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Systems

IBM Virtual Machine Facility/370: OLTSEP and Error Recording Guide

Release 6 PLC 4

This publication is intended for the IBM customer engineer (CE). The information in this book aids the CE in performing hardware I/O maintenance from a virtual machine. It includes data on error handling, the error recording process, describes how to run the online test system (OLTS) under OLTSEP and how to use the CMS CPEREP command that interfaces with OS/VS EREP (IFCEREP1) and error recorded data.

PREREQUISITE PUBLICATION

IBM Virtual Machine Facility/370: Introduction, Order No. GC20-1800

COREQUISITE PUBLICATIONS

OS/VS, DOS/VSE, VM/370 Environmental Recording, Editing and Printing (EREP) Program, Order No. GC28-0772
OS/VS, DOS/VSE, VM/370 Environmental Recording Editing and Printing (EREP) Program Logic, Order No. SY28-0773
OS/VS, DOS/VSE, VM/370 EREP Messages, Order No. GC38-1045
IBM Virtual Machine Facility/370:

CP Command Reference for General Users, Order No. GC20-1820

System Messages, Order No. GC20-1808

Terminal User's Guide, Order No. GC20-1810

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Technical changes and additions to text and illustrations are indicated by a vertical bar to the left of the change.

Changes are periodically made to the information herein; before using this publication in connection with the operation of IBM systems, consult the latest IBM System/370 Bibliography, Order No. GC20-0001, for the editions that are applicable and current.

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The entries in this Table of Contents are accumulative. They list additions to this publication by the following VM/370 System Control Program Products:

- VM/370 Basic System Extensions, Program Number 5748-XX8
- VM/370 System Extensions, Program Number 5748-XE1

However, the text within the publication is not accumulative; it only relates to the one SCP program product that is installed on your system. Therefore, there may be topics and references listed in this Table of Contents that are not contained in the body of this publication.

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As updated by GN25-0493
VM/370 Release 6 PLC 4

MULTIPLE SERVICE RECORD FILE (SRF) SUPPORT

New: Device and Program Support

VM/370 supports multiple SRFs in certain 303x attached processor environments. The existence of multiple SRFs allows CP to retrieve MCH and CCH frames from each SRF device and record them in the error recording area. Interrupt handler routines identify whether the main processor or the attached processor generated particular MCH and CCH records.

CHANNEL-SET SWITCHING FACILITY

New: Hardware Feature and Program Support

A Channel-set Switching facility exists in certain 303x attached processor environments. This facility allows CP to switch all active channels on the main processor to the attached processor when an uncorrectable error occurs on the main processor in problem program state.

Summary of Amendments
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VM/370 Release 6 PLC 1

4331, 4341 PROCESSORS WITH 3278 MODEL 2A CONSOLE AND 3031 AP SUPPORT

New: Processor Support

VM/370 now supports the 4331 and 4341 processors as well as the 3031 attached processor. The 3278 Model 2A console can be used as a virtual machine console terminal supported by VM/370 for customer engineer use in conducting diagnostic tests. When running channel check handler, limited channel logout is still available for the 4331, 4341 and 3031 AP processors. However, there is no fixed or I/O extended logout area for these new processors. Errors corrected by error checking and recording (ECC) are not recorded by the new processors. Only errors corrected through processor retry are recorded.

3203 MODEL 5 PRINTER SUPPORT

New: Hardware Support

VM/370 now supports the 3203 Model 5 printer for use in hardcopying errors encountered during diagnostic testing of the system.

MISCELLANEOUS

Changed: Documentation only

- Figure 30 has been amended to include further documentation of error record types recorded by DOS, DOS/VS, OS/VS1, OS/VS2, and VM/370.
- Correction of the default for the ACC= operand of CPEREP command in Figure 31 from NO to YES has been made.
- An expanded description of the function of the CLEARF operand of CPEREP command has been added to Figure 32.
- The term "error recording cylinder(s)" has been changed to "error recording area(s)" where applicable in the text.
- Minor editorial changes have been made.

Summary of Amendments
for GC20-1809-6
as updated by GN25-0476
VM/370 Release 5 PLC 12

ENSURING VM/370 CONTROL PROGRAM HAS ACCESS TO SRF DEVICE

Changed: Documentation only

Added to the discussion of the SRF device as it relates to VM/370 is the means of ensuring that the VM/370 control program has access to the SRF. Also documented are the steps necessary to activate the SRF device.

RDEVBLOK to determine if intensive recording mode is in effect for this device. If the conditions are met, an I/O error record is created. This record is constructed and recorded as described previously. Control is returned to the I/O supervisor, which reflects the error to the user of the I/O operation.

