default behavior for services.

Introduction

All non-application functionality under Penpoint is expressed as a service. If what you want to do does not fit the application model (documents created via Stationery or Accessories, subclass of **clsApp**, etc) then it should be a service. Some examples of services are: device drivers, inbox/outbox transfer agents such as fax and e-mail, network protocol stacks, and device drivers.

Service instances are automatically organized onto service managers. A service manager represents a category of service, such as Printers or Serial Devices. All of the service instances in a given category are can be used interchangeably; that is, they all support the API that is required to be in that category. Clients access service instances via service managers. See servmgr.h for details.

Each service instance has a text name, which is how it is uniquely identified. Clients use this name to identify a service instance on a service manager. A service instance's name is specified at **msgNew** time. Names must be unique for all services on the same service manager, and all services of the same class.

There are two exclusivity models for services: services that require exclusive access by a single client, and services that allow multiple clients simultaneous access. Services provides default behavior for arbitrating ownership of exclusive access services.

Multiple access services can either be shared (each client gets back the uid of the service when they open the service) or multi-user (each client gets back a different object when they open the service).

Service instances can optionally maintain state. By default each service instance has a node in the filesystem. **clsService** will automatically recreate service instances from their state files when PenPoint is rebooted. Also, service instances can be saved and restored from external disks by moving their state nodes on and off the machine.

A service instance can have an optional "target". A target is some other service instance. If a service has a target, the service superclass takes care of remembering what the target points at. Typically, data flows from one service instance to next, going down the target chain. Control information, such as when a physical device is becomes connected, flows up the target chain.

A service is implemented as an installable DLL. Service instances are either created in the DLLMain() of the service DLL, created dynamically after the service has been installed, or created from pre-configured instance state nodes when the service is first installed. See servimgr.h for a description of how services are installed and deinstalled, and how a service is organized on disk.

Writing A Basic Service

A minimal service that does not save state or use a target must handle just one superclass message: **msgNewDefaults**. There are four fields which need to be filled in:

pArgs->svc.style.**exclusiveOpen** - Is this an exclusive access service?>svc.style.**openClass** - Is this a multi-user service?>svc.**pManagerList** - List of service managers to add to.>svc.**numManagers** - Number of managers on the list.

Project BASICSVC is a template for a minimal service. Use it as a guide.

Writing a Service That Saves State

clsService maintains an open handle on a service's state node. By default the state node type is a file and the open handle is an instance of **clsFileHandle**. Both of these things can be overridden in your **msgNewDefaults** handler.

Services must decide for themselves when they need to update their state node. They should always maintain enough state to be able to survive a reboot. There is no explicit Save/Restore messages for services; A SERVICE MUST UPDATE ITS STATE NODE WHENEVER ITS STATE CHANGES.

When its time to save state, self-send **msgSvcGetHandle** to get your state node handle. Self-send **msgSvcSetModified** when you complete updating state. These are the only messages that you will need to use for this type of service.

Service instances will be automatically recreated when a warm boot occurs. The **msgNew** arguments to **clsService** include the locator of the state node. Service instances must check to see if this node is non-empty then a warm boot is happening, and the service must recreate itself from the state node.

State nodes can be copied out to disk, then reloaded the next time the service class is installed, or reloaded one at time. **clsService** will automatically create a service instance for each state node at this time using the same mechanism as warm boot recovery. There is no difference between warm boot recovery and creation from a pre-configured state node copied in at installation time, as far as the service is concerned.

Writing a Service That Has A Target

Services can also bind and open other services. In fact, this is such a common situation that **clsService** provides lots of support for this. Each service can have a target, which refers to some other service. When the service is first created the default behavior is to attempt to bind to the target. **clsService** will automatically open the target when the service is opened if the **autoOpen** style bit is true.

A service becomes a client of its target. All client observer notifications and ownership messages from a service's target are sent to the service.

A service's target is usually set at **msgNew** time, and can be changed anytime after with **msgSvcSetTarget**. **msgSvcGetTarget** gets a service instance's target.

Typically a service will open its target when a client opens it, using **msgSvcOpenTarget**. **msgSvcCloseTarget** should be used to close the target.

Services also support the notion of being connected. Most hardware services can detect whether their hardware is connected or disconnected. Each service has a state bit which says whether it is connected or not. When the hardware changes connection state the service sends **msgSVCSetConnected** to itself, which notifies everyone who is bound to that service.

Non-hardware services automatically change their connection state when their targets change connection state. Thus, connection state propogates up from the hardware to all services that are bound to that hardware.

A hardware service for a device that cannot auto-detect connection is always in the connected state.

Project TESTSVC provides a template for a service that deals with a target.

Advanced Features

Services that can provide both global and service instance option cards. A global option sheet sets configuration information for the entire service. It is invoked when the user calls for options of a service from the Service card of the Installer. Services can add additional cards to the global option sheet.

Service instance option sheets allow the user to set the configuration of particular instance. For example, the serial service provides a card which allows the user to set baud rate, parity, etc. Services should update their state node when the user applies a change to the option sheet. There is no default service instance option card.

Services should respond to the standard option sheet protocol (**msgOptionAddCards**, **msgOptionRefreshCard**, etc) if they wish to provide option cards. See option.h for details. The option sheet messages are either sent as class messages for global options or normal instance messages for instance options.

A service's configuration information can also be queried and set programmatically via **msgSvcGetMetrics** and **msgSvcSetMetrics**. A service must be able to respond to these messages at any time, and should update its state node when its metrics are changed. The Get/SetMetrics messages are generic; they allow a client to save and restore metrics independently of the size or contents of the metrics. This allows a client to have absolutely no knowledge of the internals of a service. The client can ask the user to set configuration options, then save and restore these configuration options via the generic Get/Set messages.

Service instances can have icons associated with them in the same fashion as documents. Create icons using **tagAppIconBitmap** and **tagAppSmallIconBitmap** and put them in the service resource file. This is done in the same manner as applications.

Services and Tasking

A service, just like any other object, is owned by some task. However, all services must be callable from outside the owning task (**objCapCall** is always true for service instances). Service authors must take this into account. Services must either use explicitly-created global heaps or instance data; never store data in a local heap or the shared process heap.

If the service is not exclusive access or multi-user, anyone who has the service open can call the service at anytime, even while someone else is in the middle of another call. Use semaphores to protect access where appropriate.

You must also make sure that the a service's owning task will remain active for the real lifetime of the service. For instance, if a service is created via some transient user interface task such as a document or a tool, then the service instance will become invalid when that tool is shut down.

An alternative to keeping the creating task around for the lifetime of the service instance is to use **msgObjectNew** to create the service instance under another task. A very good task to create instances under is the main task of the service. The service resource file handle is available for use with **msgObjectNew**. Use **msgSvcGetClassMetrics** to get this handle (metrics.**resFile**). Send **msgObjectNew** to this handle. Note that **msgObjectNew** must be sent, not called. Remember, any pointers in the **msgObjectNew pArgs** must be in global memory.

Recovering From Unexpected Client Termination

Service instances automatically detect if a client terminates unexpectedly; that is, if a client terminates while it is bound to the service instance or owns it. **msgSvcClientDestroyedEarly** is sent to the service instance when this condition is detected. Subclasses that maintain per-client state can handle this message and perform cleanup. By default the service is closed and unbound from the terminating object.

Sample DLLMain Routine

You must let the service framework know about a service by sending **msgSvcClassInitService** to your service class. Here's an example:

```
    STATUS EXPORTED DLLMain(void)
    {
        SVC_INIT_SERVICE    initService;
        STATUS              s;

        StsRet(ClsTestServiceInit(), s);
        memset(initService.spare, 0, sizeof(initService.spare));
        initService.autoCreate = true;
        initService.serviceType = 0;
        initService.initServiceFlags = 0;
        ObjCallRet(msgSvcClassInitService, clsTestService, &initService, s);

        return stsOK;

    } // DllMain
#ifndef SERVICE_INCLUDED
#define SERVICE_INCLUDED
#ifndef STREAM_INCLUDED
#include <stream.h>
#endif
#ifndef FS_INCLUDED
#include <fs.h>
#endif
```

Common #defines and typedefs

Service Status Codes

An exclusive-open service is already open by someone else (**msgSvcOpenRequested**), or a service's target is already open (**msgSvcOpenTarget**).

```
#define  stsSvcAlreadyOpen                  MakeStatus(clsService, 1)
```

A service tried to open its target but the target manager field is null.

```
#define  stsSvcNoTarget                     MakeStatus(clsService, 2)
```

A service tried to open its target but the target service doesn't exist or the target's service manager hasn't shown up yet.

```
#define  stsSvcTargetNotBound               MakeStatus(clsService, 3)
```

An **autoMsgPassing** service tried to pass a message to its target, but the target was not open.

```
#define  stsSvcTargetNotOpen                MakeStatus(clsService, 4)
```

An attempt was made to change ownership, **queryLock**, or deinstall an open service.

```
#define  stsSvcInUse                      MakeStatus(clsService, 5)
```

Someone who wasn't the owner of a **checkOwner** service tried to open it.

```
#define  stsSvcNotOwner                   MakeStatus(clsService, 6)
```

Someone tried to open or **queryLock** a service that is **queryLocked.**

```
#define  stsSvcLocked                     MakeStatus(clsService, 7)
```

Problem following the target chain during **msgSvcAutoDetectingHardware.**

```
#define  stsSvcValidConnectStyleNotFound  MakeStatus(clsService, 8)
```

A deinstallation is in process. No new clients can be accepted.

```
#define  stsSvcDeinstallInProcess         MakeStatus(clsService, 10)
```

A service of this name already exists and refuses to terminate.

```
#define  stsSvcAlreadyExists              MakeStatus(clsService, 11)
```

A service was created with style.**waitForTarget** set to false and the target wasn't found at **msgNew** or **msgSvcSetTarget** time.

```
#define  stsSvcTargetNotFound             MakeStatus(clsService, 12)
```

Target

A target references another service.

```
typedef struct SVC_TARGET {
        OBJECT              manager;
        U8                  pName[nameBufLength];
        U8                  spare[12];
} SVC_TARGET, *P_SVC_TARGET;
```

Service Class Metrics

Passed back by **msgSvcGetClassMetrics**. Also used in **clsServiceInstallMgr** (servimgr.h) and **clsServiceMgr** (servmgr.h).

```
typedef struct SVC_CLASS_METRICS {
    CLASS                  serviceClass;     // The class of this service.
    U8                     pClassName[nameBufLength]; // Service class name.
    U32                    type;             // See svctypes.h.
    U8                     pTypeName[nameBufLength];  // Service type name.
    OS_PROG_HANDLE         progHandle;       // Service dll program handle.
    U32                    initServiceFlags;// As specified in
                                             //  msgSvcClassInitService.
    OBJECT                 resFile;          // Handle to service res file.
                                             //  Can be objNull if not
                                             //  full environment and
                                             //  service.res is empty.
    OBJECT                 serviceDir;       // Dir handle to service global
                                             //  directory.
    OBJECT                 privateServiceMgr;//Private service mgr, if the
                                             //  svcCreatePrivateServiceMgr
                                             //  flag is set.
    U32                    reserved1;
    U32                    reserved2;
    U32                    reserved3;
    U32                    reserved4;
    U32                    reserved5;
} SVC_CLASS_METRICS, *P_SVC_CLASS_METRICS;
```

Auxiliary Messages

See servmisc.h for less commonly used (but important!) service messages

```
#ifndef SERVMISC_INCLUDED
#include <servmisc.h>
#endif
```

Creation Messages

msgSvcClassInitService

Initializes the service class.

Takes P_SVC_INIT_SERVICE, returns STATUS. Category: class message.

```
#define msgSvcClassInitService                    MakeMsg(clsService, 56)
```

Comments — You must send this message to the service class immediately after it has been created.

initServiceFlags

Don't show this service in the installer. User can't configure or deinstall the service if this flag is set

```
#define svcNoShow                     ((U32) flag0)
```

Automatically pop up the global service option card the first time this service is installed.

```
#define svcPopupOptions               ((U32) flag1)
```

Don't copy in the state files from the INST directory when the service is installed.

```
#define svcNoLoadInstances            ((U32) flag2)
```

Create a private service manager for instances of this class. All instances of this class will automatically be added to the private service manager. See **SVC_CLASS_METRICS** for uid of the private service manager.

```
#define svcCreatePrivateServiceMgr  ((U32) flag3)
```

Generate a complete process environment in the DLLMain() process. Right now this means creating **theProcessResList**. Also, a service resource file handle will be created even if the service resource file is empty. Note that a complete process environment takes up significant memory. Only turn this on if you need it.

```
#define svcFullEnvironment            ((U32) flag4)
typedef struct SVC_INIT_SERVICE {
    BOOLEAN                 autoCreate;  // Create an instance for each state
                                         // node at install and warm boot times.
    U32                     serviceType; // Global service type. See
                                         // svctypes.h. Usually set to 0.
    U32                     initServiceFlags; // Or-in InitService flags.
    U8                      spare[12];
} SVC_INIT_SERVICE, *P_SVC_INIT_SERVICE;
```

msgNew

Creates a new service object.

Takes P_SVC_NEW, returns STATUS. Category: class message.

Comments — Callers send **msgNew** to create a new service instance. The instance will add itself to one or more service managers. Clients should access the service instance via the service manager API after **msgNew**.

Superclass behavior includes associating the service with it's node in the filesystem, adding it to the specified service managers, and attempting to bind to a target service. If style.**waitForTarget** is false and the target isn't found then **stsSvcTargetNotFound** is returned.

The following parameters are usually set by the caller of **msgNew**:

- pServiceName
- target

The following parameters are usually set by the subclass of **clsService** in **msgNewDefaults** (after the ancestor call):

- style (including **openClass**)
- pManagerList
- numManagers

If a subclass wants to change the **handleClass**, **fsNew**, or **fsNewExtra** parameters it must also execute the following in its **msgNewDefaults** method, after sending **msgNewDefaults** to ancestor:

```
pNew->svc.handleClass = myFSHandleClass;
ObjCallOK(msgNewDefaults, pNew->svc.handleClass, &(pNew->svc.fsNew), s);
```

Most services will not need to do this.

If a service with the same name as the new service already exists on any relevant service manager, the old service will be destroyed and the new service will replace it. However, if any of the old services veto the termination then the new service will not be created and an error status (**stsSvcAlreadyExists**) is returned.

