REFERENCE MANUAL FOR THE TIME-SHARING EXECUTIVE

By

Verne E. Van Vlear

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1.0 INTRODUCTION

The Time-sharing System, (TSS), is a system for making a single computer provide simultaneous, continuously supervisable computing power to a number of authorized users. By "simultaneous" we of course mean apparently simultaneous; it is the computer's capacity for performing tasks at tremendously high speed that gives the illusion of simultaneity. TSS is furthermore designed principally for those users who, in order to obtain fruitful results, need to guide their programs more or less continuously through the course of its execution. One example of such application is in the checking-out of a program -- wherein, at each successive catastrophe, the user is called upon to make an amendment and try again.

TSS provides the following facilities:

1. Mutual protection of the users against one another.

2. Optional partial removal of this protection so that users can communicate with one another via the computer.

3. A more-or-less equal division of computing time between the current users.

4. Software packages necessary to permit one program to control others -- with overall control by the user via peripheral equipment.

5. Software packages which permit communications between computer and peripherals without regard to the latter's special physical peculiarities.

6. A filing system for preserving user's program documentation.

7. Response to a number of requests that arise naturally in the course of a user's connection with the system.

The preliminary medium by which computer and user communicate is at present the teletype console, which allows input, user to computer, from a keyboard and output, computer to user, via a type-head. Paper tape, punched card and magnetic tape are also available but are generally more cumbersome and unsuitable for primary input. These same devices, along with a high speed printer, are available for output but are not normally used during regular TSS service. Cathode ray displays and other graphical display devices are also being developed and are likely to render manageable the input and output of graphical data.

2.0 ACCESS TO THE COMPUTING FACILITIES

In order to establish a link between a teletype console and the computer, follow one of the procedures described in the "Tymshare Reference Manual" under "LOG IN", depending upon the type of teletype terminal equipment. It should be noted here that there is no direct link between keyboard and typehead. Any such link which appears to exist is established through intermediate software. The TSS software, of course, arranges that the typehead respond to keyboard input in a manner appropriate to the occasion which usually involves echoing back to the typehead, any characters input from the keyboard.

Following the "LOG IN", a printed response "carriage return, line feed, -" indicates that the user has been connected to a built-in software package, called the Executive Program, hereinafter referred to as "Exec" which awaits further teletype input in the form of stylized English language requests or commands. Via these commands the Exec will provide sufficient services to get the user into contact with all the other TSS facilities. It is, itself, primarily a medium for specifying memory requirements handling user's program documentation and establishing communications between different teletypes.

3.0 EXEC COMMAND AND FILE NAME RECOGNITION

It is appropriate here to describe the way in which Exec Commands and Input File Names are recognized. After sufficient characters have been typed in to distinguish the intended command or name from all others, succeeding characters that agree with the name string will continue to be taken from the teletype input buffer. If an alphabetic character is encountered that does not agree with the string an error is assumed and an appropriate diagnostic is given. All characters in the input buffer will be deleted. The first non-alphabetic character (carriage return, space, comma, digit, etc.) that does not agree with the selected string will act as a terminator and will be left in the buffer.

If the command "COPY" and the file names /INPUT/ and /OUTPUT/ are unique, the following string:

```
COPY /INPUT/ TO /OUTPUT/
```

could be abbreviated to:

```
C/I T /OUTPUT/
```

or COPY /INPUT/ TO TELETYPE could be abbreviated to:

```
C/I,T
```

Note the optional use of the "," or the T to act as the separator between file names.

Note that most Exec commands await a terminating Cr which is the user's confirmation that the command is to be executed. The command is not implemented until this confirmation is received and until then may be aborted by pressing usually any other character or, certainly, by pressing the "escape" key.

Exec commands that must be followed by additional input from the user (such as the COPY command that is immediately followed by the input file name) will provide some help to the user if he follows the command with a carriage return. The Exec will respond with a message that indicates the next input from the user. For example, if the command COPY is followed by a carriage return, the Exec will type:

```
FROM FILE:
```

If the user makes an error, the Exec will respond with an appropriate error message indicating where in the sequence of input the user went wrong, as follows:

```
     ERROR, TYPE FROM FILE:
```

It will be left to the user to discover the various help and error messages provided by the Exec.

4.0 FILES

Before describing the Exec's command language it would be appropriate to discuss the nature of files and the manner in which they are referenced.