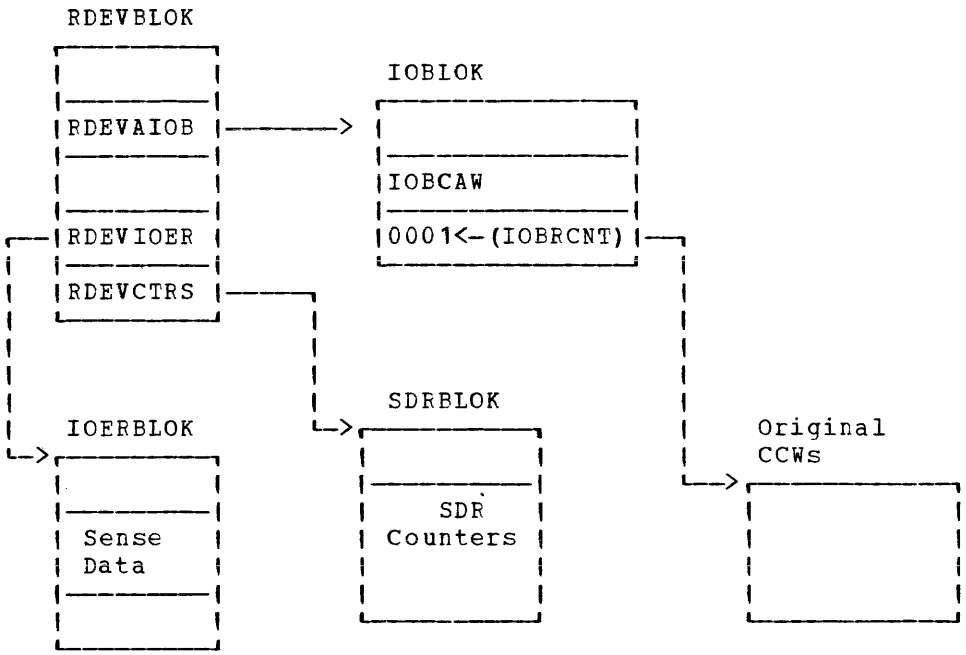

Figure 12. Control Block Relationship for SDR Counter Update

I/O Error Recording and Error Recording Area

The error recording facilities of VM/370 format and record outboard error records, and record formatted machine check and channel check records created by the RMS routines of VM/370.

The error recording routines of VM/370 do not actually perform I/O operations. Instead, the I/O error routines treat the error recording area allocated on the VM/370 system residence pack as a logical extension of VM/370 storage. These extensions of VM/370 storage are in the form of logical pages that can be read and written out of by the paging supervisor of VM/370. The error recording routines place multiple error records within a page; when an error record is assembled within a page, a pointer is updated to indicate the beginning of any unused area. The next error record is checked to see if it can be contained in the remainder of this page. If it can, the error record is read into the page and the pointer is updated to again reflect any residual storage available for the next error record. This process continues until an error record is encountered that cannot be contained within the page. When this happens, the page is scheduled to be read out to the next available slot in the error recording area and a new page in storage is assigned to accept and retain the error record. The process continues in like manner.

The error recording area is from two to nine adjacent cylinders assigned on the system residence volume. The starting cylinder number and number of cylinders are specified in VM/370 generation procedures. When the error recording area is 90% full, and again when 100% full, the I/O error routines instruct the VM/370 system operator to invoke the CPEREP command to print (or create a tape of) the error data and erase the recording area. Errors are recorded in the order of occurrence until the allotted space is exhausted.

Because of the support provided for the 303x processors in uniprocessor or attached processor modes, CPEREP processing is not dependent on the content or engineering change (EC) level of the processor logouts to format machine check and channel check records. Instead, the 7443 Service Record File (SRF) device provides format and content information contained in frames on diskette to format MCH and CCH records. In a 303x attached processor environment, each processor has its own SRF device. Customer engineering maintains the SRF frames (records containing text and scan buffer codes to format MCH and CCH records) on each SRF device. CPEREP makes use of these frames to interpret and format inboard errors for hardcopy output.

At initialization, the VM/370 system control program recognizes the presence of multiple SRF devices in certain 303x attached processor environments. CP accesses the SRF device(s) at initialization, retrieves the frames, and records them at the beginning of the error recording area. When multiple SRF devices exist in a 303x AP environment, the header portion of each SRF frame record written to the error recording area identifies the processor by processor number and model number. The interrupt handler routine identifies which MCH and CCH records the main processor generated and which records the attached processor generated. In this way, CPEREP uses SRF frames to format MCH and CCH records for printed reports by matching the inboard error records to their respective frames.