Return Value

stsNoMatch Target not found and style.**waitForTarget** is false.

stsSvcAlreadyExists Service of this name already exists and can't be terminated.

stsBadParam Illegal target type.

style.connectStyle

```
#define svcAutoDetect    0  // Can auto-detect hardware connect/disconnect.
#define svcNoAutoDetect  1  // Can't do hardware auto-detect.
#define svcFollowTarget  2  // Connect state follows target's connect state.
typedef struct SVC_STYLE {
    U16 waitForTarget   : 1,    // OK if target doesn't exist; wait for it
                                //   to show up.
        exclusiveOpen   : 1,    // Allow only one open or QueryLock at a time.
        reserved1       : 1,    // Reserved.
        autoOwnTarget   : 1,    // Set this service to be the owner of its
                                //   target when it receives
                                //   msgSvcChangeOwnerRequested.
        autoOpen        : 1,    // Open/close our target when we are
                                //   opened/closed.
        autoMsgPass     : 1,    // Forward all messages that are not
                                //   clsObject, clsService or clsOption
                                //   messages to target.
        checkOwner      : 1,    // Only allow the owner to open us;
                                //   return stsNotOwner if opener is wrong.
        autoOption      : 1,    // Forward all option sheet messages to
                                //   target. If the target is exclusive open
                                //   and checkOwner, then only forward if
                                //   target is owned by this service instance.
        connectStyle    : 2,    // Connect detect abilities.
        reserved2       : 6;    // Reserved.
    CLASS openClass;            // Class used to create object returned from
                                //   msgSMOpen. Can be objNull to return the
                                //   service instance object itself.
    U16 spare1;
    U16 spare2;
} SVC_STYLE, *P_SVC_STYLE;
typedef struct SVC_NEW_ONLY {
    SVC_TARGET             target;         // Initial target. target.manager
                                           //   can be objNull for no target.
    P_STRING               pServiceName;   // Name of instance.
    SVC_STYLE              style;          // Overall style.
    CLASS                  handleClass;    // Class of service's node handle.
    FS_NEW                 fsNew;          // NewArgs for handle, filled in
                                           //   at msgNewDefault time.
    U32                    fsNewExtra[25]; // Extra fsNew space.
    P_UID                  pManagerList;   // List of service managers that
                                           //   self should be added to.
    U16                    numManagers;    // Number of uids in manager list.
    U32                    unused1;
    U32                    unused2;
    U32                    unused3;
    U32                    unused4;
} SVC_NEW_ONLY, *P_SVC_NEW_ONLY;
#define serviceNewFields    \
    streamNewFields         \
    SVC_NEW_ONLY           svc;
typedef struct SVC_NEW {
    serviceNewFields
} SVC_NEW, *P_SVC_NEW;
```

msgNewDefaults

Initializes the SVC_NEW structure to default values.

Takes P_SVC_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct SVC_NEW {
    serviceNewFields
} SVC_NEW, *P_SVC_NEW;
```

Comments

Sets

object.cap |= **objCapCall**; // Client must not override this in **msgNew**

svc.target.manager = **objNull;**

strcpy(**pNew**->svc.target.**pName**, "");

svc.**pServiceName** = **pNull**;

svc.style.**waitForTarget** = true;

svc.style.**exclusiveOpen** = false;

svc.style.**autoOwnTarget** = true;

svc.style.**autoOpen** = false;

svc.style.**autoMsgPass** = false;

svc.style.**checkOwner** = false;

svc.style.**autoOption** = false;

svc.style.**connectStyle** = **svcFollowTarget;**

svc.style.**openClass** = **objNull**;

svc.**handleClass** = **clsFileHandle**;

ObjCallOK(**msgNewDefaults**, **pNew**->svc.**handleClass**, &(svc.**fsNew**), s);

svc.**fsNew.fs.exist** = **fsExistOpen** | **fsNoExistCreate**;

svc.**pManagerList** = **pNull**;

svc.**numManagers** = 0;

State File Messages

msgSvcGetHandle

Returns a handle to the service's state node.

Takes P_OBJECT, returns STATUS.

```
#define msgSvcGetHandle                          MakeMsg(clsService, 12)
```

Comments

Every service instance has an open handle to its state node. Use this message when you want to update the contents of your state node.

NOTE: This handle must NOT be freed, closed, or changed.

msgSvcGetModified

Gets the modified state of this service.

Takes P_SVC_GET_SET_MODIFIED, returns STATUS.

```
#define msgSvcGetModified                        MakeMsg(clsService, 36)
```

Arguments

```
typedef struct SVC_GET_SET_MODIFIED {
    BOOLEAN                 modified;    // modified state
} SVC_GET_SET_MODIFIED, *P_SVC_GET_SET_MODIFIED;
```

msgSvcSetModified

Sets modified state of self.

Takes P_SVC_GET_SET_MODIFIED, returns STATUS.

```
#define msgSvcSetModified                        MakeMsg(clsService, 20)
```

Message Arguments

```
typedef struct SVC_GET_SET_MODIFIED {
    BOOLEAN                 modified;    // modified state
} SVC_GET_SET_MODIFIED, *P_SVC_GET_SET_MODIFIED;
```

Comments

Service subclasses must send this message with **pArgs**->modified set to true whenever they change their state file.

Propogates **msgIMModifiedChanged** to everyone who has bound to this service and is an observer of all service managers that this service is on.

See Also

msgIMModifiedChanged (instlmgr.h)

Target Messages

msgSvcOpenTarget

Attain access to the target service for data transfer.

Takes P_SVC_OPEN_CLOSE_TARGET, returns STATUS.

```
#define msgSvcOpenTarget                        MakeMsg(clsService, 13)
```

Arguments

```
typedef struct SVC_OPEN_CLOSE_TARGET {
    P_ARGS                  pArgs;      // Open or close parameters.
} SVC_OPEN_CLOSE_TARGET, *P_SVC_OPEN_CLOSE_TARGET;
```

Backwards compatibility

```
typedef SVC_OPEN_CLOSE_TARGET   SVC_OPEN_TARGET, *P_SVC_OPEN_TARGET;
```

Comments

This call should be made when the service is ready to actually transfer data to its target. It will cause **msgSMOpen** to be sent to the target's service manager. The target service instance can refuse the subsequent **msgSvcOpenRequested** request if it wants. The target service should be kept open for the minimum time possible.

This message is sent automatically if **newArgs.style.autoOpen** is true. Note that **pArgs** is set to **pNull** in this case.

Return Value

stsFailed target.type is not **svcTypeService.**

stsSvcNoTarget target.manager is null.

stsSvcNotBound service is still waiting to bind to its target.

stsSvcAlreadyOpen target is already open.

errors from **msgSMOpen**

target service-specific errors

See Also

msgSMOpen (servmgr.h)

msgSvcCloseTarget

Give up data transfer access to the target service.

Takes P_SVC_OPEN_CLOSE_TARGET, returns STATUS.

```
#define msgSvcCloseTarget                       MakeMsg(clsService, 14)
```

Message Arguments

```
typedef struct SVC_OPEN_CLOSE_TARGET {
    P_ARGS                  pArgs;      // Open or close parameters.
} SVC_OPEN_CLOSE_TARGET, *P_SVC_OPEN_CLOSE_TARGET;
```

Comments

This will cause **msgSMClose** to be sent to the target's service manager, resulting in **msgSVCCloseRequested** being sent to the target.

This message is sent automatically if **newArgs.style.autoOpen** is true. Note that **pArgs** is set to **pNull** in this case.

Return Value

stsFailed target.type is not **svcTypeService.**

See Also

msgSMClose (servmgr.h)

msgSvcGetTarget

Returns current target.

Takes P_SVC_GET_TARGET, returns STATUS.

```
#define msgSvcGetTarget                         MakeMsg(clsService, 15)
```

Arguments

```
typedef struct SVC_GET_TARGET {
    SVC_TARGET              target;        // Out: target
    OBJECT                  targetHandle; // Out: handle to target, if bound
    OBJECT                  targetService;// Out: target service, if open
} SVC_GET_TARGET, *P_SVC_GET_TARGET;
```

Comments

target contains the target that was specified at **msgNew** time or by the last **msgSvcSetTarget**.

targetHandle contains the service manager handle onto our target if we have bound with the target, or **objNull** if we haven't yet bound.

targetService is the actual service object if the target has been opened, **objNull** if it isn't open.

msgSvcSetTarget

Change our target.

Takes P_SVC_SET_TARGET, returns STATUS.

```
#define msgSvcSetTarget                         MakeMsg(clsService, 16)
```

Arguments

```
typedef struct SVC_SET_TARGET {
    SVC_TARGET              target;
} SVC_SET_TARGET, *P_SVC_SET_TARGET;
```

Comments

Closes the old target (if it is open), unbinds the old target (if it is bound) and attempts to bind with the new target. style.**waitForTarget** specifies whether we will wait for the target to show up if it does not exist.

Causes **msgSvcTargetChanged** to be sent.

Return Value

stsNoMatch new target doesn't exist and style.**waitForTarget** is false.

Connection Messages

msgSvcGetConnected

Gets the connected state of this service.

Takes P_SVC_GET_SET_CONNECTED, returns STATUS.

```
#define msgSvcGetConnected                      MakeMsg(clsService, 19)
```

Arguments

```
typedef struct SVC_GET_SET_CONNECTED {
    BOOLEAN                 connected;  // connect state
} SVC_GET_SET_CONNECTED, *P_SVC_GET_SET_CONNECTED;
```

msgSvcSetConnected

Sets connection state of self.

Takes P_SVC_GET_SET_CONNECTED, returns STATUS.

```
#define msgSvcSetConnected                      MakeMsg(clsService, 35)
```

Message Arguments

```
typedef struct SVC_GET_SET_CONNECTED {
    BOOLEAN                 connected;  // connect state
} SVC_GET_SET_CONNECTED, *P_SVC_GET_SET_CONNECTED;
```

Comments

This message should only be used by auto-detecting services that interface directly to hardware when they have determined that their connection state has changed.

Propogates **msgSMConnectedChanged** to everyone who has bound to this service and is an observer of all service managers that this service is on.

If a binding service's **connectStyle** is **svcFollowTarget**, then it's connected state will mirror that of its target. This is will be the case for most services, and is how the connect state propogates up the target links.

See Also

msgSMConnectedChanged (servmgr.h)

Client Access Messages

msgSvcBindRequested

Client asked to bind to this service.

Takes P_SVC_BIND, returns STATUS.

```
#define msgSvcBindRequested                    MakeMsg(clsService, 2)
```

Arguments

```
typedef struct SVC_BIND {
    OBJECT                  caller;     // Object making the request.
    OBJECT                  manager;    // Service manager the request is
                                        //   being made through.
} SVC_BIND, *P_SVC_BIND;
```

Comments

A client sent **msgSMBind** to a service manager. The service can refuse the request by returning **stsFailed**. The default superclass behavior is to return **stsOK**.

The service manager maintains a list of all the objects that have bound to this service instance. The caller is added to this list if this message returns **stsOK**. This list is available via **msgSvcGetBindList**.

Subclasses usually let ancestor handle this message. This message must always be passed to ancestor.

msgSvcUnbindRequested

Client asked to unbind from this service.

Takes P_SVC_BIND, returns STATUS.

```
#define msgSvcUnbindRequested                  MakeMsg(clsService, 3)
```

Message Arguments

```
typedef struct SVC_BIND {
    OBJECT                  caller;     // Object making the request.
    OBJECT                  manager;    // Service manager the request is
                                        //   being made through.
} SVC_BIND, *P_SVC_BIND;
```

Comments

A client sent **msgSMUnbind** to a service manager or a client who was bound to the service was destroyed.

The service cannot veto this request. The caller is removed from the service instance's bind list before this message is sent.

Subclasses usually let ancestor handle this message. This message must be passed to ancestor.

msgSvcOpenRequested

Client asked to open this service.

Takes P_SVC_OPEN_CLOSE, returns STATUS.

```
#define msgSvcOpenRequested                    MakeMsg(clsService, 4)
```

Arguments

```
typedef struct SVC_OPEN_CLOSE {
    OBJECT                  caller;      // Object making the request.
    OBJECT                  manager;     // Service manager the request is
                                         //   being made through.
    P_ARGS                  pArgs;       // Service-specific open or close
                                         //   parameters.
    OBJECT                  service;     // Out (msgSvcOpen): In (msgSvcClose):
                                         //   uid of open handle or service.
} SVC_OPEN_CLOSE, *P_SVC_OPEN_CLOSE;
```

Comments

A client sent **msgSMOpen** to a service manager. The service instance can refuse the open request by returning **stsFailed**.

The service manager maintains a list of all the objects that have opened this service instance. The caller is added to this list if this message returns **stsOK**. This list is available via **msgSvcGetOpenList**.

The service instance is marked in use when one or more clients have it open. A service that has instances that are in use cannot be deinstalled.

If the style.**exclusiveOpen** is true then only one client can have the service open at a time. If style.**checkOwner** is true then the owner of the service is the only one that can open the service. Errors are returned to the client if these conditions aren't true; see servmgr.h for details.

Subclasses usually do some processing, then pass this message to superclass. This message must be passed to ancestor.

msgSvcOpenDefaultsRequested

Client wants open **pArgs** initialized.

Takes P_SVC_OPEN_CLOSE, returns STATUS.

```
#define msgSvcOpenDefaultsRequested                    MakeMsg(clsService, 9)
```

Message Arguments

```
typedef struct SVC_OPEN_CLOSE {
    OBJECT                  caller;      // Object making the request.
    OBJECT                  manager;     // Service manager the request is
                                         //   being made through.
    P_ARGS                  pArgs;       // Service-specific open or close
                                         //   parameters.
    OBJECT                  service;     // Out (msgSvcOpen): In (msgSvcClose):
                                         //   uid of open handle or service.
} SVC_OPEN_CLOSE, *P_SVC_OPEN_CLOSE;
```

Comments

A client sent **msgSMOpenDefaults** to a service manager.

msgSvcCloseRequested

Client asked to close this service.

Takes P_SVC_OPEN_CLOSE, returns STATUS.

```
#define msgSvcCloseRequested                    MakeMsg(clsService, 5)
```

Message Arguments

```
typedef struct SVC_OPEN_CLOSE {
    OBJECT                  caller;     // Object making the request.
    OBJECT                  manager;    // Service manager the request is
                                        //   being made through.
    P_ARGS                  pArgs;      // Service-specific open or close
                                        //   parameters.
    OBJECT                  service;    // Out (msgSvcOpen): In (msgSvcClose):
                                        //   uid of open handle or service.
} SVC_OPEN_CLOSE, *P_SVC_OPEN_CLOSE;
```

Comments

A client has send **msgSMClosed** to a service manager or a client who had the service open was destroyed. The service cannot veto this request; it must perform any cleanup required at this time. The caller is removed from the open list before this message is sent.

Subclasses usually do some processing, then pass this message to superclass. This message must be passed to ancestor.

msgSvcQueryLockRequested

Client asked to QueryLock this service.

Takes **pNull**, returns STATUS.

```
#define msgSvcQueryLockRequested                MakeMsg(clsService, 6)
```

Comments

A client has sent **msgSMQueryLock** to a service manager. QueryLocking a service lets the client get access to the service without opening it. However, if style.**exclusiveOpen** is true then the QueryLock counts as an open as far as allowing only one open at a time.

Subclasses usually let ancestor handle this message. This message must be passed to ancestor.

msgSvcQueryUnlockRequested

Client asked to QueryUnlock this service.

Takes **pNull**, returns STATUS.