Files are the primary means by which the user establishes continuity between one computer run and the next (a "run" being that sequence of activities, mutual to the computer and a user, between "LOG IN" and the next EXIT or LOGOUT command -- see sec. 5.1). A file is any named block of information which the user finds is convenient to regard as a single entity; the commonest example of a file is just a program. To provide a check against inappropriate use, files created by the Exec and TSS subsystems are classified, according to the nature of the information in them, into one of five types -- with each of which is associated a type number. This type number is carried along with the information content and is checked whenever the file is referenced by an Exec command (or any other of the TSS facilities which reference files). If the file is found to be of a type inappropriate to the context the command is not executed and an error is indicated.

The file types are:

1. Core Image - The information in this originates from specified segments of core memory.
2. Binary - The information has the form of an assembled but unloaded program.
3. Symbolic - The information is of a form which can be readily listed on some printing device.
4. Dump - Comprises all the information in memory necessary to restart the user from his current situation, i.e., the situation at the time of creation of the dump file.
5. Subsystem - Comprises up to eight 2K blocks which can be read into shared memory. The information originates from core memory and is normally executable as an assembled and loaded program.

Files of types 1, 4 and 5 originate from information in core. Before names have been explicitly assigned to them, type 1, "Core Image" files are referred to by their bounding core addresses; the whereabouts of a type 4, "Dump" file, is implicit in its nature, while type 5, "Subsystem" files are specified by delivering the pseudo-relabeling of the pages containing the information to the command which attaches a name to them.

The information in type 3, "Symbolic" files may come directly from paper tape, teletype or cards and in such a case is referred to by using the name of the corresponding physical medium, viz.,

PAPER TAPE
TELETYPE
PRINTER
CARDS

These names are built into the system and are always appropriately recognized. Another built-in "file" name is

NOTHING

which always contains precisely nothing and whose function is to act as an infinite sink in which limitless unwanted output can be lost.

A more common source of symbolic files is the output from a subsystem, notably the text editor, QED.

Type 2, "Binary" files may originate from paper tape or cards, but, more commonly, arise as the output from the machine language assembly subsystem, ARPAS, and as the data output of a program.

Until the actual process of output from the subsystem occurs, identification of the information is handled by the said subsystem and is usually implicit since the subsystems can usually handle only one file at a time. However, when the information is ejected into a contest involving many other blocks of information of a similar kind some explicit identification must be attached to it.

4.1 File Naming

The names which the user is free to invent (although with some restrictions) and assign to files are of three types:

1. Slashed names
2. Unslashed names
3. Quoted names

Slashed names are reserved for files that are on the disc, quoted names are reserved for files that are on magnetic tape, while unslashed names may be of any type. Tape files may be created and used only by the class of users that are assigned "peripheral" status so that the general use of quoted file names is also restricted to the peripheral class of users. By the use of the command RENAME, to be described later, slashed and quoted file names may be renamed into unslashed names.

When reference is made to an unslashed file name, the Exec will consider the name to be fully delivered as soon as it has received sufficient characters to distinguish the name from all others currently defined by the user. This also applies to slashed and quoted names when the file is used for input. Note that a new name can never be introduced in its unslashed form, and that slashed and quoted names must be typed in their entirety when the name is used for an output file. See Section 3.0.

4.2 Accessing Other User's Files

The naming system described is adequate to reference all the files belonging to the current user, in whose name the Exec was entered. However, to refer to files belonging to another user, it is necessary to augment the file name by that user's account number and name. For example:

```
(B2 JONES) /@FILE1/
```

The access that any other user may have to each of Jones' files is in the hands of Jones, himself. Jones may declare that a member of the public at large has read-only access to the file by placing a control character or the "@" character, as shown above, in the file name. It is also possible to refer to a file belonging to another user in the same account without indicating the account number. For example:

```
(JONES) /@FILE1/
```

5.0 THE EXECUTIVE COMMAND LANGUAGE

This section will describe the functions available to the user through the executive program. These functions are initiated by special commands recognized by the executive program. The commands are divided into the following six logical areas for ease of reference.

1. Entering and Leaving TSS
2. Allocation of Memory
3. Interaction of Teletypes
4. Creating and Manipulating Files
5. "System" and Tape Functions
6. Miscellaneous Functions

5.1 Entering and Leaving TSS

Before the Exec will execute any of the possible commands which may be given to it, the prospective user must make himself known by executing the "LOG IN" procedure. The procedure is explained in the "Tymshare Reference Manual". This brings into core the user's complete file directory. See Section 5.4 for commands to control the handling of files.

To leave the TSS system, the user may give the commands EXIT or LOGOUT or he may simply hang up. For a description of LOGOUT and what happens when the user hangs up, see the "Tymshare Reference Manual". EXIT is similar to LOGOUT except that the user's file directory is NOT written back on the disc with the EXIT command. This means that the user would lose any new files created since logging in or since the last file DELETE or since giving the command WRITE FD (see section 5.4).