Each time an engineering change (EC) requiring a new diskette is installed in a 303x uniprocessor or in certain 303x attached processor environments, the privilege class F user must issue the CPEREP CLEARF

command. This command clears and reformats the error recording area by accessing the format information in the SRF frames on the newly installed diskette.

In 303x uniprocessor mode or in certain 303x attached processor environments, system generation procedures provide support for the SRF device(s) so that CPEREP can properly format machine check and channel check records created by each processor. A channel path must also exist between the main processor and the SRF of the attached processor in a 303x attached processor environment. Establishing this channel path allows CP to read frames from each of the SRF devices to the error recording area. Refer to VM/370 Planning and System Generation Guide for the requirements needed to generate support for the SRF device(s).

The SRF device is accessed by VM/370 to read frame data (a) during VM/370 system initialization if the error recording cylinders have not been previously formatted; and (b) as a result of running CPEREP with the CLEARF operand. To ensure that the VM/370 control program has access to the SRF device after initialization, the following steps should be followed to activate the SRF:

1. Check that the I/O interface for the service support console is enabled.

2. Obtain the configuration frame on the service support console.

3. The SRF appears disabled until accessed on the 3032. Activate the SRF on the 3031 and 3033 by selecting SRF mode A2.

If CCH determines that system integrity has been damaged (for example, if the channel has been reset, or if the device address stored is invalid), CCH places the system in a disabled wait state and sends a message to the VM/370 primary system operator. For the 4331 and 4341 processors, limited channel logout is still available, but no fixed or I/O extended logout area exists.

HANDLING OF HARD MACHINE CHECKS

If a permanent error (hard machine check) occurs on the main processor (or attached processor), the error is analyzed to determine whether or not it is correctable by programming. Time-of-day clock and timer errors that result in a machine check interruption that are not correctable and cannot be circumvented place the real computing system in a disabled wait state.

Uncorrectable or unretryable processor errors, storage errors, and storage protect key failures are handled as discussed in the following paragraphs.

Processor Errors

When a machine check interruption indicates that a processor error associated with VM/370 cannot be corrected or retried the system operator is informed of the error and the system is put in a disabled wait state. All virtual machine users must log on again. If the error is associated with a virtual machine, the user is informed of the error and the virtual machine is reset, unless it is using the virtual=real option. In that case, the virtual machine is terminated, and the user must then log on and reinitialize (via IPL) his machine.

If VM/370 is being run in attached processor mode and an uncorrectable error is encountered on the attached processor while executing in problem program state, system operation continues in uniprocessor mode on the main processor.

In certain 303x attached processor environments, a Channel-set Switching facility may exist. This facility allows processing to continue on the attached processor in uniprocessor mode after the main processor enters a disabled wait state following a hard machine check or channel check that results in an uncorrectable error. Automatic processor recovery routines test for the Channel-set Switching facility. If the facility is present, CP switches all active channels on the main processor to the attached processor, and the processing continues on the attached processor in uniprocessor mode. Refer to VM/370 Planning and System Generation Guide for the specific 303x attached processors that support Channel-set Switching.

Storage Errors in a Virtual Machine Page

When the control program (CP) detects a permanent storage error (hard machine check) in a real storage page frame that is being used by a virtual machine, the frame is marked invalid if the error is intermittent, or unavailable if the error is solid. If the page frame has not been altered by the virtual machine, a new page frame is assigned to the virtual machine and a backup copy of the page is brought in the next time the page is referenced. All storage errors are transparent to the virtual machine user.

If the page frame has been altered, VM/370 resets the virtual machine, clears its virtual storage to zeros, and sends an appropriate message to the user. If the virtual machine is using the virtual=real option, it is terminated. In either case, normal system operation continues for all other users.

Storage Errors in the CP Nucleus

Multiple-bit storage errors in the CP nucleus cannot be corrected; they cause VM/370 to terminate. (Single-bit storage errors are corrected by ECC, as noted above.)

Storage Protect Key Failures

When intermittent storage protect key failures occur, whether associated with VM/370 or a virtual machine, the key is corrected and operation continues.

If the storage protect key error is uncorrectable (solid) and is associated with a virtual machine, the user is notified and the virtual machine is terminated. The page frame is marked unavailable. Uncorrectable storage protect key failures associated with VM/370 cause the VM/370 system to be terminated. An automatic restart reinitializes VM/370.

HANDLING OF SOFT MACHINE CHECKS

Although hard machine checks always cause a machine check interruption to occur and logouts to be written, soft machine checks are handled in one of two operating modes -- recording mode or quiet mode.

- In recording mode, soft machine checks cause machine check interruptions and write logouts.
- In quiet mode, only hard machine checks cause machine check interruptions and write logouts.