```
#define msgSvcQueryUnlockRequested              MakeMsg(clsService, 7)
```

Comments

A client has sent **msgSMQueryUnlock** to a service manager. This releases a previous QueryLock.

Subclasses usually let ancestor handle this message. This message must be passed to ancestor.

msgSvcCharactersticsRequested

Client asked to get characteristics of this service.

Takes P_SVC_CHARACTERISTICS, returns STATUS.

```
#define msgSvcCharacteristicsRequested          MakeMsg(clsService, 54)
```

Arguments

```
typedef struct SVC_CHARACTERISTICS {
    OBJECT              handle;   // Handle of item to get characteristics of.
    P_UNKNOWN           pBuf;     // Out through Ptr: Characterisitics buffer.
    U16                 len;      // In/Out: Buffer size. If 0 then the
                                  // actual size is returned.
} SVC_CHARACTERISTICS, *P_SVC_CHARACTERISTICS;
```

Comments

A client sent **msgSMGetCharacteristics** to a service manager. The service will return service-specific characteristics via **pArgs**->pBuf. **pArgs**->len specifies the maximum size of the client's buffer. If **pArgs**->len is 0 then the service should return the actual size of its characteristics in **pArgs**->len and not pass back any data.

Tags

```
#define tagServiceClassOptionSheet            MakeTag(clsService, 1)
#define tagServiceFirstTime                   MakeTag(clsService, 2)
// Next message up: 59
// Obsolete, here for backwards compatibility.
```

Function Prototype

```
STATUS EXPORTED InitService(
    P_STRING                pReserved1,  // Set this to pNull.
    CLASS                   serviceClass,// class id.
    BOOLEAN                 autoCreate,  // Create an instance for each state
                                         // node at install and warm boot times.
    U32                     serviceType, // Global service type. See
                                         // svctypes.h. Usually set to 0.
    U32                     initServiceFlags, // Or-in InitService flags.
    U32                     reserved2,   // Set this to 0
    U32                     reserved3);  // Set this to 0
```

SERVMGR.H

This file contains the API definition for **clsServiceMgr**.

clsServiceMgr inherits from **clsInstallMgr**.

Provides access to a category of PenPoint service instances.

Introduction

A service manager represents a category of services in PenPoint. Service managers have well-known ids so they can be globally accessed. PenPoint creates several service managers by default. They are:

theModems Modems.

thePrinters Printers.

thePrinterDevices Devices that a printer can talk to.

theSendableServices All services that interface to the Send Manager. See sendserv.h.

theTransportHandlers Transport level network protocol handlers.

theLinkHandlers Link level network protocol stacks.

theHWXEngines Installable handwriting engines.

theMILDevices All MIL services (device drivers).

theParallelDevices Parallel port devices.

theSerialDevices Serial port devices.

theHighSpeedPacketHandlers High performance packet drivers.

theOutboxServices All outbox services.

theInboxServices All inbox services.

theDatabases All PIA databases.

Additional service managers can be created on the fly by third parties or by GO.

All of the service instances in a given category are on that service manager. All the instances on a service manager support the same API, so they can be used interchangeably.

Each service instance on a service manager is identified with a unique string name. For example, there might be three printers on **thePrinters**: "MyLaserJet", "MarketingPrinter1", and "LittleDotMatrix".

You can find a particular service instance or enumerate all the instances that are available. You can observe a service manager and be informed when a new instance is added or an existing one goes away.

Once you know which service instance you want to use you must open it in order to gain access. This returns the uid of the service. You can then send messages directly to the service object. You must close the service instance after you are done using it.

Basic Service Manager Usage

The simplest use of a service manager is to access a known service instance on the manager. Here's an example:

```
SM_ACCESS       access;
SM_RELEASE      release;
access.pServiceName = "Service Instance Name";
access.caller = self;
ObjCallRet(msgSMAccess, aServiceManager, &access, s);
// access.service can now be sent messages.
...
// When you are done with the service, release it.
release.caller = self;
release.service = access.service;
release.handle = access.handle;
ObjCallRet(msgSMRelease, aServiceManager, &release, s);
```

Some service instances allow the client to specify **pArgs**. You must initialize the **pArgs** with **msgSMAccessDefaults** for these. For example:

```
access.pServiceName = "Service Instance Name";
access.caller = self;
access.pArgs = &args;
ObjCallRet(msgSMAccessDefaults, aServiceManager, &access, s);
args.foo = ...;
ObjCallRet(msgSMAccess, aServiceManager, &access, s);
```

Advanced Service Manager Usage

Accessing a service instance is actually composed of several steps. **msgSMAccess** and **msgSMRelease** performs all of them at once; more sophisticated users might find situations where they need to control the intermediary steps themselves.

Each service instance has a 32 bit "handle" associated with it in addition to its name. This handle is a convenient shorthand for referencing a service instance. Most service manager messages use handles. Note that a handle is not a permanent id; it is dynamically generated when a service instance is first added to a service manager, and regenerated whenever PenPoint is rebooted. Handles should never be filed.

Enumerating all of the service instances on a service manager is done by getting a list of all the handles and going through the list. For example, here's some code that gets all the names of all the service instances on a manager list:

```
OBJECT              list;
LIST_ENTRY          le;
IM_GET_SET_NAME     getName;
ObjectCall(msgIMGetList, aServiceManager, &list);
ObjectCall(msgListNumItems, list, &n);
for (le.position = 0; le.position < n; le.position++) {
    ObjectCall(msgListGetItem, list, &le);
    getName.handle = (OBJECT) le.item;
    getName.pName = pName;
    ObjectCall(msgIMGetName, aServiceManager, &getName);
    // le.item is the handle, pName contains the name.
}
ObjCallWarn(msgDestroy, list, pNull);
```

If you know the name of a service, you can get its handle with **msgIMFind**:

```
find.pName = "Service Instance Name";
ObjectCall(msgIMFind, aServiceManager, &find);
serviceInstanceHandle = find.handle;
```

The next step in accessing a service instance is binding. Binding tells a service instance that you are interested in it. After you have bound to a service you will get messages from that service telling you about changes in its state, such as when it becomes connected or disconnected.

```
bind.handle = serviceInstanceHandle;
bind.caller = self;
ObjectCall(msgSMBind, aServiceManager, &bind);
```

Next you become the owner of the service instance. Ownership gives you the right to open the instance. It is the mechanism used to ensure that only one client is using a exclusive access device (such as a serial port) at a time. Some services are non-exclusive access (such as network devices). Setting owner is a no-op for these.

The owner protocol informs the both the new and old owners that an ownership change is being proposed. Either of them can veto the change. The service instance can also veto the change.

The owner of a service can be set to **objNull** to signify no owner. You should do this when you want to give up ownership of a service instance.

Here is an example of requesting an owner change:

```
setOwner.owner = newOwner;
setOwner.handle = serviceInstanceHandle;
ObjectCall(msgSMSetOwner, aServiceManager, &setOwner);
```

Now you can open the service. An open request can optionally take **pArgs**. The format of the **pArgs** is service-specific. However, all the service instances on a particular service manager have the same **pArgs** format. The **pArgs** must be set to defaults with **msgSMOpenDefaults**.

A service that has open instances cannot be deinstalled. An open service instance cannot have its owner changed. Here is an example of opening a service instance:

```
open.caller = self;
open.handle = serviceInstanceHandle;
open.pArgs = &openArgs;
ObjectCall(msgSMOpenDefaults, aServiceManager, &open);
ObjectCall(msgSMOpen, aServiceManager, &open);
// open.service contains the service object at this point
```

Clients should close a service instance when they have completed using it:

```
close.caller = self;
close.handle = serviceInstanceHandle;
close.service = open.service;
close.pArgs = pNull;
ObjectCall(msgSMClose, aServiceManager, &close);
```

Clients should unbind from a service instance when they are no longer interested in it.

```
unBind.handle = serviceInstanceHandle;
unBind.caller = self;
ObjectCall(msgSMUnbind, aServiceManager, &unBind);
```

Additional Service Manager Functionality

Adding yourself as an observer of a service manager will cause all notification messages from the service manager and all the service instances on the service manager to go to you. These messages include:

msgIMInstalled A new service has been added to the service manager.

msgIMDeinstalled A service has been removed from the service manager.

msgIMInUseChanged A service has been opened or closed.

msgIMModifiedChanged A service has modified its state node.

msgSMConnectedChanged A service has become connected or disconnected.

msgSMOwnerChanged The owner of a service has changed.

Plus, any service instance can send service-specific notification messages via **msgSvcPropagateMsg** (see service.h). All observer messages include the handle of the service instance being affected and the uid of the service manager.

Sometimes a client needs to access a service object without becoming the owner, or need to override the open checks. This can be done, but it must be done with care. **msgSMQueryLock** and **msgSMQuery** can be used to do this.

QueryLocking a service returns the service uid without opening it. However, the call will fail if the service is exclusive-open and currently open. Also, a query lock will lock out other opens until the query lock is released. **msgSMQueryUnlock** must be sent to release the query lock.

msgSMQuery is just like **msgSMQueryLock**, except no open check is made.

Service managers automatically clean up if an object that owns or opens a service instance terminates before releaseing the service instance.

There is a well-known list object, **theServiceManagers**, that is a list of all the service managers in the system. You can observe this list and get notification when a service manager is added and removed.

Creating New Service Managers

As stated above, PenPoint defines several default service managers. You can create additional service managers if you desire.

PenPoint will automatically create a service manager if a service instance tries to add itself to a service manager and the service manager doesn't exist. This allows services to be arbitrarily installed and deinstalled without having to worry about who creates and frees the service manager.

```
#ifndef SERVMGR_INCLUDED
#define SERVMGR_INCLUDED
#ifndef SERVICE_INCLUDED
#include <service.h>
#endif
#ifndef INSTLMGR_INCLUDED
#include <instlmgr.h>
#endif
```

Core Messages

msgNew

Creates a new service manager.

Takes P_SM_NEW, returns STATUS. Category: class message.

Arguments

```
typedef struct SM_NEW_ONLY {
    BOOLEAN                 autoDestroy;   // Have the service manager be owned
                                           // by a system process, and have it
                                           // destroy itself when the number of
                                           // service instances on it goes to 0.
    BOOLEAN                 noChecks;      // Turn off error checking, client
                                           // tracking and binding; a service
                                           // on this list cannot be a target.
                                           // This improves performance but
                                           // is dangerous. Experts only!
    U32                     unused2;
    U32                     unused3;
    U32                     unused4;
} SM_NEW_ONLY, *P_SM_NEW_ONLY;
#define serviceManagerNewFields \
    installMgrNewFields         \
    SM_NEW_ONLY             sm;
typedef struct SM_NEW {
    serviceManagerNewFields
} SM_NEW, *P_SM_NEW;
```

Comments

Clients (other than those who are creating their own service managers) do not call this message. The well-known service managers are created by the system at cold-boot time.

msgNewDefaults

Initializes the SM_NEW structure to default values.

Takes P_SM_NEW, returns STATUS. Category: class message.

Message Arguments

```
typedef struct SM_NEW {
    serviceManagerNewFields
} SM_NEW, *P_SM_NEW;
```

Comments

Sets

installMgr.style.createInitial = false;

installMgr.style.copyOnInstall = false;

installMgr.style.addToGlobalList = false;

installMgr.style.createIcon = false;

sm.**autoDestroy** = false;

sm.**noChecks** = false;

msgDump

Prints out the services known by this service manager and their state.

Takes OBJ_KEY, returns STATUS.

Comments

clsServiceManager provides an elaborate response to **msgDump**. This is very useful for debugging services!

msgSMAccess

Accesses a service instance, given its name.

Takes P_SM_ACCESS, returns STATUS.

```
#define msgSMAccess                        MakeMsg(clsServiceMgr, 43)
```

Arguments

```
typedef struct SM_ACCESS {
    P_STRING          pServiceName; // Service name.
    OBJECT            caller;       // Object making this call,
                                    //  typically self.
    P_ARGS            pArgs;        // Use this if service requires pArgs.
                                    //  Send msgSMAccessDefaults first.
    OBJECT            handle;       // Out: Service handle.
    OBJECT            service;      // Out: Service instance.
} SM_ACCESS, *P_SM_ACCESS;
```

Comments

This is a convenience message that performs the sequence most clients do to access a service.

This message performs a find, bind, **setOwner**, and open for the specified service.

Note: This message cannot be used when you want to provide **pArgs** to a service.

Return Value

stsNoMatch Item not found.

stsSvcLocked Someone has this exclusive-open service query locked.

stsSvcNotOwner Someone else is the owner of this owner-checked service.

stsSvcAlreadyOpen Someone already has this exclusive-open service open.

Service-Specific Error Returns.

See Also

msgIMFind

msgSMAccessDefaults

Sets **pArgs** defaults for **msgSMAccess**.

Takes P_SM_ACCESS, returns STATUS.

```
#define msgSMAccessDefaults                MakeMsg(clsServiceMgr, 45)
```

Message Arguments

```
typedef struct SM_ACCESS {
    P_STRING          pServiceName; // Service name.
    OBJECT            caller;       // Object making this call,
                                    //  typically self.
    P_ARGS            pArgs;        // Use this if service requires pArgs.
                                    //  Send msgSMAccessDefaults first.
    OBJECT            handle;       // Out: Service handle.
    OBJECT            service;      // Out: Service instance.
} SM_ACCESS, *P_SM_ACCESS;
```

Comments

This message should be used if the service you wish to access takes **pArgs**. This message sets up the defaults for the **pArgs**.

Return Value

stsNoMatch Item not found.

See Also

msgSMAccess

msgSMRelease

Releases a service instance.

Takes P_SM_RELEASE, returns STATUS.

```
#define msgSMRelease                        MakeMsg(clsServiceMgr, 44)
```

Arguments

```
typedef struct SM_RELEASE {
    OBJECT              caller;         // Object making this call,
                                        //  typically self.
    OBJECT              handle;         // Service handle.
    OBJECT              service;        // Service instance.
} SM_RELEASE, *P_SM_RELEASE;
```

Comments

Call this message when you are finished using a service.

This is a convenience message that performs the sequence most clients do when they are finished with a service.

This message performs a close, sets the owner to **objNull**, and unbinds.

Return Value

stsFailed Service is not open by the caller.

Service-Specific Error Returns.

See Also

msgSMClose

msgSMBind

Binds to a service.

Takes P_SM_BIND, returns STATUS.