5.2 Commands Relating to the Allocation of Memory

The commands described in this section are:

STATUS
UNUSED MEMORY
RELEASE
KILL PROGRAM
RESET
PMT

*SMT
*RSMT

*These commands require the user to have System Status.

STATUS

Types the status of user's memory. The format is as follows:

```
PROGRAM: nn nn - -/- - - -
s.s.n: nn - - -/- - ss ss
M.S. 30K, U.M. xxK
```

where nn is the relabeling byte from the program memory table,
ss is the relabeling byte from the shared memory table,
s.s.n. is the sub-system name,
xx is the number (in thousands of words) of unused memory in the user's virtual memory.

The M.S. is the current Machine Size (virtual) for the user. The dashes indicate pages in the relabeling words that are not currently being used. Note that the program line corresponds to the two words of program relabeling kept in an exec table and the "s.s.n." line corresponds to the two words of sub-system relabeling kept in the exec table. The pages indicated by "nn" are swapped. There may be other pages currently assigned to the user as listed in his PMT (see PMT command) that are not shown by the Status typeout since his program is not currently relabeled over them.

UNUSED MEMORY

```
nnKCr
```

where nn is the number of K (1024) blocks of words of the user's total memory allocation remaining unaccessed. The user is assigned 32K upon logging in. He has no control of the one page (2K) immediately assigned as his temporary storage (T.S.) block.

The following three commands return parts of the memory currently assigned to the user to the pool of unused memory retained by the Monitor. Any information in the memory so released is irretreivable.

RELEASE

Releases the blocks (up-to-eight) of memory assigned to the subsystem the user was last using.

KILL PROGRAM

Releases the blocks (up-to-eight) of memory listed by the STATUS command under the heading PROGRAM.

RESET

Releases all the memory assigned to the user except the one block used by the Exec for temporary storage. (The T.S. block)

PMT

Types the user's current Program Memory Table in the following format:

```
    aa DRMPOS: bbb, cc (PAGE dd)
```

```
where aa is the pseudo relabeling byte number,
      bb is the drum address (shifted right three
         places),
      cc will type as RO for read only,
                      EX for exec page,
                      DR for drum.
      dd (if typed) will be the real page number
         in memory.
```

SMT

Types the Shared Memory Table. The format is the same as that indicated under the command PMT, above.

5.3 Commands Relating to the Interaction of Teletypes

The commands described in this section are:

```
    USERS
    WHERE IS
    WHO IS ON
  #*SHUT DOWN
  #*UP
  #*ANSWER
  #*HANG UP
   *LETTER
```

*These commands require Operator or System Status. All of the above commands require at least Subsystem Status. In addition, the commands marked with # require console switch one to be toggled.

USERS
nn

Types the number of users (nn) currently logged on the system.

WHERE IS aa nnnnnnn
xx

By typing the Account Number of "aa" and the user's name for "nnnnnnn...", this command will type the teletype number "xx" that the user is on currently.

WHO IS ON
xx aa nnnnnnn..
xx sss

This command causes a complete list of the current TSS users to be typed where:

xx	teletype number
aa	user's account number
nnnn..	user's name
ssss	status of lines if the line is NOT completely idle (-1) and no one is logged on the line.

SHUT DOWN (toggle switch 1 required)

After the operator toggles console switch 1, the command will set a flag that initiates system shutdown. All lines that are not currently being used will be made unavailable.

UP (toggle switch 1 required)

After the operator toggles console switch 1, the automatic shut down flag described under SHUT DOWN is reset so that teletype lines are no longer unavailable. The operator must re-answer (by using the ANSWER command) all lines that have previously been made unavailable.

ANSWER (toggle switch 1 required)
K,m-n,...

This command enables selected teletype lines so that the users may make use of these lines. The operator may specify single numbers, indicated by "k", separated by commas, or a range of numbers where the range is separated by a dash, or any combination as indicated. Spaces are ignored and the string is terminated by a carriage return. If the line has already been enabled, the command will have no effect. Note that after the SHUT DOWN command has been issued, a line can be made available by this command but it will become unavailable after the user logs out.

HANG UP (toggle switch 1 required)
k,m-n,...

The command has two functions; it may be used to hang up a user while he is logged in (in this case the line will go ready again after the hang up operation has been completed unless the SHUT DOWN command has been used), or it may be used to make a line not available if no one is currently using the line. The format is exactly as described under ANSWER.

