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System Recovery Procedures

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Complex Systems
Recovery and Availability
System Recovery Procedures

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This document provides guidelines and procedures for recovery in an IBM ES/3090 Processor Complex running MVS/ESA. The document is intended for systems programmers and operating staff and can be tailored for customer needs.

LSYS (129 pages)

First Edition (May 1989)

This edition applies to SEC level 223770 for the IBM ES/3090 Processor Complex and MVS/SP V3.1.0e.

Preface

This manual contains recovery procedures for complex systems environments. The customer may wish to tailor the document to the requirements of his installation.

This document provides the basis for a quick reference handbook for IBM ES/3090 operators. Emphasis in the book is on MVS/ESA recovery facilities and I/O recovery procedures. This edition of *IBM ES/3090 Complex Systems Recovery and Availability System Recovery Procedures* is based on a publication that was previously published as *IBM 3090 Models 400E and 600E System Recovery Procedures*. Processor Complex recovery and recovery planning, a reconfiguration checklist and Processor Complex recovery procedures can be found in *IBM ES/3090 Complex Systems Recovery and Availability Reconfiguration and Recovery Procedures*.

Since data processing installations vary widely, this book cannot include all procedures for all IBM ES/3090 installations, or, indeed, all procedures for any installation.

Currency

One difficult aspect of any documentation dealing with a product subject to frequent changes is keeping the document current. Furthermore, there are several levels of software and hardware installed at any one time, so there can be different correct procedures for certain situations. This document attempts to reflect the state of the products, both hardware and software, at the time of the final draft of this document (January 1989). Additional documentation is included about features that have been announced but are not necessarily available at this time in all installations.

All procedures described in this bulletin were tested on an IBM 3090 Model 200S at system EC level 223770 with MVS/ESA Version 3 Release 1.0e (MVS/ESA 3.1.0e) installed, with several APARs that were available at the time when the system was built.

Organization

This manual is divided into 19 chapters, each of which addresses a different aspect of system recovery.

Chapter One provides a reference table that lists symptoms and refers to the chapters in this book where the symptom is discussed.

Chapter Two describes disabled wait states and gives directions about the actions to be taken for each of them.

Chapter Three offers wait state diagnostic procedures for wait state problems. The contents of this chapter are mainly referred to from the previous chapter and describe the use of the ALTCP frame in several situations.

Chapter Four gives an overview of appropriate actions if the system appears to be in an enabled wait state.

Chapter Five offers procedures for handling problems that are common at IPL time and instructs the user on how to overcome these situations.

Chapter Six offers procedures for handling disabled and enabled loops and instructs the user on how to perform a proper instruction trace.

Chapter Seven describes what to do when one or more of the MVS consoles are lost.

Chapter Eight introduces DCCF messages, how to recognize them, and how to respond to them.

Chapter Nine introduces the concept of device boxing.

Chapter Ten describes how to recognize and how to react to missing interrupts.

Chapter Eleven gives procedures for handling DPS devices, and shows the user how to recognize and re-synchronize DPS array out-of-sync situations.

Chapter Twelve offers procedures for recognizing and removing write inhibit conditions.

Chapter Thirteen describes 3990 SIM messages and gives procedures for unfencing all types of fencing conditions.

Chapter Fourtteen describes how to decide whether an unconditional reserve channel command is to be issued by the system, especially when reserved devices are involved.

Chapter Fifteen contains procedures for recognizing hot I/O and handling hot I/O wait states.

Chapter Sixteen has procedures for handling channel path recovery situations.

Chapter Seventeen describes the recognition and handling of I/O hang conditions.

Chapter Eighteen describes the recognition and handling of GRS ring reconfiguration, recovery, and re-start.

Chapter Nineteen describes how to react to configuration and malfunction alerts.

How to Tailor this Book

This manual can be obtained from ITSC Poughkeepsie in machine-readable form to allow you to tailor it to your needs or to integrate it into your existing operator documentation. Either send the Reader's Comment Form from the back of this publication or send a request, through your IBM representative, to userid *ITSCMAN* at *WTSCPOK*.