```
#define msgSMBind                              MakeMsg(clsServiceMgr, 1)
```

Arguments

```
typedef struct SM_BIND {
    IM_HANDLE           handle;       // Service handle to bind to.
    OBJECT              caller;       // Object making this call.
} SM_BIND, *P_SM_BIND;
```

Comments

The caller is made an observer of this service. Service manager notification messages will be sent to the caller.

The caller is added to the bind list of the service instance.

Sends **msgSvcBindRequested** to the service being bound to. The service has the right to refuse the bind. The service-specific error return that indicates a refusal is passed back to the client.

Return Value

stsBadObject Caller is not an object.

stsBadAncestor Caller has invalid ancestor.

Service-Specific Error Returns.

See Also

msgSvcBindRequested (service.h) (service.h)

msgSMUnbind

Unbinds from a service.

Takes P_SM_BIND, returns STATUS.

```
#define msgSMUnbind                            MakeMsg(clsServiceMgr, 2)
```

Message Arguments

```
typedef struct SM_BIND {
    IM_HANDLE           handle;     // Service handle to bind to.
    OBJECT              caller;     // Object making this call.
} SM_BIND, *P_SM_BIND;
```

Comments

This removes the caller as an observer of the handle and removes the caller from the service instance's bind list.

Note: Clients *must* first close a service before unbinding from it.

The service manager will automatically send **msgSMUnbind** for all services that are bound to a client when that client object is freed. This means that you must not send **msgSMUnbind** from your **msgFree** routine; the object freed notification occurs before your **msgFree** routine is entered.

Sends **msgSvcUnbindRequested** to the service being unbound from.

Return Value

stsFailed Service is not bound by the caller.

msgSMGetOwner

Gets the current owner of a service.

Takes P_SM_GET_OWNER, returns STATUS.

```
#define msgSMGetOwner                           MakeMsg(clsServiceMgr, 31)
```

Arguments

```
typedef struct SM_GET_OWNER {
    IM_HANDLE           handle;     // Handle of item to get owner on.
    OBJECT              owner;      // Out: current owner.
} SM_GET_OWNER, *P_SM_GET_OWNER;
```

msgSMSetOwner

Sets a new service owner.

Takes P_SM_SET_OWNER, returns STATUS.

```
#define msgSMSetOwner                           MakeMsg(clsServiceMgr, 11)
```

Arguments

```
typedef struct SM_SET_OWNER {
    IM_HANDLE           handle;     // Handle of item to set owner on.
    OBJECT              owner;      // New owner.
} SM_SET_OWNER, *P_SM_SET_OWNER;
```

Comments

Old and new owners (whether they are clients or other services) will recieve service messages which allow them to veto the ownership change and informs them that the change has taken effect. The message sequence is as follows:

1. **msgSvcOwnerAquireRequested** is sent to the new owner. The new owner can veto the owner change by returning a status of anything other than **stsOK** or **stsNotUnderstood. msgSMSetOwner** returns with the abort status.
2. **msgSvcOwnerReleaseRequested** is sent to the old owner. The old owner can veto the owner change by returning a status of anything other than **stsOK** or **stsNotUnderstood**. If the old owner agrees to the ownership change it must immediately close the service if it is open.
3. **msgSvcChangeOwnerRequested** is sent to the service. This informs the service that ownership is going to be changed and allows it to veto. By default the services will veto the change if they are open.
4. **msgSvcOwnerReleased** is sent to the old owner.
5. **msgSvcOwnerAquired** is sent to the new owner.
6. **msgSMOwnerChanged** is sent to everyone who is bound to the service or observing a service manager that the service is on.

Return Value

stsBadObject New owner is not an object.

stsBadAncestor New owner has invalid ancestor.

stsSvcInUse Service is open.

See Also

service.h, for definition of **msgSvc...** messages.

msgSMOpen

Opens a service, given its handle.

Takes P_SM_OPEN_CLOSE, returns STATUS.

```
#define msgSMOpen                              MakeMsg(clsServiceMgr, 4)
```

Arguments

```
typedef struct SM_OPEN_CLOSE {
    IM_HANDLE          handle;      // Handle of service to open.
    OBJECT             caller;      // Object making this call.
    P_ARGS             pArgs;       // Service-specific open parameters.
    OBJECT             service;     // In: (SMClose) Out: (SMOpen) Service
                                    //   object.
} SM_OPEN_CLOSE, *P_SM_OPEN_CLOSE;
```

Comments

Clients should do this only when they are ready to transfer data to the service, and should leave the service open for as little time as possible.

A bind is automatically performed if the client is not yet bound.

The caller is added to the open list of the service instance.

Sends **msgSvcOpenRequested** to the service being opened. The service has the right to refuse the open. The service-specific error return that indicates a refusal is passed back to the client.

Return Value

stsBadObject Caller is not an object.

stsBadAncestor Caller has invalid ancestor.

stsSvcNotBound Caller is not bound to the service.

stsSvcLocked Someone has this exclusive-open service query locked.

stsSvcNotOwner Someone else is the owner of this owner-checked service.

stsSvcAlreadyOpen Someone already has this exclusive-open service open.

Service-Specific Error Returns

See Also

msgSMBind (service.h) (service.h)(service.h)

msgSMOpenDefaults

Initializes SMOpen **pArgs** to default value.

Takes P_SM_OPEN_CLOSE, returns STATUS.

```
#define msgSMOpenDefaults                      MakeMsg(clsServiceMgr, 34)
```

Message Arguments

```
typedef struct SM_OPEN_CLOSE {
    IM_HANDLE          handle;      // Handle of service to open.
    OBJECT             caller;      // Object making this call.
    P_ARGS             pArgs;       // Service-specific open parameters.
    OBJECT             service;     // In: (SMClose) Out: (SMOpen) Service
                                    //   object.
} SM_OPEN_CLOSE, *P_SM_OPEN_CLOSE;
```

See Also

msgSMOpen (service.h)

msgSMClose

Close an open service.

Takes P_SM_OPEN_CLOSE, returns STATUS.

```
#define msgSMClose                                  MakeMsg(clsServiceMgr, 5)
```

Message Arguments

```
typedef struct SM_OPEN_CLOSE {
    IM_HANDLE           handle;     // Handle of service to open.
    OBJECT              caller;     // Object making this call.
    P_ARGS              pArgs;      // Service-specific open parameters.
    OBJECT              service;    // In: (SMClose) Out: (SMOpen) Service
                                    //   object.
} SM_OPEN_CLOSE, *P_SM_OPEN_CLOSE;
```

Comments

The caller is removed from the open list of the service instance.

Clients should send **msgSMClose** as soon as they are finished actively transfering data. Clients *must* first close a service before unbinding from it.

The service manager will automatically send **msgSMClose** for all services that are held open by a client when that client object is freed. This means that you must not send **msgSMClose** from your **msgFree** routine; the object freed notification occurs before your **msgFree** routine is entered.

Sends **msgSvcCloseRequested** to the service being opened.

Return Value

stsFailed Service instance is not open by the caller.

msgSMQueryLock

Gets the uid of a service and locks out any opens.

Takes P_SM_QUERY_LOCK, returns STATUS.

```
#define msgSMQueryLock                          MakeMsg(clsServiceMgr, 8)
```

Arguments

```
typedef struct SM_QUERY_LOCK {
    IM_HANDLE           handle;     // Handle of service instance to query.
    OBJECT              service;    // Out: Service object.
} SM_QUERY_LOCK, *P_SM_QUERY_LOCK;
```

Comments

This message is similar to **msgSMOpen**, in that it returns a service object, given a handle. However, it is not seen as an open by the service.

This message is meant for non-data transfer access to a service, for example, generating a service's option card.

The sender of this message does *not* have to be the owner of the service.

This message will fail if the service instance is exclusive open and currently in use (open). If this message succeeds then all opens will fail until **msgSMQueryUnlock** is sent.

This message will return the real uid of the service instance in the case of a multi-user service.

Return Value

stsSvcLocked Service instance is already query locked.

stsSvcInUse Service instance is open.

msgSMQueryUnlock

Unlocks a service that was locked via **msgSMQueryLock**.

Takes P_SM_QUERY_UNLOCK, returns STATUS.

```
#define msgSMQueryUnlock                    MakeMsg(clsServiceMgr, 9)
```

Arguments

```
typedef struct SM_QUERY_UNLOCK {
    IM_HANDLE           handle;     // Handle of service instance to unlock.
} SM_QUERY_UNLOCK, *P_SM_QUERY_UNLOCK;
```

msgSMQuery

Gets the uid of a service.

Takes P_SM_QUERY_LOCK, returns STATUS.

```
#define msgSMQuery                          MakeMsg(clsServiceMgr, 33)
```

Message Arguments

```
typedef struct SM_QUERY_LOCK {
    IM_HANDLE           handle;     // Handle of service instance to query.
    OBJECT              service;    // Out: Service object.
} SM_QUERY_LOCK, *P_SM_QUERY_LOCK;
```

Comments

This message gets the uid of a service instance. It must be used very carefully. It bypasses all checking mechanisms, so the caller can get into trouble if he subsequently sends messages to the service that are not expected. Use **msgSMQueryLock** instead of **msgSMQuery** if at all possible.

msgSMGetCharacteristics

Gets the characteristics of the specified service instance.

Takes P_SM_GET_CHARACTERISTICS, returns STATUS.

```
#define msgSMGetCharacteristics             MakeMsg(clsServiceMgr, 42)
```

Arguments

```
typedef struct SM_GET_CHARACTERISTICS {
    IM_HANDLE           handle;   // Handle of item to get characteristics of.
    P_UNKNOWN           pBuf;     // Out through Ptr: Characterisitics buffer.
    U16                 len;      // In/Out: Buffer size. If 0 then the
                                  // actual size is returned.
} SM_GET_CHARACTERISTICS, *P_SM_GET_CHARACTERISTICS;
```

Comments

Characterstics are service-specific properties of a particular service. For example, modem services might pass back whether Fax is supported, maximum baud rate, etc. All the services on a particular service manager return the same characterstics set.

Callers should first send this message with **pArgs**->len set to 0. This will return the size of the actual characterisitics buffer. Callers should then allocate this space and make the call again with **pArgs**->len set to this size. **pArgs**->len can be less than the actual size, in which case only the number of bytes specified by **pArgs**->len is returned.

msgSMSave

Saves a service instance to a specified external location.

Takes P_SM_SAVE, returns STATUS.

```
#define msgSMSave                           MakeMsg(clsServiceMgr, 36)
```

Arguments

```
typedef struct SM_SAVE {
    IM_HANDLE           handle;     // Handle of service instance to save.
    BOOLEAN             reserved;   // Reserved.
    FS_FLAT_LOCATOR     flat;       // Location to save to.
} SM_SAVE, *P_SM_SAVE;
```

Comments

The **pArgs** specify the parent directory that the service instance will save itself into. Note that the service instance's current target is also saved. When the service instance is reloaded it will try and bind to this target.

See Also

msgSvcClassLoadInstance load a service instance from arbitrarylocation on disk (service.h).

Auxiliary Messages

msgSMFindHandle

Finds a handle, given a service instance uid.

Takes **P_SM_FIND_HANDLE**, returns **STATUS**.

```
#define msgSMFindHandle                     MakeMsg(clsServiceMgr, 10)
```

Arguments

```
typedef struct SM_FIND_HANDLE {
    OBJECT              service;    // Service object to look for.
    IM_HANDLE           handle;     // Out: resulting handle.
} SM_FIND_HANDLE, *P_SM_FIND_HANDLE;
```

Comments

This message allows you to find the handle of a service if you know its uid.

Return Value

stsNoMatch Service not found on this service manager list.

msgSMSetOwnerNoVeto

Sets a new service owner without giving owners veto power.

Takes **P_SM_SET_OWNER**, returns **STATUS**.

```
#define msgSMSetOwnerNoVeto                 MakeMsg(clsServiceMgr, 30)
```

Message Arguments

```
typedef struct SM_SET_OWNER {
    IM_HANDLE           handle;     // Handle of item to set owner on.
    OBJECT              owner;      // New owner.
} SM_SET_OWNER, *P_SM_SET_OWNER;
```

Comments

This message is the same as **msgSMSetOwner**, except the old owner and new owners do not get the chance to veto. **msgSvcReleaseRequest** and **msgSvcAquireRequest** are not sent. This message does the following:

1. The open status of the service is checked. If it is open (in use) the SetOwner fails, with a return status of **stsSvcInUse**.
2. msgSvcChangeOwnerRequested is sent to the service. This informs the service that ownership is going to be changed and allows it to veto the owner change by returning anything other than **stsOK** or **stsNotUnderstood**. **msgSMSetOwner** returns with the abort status.
3. msgSMOwnerChanged is sent to everyone who is bound to the service or observing a service manager that the service is on.
4. msgSvcOwnerReleased is sent to the old owner.
5. msgSvcOwnerAquired is sent to the new owner.

Return Value

stsSvcInUse Service is open.

msgSMGetState

Gets the state of a service.

Takes P_SM_GET_STATE, returns STATUS.

```
#define msgSMGetState                          MakeMsg(clsServiceMgr, 12)
```

Arguments

```
typedef struct SM_GET_STATE {
    IM_HANDLE           handle;     // In:  Handle of service to get state on.
    BOOLEAN             connected;  // Out: Is service connected?
    OBJECT              owner;      // Out: My owner, if any.
    OBJECT              owned;      // Out: The service that I own, if any.
    U8                  reserved[24];
} SM_GET_STATE, *P_SM_GET_STATE;
```

Comments

This message provides service state. There is some additional state (in use, modified) that is gotten via **msgIMGetState**. See instlmgr.h for details.

msgSMGetClassMetrics

Gets the service's class metrics.

Takes P_SM_GET_CLASS_METRICS, returns STATUS.

```
#define msgSMGetClassMetrics                   MakeMsg(clsServiceMgr, 13)
```

Arguments

```
typedef struct SM_GET_CLASS_METRICS {
    IM_HANDLE           handle;     // Handle of item to get class metrics on.
    SVC_CLASS_METRICS   metrics;
} SM_GET_CLASS_METRICS, *P_SM_GET_CLASS_METRICS;
```

Comments

This message passes back information about the service class. See service.h for a definition of SVC_CLASS_METRICS.

msgIMDeinstall

Remove and free a service instance.

Takes P_IM_DEINSTALL, returns STATUS.

Comments

This will remove the specified service instance from all the service managers that it is on, destroy its state file, and free it.

Note that a service is initially created by sending **msgNew** to the service class. Services automatically add themselves to service manager. Do not use **msgIMInstall** for this purpose; **msgIMInstall** should NEVER be used by clients.

Causes observer message **msgIMDeinstalled** to be propogated to all objects that are bound to the service instance and to the service managers.

This message causes **msgSvcDeinstallRequested** to be sent to the service instance. The instance can veto the deinstall at this point; if it does then the return value from **msgIMDeinstall** is the status that the service instance used to veto the deinstall.

See Also

msgSvcDeinstallRequested

Notification Messages

msgSMConnectedChanged

A service's connection state changed.

Takes P_SM_CONNECTED_NOTIFY, returns STATUS. Category: observer notification.