LETTER Cr
LETTER OFF/ON

LETTER n

This command has three functions and two formats. The second format, where a number n is typed after the command, is used to type a broadcast letter, where n is the letter number from one to six.

The first format is used to control the transmission of broadcast letter. It is used by typing a carriage return immediately after the command. If the response is LETTER OFF, then no one will receive the broadcast letters. The exec will not come back to the "-" response until all users currently on the system have finished receiving any letters addressed to them. If the operator desires, he may "escape" from this condition by typing the escape key. No harm is normally done except that it is possible that a user may receive the same letter twice. The operator must set the LETTER OFF condition before he can use the "Operator Program" to create new letters or cancel old ones. If the response is LETTER ON then all users will start receiving broadcast letters. Any new letters created by the operator will not start being received by all users currently on the system.

5.4 Creating and Manipulating Files

The following Exec commands are available. They are described in the references indicated.

FILES	1,2
WRITE FD	1
DF	1
FD FOR	1
DELETE	1,2
RENAME	1,2
GO TO	See Below
PLACE	See Below
SAVE	See Below
DUMP	2
RECOVER	2
CONTINUE	2
COPY	2
*GFD	See Below
*REMOVE FILE	See Below
CREATION	1
CD FOR	1

*These commands require Operator or System Status in the user's control parameters.

GO TO (input file name)

The action is initially as for the PLACE command. However, after transferring the file to core, instead of a return to the Exec, there is a branch of control into the user's own environment at the starting address specified at the time of the file's creation. If a zero starting address or none at all was then given, the transfer is back to the Exec as for the PLACE command.

PLACE (input file name)

The contents of the named input file is transferred to the core addresses specifed at the time of its creation (by BRS 93 or the "SAVE" command. It is transferred into the user's current environment which is extended, as necessary to accommodate it.

The file name must be in the user's file directory. If it is not, a ? is printed, the name is forgotten and must be delivered anew. The file name must be terminated by a carriage return. The file must be a core-image (type 1) file (see section 4.0). If any of these conditions is not satisfied, the command is aborted -- as it is also if the attempted data transfer to core results in some transfer-error conditions arising.

SAVE

This command is typed in the following format:

```
    SAVE bbb TO eee ON nnnnn Cr
    OLD/NEW FILE Cr

            or (optionally)

    OLD/NEW FIlE Lf
    STARTING LOCATION sss Cr
```

The contents of the specified range of core starting with "bbb" and ending with "eee" together with the starting location "sss" if provided, are preserved on the named output file "nnnnn".

The output file name must be of a form accepted by BRS 16. If it satisfies the conditions for a no-skip return from BRS 16, the name is ignored and another name must be provided. The name may be terminated by a carriage return, thus terminating the command and causing it to be executed, or a line feed, in which case a "starting address" (see also the "GO TO" command) must be typed in.

Each of the addresses bbb,eee,sss, whether core range limit or starting address, is interpreted as an octal number. The starting address, sss, must be terminated by a carriage return. Delivery of any other non-octal digit character, except rubout, aborts the address -- which must be retyped. The octal numbers, bbb and eee must all be terminated by a space, a comma, or a carriage return. Any other character aborts the command.

If a carriage return is typed immediately after the command "SAVE" the Exec will respond with "FIRST LOC". If a carriage return is typed immediately after "bbb", the Exec will respond with "LAST LOC".

If a carriage return is typed immediately after "eee" the Exec will respond with "TO FILE".

GFD aa nnnnn Cr

The command is used by the operator to get a file directory belonging to another user for special background or non-timesharing processing. The operator's own file directory and user number is replaced by that belonging to the account number "aa" and user name, "nnnnn" but the operator's account number and control parameters are retained.

REMOVE FILE nn, Cr

This command allows a user with System or Operator Status to remove an entry from a file directory without using the DELETE command. Since it may be possible to delete a file if the name contains leading spaces or other spurious characters, it may be required to use this command as a last resort. The command removes a file from the "in-core" directory by referring to the file name's position "nn" in the printed file directory. The command FILES must be used just before using this command in order to find the current relative position of the name. The file directory is NOT rewritten on the disc by this command.

References:

1 Reference Manual for the Time-Sharing System, Chapter 13, "Executive Commands Related to Files".

2 Tymshare Reference Manual

5.5 "System" and Tape Commands

The commands described here are:

```
 REWIND
 RLT
 STN
 PTN
 POSITION TAPE
 TAPE POSITION
*ABT
#SYSDP
#SYSLD
*LOOK
```

*These commands require operator user status.
#Require system status.

The commands controlling tape are system commands and only one user, normally the operator, will be mkaing use of the commands at a time.