The normal operating state of VM/370 for CPU retry reporting is recording mode. For ECC (error checking and correction) reporting, the initialized (normal) state of VM/370 is model-dependent: quiet mode for all VM/370-supported processors except Models 155II and the 165II. The initial state for the 155II and 165II is record mode.

A change from recording mode to quiet mode can occur in one of two ways: when 12 soft machine checks have occurred, or when the SET MODE RETRY/MAIN QUIET command is executed by maintenance personnel.

To revert to record mode again, the command SET MODE RETRY/MAIN RECORD must be issued.

In attached processor applications, soft error recording can be set or reset for the selected processor if so desired.

If a soft machine check (a transient error) occurs while the system is in recording mode, a machine check record containing information about the error is written on the error recording cylinders. This record includes the data in the fixed logout area, the date, the time of day, and other pertinent data. The operator is not informed that a soft machine check has occurred.

If a transient error occurs while the system is in quiet mode, no machine check interruption occurs, and no logouts are written. The hardware, which had gained control when the soft machine check occurred, returns control to either VM/370 or the problem program, depending on which had control at the time the machine check occurred.

machine check interruption, the processor logs out fields of information in main storage detailing the cause and nature of the error. The model independent data is stored in the fixed logout area and the model dependent data is stored in the extended logout area. The machine check handler uses these fields to analyze the error and to produce the error report.

If the machine fails to recover from the error through its own recovery facilities, a machine check interruption occurs, and the fixed logout contains an interruption code that indicates the recovery attempt was unsuccessful. The machine check handler then analyzes the data and attempts to keep the system as fully operational as possible. The cause of the malfunction determines what actions MCH takes:

- Resume operations leaving no adverse effects on the system.
- Resume system operations by terminating the user that was interrupted.
- Isolate the failure to a page and flag the page as invalid or unavailable for use by the paging supervisor.
- Place the system in a disabled wait state.
- In VM/370 attached processor operations, processing may continue in uniprocessor mode if the attached processor malfunctions while in problem program state and recovery is not possible.
- In certain 303x attached processor environments, processing may continue in uniprocessor mode on the attached processor by the Channel-set Switching facility. If this facility is present, CP switches all active channels on the main processor to the attached processor if the main processor malfunctions while in the problem program state and recovery is not possible.

Note: Loss of system integrity prevents the recording of hard machine checks in the supervisor (CP). Error information of this type may be obtained through the use of the processor's hard stop facility if the machine check is repetitive.

LEVELS OF ERROR RECOVERY

Recovery from machine malfunctions can be divided into the following categories: functional recovery, system recovery, operator-initiated restart, and system repair. These levels of error recovery are discussed in order from the easiest type of recovery to the most difficult.

Functional Recovery

Functional recovery is recovery from a machine check without adverse effect on the system or the interrupted user. This type of recovery can be made by either the processor retry or the ECC facility, or the machine check handler. The processor retry and ECC error correcting facilities are discussed separately in this section since they are significant in the total error recovery scheme. Functional recovery by the machine check handler is made by correcting Storage Protect Feature (SPF) keys and intermittent errors in main storage.

System Recovery

System recovery is attempted when functional recovery is impossible. System recovery is the continuation of system operations by terminating the user who experienced the error. System recovery can take place only if the user in question is not critical to continued system operation. A system routine containing an error that is considered to be critical to system operation precludes functional recovery and would require logout and a system dump followed by reloading the system.

Operator Initiated Restart

When the errors may have caused a loss of supervisor or system integrity, the system is put into a disabled wait state. The operator must then reload the system.

System Repair

If system recovery is not possible, the system may require the services of maintenance personnel to effect a system hardware repair. System repair by this method occurs when the error is so critical to system operations that the system cannot be used to record the error.

MACHINE CHECK HANDLER--SUMMARY

The machine check handler (MCH) consists of entirely resident routines in the CP nucleus.

Recovery from most machine malfunctions on System/370 is initially attempted by the instruction retry, and the error checking and correction (ECC) machine facilities. However, if the retry or storage correction is unsuccessful, if the interrupted instruction is non-retryable, or if the storage failure cannot be repaired, RMS will assess the damage and do the following:

- If the fault is an SPF key failure, refresh the key if conditions warrant such action.
- If the fault is related to main storage, either (1) refresh that page or (2) have CP flag that page as unusable and assign a new page; then refresh the data if valid to do so.
- Terminate or reset the virtual machine if the malfunction cannot be repaired but is traceable to a particular virtual machine.
- Terminate all SCP operations and post a wait state code if system integrity is lost and nonrecoverable.
- In attached processor applications, if the malfunction is associated with the attached processor while running in problem program state and attached processor recovery is not possible, cease all operations on the attached processor and allow the system to continue in uniprocessor mode on the main processor.
- If the error is a channel group inoperative on a 3031, 3032 or 3033 processor, place the system in a disabled wait state.