```
#define msgSMConnectedChanged               MakeMsg(clsServiceMgr, 20)
```

Arguments

```
typedef struct SM_CONNECTED_NOTIFY {
    OBJECT              manager;    // manager that sent notification
    IM_HANDLE           handle;     // handle to service
    BOOLEAN             connected;  // new connect state
} SM_CONNECTED_NOTIFY, *P_SM_CONNECTED_NOTIFY;
```

msgSMOwnerChanged

A service's owner has changed.

Takes P_SM_OWNER_NOTIFY, returns STATUS. Category: observer notification.

```
#define msgSMOwnerChanged                   MakeMsg(clsServiceMgr, 21)
```

Arguments

```
typedef struct SM_OWNER_NOTIFY {
    OBJECT              manager;    // manager that sent notification
    IM_HANDLE           handle;     // handle to service
    OBJECT              oldOwner;   // old owner
    OBJECT              owner;      // new owner
} SM_OWNER_NOTIFY, *P_SM_OWNER_NOTIFY;
```

SERVMISC.H

This file contains additional API definitions for **clsService**.

clsService inherits from **clsStream.**

Provides default behavior for services.

This header file defines auxiliary **clsService** messages that are not used by the majority of service clients.

```
#ifndef SERVMISC_INCLUDED
#define SERVMISC_INCLUDED
```

Owner Messages

msgSvcGetMyOwner

Gets the current owner of this service, if any.

Takes P_OBJECT, returns STATUS.

```
#define msgSvcGetMyOwner                        MakeMsg(clsService, 21)
```

Comments Passes back **objNull** if there is no current owner.

msgSvcGetOwned

Passes back the item that this service owns.

Takes P_OBJECT, returns STATUS.

```
#define msgSvcGetOwned                          MakeMsg(clsService, 31)
```

Comments This message is only valid for **autoOwnTarget** services (style.**autoOwnTarget** is true).

If this service has become the owner of its target then this message passes back the item that it owns; otherwise it returns **objNull.**

msgSvcOwnerReleaseRequested

Is it OK to remove you as the owner of a service?

Takes P_SVC_OWNED_NOTIFY, returns STATUS.

```
#define msgSvcOwnerReleaseRequested             MakeMsg(clsService, 38)
```

Arguments
```
typedef struct SVC_OWNED_NOTIFY {
    OBJECT              ownedService; // The service or MIL conflict
                                      //   group which will have its
                                      //   owner changed.
    OBJECT              oldOwner;     // The old owner.
    OBJECT              newOwner;     // The proposed new owner.
    U8                  reserved[16];
} SVC_OWNED_NOTIFY, *P_SVC_OWNED_NOTIFY;
```

Comments A client sent **msgSMSetOwner** to a service manager for a service you currently own. See servmgr.h/msgSMSetOwner for details on the entire owner change message protocol.

You can veto the ownership change by returning anything other than **stsOK** or **stsNotUnderstood**.

The service must not be in use for the owner change to occur. If you have the service open and want to give up ownership, you should close the service when you receive this message.

This message must be passed to ancestor.

msgSvcOwnerAcquireRequested

Is it OK to make you the new owner of a service?

Takes P_SVC_OWNED_NOTIFY, returns STATUS.

```
#define msgSvcOwnerAcquireRequested          MakeMsg(clsService, 39)
```

Message Arguments

```
typedef struct SVC_OWNED_NOTIFY {
    OBJECT                  ownedService; // The service or MIL conflict
                                          //   group which will have its
                                          //   owner changed.
    OBJECT                  oldOwner;     // The old owner.
    OBJECT                  newOwner;     // The proposed new owner.
    U8                      reserved[16];
} SVC_OWNED_NOTIFY, *P_SVC_OWNED_NOTIFY;
```

Comments

A client sent **msgSMSetOwner** to a service manager, proposing that you be the new owner of a service. See servmgr.h/msgSMSetOwner for details on the entire owner change message protocol.

You can veto the ownership change by returning anything other than **stsOK** or **stsNotUnderstood**.

This message must be passed to ancestor.

msgSvcOwnerAcquired

You are now the new owner of a service.

Takes P_SVC_OWNED_NOTIFY, returns STATUS.

```
#define msgSvcOwnerAcquired                 MakeMsg(clsService, 29)
```

Message Arguments

```
typedef struct SVC_OWNED_NOTIFY {
    OBJECT                  ownedService; // The service or MIL conflict
                                          //   group which will have its
                                          //   owner changed.
    OBJECT                  oldOwner;     // The old owner.
    OBJECT                  newOwner;     // The proposed new owner.
    U8                      reserved[16];
} SVC_OWNED_NOTIFY, *P_SVC_OWNED_NOTIFY;
```

Comments

A client sent **msgSMSetOwner** to a service manager and requested that you become the new owner of the service. This message signifies that you are the new owner of the service. See servmgr.h/msgSMSetOwner for details on the entire owner change message protocol.

Any saved state that you have for the owned service should be restored (typically via **msgSvcSetMetrics**).

This message must be passed to ancestor.

msgSvcOwnerReleased

You are no longer the owner of a service.

Takes P_SVC_OWNED_NOTIFY, returns STATUS.

```
#define msgSvcOwnerReleased                 MakeMsg(clsService, 30)
```

Message Arguments

```
typedef struct SVC_OWNED_NOTIFY {
    OBJECT                  ownedService; // The service or MIL conflict
                                          //   group which will have its
                                          //   owner changed.
    OBJECT                  oldOwner;     // The old owner.
    OBJECT                  newOwner;     // The proposed new owner.
    U8                      reserved[16];
} SVC_OWNED_NOTIFY, *P_SVC_OWNED_NOTIFY;
```

Comments

A client sent **msgSMSetOwner** to a service manager for a service you currently own. This message signifies that you are no longer the owner of the service. See servmgr.h/msgSMSetOwner for details on the entire owner change The ownership change actually happens when you return from this message.

Any state for the owned state that you are interested in preserving should be gotten (typically via **msgSvcGetMetrics**) and saved in your state file. You can manipulate the service as its owner until you return from this message.

This message must be passed to ancestor.

msgSvcChangeOwnerRequested

Owner change request message.

Takes P_SVC_OWNED_NOTIFY, returns STATUS.

```
#define msgSvcChangeOwnerRequested          MakeMsg(clsService, 40)
```

Message Arguments

```
typedef struct SVC_OWNED_NOTIFY {
    OBJECT                  ownedService; // The service or MIL conflict
                                          //   group which will have its
                                          //   owner changed.
    OBJECT                  oldOwner;     // The old owner.
    OBJECT                  newOwner;     // The proposed new owner.
    U8                      reserved[16];
} SVC_OWNED_NOTIFY, *P_SVC_OWNED_NOTIFY;
```

Comments

This message is sent to the service instance whose owner is being changed. The service instance can veto the ownership change by returning anything other than **stsOK** or **stsNotUnderstood**.

This message must be passed to ancestor if the service does not want to veto the owner change.

Save Messages

msgSvcSaveRequested

Client asked to save this instance to external media.

Takes P_FS_FLAT_LOCATOR, returns STATUS.

```
#define msgSvcSaveRequested                 MakeMsg(clsService, 34)
```

Comments

A client sent **msgSMSave** to a service manager.

Default superclass behavior is to save the state file and the current target only. Subclasses should ensure that their state file is up to date if they wish to make use of this behavior. Alternatively, subclasses can not pass this message to ancestor and perform whatever form of save they wish.

The **pArgs** references the parent directory in which this service instance should be saved. If a node with the same name as the service instance already exists within this directory, default superclass behavior is to overwrite the destination. Subclasses can perform other forms of behavior if the destination exists before passing this message to ancestor.

This message does not have to be passed to ancestor.

msgSvcClassLoadInstance

Loads an instance state file from disk and creates a new instance.

Takes P_SVC_LOAD_INSTANCE, returns STATUS. Category: class message.

```
#define msgSvcClassLoadInstance                    MakeMsg(clsService, 47)
```

Arguments

```
typedef struct SVC_LOAD_INSTANCE {
    FS_LOCATOR              source;     // Source state file location.
} SVC_LOAD_INSTANCE, *P_SVC_LOAD_INSTANCE;
```

Comments

This function copies the state node specified by **pArgs**->source into the INST directory of the service and starts up an instance of the service on this state file. This is very similar to what happens when a warm-boot occurs, or when state nodes are automatically loaded when a service is first installed.

If a service instance with the same name already exists, default behavior is to generate a unique name for the new service instance.

Subclasses do not normally process this message, but can if they wish to change the exist behavior.

Return Value

stsFSNodeNotFound source file not found.

See Also

msgSMSave

Class Metrics Messages

msgSvcGetClassMetrics

Gets metrics for the service class that controls this instance.

Takes P_SVC_CLASS_METRICS, returns STATUS.

```
#define msgSvcGetClassMetrics                      MakeMsg(clsService, 23)
```

Comments

Note: This message can also be sent directly to the service class.

Instance Metrics Messages

msgSvcGetMetrics

Passes back the current configuration metrics.

Takes P_SVC_GET_SET_METRICS, returns STATUS.

```
#define msgSvcGetMetrics                           MakeMsg(clsService, 32)
```

Arguments

```
typedef struct SVC_GET_SET_METRICS {
    P_UNKNOWN               pMetrics;   // Out through Ptr: Metrics buffer.
    U16                     len;        // In/Out: Metrics buffer size in
                                        //   bytes. If 0 then the actual
                                        //   size is returned.
} SVC_GET_SET_METRICS, *P_SVC_GET_SET_METRICS;
```

Comments

Configuration metrics are service specific. This interface allows the caller to find out how large the metrics set for a given service are.

The caller should first send **msgSvcGetMetrics** with **pArgs**->len set to 0 to get the actual size of the metrics buffer. The caller should allocate a buffer of this size then send the message again.

Subclasses that have configuration metrics must handle this message.

msgSvcSetMetrics

Sets the configuration metrics.

Takes P_SVC_GET_SET_METRICS, returns STATUS.

```
#define msgSvcSetMetrics                        MakeMsg(clsService, 33)
```

Message Arguments

```
typedef struct SVC_GET_SET_METRICS {
    P_UNKNOWN               pMetrics;    // Out through Ptr: Metrics buffer.
    U16                     len;         // In/Out: Metrics buffer size in
                                         //   bytes. If 0 then the actual
                                         //   size is returned.
} SVC_GET_SET_METRICS, *P_SVC_GET_SET_METRICS;
```

Comments

Configuration metrics are service specific. The caller should set **pArgs**->len to the size that was returned from **msgSvcGetMetrics** when the metrics were originally gotten. A caller should never try and synthesize a metrics buffer; he should only pass back a buffer that was gottem from **msgSvcGetMetrics**.

Subclasses can determine the version of a configuration buffer from its size. Subclasses should make sure that different versions of configuration information have different sizes.

Subclasses must update their state node when they handle this message.

Subclasses that have configuration metrics must handle this message.

Service Manager Messages

msgSvcAddToManager

Add this service instance to a service manager.

Takes P_SVC_ADD_TO_MANAGER, returns STATUS.

```
#define msgSvcAddToManager                      MakeMsg(clsService, 17)
```

Arguments

```
typedef struct SVC_ADD_TO_MANAGER {
    OBJECT                  manager;
} SVC_ADD_TO_MANAGER, *P_SVC_ADD_TO_MANAGER;
```

Comments

This message allows a service to add itself to additional service managers after **msgNew** time.

This results in **msgIMInstalled** being sent to observers of the service manager.

msgSvcRemoveFromManager

Removes this service instance from a service manager.

Takes P_SVC_REMOVE_FROM_MANAGER, returns STATUS.

```
#define msgSvcRemoveFromManager                 MakeMsg(clsService, 18)
```

Arguments

```
typedef struct SVC_REMOVE_FROM_MANAGER {
    OBJECT                  manager;        // Manager to remove self from
} SVC_REMOVE_FROM_MANAGER, *P_SVC_REMOVE_FROM_MANAGER;
```

Comments

This message allows a service to remove itself from a service manager it is currently on.

This results in **msgIMDeinstalled** being sent to observers of the service manager and any objects which have bound to this service. It cleans up this service's bind list, removing anyone who bound via the specified service manager.

Note: service managers automatically remove a service when the service class is deinstalled. There is no need to do so explicitly.

Return Value

stsNoMatch Service instance is not on the specified service manager.

Client List Messages

msgSvcGetBindList

Gets a list of all the callers that have bound to this service.

Takes P_SVC_GET_LIST, returns STATUS.

```
#define msgSvcGetBindList                        MakeMsg(clsService, 26)
```

Arguments

```
typedef struct SVC_GET_LIST {
    P_OBJECT                pList;   // Out: list, allocated from process heap.
                                     //  CLIENT MUST OSHeapBlockFree WHEN
                                     //  FINISHED!
    U16                     count;   // Out: number of elements in list
} SVC_GET_LIST, *P_SVC_GET_LIST;
```

msgSvcGetOpenList

Gets a list of all the callers that have opened this service.

Takes P_SVC_GET_LIST, returns STATUS.

```
#define msgSvcGetOpenList                        MakeMsg(clsService, 27)
```

Message Arguments

```
typedef struct SVC_GET_LIST {
    P_OBJECT                pList;   // Out: list, allocated from process heap.
                                     //  CLIENT MUST OSHeapBlockFree WHEN
                                     //  FINISHED!
    U16                     count;   // Out: number of elements in list
} SVC_GET_LIST, *P_SVC_GET_LIST;
```

See Also msgSvcGetOpenObjectList

msgSvcGetOpenObjectList

Gets a list of the open objects which were returned for each open.

Takes P_SVC_GET_LIST, returns STATUS.

```
#define msgSvcGetOpenObjectList                  MakeMsg(clsService, 49)
```

Message Arguments

```
typedef struct SVC_GET_LIST {
    P_OBJECT                pList;   // Out: list, allocated from process heap.
                                     //  CLIENT MUST OSHeapBlockFree WHEN
                                     //  FINISHED!
    U16                     count;   // Out: number of elements in list
} SVC_GET_LIST, *P_SVC_GET_LIST;
```

Comments This list is ordered the same as the open list. The caller in openlist[i] was given the object in **openObjectList**[i].

See Also msgSvcGetOpenList

msgSvcGetManagerList

Gets a list of all the service managers that this service is on.

Takes P_SVC_GET_LIST, returns STATUS.

```
#define msgSvcGetManagerList                     MakeMsg(clsService, 28)
```

Message Arguments

```
typedef struct SVC_GET_LIST {
    P_OBJECT                pList;  // Out: list, allocated from process heap.
                                    //  CLIENT MUST OSHeapBlockFree WHEN
                                    //  FINISHED!
    U16                     count;  // Out: number of elements in list
} SVC_GET_LIST, *P_SVC_GET_LIST;
```

See Also **msgSvcGetManagerHandleList**

msgSvcGetManagerHandleList

Gets a list of the svc mgr handles that this service is represented by.

Takes P_SVC_GET_LIST, returns STATUS.