REWIND Cr

This command frees up the tape, regardless of its current status and rewinds the tape. It is applied to the current tape number (0 or 1).

RLT Cr

This command releases the tape so that it is available for other users.

STN n Cr

Allows a user to set his own tape number, where "n" is 0 or 1.

PTN Cr
n Cr

Types a user's current tape number, where "n" is 0 or 1.

POSITION TAPE Cr

This command will cause a user's current tape to position to the beginning of the next file.

TAPE POSITION Cr

Types the current tape position as far as it is known by the Exec. This command does not check the actual position by reading tape.

ABT Cr

This command will abort any tape operation currently in progress. It may be used by the operator to stop run-away tape.

LOOK

This command is typed in the following format:

```
LOOK a,n Cr
a   bbbbbbbb
a+1 bbbbbbbb
etc.
```

This command allows an operator or system class user to display real memory addresses where "a" is the first location to be displayed (in octal) and "n" is the number of locations in decimal to be displayed. The format of the type out is as indicated in the example where "a" and "a+1" are the octal addresses and "b" represents the contents in octal.

The following two commands require a special system status by the user since they allow direct writing and reading at any location on the disc.

SYSLD

The command is typed in the format:

```
SYSLD a Cr
TO    b Cr
LOC   c Cr
```

This command allows a user to load his program memory from any location on the disc into any of his eight pages. "a" and "b" refer to his page numbers from 0 to 7 and "c" is either a real disc address or a number from 0 to 7 referring to disc 0 to 7, with the load (or dump, see below) starting at arm position 63 of the given disc. Also, "c" may be of the format "n.m" where "n" is the disc number described above and "m" is a number from 0 to 7 referring to a relative page number of arm position 63. Note that the dump and load location using the specified disc format corresponds to the area of the disc addressed by the disc swap utility program using the console switch settings 0 to 7.

SYSDP

The command is typed in the following format:

```
    SYSDP a Cr
    TO    b Cr
    LOC   c Cr
```

This command allows a user to dump his program memory onto any location on the disc from any selected pages of his eight pages of program relabeling. The nomenclature is the same as that described under SYSLD (see above).

5.6 Miscellaneous Commands

These fall into none of the preceding categories. They are described in the references indicated.

BRANCH	See Below
DATE	See Time-sharing System Ref. Manual
TIME	" " " " " "
	" " " " " "
ACCOUNTING	See Below
PSP	" "
SETEXEC	" "
ENABLE/DISABLE	" "

BRANCH adr Cr

A transfer of control is made to the specified address "adr" in the user's own environmnet. The address (an octal number) must be terminated by a carriage return. Any other character aborts the command. If the user does not have the page containing the address under his relabeling, he will receive a memory trap. If he has a blank page (containing the illegal instruction HLT), he will receive an instruction trap.

SETEXEC nn Cr

This command is available only to users with one of the special status. These users may use the command to set one of the following classes of executivity if the user's status parameters agree that the user is permitted to use this class. The class set is then propogated to any fork started by the system executive under the "GO TO" command.

"NN"	DESCRIPTION
1	Subsystem
0	Cancel status
-1	Subsystem & system
-2	System only

The various classes allow the user's program to issue special BRS's that are needed for system software but could cause great havoc to the TSS if used improperly. Debugging of programs which use these BRS's must be restricted to certain time periods so as not to disrupt T.S. operations.

PSP Cr

This command requires operator status or a higher status. It will type out with symbols the current system error counters. For a key to the symbols and their meaning, see the current Tymshare Monitor Manual.

ACCOUNTING n Cr

This command requires operator status or a higher status. After the Cr is typed, the following message will type:

```
TOGGLE SW. 1 Cr
```

The command will not execute until console switch 1 is toggled. It will then perform one of the following functions depending on n.

n = 0 Stops the accounting information from being punched on paper tape when users log out.

n=-1 Starts the punching of the accounting information on paper tape when users log out.

A number of special purpose TSS software aids, called "subsystems" can be requested simply by typing the name of the subsystem as a command. Two commands allow the operator to ENABLE or DISABLE groups of subsystems so that various classes of users may or may not use the subsystem group. The commands are typed as follows:

```
ENABLE s or
DISABLE s
```

where s is the name of a subsystem in the group. The subsystems currently available are grouped as follows:

Group 1 - ARPAS, DDT
Group 2 - LISP, SNOBOL

The following subsystems have no group restrictions and are always available to all users:

BASIC
FTC
FOS
QED
CAL
FORTRAN

For details of any subsystem, the appropriate subsystem manual should be consulted.