Any of the above conditions can produce one or more of the following results:

-- Wherever possible, a record of the error is produced in the system's error recording area.

-- Wherever possible, the primary system operator is informed of the error.

Errors corrected by instruction retry and main storage errors corrected by ECC are not reflected to the system operator's console, and these errors may or may not be recorded. See "Recovery Modes" in this section for a discussion of this.

The messages produced by the machine check handler on supported VM/370 systems are described in VM/370 System Messages. Wait state codes 001 and 013 produced by the machine check handler routines are also described in VM/370 System Messages.

Operand	Description
ACC=	Indicates that selected error records are to be accumulated in an output data set. The particular error records selected and the source of these records (either the VM/370 error recording cylinders, or a history file, or both) depends on what other operands are coded. The output accumulation data set is normally a tape mounted on tape drive 181, but this can be changed (see the section "CPEREP FILEDEFS"). When output is accumulated on tape 181, the output is added as an extension of the existing file: the tape is rewound and then spaced out to the end of the first file prior to writing. Therefore, if a tape is to be used for the first time, the user should write a tape mark at the beginning of the tape before invoking CPEREP (the CMS TAPE command can do this). When output is accumulated on a tape, the tape should be mounted, readied, and attached to the user's virtual machine as tape 181 prior to invoking CPEREP. Note that for most types of reports, ACC=Y is the default.
CLEAR CLEARF	CLEAR clears all errcr records from the error recording area, but does not clear the SRF frame records. CLEARF clears the SRF frame records from the error recording area, as well as error records subsequent to re-reading the SRF frames, and writing the frame records at the beginning of the error recording area. A CLEAR or CLEARF operand cannot be invoked with other operands. It must be invoked in a standalone manner. Therefore, the user should capture pertinent error area information before invoking one of these operands. It is recommended that the user acquaint himself with the ZERO operand for erasing the VM/370 error recording area. The ZERO operand is used in conjunction with report generation operands and does not execute the erase process until the report generation process is complete. The service support console must be in SRF mode. Note: The CLEARF operand is designed for the 3031, 3032, and 3033 processors in uniprocessor and attached processor mode. CPEREP should be invoked with CLEARF specified after the installation of engineering changes to the processor and channels. To access the SRF: (1) enable the I/O interface for the service support console, (2) activate the C1 frame, (3) select SRF mode (A2) for 3031 and 3033 processors (SRF appears disabled until accessed on the 3032), (4) vary on SRF, and (5) attach the SRF to the console of the class F user running CPEREP. CLEARF clears error records on a 158 or 168 processor.
CPU	An error record selection operand.--It allows the selection of error records by the central processor unit's serial and model number. Multiple processor values may be specified as multiple sub-operands of CPU.
CPUCUA	An error record selection operand.--It allows the selection of error records that relate to a specific processor (serial address) and an attached device (cuu) address. Multiple processor and devices can be specified as multiple sub-operands of CPUCUA.

Figure 32. Operands Used with CPEREP (Part 1 of 5)

Operand	Description
CTLCRD	An error record selection operand.--When the RDESUM operand requests an IPL report, CTLCRD controls the selection of error records via its span of dates and IPL clustering interval. Note: This operand and the date1, date2, interval, and title operands associated with it must be completed on one line of input and must not be followed by any other operands on this one line of input.
CUA=	An error record selection operand.--It allows the selection of error records by specific device address a range of device addresses, all the devices on a particular control unit, and all the devices on a particular channel. Multiple address values or ranges of values can be specified as multiple sub-operands of CUA.
DATE=	An error record selection operand.--It allows the selection of error records by the date or span of dates (Julian day values) specified.
DEV=	An error record selection operand.--It allows the selection of error records by device type (for example, 2314, 3330). Multiple device types can be specified as multiple suboperands of DEV.
DEVSER=	An error record selection operand.--It allows the selection of error records by the specific device serial number in the service data field in the error record. This operand is valid for only 3410/3420 devices. Multiple device serial numbers can be specified as multiple suboperands of DEVSER.
ERRORID=	An error record selection operand.--It applies only to MCH and software records generated by OS/VS2 MVS. It allows selection by the five digit error identifier alone or by the five digit error identifier, processor identifier, address space identifier, and date/time values.
EVENT=	A report generation operand. -- This operand generates one line abstracts of all or selected error records in chronological order.
HIST=	Indicates that the source of the error records for this run is to be a history data set rather than the VM/370 error recording cylinders. A history data set is a data set that was created as an accumulation (ACC) data set during an earlier session. Usually, the history data set is a tape mounted on tape drive 182, but this can be changed (see the section "CPEREP FILEDEFs"). When input is from a history tape, the tape should be mounted, ready, and attached to the user's virtual machine as tape 182 prior to invoking CPEREP.