```
#define msgSvcGetManagerHandleList              MakeMsg(clsService, 50)
```

Message Arguments

```
typedef struct SVC_GET_LIST {
    P_OBJECT                pList;  // Out: list, allocated from process heap.
                                    //  CLIENT MUST OSHeapBlockFree WHEN
                                    //  FINISHED!
    U16                     count;  // Out: number of elements in list
} SVC_GET_LIST, *P_SVC_GET_LIST;
```

Comments This list is ordered the same as the manager list. The handle in **handleList**[i] is this service's handle in **serviceManagerList**[i].

See Also **msgSvcGetManagerList**

msgSvcGetDependentAppList

Gets a list of **theInstalledApps** handles for all dependent apps.

Takes P_SVC_GET_LIST, returns STATUS.

```
#define msgSvcGetDependentAppList               MakeMsg(clsService, 51)
```

Message Arguments

```
typedef struct SVC_GET_LIST {
    P_OBJECT                pList;  // Out: list, allocated from process heap.
                                    //  CLIENT MUST OSHeapBlockFree WHEN
                                    //  FINISHED!
    U16                     count;  // Out: number of elements in list
} SVC_GET_LIST, *P_SVC_GET_LIST;
```

msgSvcGetDependentServiceList

Gets a list of **theInstalledServices** handles for all dependent services.

Takes P_SVC_GET_LIST, returns STATUS.

```
#define msgSvcGetDependentServiceList           MakeMsg(clsService, 52)
```

Message Arguments

```
typedef struct SVC_GET_LIST {
    P_OBJECT                pList;  // Out: list, allocated from process heap.
                                    //  CLIENT MUST OSHeapBlockFree WHEN
                                    //  FINISHED!
    U16                     count;  // Out: number of elements in list
} SVC_GET_LIST, *P_SVC_GET_LIST;
```

Deinstallation/Destruction Messages

msgSvcClassTerminateOK

Deinstalls the entire service.

Takes P_OBJECT, returns STATUS. Category: class message.

```
#define msgSvcClassTerminateOK                    MakeMsg(clsService, 43)
```

Comments

Deinstallation is a two-phase process. The first phase allows any of the services or apps being deinstalled to cancel the entire deinstall. **msgSvcClassTerminateOK** is the veto phase. Returning anything other than **stsOK** signifies a veto. If anyone vetos the deinstall then **msgSvcClassTerminateVetoed** is sent to all services that were sent **msgSvcClassTerminateOK**. If nobody vetos the deinstall then **msgSvcClassTerminate** is sent.

The **pArgs** to **msgSvcClassTerminateOK** is used to pass back the object which is responsible for the veto.

Default superclass behavior is to send **msgSvcDeinstallRequested** to each instance of the service, and veto the deinstallation if any service instance vetos the deinstallation. The uid of the instance that vetoed the deinstall is passed back via the **pArgs**.

This approach allows multiple services and applications that are dependent on each other to be deinstalled in a coherent fashion.

Subclasses can override this message if they wish.

See Also

msgSvcDeinstall

msgSvcClassTerminateVetoed

Deinstall process was vetoed.

Takes P_SVC_TERMINATE_VETOED, returns STATUS. Category: class message.

```
#define msgSvcClassTerminateVetoed                MakeMsg(clsService, 45)
```

Arguments

```
typedef struct SVC_TERMINATE_VETOED {
    OBJECT                  vetoer; // Object that vetoed the deinstall.
    STATUS                  status; // Veto status.
} SVC_TERMINATE_VETOED, *P_SVC_TERMINATE_VETOED;
```

Comments

This message informs the service that the deinstallation sequence that started with **msgSvcClassTerminateOK** has been vetoed by one of the services or applications that was part of the deinstall.

pArgs->vetoer gives the uid of the object or class which vetoed the deinstall. **pArgs**->status gives the return status of the veto.

Default superclass behavior is to send **msgSvcDeinstallVetoed** to each instance of the service.

Subclasses can override this message if they wish.

See Also

msgSvcDeinstallVetoed

msgSvcClassTerminate

Terminate the service.

Takes **pNull**, returns STATUS. Category: class message.

```
#define msgSvcClassTerminate                MakeMsg(clsService, 24)
```

Comments Unconditionally terminate the service. All applications and services that are to be deinstalled have agreed to the deinstallation.

Default superclass behavior is to send **msgDestroy** to each instance of the service.

Subclasses must pass this message to ancestor.

See Also **msgDestroy**

msgSvcClientDestroyedEarly

An active client was destroyed.

Takes OBJECT, returns STATUS.

```
#define msgSvcClientDestroyedEarly          MakeMsg(clsService, 48)
```

Comments This message is sent to the service instance when a caller or service owner terminates unexpectedly. The **pArgs** is the uid of the caller or owner.

Superclass behavior is to clean up the service instance by sending **msgSMUnbind**, **msgSMClose** and **msgSMSetOwner** to self as appropriate.

Services that keep their own per-client information will need to process this message in order to clean up their state.

This message must be passed to ancestor.

msgSvcDeinstallRequested

Client asked to destroy this service instance.

Takes **pNull**, returns STATUS.

```
#define msgSvcDeinstallRequested            MakeMsg(clsService, 8)
```

Comments A client has sent **msgSMDeinstall** to a service manager (to get rid of just this service instance), or the entire service class is being deinstalled.

Deinstallation is a two phase process. All service instances that are going to be deinstalled are sent **msgSvcDeinstallRequested**. Each service has the chance to veto the deinstall by returning an error status. If all parties agree to the deinstall then **msgFree** is sent to each service instance. **msgFree** cannot be vetoed. It causes the service to be removed from all service managers.

If anybody vetos the deinstall then **msgSvcDeinstallVetoed** is sent to each service that is part of the deinstall process. Services should not accept any new clients while a deinstall is in process. **msgSvcDeinstallVetoed** indicates that new clients can once again be accepted.

Default superclass behavior is to veto the deinstall if the service is in use (open). The superclass will also handle new client rejection while a deinstall is in process if it gets this message.

This message must be passed to ancestor.

Note: A service might get **msgSvcDeinstallRequested** more than once for a given deinstallation sequence.

msgSvcDeinstallVetoed

Deinstallation process was vetoed.

Takes P_SVC_DEINSTALL_VETOED, returns STATUS.

```
#define msgSvcDeinstallVetoed               MakeMsg(clsService, 47)
```

Arguments

```
typedef struct SVC_DEINSTALL_VETOED {
    OBJECT                  vetoer; // Object that vetoed the deinstall.
    STATUS                  status; // Veto status.
} SVC_DEINSTALL_VETOED, *P_SVC_DEINSTALL_VETOED;
```

Comments

One of the objects or classes in the deinstall process decided to veto the deinstall.

Services can once again accept new clients.

This message must be passed to ancestor.

msgDestroy

Frees a service instance.

Takes OBJ_KEY, returns STATUS.

Comments

Subclasses should destroy all dynamic resources. Warning: Do not destroy any **clsService** resources, such as the state node handle!

WARNING: Clients must NEVER send **msgDestroy** directly to a service instance; instead they should send **msgIMDeinstall** to a service manager which the service instance is on.

Note that service manager message **msgSMRemoveReference** allows a service instance to be removed from a single service manager without removing it from other service managers, or destroying the instance. See servmgr.h for details on **msgIMDeinstall** and **msgSMRemoveReference**.

Miscellenous Messages

msgSvcGetStyle

Returns current style settings.

Takes P_SVC_STYLE, returns STATUS.

```
#define msgSvcGetStyle                          MakeMsg(clsService, 10)
```

msgSvcSetStyle

Changes style settings.

Takes P_SVC_STYLE, returns STATUS.

```
#define msgSvcSetStyle                          MakeMsg(clsService, 11)
```

msgSvcGetFunctions

Passes back a pointer to a table of function entry points.

Takes P_SVC_GET_FUNCTIONS, returns STATUS.

```
#define msgSvcGetFunctions                      MakeMsg(clsService, 1)
```

Arguments

```
typedef struct SVC_GET_FUNCTIONS {
    P_UNKNOWN               pFunctions;     // Out: Pointer to function table.
    U32                     info;           // Out: service-specific info.
} SVC_GET_FUNCTIONS, *P_SVC_GET_FUNCTIONS;
```

Comments

This is for services that cannot afford the overhead of being accessed via object calls. The format of this pointer block is up to the subclass. Default superclass behavior is to set **pFunctions** to **pNull**, which means this service doesn't provide a table.

Subclasses should handle this message if they wish to provide a function interface to their service.

Default superclass behavior is to set **pArgs**->pFunctions to **pNull** and **pArgs**->info to 0.

msgSvcGetName

Gets the name of this service instance.

Takes P_SVC_GET_NAME, returns STATUS.

```
#define msgSvcGetName                          MakeMsg(clsService, 22)
```

Arguments

```
typedef struct SVC_GET_NAME {
    P_STRING              pName;       // Out: caller must allocate
                                       //   nameBufLength buffer here
} SVC_GET_NAME, *P_SVC_GET_NAME;
```

msgSvcNameChanged

The service's name has been changed.

Takes **pNull**, returns STATUS.

```
#define msgSvcNameChanged                      MakeMsg(clsService, 55)
```

Comments

This message is self-sent to the service instance when its name is changed. This occurs when **msgIMSetName** is sent to a service manager that this service is on.

The service is already set to the new name when this message is recieved. **msgSvcGetName** can be used to get the new name.

This message is informational only. It does not have to be passed to ancestor.

msgSvcPropagateMsg

Propagates a service-specific message.

Takes P_SVC_PROPAGATE_MSG, returns STATUS.

```
#define msgSvcPropagateMsg                     MakeMsg(clsService, 25)
 typedef struct SVC_PROPAGATE_MSG {
    P_ARGS             pArgs;
    SIZEOF             pArgsSize;
    MESSAGE            msg;
 } SVC_PROPAGATE_MSG, *P_SVC_PROPAGATE_MSG;
```

Comments

This message allows services to send their own informational messages to everyone who is bound to the service and everyone who is an observer of any service manager that this service is on. This is similar to what the system does with messages like **msgSMConnectedChanged**.

The first two arguments of the **pArgs** of your notification message must be:

OBJECT manager; // manager that sent notification_HANDLE handle; // handle to service

msgSvcPropagateNotify will fill these in with the correct service manager and handle for all of the observers. For example:

```
typedef struct FOO_NOTIFY {
OBJECT                 manager;     // svc manager that sent notification.
OBJECT                 handle;      // handle to service.
FOO                    newFoo;      // new foo.
FOO                    oldFoo;      // old foo.
} FOO_NOTIFY, *P_FOO_NOTIFY;
FOO_NOTIFY             fooNotify; SVC_PROPAGATE_MSG  propagate;
propagate.pArgs = fooNotify; propagate.pArgsSize = SizeOf(fooNotify); propagate.msg = msgFoo;
ObjCallRet(msgSvcPropagateMsg, self, &propagate, s);
```

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msgSvcAutoDetectingHardware

Is the hardware that this service ultimately talks to auto-detecting?

Takes P_BOOLEAN, returns STATUS.

```
#define msgSvcAutoDetectingHardware          MakeMsg(clsService, 37)
```

Comments

This message is propogated to this service's target, then the target's target, etc. until it finds the service which actually interfaces to hardware (has no target). The hardware interface service is then asked if it can autodetect connect/disconnect.

Return Value

stsSvcValidConnectStyleNotFound target chain ended without reaching hardware service instance.

msgSvcClassPopUpOptionSheet

Creates an option sheet for the service's global options and pops it up.

Takes **pNull**, returns STATUS. Category: class message.

```
#define msgSvcClassPopUpOptionSheet          MakeMsg(clsService, 57)
```

Comments

The option sheet is only displayed if this is the first time the service is installed.

Subclasses do not normally process this message.

msgSvcClassGetInstallDir

Creates a directory handle on the service's installation directory.

Takes P_OBJECT, returns STATUS.

```
#define msgSvcClassGetInstallDir             MakeMsg(clsService, 58)
```

Comments

The service class creates a **clsDirHandle** object which references the location on external media that the service was installed from. If the external volume is not connected, the user is asked to attach it.

If this service was bundled with PenPoint then there is no valid external volume beyond installation time. **stsFailed** is returned in this case.

NOTE: CALLER IS RESPONSIBLE FOR DESTROYING THE DIR HANDLE WHEN DONE.

Return Value

stsOK The external volume is attached. The user tapped the Cancel button when promptedto attach the external volume. The external volume cannot be determined becausethis application was bundled with PenPoint.

Descendants: You normally do not handle this message.

Notification Messages

msgSvcTargetChanged

A service's target has changed.

Takes P_SVC_TARGET_CHANGE_NOTIFY, returns STATUS. Category: observer notification.

```
#define msgSvcTargetChanged                MakeMsg(clsService, 53)
```

Arguments

```
typedef struct SVC_TARGET_CHANGE_NOTIFY {
    OBJECT              manager;    // svc manager that sent notification.
    OBJECT              handle;     // handle to service.
    SVC_TARGET          oldTarget;  // old target.
    SVC_TARGET          newTarget;  // new target.
} SVC_TARGET_CHANGE_NOTIFY, *P_SVC_TARGET_CHANGE_NOTIFY;
```

Comments

This message is broadcast to all service managers that this service is on.

SVCTYPES.H

This file contains the type tags for services. These tags are used to provide categories of service classes. This allows UIs like the printer manager UI to decide what types are available.

```
#ifndef SVCTYPES_INCLUDED
#define SVCTYPES_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#define svcTypePrinter                      MakeTag(clsService, 1)
#define svcTypeEMail                        MakeTag(clsService, 2)
```

Part 14 / Miscellaneous

BATTERY.H

This file contains the API definition for **clsMILPowerDevice**.

clsMILPowerDevice inherits from **clsService.**

theBattery is a well-known instance of **clsMILPowerDevice. theBattery** provides access to the primary battery of the computer.

theBatteries is a well-known instance of **clsServiceManager. theBatteries** is the service manager that manages the instances of **clsMILPowerDevice** that represent the computer's batteries (including **theBattery**).

clsMILPowerDevice provides an object interface to the computer's power devices (i.e. batteries).

```
#ifndef BATTERY_INCLUDED
#define BATTERY_INCLUDED
#ifndef MILSERV_INCLUDED
#include <milserv.h>
#endif
```

Types and Constants

```
// battery flags
#define milRawVoltsSupported            flag0
#define milPercentLeftSupported         flag1
#define milSecondsLeftSupported         flag2
#define milSetLevelSupported            flag3
```

Messages

msgBatteryGetMetrics

Passes back the battery's metrics.

Takes P_BATTERY_METRICS, returns STATUS.

```
#define msgBatteryGetMetrics                MakeMsg(clsMILPowerDevice, 1)
```

Arguments

```
typedef struct BATTERY_METRICS {
    U16 batteryFlags;                   // flags defined above
    U16 maxMillivolts;
    U16 warnMillivolts;
    U16 failMillivolts;
    U16 currentMillivolts;
    U16 percentOfBatteryLeft;
    U16 maxSeconds;
    U16 secondsOfBatteryLeft;
} BATTERY_METRICS, * P_BATTERY_METRICS;
```

msgBatterySetLevel

Sets the percentage of battery remaining.

Takes U16, returns STATUS.

```
#define msgBatterySetLevel              MakeMsg(clsMILPowerDevice, 2)
```

Comments The MIL request **milPowerSetBatteryLevel** is sent to the MIL device unit represented by the receiver.

msgBatteryLow

Sent when a battery level is dangerously low.

Takes void, returns STATUS. Category: observer notification.

```
#define msgBatteryLow                 MakeMsg(clsMILPowerDevice, 128)
```

msgBatteryCritical

Sent when a battery drops level below the shutdown level.

Takes void, returns STATUS. Category: observer notification.

```
#define msgBatteryCritical            MakeMsg(clsMILPowerDevice, 129)
```

DYNARRAY.H

This file contains the API definition for dynarray. Dynarrays provide a set of dynamic array routines.

The functions described in this file are contained in XLIST.LIB.

Implements a dynamic array of elements. Standard interface routines for indexing, inserting, deleting, and other common operations are provided. This interface is primarily used internally to GO, and is therefore tailored to meet internal needs.

A dynamic array is a simple data structure that contains some array information fields, and a pointer to a block of memory. This block of memory is equal to **pArray**->entries * **pArray**->elementSize.

The number of entries is specified at initialization time in DynArrayNew, and can be changed via DynArrayContract, or DynArrayExpand. These are implicitly called from DynArrayInsert and DynArrayDelete when inserting an item into a list that does not have enough entries available, or when deleting an item from the list. At any time, the value returned by DynArrayCount, or **pArray**->entries, will be equal to the number of entries allocated in the array in **pArray**->pData. The size of the array in **pArray**->pData will be equal to **pArray**->entries * **pArray**->elementSize.

The maximum index set in the array at any given time, independent of the number of entries in the array, is referred to as **maxCount**. This is equal to the greatest array index number set via DynArraySet or inserted via DynArrayInsert. It is also updated in DynArrayGetPtr, even if the user is getting the pointer to a cleared data pointer that has not been set or inserted. DynArrayGetPtr is also used during binary searches, and hence that function will modify **maxCount** if the binary search expands to empty elements in the list. This is necessary because client functions can modify the contents of the element via DynArrayGetPtr, because they have direct access to the data. Typical users of dynamic arrays will not call DynArrayGetPtr in such a manner as to modify **maxCount**.

In summary, entries is the amount of space allocated by the array, and **maxCount** is the number of elements set or inserted into the array.

When memory is allocated for entries in the array, via DynArrayInsert, DynArrayNew, or DynArrayExpand, it is initialized to 0.

```
#ifndef DYNARRAY_INCLUDED
#define DYNARRAY_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef OSHEAP_INCLUDED
#include <osheap.h>
#endif
```

Common #defines and typedefs

Dynamic Array

This data structure is the dynamic array data structure. A dynamic array created and manipulated is simply a pointer to this data structure that is passed to the dynarray functions. Accessing the fields in this data structure is possible, but care should be taken as changing their values could have drastic side affects. This data structure is sometimes referred to as the array header.

```
typedef struct DYNARRAY {
    OS_HEAP_ID heap;     // heap used for allocations
    U16 entries;         // total # entries in the array
    U16 elemSize;        // size in bytes of individual elements
    P_U8 pData;          // pointer to the array of values
    U16 maxCount;        // Max index accessed in the array via
                         // DynArraySet, DynArrayGetPtr, DynArrayBinSearch
                         // Updated when inserting, deleting, or contracting
                         // array.
} DYNARRAY, *P_DYNARRAY;
```

Public Functions

DynArrayNew

Allocates a new dynamic array. Passes back the **P_DYNARRAY** header.

Returns **STATUS**.

Function Prototype

```
STATUS DynArrayNew(
    OS_HEAP_ID heap,        // In: heap for memory allocation
                            // NULL=>osProcessHeapId
    U16 elementSize,        // In: size in bytes of each array element
    U16 startSize,          // In: initial array size in number of elements
    U16 extraHeader,        // In: additional bytes to allocate in the header
    P_DYNARRAY *ppArray);   // Out: pointer to the header pointer
```

Comments

Allocates memory for the array header, the **P_DYNARRAY** that is passed to the dynarray functions. Allocates memory for the initial elements in the array. Parameters include: the allocation heap to perform memory allocations, the size of an individual element, the initial size of the array (**pArray**->elements will the same as this value when this function returns), and any extra space to be allocated in the **P_DYNARRAY** pointer. This space can be used by clients to store list-wide information or flags. Passes back a pointer to the array data structure, **P_DYNARRAY**.

DynArrayFree

Destroys the dynamic array and frees memory used by the array.

Returns **STATUS**.

Function Prototype

```
STATUS DynArrayFree(
    P_DYNARRAY pArray); // In: array header. Will be freed.
```

Comments

Will free all memory allocated by the array to store the header information and the elements. Does not do anything with the entries in the array.

DynArrayExpand

Expands the array by the specified number of entries.

Returns STATUS.

Function Prototype
```
STATUS DynArrayExpand(
    P_DYNARRAY pArray,  // In: array header
    U16 add);           // In: Number of elements to add
```

Comments

Expands the array by a number of entries, updating **pArray**->entries, the returned value of calling DynArrayCount, and the reallocation of **pArray**->pData to be equal to **pArray**->entries * **pArray**->elementSize. This function is called when calling DynArrayInsert to add space for one more entry. It is also called in DynArraySet if the index is greater than the number of entries.

See Also

DynArraySet

DynArrayContract

Contracts the array by the number of entries.

Returns STATUS.

Function Prototype
```
STATUS DynArrayContract(
    P_DYNARRAY pArray,  // In: array header
    U16 truncate);      // In: Number of elements to free
```

Comments

Will contract the number of entries in the array, and free the memory associated with those entries. Will resize the amount of memory allocated by the array **pArray**->pData to be **pArray**->entries * **pArray**->elementSize. If the **maxCount** (return code of DynArrayCount) is greater than the new number of entries allocated, **maxCount** will be adjusted. Called from DynArrayDelete to contract the array when deleting items.

See Also

DynArrayDelete

DynArrayGet

Passes back the index'th element in the array.

Returns STATUS.

Function Prototype
```
STATUS DynArrayGet(
    P_DYNARRAY pArray,  // In: array header
    U16 index,          // In: element index
    P_UNKNOWN pData);   // Out: pointer to data buffer. Must be elementSize.
```

Comments

Will pass back the contents of the index'th element in the array. Will copy the memory of size **elementSize** containing the data for the element into **pData**. It is the clients responsibility to ensure that this data pointer is large enough.

DynArraySet

Sets the index'th item to the given value. Update **maxCount**.

Returns STATUS.

Function Prototype
```
STATUS DynArraySet(
    P_DYNARRAY pArray,  // In: array header
    U16 index,          // In: element index
    P_UNKNOWN pData);   // In: pointer to data or NULL for zero fill
```

Comments

Sets the contents of the index'th item to the given value. Will copy the contents of the **pData** pointer to the memory for the index'th element in the array. It is the clients responsibility to ensure that **pData** is correct. If index is greater than **maxCount**, it will update **maxCount**. If the index is greater than the number of entries, the array is expanded via DynArrayExpand to be large enough. Called from DynArrayInsert to set the value of the new index.

See Also

DynArrayInsert

DynArrayGetPtr

Passes back a pointer to the index'th element in the array.

Returns STATUS.

Function Prototype

```
STATUS DynArrayGetPtr(
    P_DYNARRAY pArray,  // In: array header
    U16 index,          // In: element index
    PP_UNKNOWN pData);  // Out: pointer to data buffer
```

Comments

Will pass back the direct pointer to the index'th element in the dynamic array. Care should be taken when accessing this pointer, as it is memory that is allocated and managed by the array. Accessing the data in this manner WILL cause the **maxCount** to be increased if **maxCount** < index. This function is called during a binary search via DynArrayBinSearch. Hence that function could modify **maxCount**.

See Also

DynArrayBinSearch

DynArrayInsert

Inserts a new element in the array.

Returns STATUS.

Function Prototype

```
STATUS DynArrayInsert(
    P_DYNARRAY pArray,  // array header
    U16 index,          // element index
    P_UNKNOWN pData     // new data to insert or NULL
);
```

Comments

The new element is indexed by index. If the array is not big enough, will expand the array appropriately. Elements are copied from the index'th location to the next location.

See Also

DynArrayExpand

DynArrayDelete

Deletes the index'th element from the array.

Returns STATUS.

Function Prototype

```
STATUS DynArrayDelete(
    P_DYNARRAY pArray,  // array header
    U16 index           // element index to delete
);
```

Comments

Will delete the index'th element from the array. If index is > entries, will return **stsOK** and do nothing. Will move all elements greater than the index down by one in the array. Will adjust **maxCount** if necessary. Will call DynArrayContract with parameter of one.

DynArrayCount

Passes back the number of entries allocated in the array.

Returns STATUS.

Function Prototype
```
STATUS DynArrayCount(
    P_DYNARRAY pArray,  // In: array header
    P_U16 pCount);      // Out: pointer to the count
```

Comments: Passes back the number of entries allocated in the array. This number is the amount of space allocated, and not the number of items stored in the array. That value is returned by DynArrayMax.

DynArrayMax

Passes back the highest index stored.

Returns STATUS.

Function Prototype
```
STATUS DynArrayMax(
    P_DYNARRAY pArray,  // In: array header
    P_U16 pMax);        // Out: pointer to the max index
```

Comments: Will return the highest index stored via DynArraySet or DynArrayGetPtr, plus one. This is the "maxCount" field, and is used to indicate the highest array entry that has a valid value.

DynArrayElemSize

Passes back the size, in bytes, of each element.

Returns STATUS.

Function Prototype
```
STATUS DynArrayElemSize(
    P_DYNARRAY pArray,  // In: array header
    P_U16 pSize);           // Out: pointer to the size
```

Comments: Passes back the size allocate in the array for each element. The **pArray**->pData size will be the value passed back by this function * the value passed back by DynArrayCount.

DynArrayBinSearch

Performs a binary search on the array.

Returns STATUS.

```
typedef S16 FunctionPtr(P_BIN_PROC)(P_UNKNOWN, P_UNKNOWN);
```

Arguments
```
typedef struct DYNARRAY_SEARCH {
    P_UNKNOWN pData;    // In: Pointer to search data.
    U16 start;          // In: start index, Out: first occurrence
    U16 stop;           // In: end index, Out: last occurrence
    P_BIN_PROC pCompare;// In: routine to perform comparisons
    S16 result;         // Out: 0 if equal, -1 less, 1 greater
}DYNARRAY_SEARCH, *P_DYNARRAY_SEARCH;
```

Function Prototype
```
STATUS DynArrayBinSearch(
    P_DYNARRAY pArray,          // In: array header
    P_DYNARRAY_SEARCH pSearch); // In: search data
```

Comments: Performs a binary search on the array. Assumes that the array is "sorted" from lowest value to highest value. Will access the value of data in the array via DynArrayGetPtr. Hence care should be taken when using the data in the comparison callback routine.

Return Value	
stsNoMatch	No matching data could be found within the range.

See Also DynArrayGetPtr

P_BIN_PROC is the comparison routine callback. Will be called to test items. Called parameters containing pointers to an element in the array, and a pointer to a test 'element' to check for comparison. Returns 0 for equal, -1 for less, 1 for greater.

DYNARRAY_SEARCH is the parameter into the DynArrayBinSearch function. Takes the search data pointer to locate, a starting index into the array to search, a stopping index into the array to search, and a comparison callback function to test the data pointer against elements in the array. If result is 0, passes back the starting and ending indices that match. If result is -1, the target data pointer was less than both the starting and ending indices searched. Similarly, if result is 1, the target data pointer was greater than both indices.

GOSEARCH.H

This file contains the API definition for GO's modified binary search. The function described in this file is contained in MISC.LIB.

The fundamental difference between this binary search and the search that is part of the standard runtime is that if the search fails, this search indicates where a searched for element should have been located, thereby aiding insertion of a new element.

```
#ifndef GOSEARCH_INCLUDED
#define GOSEARCH_INCLUDED $Revision:   1.6  $
                                                      #ifndef GO_INCLUDED
#include <go.h>
                                                      #endif
```

Function Prototype

```
typedef P_UNKNOWN (CDECL *ACCESS_FUNC)(
                        const P_UNKNOWN,        // context
                        const U32);             // index
```

Function Prototype

```
typedef int       (CDECL *COMPARE_FUNC)(
                        const P_UNKNOWN,        // context
                        const P_UNKNOWN,        // key1
                        const P_UNKNOWN);       // key2
```

binarySearch

Performs a binary search for specified key within **dataStructure**.

Returns STATUS.

Function Prototype

```
STATUS EXPORTED binarySearch(
    const P_UNKNOWN key,
    const P_UNKNOWN dataStructure,
    const U32       count,
    COMPARE_FUNC    compare,
    ACCESS_FUNC     access,
    const U16       itemSize,
    PP_UNKNOWN      pFoundOrInsert,
    P_U32           pIndex);
```

Comments

binarySearch performs a binary search on a sorted, indexed data structure.

The caller provides an count of the number of items in the data structure, an access function that translates an item index into an address for the item key, and a comparison function to compare a pair of keys.

A detailed description of the parameters follows.

key key to search for.

dataStructure handle of data structure to search.

count number of items in data structure.

compare pointer to comparison function (see below).

access pointer to access function (see below). If Nil, **dataStructure** is assumed to be the address of a sorted, contiguous array of items (**itemSize** bytes long) with the item key at the start of each item.

itemSize size of item in bytes (only used if access is Nil).

pFoundOrInsert pointer to key (see below).

pIndex pointer to index (see below).

The access function is provided with the client provided **dataStructure** and a (zero origin) index. It is responsible for returning the key for the indexed item. This key must be comprehensible to the comparison function, but is otherwise uninterpreted by the search.

The comparison function is responsible for actually comparing two keys, and returning values as follows.