Figure 32. Operands Used with CPEREP (Part 2 of 5)

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The entries in this Index are accumulative. They list additions to this publication by the following VM/370 System Control Program Products:

- VM/370 Basic System Extensions, Program Number 5748-XX8
- VM/370 System Extensions, Program Number 5748-XE1

However, the text within the publication is not accumulative; it only relates to the one SCP program product that is installed on your system. Therefore, there may be topics and references listed in this Index that are not contained in the body of this publication.

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IBM Virtual Machine Facility/370:
OLTSEP and Error Recording Guide

This Technical Newsletter contains replacement pages for VM/370 OLTSEP and Error Recording Guide to support VM/370 System Extensions (Program No. 5748-XE1).

Before inserting any of the attached pages into the VM/370 OLTSEP and Error Recording Guide, read carefully the instructions on this cover. They indicate when and how you should insert pages.

Pages to be Removed	Attached Pages to be Inserted*
47-48.2	47-48.2
61-62	61-62.2

*If you are inserting pages from different Newsletters/Supplements and identical page numbers are involved, always use the pages with the latest date (shown in the slug at the top of the page). The page with the latest date contains the most complete information.

Changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

SUMMARY OF AMENDMENTS

This Technical Newsletter incorporates modification to pages of the VM/370 System Extensions Supplement affected by updates to base material.

Note: Please file this cover letter at the back of the base publication to provide a record of changes.

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RDEVBLOK to determine if intensive recording mode is in effect for this device. If the conditions are met, an I/O error record is created. This record is constructed and recorded as described previously. Control is returned to the I/O supervisor, which reflects the error to the user of the I/O operation.

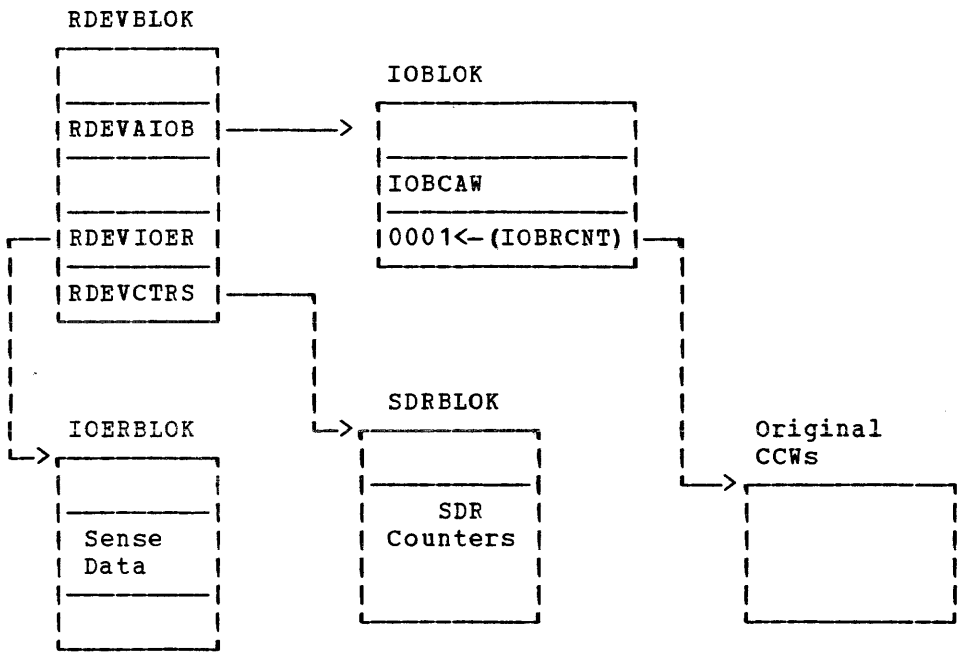

Figure 12. Control Block Relationship for SDR Counter Update

I/O Error Recording and Error Recording Area

The error recording facilities of VM/370 format and record outboard error records, and record formatted machine check and channel check records created by the RMS routines of VM/370.

The error recording routines of VM/370 do not actually perform I/O operations. Instead, the I/O error routines treat the error recording area allocated on the VM/370 system residence pack as a logical extension of VM/370 storage. These extensions of VM/370 storage are in the form of logical pages that can be read and written out of by the paging supervisor of VM/370. The error recording routines place multiple error records within a page; when an error record is assembled within a page, a pointer is updated to indicate the beginning of any unused area. The next error record is checked to see if it can be contained in the remainder of this page. If it can, the error record is read into the page and the pointer is updated to again reflect any residual storage available for the next error record. This process continues until an error record is encountered that cannot be contained within the page. When this happens, the page is scheduled to be read out to the next available slot in the error recording area and a new page in storage is assigned to accept and retain the error record. The process continues in like manner.

On count-key-data devices, the error recording area is from two to nine adjacent cylinders assigned on the system residence volume. The starting cylinder number and number of cylinders are specified in VM/370 generation procedures. On FB-512 devices the error recording area is any number of adjacent pages assigned on the system residence volume. The starting page number and the number of pages are specified in the VM/370 generation procedures. In any case when the error recording area is 90% full, and again when 100% full, the I/O error routines instruct the VM/370 system operator to invoke the CPEREP command to print (or create a tape of) the error data and erase the recording area. Errors are recorded in the order of occurrence until the allotted space is exhausted.

Because of the support provided for the 303x processors in uniprocessor or attached processor modes, CPEREP processing is not dependent on the content or engineering change (EC) level of the processor logouts to format machine check and channel check records. Instead, the 7443 Service Record File (SRF) device provides format and content information contained in frames on diskette to format MCH and CCH records. In a 303x attached processor environment, each processor has its own SRF device. Customer engineering maintains the SRF frames (records containing text and scan buffer codes to format MCH and CCH records) on each SRF device. CPEREP makes use of these frames to interpret and format inboard errors for hardcopy output.

At initialization, the VM/370 system control program recognizes the presence of multiple SRF devices in certain 303x attached processor environments. CP accesses the SRF device(s) at initialization, retrieves the frames, and records them at the beginning of the error recording area. When multiple SRF devices exist in a 303x AP environment, the header portion of each SRF frame record written to the error recording area identifies the processor by processor number and model number. The interrupt handler routine identifies which MCH and CCH records the main processor generated and which records the attached processor generated. In this way, CPEREP uses SRF frames to format MCH and CCH records for printed reports by matching the inboard error records to their respective frames.

Each time an engineering change (EC) requiring a new diskette is installed in a 303x uniprocessor or in certain 303x attached processor environments, the privilege class F user must issue the CPEREP CLEARF command. This command clears and reformats the error recording area by accessing the format information in the SRF frames on the newly installed diskette.

In 303x uniprocessor mode or in certain 303x attached processor environments, system generation procedures provide support for the SRF device(s) so that CPEREP can properly format machine check and channel check records created by each processor. A channel path must also exist between the main processor and the SRF of the attached processor in a 303x attached processor environment. Establishing this channel path allows CP to read frames from each of the SRF devices to the error recording area. Refer to VM/370 Planning and System Generation Guide for the requirements needed to generate support for the SRF device(s).

The SRF device is accessed by VM/370 to read frame data (a) during VM/370 system initialization if the error recording cylinders have not been previously formatted; and (b) as a result of running CPEREP with the CLEARF operand. To ensure that the VM/370 control program has access to the SRF device after initialization, the following steps should be followed to activate the SRF:

1. Check that the I/O interface for the service support console is enabled.

2. Obtain the configuration frame on the service support console.

3. The SRF appears disabled until accessed on the 3032. Activate the SRF on the 3031 and 3033 by selecting SRF mode A2.

If CCH determines that system integrity has been damaged (for example, if the channel has been reset, or if the device address stored is invalid), CCH places the system in a disabled wait state and sends a message to the VM/370 primary system operator. For the 4331 and 4341 processors, limited channel logout is still available, but no fixed or I/O extended logout area exists.

Virtual machines for which VMSAVE (Directory option or SET command operand) is enabled normally have their register and storage contents saved in the event of certain abend situations. However, catastrophic channel errors cause a disabled wait PSW to be loaded and may prevent saving the contents of a virtual machine.

HANDLING OF HARD MACHINE CHECKS

If a permanent error (hard machine check) occurs on the main processor (or attached processor), the error is analyzed to determine whether or not it is correctable by programming. Time-of-day clock and timer errors that result in a machine check interruption that are not correctable and cannot be circumvented place the real computing system in a disabled wait state.

Uncorrectable or unretryable processor errors, storage errors, and storage protect key failures are handled as discussed in the following paragraphs.

Processor Errors

When a machine check interruption indicates that a processor error associated with VM/370 cannot be corrected or retried the system operator is informed of the error and the system is put in a disabled wait state. All virtual machine users must log on again. If the error is associated with a virtual machine, the user is informed of the error and the virtual machine is reset, unless it is using the virtual=real option. In that case, the virtual machine is terminated, and the user must then log on and reinitialize (via IPL) his machine.