```
<  0:   when key1 < key2,
== 0:   when key1 == key2,
>  0:   when key1 > key2.
```

key1 is always the key originally passed to **binarySearch** as a parameter. key2 is always a key generated from **dataStructure** by the access function.

When **binarySearch** returns, *pFoundOrInsert contains either:

```
the first occurrence of the desired key, if it was found; or
NULL, if the key was not found but was greater than the keys
    of all the items in dataStructure; or
the first key larger than the desired key.
```

In addition, when **binarySearch** returns, *pIndex contains either count, if *pFoundOrInsert == NULL, or the index used to access the key returned via *pFoundOrInsert.

The return value is:

stsOK if desired key located, or

stsNoMatch if desired key not located

PDICT.H

This file contains the Personal Dictionary Class API. This class contains methods that maintain an ordered ASCII list of words and can produce a compressed list (called the template), which is specially organized for use with handwriting translation software.

clsPDict inherits from **clsObject**.

thePersonalDictionary is a well known instance of **clsPDict**.

The word list maintained by **thePersonalDictionary** is used by default whenever spelling-assisted handwriting translation is performed.

See Also spell.h

```
#ifndef PDICT_INCLUDED
#define PDICT_INCLUDED
#ifndef FS_INCLUDED
#include <uuid.h>
#include <fs.h>
#endif
#ifndef INSTLMGR_INCLUDED
#include <instlmgr.h>
#endif
```

Common typedefs

Personal Dictionary Metrics

This structure is used in conjunction with **msgPDictGetMetrics** to get two very important parameters of a personal dictionary: the number of words in it and a pointer to the compressed template. The word count is useful for a variety of things, but the compressed template is valuable because it can be used directly in the **pTemplate** field of a translator object (see xlate.h)

```
typedef struct PDICT_METRICS {
    U16         wordCount;  // number of words in the personal dictionary (RO)
    P_UNKNOWN   pXTemplate; // pointer to compressed template
} PDICT_METRICS, * P_PDICT_METRICS;
```

Personal Dictionary New Structs

```
typedef struct PDICT_NEW_ONLY {
    IM_HANDLE           handle;     // if objNull then use current pdict.
    U32 spare;
} PDICT_NEW_ONLY, * P_PDICT_NEW_ONLY;
typedef struct PDICT_NEW {
    OBJECT_NEW_ONLY     object;
    PDICT_NEW_ONLY      pdict;
} PDICT_NEW, * P_PDICT_NEW;
```

Miscellaneous

This structure is used for converting a word index into a word and vice versa. (That is, for example, to get word #5 from the PDict or to find out which word number in the PDict "PenPoint" is.)

```
typedef struct PDICT_NUM_WORD {
    U16         number;
    P_CHAR      pWord;
} PDICT_NUM_WORD, * P_PDICT_NUM_WORD;
```

Messages

msgPDictGetMetrics

Gets a copy of the personal dictionary metrics structure.

Takes P_PDICT_METRICS, returns STATUS.

```
#define msgPDictGetMetrics                      MakeMsg(clsPDict,1)
```

Message Arguments

```
typedef struct PDICT_METRICS {
    U16         wordCount;  // number of words in the personal dictionary (RO)
    P_UNKNOWN   pXTemplate; // pointer to compressed template
} PDICT_METRICS, * P_PDICT_METRICS;
```

This is mainly useful to find out how many words are in thedictionary.

msgPDictEnumerateWords

Fills a list of pointers to strings with pointers to all the words in the personal dictionary.

Takes PP_CHAR, returns STATUS.

```
#define msgPDictEnumerateWords              MakeMsg(clsPDict,2)
```

The **pArgs** must be the address of the base of an array of pointers tofilled in. This array must have an entry for every word in thedictionary plus one for the final null (get the metrics toout how many words are in the PDict. The words will be in ASCIIsequence, and because the pointers all point to an internalstructure, no memory is allocated. N.B. you must treat thisas strictly read-only!

msgPDictAddWord

Adds a word to the personal dictionary.

Takes P_PDICT_NUM_WORD, returns STATUS.

```
#define msgPDictAddWord                         MakeMsg(clsPDict,3)
```

Message Arguments

```
typedef struct PDICT_NUM_WORD {
    U16         number;
    P_CHAR      pWord;
} PDICT_NUM_WORD, * P_PDICT_NUM_WORD;
```

The routine SpellAddWord(), defined in spell.h, is a better way forclients to add words to the Personal Dictionary, since it has aAPI, strips excess punctuation, checks for duplicates, etc.

msgPDictAddWord adds the string from the PDICT_NUM_WORD structure,the zero-based offset of the new word in the personal, and passes back that offset in the number component ofPDICT_NUM_WORD structure.

Although the ASCII representation of the Personal Dictionary isimmediately, the compressed template is not rebuilt until thetime **msgPDictUpdateTemplate** is called. Handwriting Translationthis automatically when it needs the template, but spelling does.

msgPDictDeleteWord

Deletes a word from the personal dictionary.

Takes P_PDICT_NUM_WORD, returns STATUS.

```
#define msgPDictDeleteWord                      MakeMsg(clsPDict,4)
```

Message Arguments

```
typedef struct PDICT_NUM_WORD {
    U16         number;
    P_CHAR      pWord;
} PDICT_NUM_WORD, * P_PDICT_NUM_WORD;
```

The reverse of **msgPDictAddWord**, this message removes the word frompersonal dictionary and passes back the zero-based offset of thewhere it formerly was.

Like **msgPDictAddWord**, this only affects the ASCII representation ofPersonal Dictionary. The next handwriting translation operationrebuild the template, but if you need it built before that (for, to change the behavior of spelling), send.

msgPDictNumToWord

Locates a word in the personal dictionary by index number, passing back the word at that offset.

Takes P_PDICT_NUM_WORD, returns STATUS.

```
#define msgPDictNumToWord                       MakeMsg(clsPDict,5)
```

Message Arguments

```
typedef struct PDICT_NUM_WORD {
    U16         number;
    P_CHAR      pWord;
} PDICT_NUM_WORD, * P_PDICT_NUM_WORD;
```

Words are indexed in ASCII collating sequence from zero.

msgPDictFindWord

Checks if a word is in the personal dictionary.

Takes P_CHAR, returns STATUS.

```
#define msgPDictFindWord                        MakeMsg(clsPDict,6)
```

stsOK means it was found; **stsFailed** means it was not.

msgPDictDeleteNum

Locates a word in the personal dictionary by index number and deletes the word at that offset.

Takes P_PDICT_NUM_WORD, returns STATUS.

```
#define msgPDictDeleteNum                       MakeMsg(clsPDict,7)
```

Message Arguments

```
typedef struct PDICT_NUM_WORD {
    U16         number;
    P_CHAR      pWord;
} PDICT_NUM_WORD, * P_PDICT_NUM_WORD;
```

Words are indexed in ASCII collating sequence from zero. The numberthe word to delete is the number field from the PDICT_NUM_WORD; the actual word deleted is passed back in **pWord**. (This MUSTset to point to something by the caller! Max size is+1. Setting **pWord** to Nil(P_CHAR) passes nothing back.)

msgPDictWordToNum

Given a word, computes its offset within the personal dictionary.

Takes P_PDICT_NUM_WORD, returns STATUS.

```
#define msgPDictWordToNum                        MakeMsg(clsPDict,8)
```

Message Arguments

```
typedef struct PDICT_NUM_WORD {
    U16         number;
    P_CHAR      pWord;
} PDICT_NUM_WORD, * P_PDICT_NUM_WORD;
```

Words are counted from zero in ASCII collating sequence.

msgPDictUpdateTemplate

Recomputes the compressed template from the word list and updates the pointer.

Takes PP_UNKNOWN, returns STATUS.

```
#define msgPDictUpdateTemplate              MakeMsg(clsPDict,9)
```

When the ASCII form of the personal dictionary is modified, thetemplate is not automatically modified. Since compressionbe time consuming, this is deferred until it is absolutely. This routine is called by Handwriting Translation at theof every translation.

If the current template is not out of date, this just copies old value intoargument.

Miscellaneous

Base of the template of **thePersonalDictionary**. Handwritingneeds to be able to get at this very quickly, so it'sas an exported global variable to allow it to avoid the.

```
extern P_UNKNOWN PASCAL pPDictBase;
#define hlpPDAppBackground  MakeTag(clsPDApp,1)
```

POWER.H

This file contains the API definition for class **clsPowerButton**.

clsPowerButton inherits from **clsObject**.

"thePowerButton" is a well known object that provides notification when the machine is turned off and on.

```
#ifndef POWER_INCLUDED
#define POWER_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
```

Messages

msgPBMachinePoweringUp

Notifies clients that the machine is powering up.

Takes nothing, returns nothing. Category: observer notification.

```
#define msgPBMachinePoweringUp              MakeMsg(clsPowerButton, 1)
```

Comments

Sent by the system to observers of **thePowerButton**. Indicates that the machine is in the process of powering up.

The system will not power up until all observers of **thePowerButton** are notified. The system will wait until the notification message has completed for each client.

msgPBMachinePoweringDown

Notifies clients that the machine is powering down.

Takes nothing, returns nothing. Category: observer notification.

```
#define msgPBMachinePoweringDown            MakeMsg(clsPowerButton, 2)
```

Comments

Sent by the system to observers of **thePowerButton**. Indicates that the machine is in the process of powering down.

Most applications do not need to observe the power button, since **theSystem** sends the appropriate messages to all applications and services when the machine powers down.

The system will not power down until all observers of **thePowerButton** are notified. The system will wait until the notification message has completed for each client.

POWERMGR.H

This file contains the API definition for class **clsPowerMgr**.

clsPowerMgr inherits from **clsObject**.

"thePowerMgr" is a well known object that provides system power management.

```
#ifndef POWERMGR_INCLUDED
#define POWERMGR_INCLUDED
#ifndef GO_INCLUDED
#include <go.h>
#endif
#ifndef CLSMGR_INCLUDED
#include <clsmgr.h>
#endif
```

Common #defines and typedefs

```
typedef U16         PM_POWER_STATE;
typedef U16         PM_POWER_METRICS, *P_PM_POWER_METRICS;
```

Messages

msgPMSetPowerState

Sets the machine power state.

Takes PM_POWER_STATE, returns nothing.

```
#define msgPMSetPowerState                      MakeMsg(clsPowerMgr, 1)
#define pmStandby       flag0   // power down to stand by state.
#define pmPowerOff      flag1   // power down to complete off.
#define pmForceBoot     flag2   // Force a cold boot on the machine
#define pmQuickestPowerOnState (pmStandby | pmPowerOff)
                                // quickest allowable power on state.
```

Comments

Initiates the powering down of the machine. The machine can be powered down in "standby" state (i.e. RAM is maintained, but the rest of the system is shut down) or "complete off" state.

Powering down the machine will force all data to be saved to disk (if applicable) and will notify all observers of the power button of this event (see power.h).

If the client is unfamiliar with the hardware configurations, use **pmQuickestPowerOnState**. This mode will power down the machine to the state that will cause the machine to come up in the quickest possible time.

pmForceBoot will force the machine to reset and cold boot the software. Caution: Under certain configurations this may cause loss of data!!! Specifically, under a RAM only configuration, all the contents of RAM will be lost.

msgPMGetPowerMetrics

Passes back the machine power information.

Takes P_PM_POWER_METRICS, returns STATUS.

```
#define msgPMGetPowerMetrics            MakeMsg(clsPowerMgr, 2)
#define pmStandbyPowerSupported         flag0       // only ram is alive
#define pmNoPowerSupported              flag1       // everything is off
#define pmStandbyButtonSupported        flag2       // power button usage
#define pmChargerConnectedSupported     flag3       // power connection
#define pmIdleStateSavesPower           flag4       // idle = low power state?
#define pmChargerConnected              flag5       // is power connected?
#define pmSomeDevicePoweredDown         flag15      // something is off
```

Comments

Passes back information on what power states are supported on this machine. The machine can support either 1) standby or 2) power off or 3) both or 4) none. Setting none indicates that the software is unable to change the power state of the machine.

This message also returns information on the charger and whether a standby button is supported.

msgPMDevicesPowerOn

Turns power on to all devices in the system.

Takes nothing, returns STATUS.

```
#define msgPMDevicesPowerOn             MakeMsg(clsPowerMgr, 3)
```

msgPMDevicePoweringOn

Notifies observers that a device is powering up.

Takes U16, returns nothing. Category: observer notification.

```
#define msgPMDevicePoweringOn           MakeMsg(clsPowerMgr, 4)
```

Comments

Sent by the system to observers of **thePowerMgr**. Indicates that a device (specified by MIL logical Id) is powering up.

msgPMDevicePoweringOff

Notifies observers that a device is powering down.

Takes U16, returns nothing. Category: observer notification.

```
#define msgPMDevicePoweringOff          MakeMsg(clsPowerMgr, 5)
```

Comments

Sent by the system to observers of **thePowerMgr**. Indicates that a device (specified by MIL logical Id) is powering off.

msgPMAllDevicesPoweredOn

Notifies observers that all devices have powered up.

Takes nothing, returns nothing. Category: observer notification.

```
#define msgPMAllDevicesPoweredOn        MakeMsg(clsPowerMgr, 6)
```

Comments

Sent by the system to observers of **thePowerMgr**.

PENPOINT API REFERENCE / VOL II
INDEX

API1 denotes *PenPoint API Reference, Volume I* **API2** denotes *PenPoint API Reference, Volume II*

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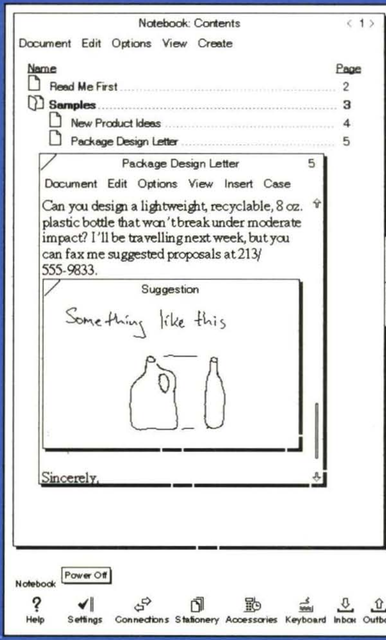
PenPoint™ Application Programmatic Interface, Volume II

Together with Volume I, *PenPoint™ Application Programmatic Interface, Volume II* provides a complete reference to the classes, messages, functions, and structures provided by the PenPoint Software Development Kit (SDK).

The parts in the *PenPoint API Reference* are organized in parallel with the parts in the *PenPoint Architectural Reference* (also available from Addison-Wesley). This volume contains datasheets on the APIs to the:

Text subsystem
PenPoint file system
PenPoint operating system kernel
Utility classes
Connectivity classes
PenPoint resource classes
Installation interface
PenPoint services
Miscellaneous other classes



Can you design a lightweight, recyclable, 8 oz. plastic bottle that won't break under moderate impact? I'll be travelling next week, but you can fax me suggested proposals at 213/555-9833.

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PenPoint User Interface Design Reference describes the elements of the PenPoint Notebook User Interface, sets standards for using those elements, and describes how PenPoint uses the elements.
PenPoint Development Tools describes the environment for developing, debugging, and testing PenPoint applications.
PenPoint Architectural Reference, Volume I presents the concepts of the fundamental PenPoint classes.
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PenPoint API Reference, Volume I provides a complete reference to the supplemental PenPoint classes, messages, and data structures.

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