If VM/370 is being run in attached processor mode and an uncorrectable error is encountered on the attached processor while executing in problem program state, system operation continues in uniprocessor mode on the main processor.

In certain 303x attached processor environments, a Channel-set Switching facility may exist. This facility allows processing to continue on the attached processor in uniprocessor mode after the main processor enters a disabled wait state following a hard machine check or channel check that results in an uncorrectable error. Automatic processor recovery routines test for the Channel-set Switching facility. If the facility is present, CP switches all active channels on the main processor to the attached processor, and the processing continues on the attached processor in uniprocessor mode. Refer to VM/370 Planning and System Generation Guide for the specific 303x attached processors that support Channel-set Switching.

Storage Errors in a Virtual Machine Page

When the control program (CP) detects a permanent storage error (hard machine check) in a real storage page frame that is being used by a virtual machine, the frame is marked invalid if the error is

intermittent, or unavailable if the error is solid. If the page frame has not been altered by the virtual machine, a new page frame is assigned to the virtual machine and a backup copy of the page is brought in the next time the page is referenced. All storage errors are transparent to the virtual machine user.

If the page frame has been altered, VM/370 resets the virtual machine, clears its virtual storage to zeros, and sends an appropriate message to the user. If the virtual machine is using the virtual=real option, it is terminated. In either case, normal system operation continues for all other users.

Storage Errors in the CP Nucleus

Multiple-bit storage errors in the CP nucleus cannot be corrected; they cause VM/370 to terminate. (Single-bit storage errors are corrected by ECC, as noted above.)

Storage Protect Key Failures

When intermittent storage protect key failures occur, whether associated with VM/370 or a virtual machine, the key is corrected and operation continues.

If the storage protect key error is uncorrectable (solid) and is associated with a virtual machine, the user is notified and the virtual machine is terminated. The page frame is marked unavailable. Uncorrectable storage protect key failures associated with VM/370 cause the VM/370 system to be terminated. An automatic restart reinitializes VM/370.

HANDLING OF SOFT MACHINE CHECKS

Although hard machine checks always cause a machine check interruption to occur and logouts to be written, soft machine checks are handled in one of two operating modes -- recording mode or quiet mode.

- In recording mode, soft machine checks cause machine check interruptions and write logouts.
- In quiet mode, only hard machine checks cause machine check interruptions and write logouts.

The normal operating state of VM/370 for CPU retry reporting is recording mode. For ECC (error checking and correction) reporting, the initialized (normal) state of VM/370 is model-dependent: quiet mode for all VM/370-supported processors except Models 155II and the 165II. The initial state for the 155II and 165II is record mode.

A change from recording mode to quiet mode can occur in one of two ways: when 12 soft machine checks have occurred, or when the SET MODE RETRY/MAIN QUIET command is executed by maintenance personnel.

To revert to record mode again, the command SET MODE RETRY/MAIN RECORD must be issued.

In attached processor applications, soft error recording can be set or reset for the selected processor if so desired.

If a soft machine check (a transient error) occurs while the system is in recording mode, a machine check record containing information about the error is written on the error recording cylinders. This record includes the data in the fixed logout area, the date, the time of day, and other pertinent data. The operator is not informed that a soft machine check has occurred.

If a transient error occurs while the system is in quiet mode, no machine check interruption occurs, and no logouts are written. The hardware, which had gained control when the soft machine check occurred, returns control to either VM/370 or the problem program, depending on which had control at the time the machine check occurred.

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IBM Virtual Machine Facility/370: OLTSET and Error Recording Guide

This Technical Newsletter contains replacement pages for VM/370 OLTSEP and Error Recording Guide to support Release 6 PLC 4 of IBM Virtual Machine Facility/370.

Before inserting any of the attached pages into the VM/370 OLTSEP and Error Recording Guide, read carefully the instructions on this cover. They indicate when and how you should insert pages.

Pages to be Removed	Attached Pages to be Inserted*
Title, Edition Notice	Title, Edition Notice
Contents vii-viii	Contents vii-viii
Summary of Amendments ix-xii	Summary of Amendments ix-xii
47-48	47-48.2
61-62	61-62.2
67-68	67-68.2
85-86	85-86
Index 115-120	Index 115-120

*If you are inserting pages from different Newsletters/Supplements and identical page numbers are involved, always use the pages with the latest date (shown in the slug at the top of the page). The page with the latest date contains the most complete information.

Changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

Summary of Amendments

This Technical Newsletter incorporates changes reflecting Multiple Service Record Files and Channel-set Switching.

Note: Please file this cover letter at the back of the base publication to provide a record of changes.

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