The book was created using the starter set of the Generalized Markup Language (GML) of Release 3 of the IBM Document Composition Facility Program Product (program number 5748-XX9) and can be formatted and printed by anyone having access to that product.

We suggest you delete the procedures and paragraphs that are not needed for your installation and add your own recovery procedures, as appropriate.

Related Publications

The following publications provide additional information that may assist the presenter or student to obtain a fuller understanding of the subject area:

IBM ES/3090 Processor Complex: Recovery Guide, SC38-0070

MVS/ESA Planning: Recovery and Reconfiguration, GC28-1837

IBM ES/3090: Complex Systems Recovery and Availability Configuration Considerations, Volume I: GG24-3340, Volume II: GG24-3341, and Volume III: GG24-3342

IBM ES/3090: Complex Systems Recovery and Availability, Volume I: GG24-3343, Volume II: GG24-3344, and Volume III: GG24-3345

IBM ES/3090: Complex Systems Recovery and Availability Reconfiguration and Recovery Procedures, GG24-3347

IBM ES/3090: Complex Systems Recovery and Availability Technical Guide, GG24-3348

IBM ES/3090: Complex Systems Recovery and Availability Exercise Guide, GG24-3349

IBM ES/3090: Complex Systems Recovery and Availability Exercise Installation and Run-Time Procedures, GG24-3350

IBM 3090 Processor Complex: Recovery Concepts, GG24-3077

IBM/3090 Processor Complex: System Recovery in a Complex Environment, Volume I: GG24-3195, Volume II: GG24-3196, and Volume III: GG24-3197

Storage Subsystem Library: IBM 3990 Storage Control Introduction, GA32-0098

Storage Subsystem Library: IBM 3990 Storage Control Reference, GA32-0099

Storage Subsystem Library: IBM 3990 Storage Control Planning, Installation, and Administration Guide, GA32-0100

System/370 Extended Architecture Reference Summary, GX20-0157

MVS/ESA Diagnosis: Data Areas, Volume 5, LY28-1047

MVS/Extended Architecture: System Messages, Volume 2, GC28-1377.

MVS/ESA Message Library: System Messages, Volume 1, GC28-1812

MVS/ESA Message Library: System Messages, Volume 2, GC28-1813

MVS/ESA Message Library: System Codes, GC28-1815

MVS/ESA System Programming Library: Initialization and Tuning, GC28-1828

IBM Enterprise Systems Architecture/370: Principles of Operation, SA22-7200.

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This edition of *IBM ES/3090 Complex Systems Recovery and Availability System Recovery Procedures* contains an updated version of the information that was previously published in Chapter 3 through 16 of *IBM 3090 Models 400E and 600E System Recovery Procedures*.

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Ole Andreas Batnes	IBM Norway
Roar Framhus	ITSC Poughkeepsie
Margaret Gibson	IBM Australia
Tim Hewitt	IBM Canada
Jean Luc Hoorens	IBM France
Geoff Hopkin	IBM UK
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Comments by readers of this document will be greatly appreciated. Please feel free to return your Reader's Comment Form to ITSC, Poughkeepsie.

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1.0 Using this Book

Each chapter in this book deals with a separate aspect of system recovery. The way the information in a chapter is presented depends on the particular problems discussed in the chapter. Note, however, that the information is presented in the way that will make it easiest for you to use and tailor. For example, most procedures are presented on a single page, or on facing pages. Further, when a particular diagram is required for several procedures (as in Chapter 8) the diagram is repeated for each procedure. This arrangement provides you with all the needed information at the point you need it, and relieves you of the necessity for looking in two places to get a complete procedure.

Within each chapter, the information is presented in a sequence that is either alphameric (such as diagnostic procedures in procedure number order) or logical, with similar problems grouped together.

Figure 1 through Figure 3 are reference tables that direct you to the appropriate part in this book. Find the problem under the headings "Action or Symptom" and refer to the section listed under "Task to Perform".

Figure 4 through Figure 6 are reference tables that direct you to the actions to be taken if the listed message appears. Find the message number under the heading "Message" and refer to the section listed under "Task to Perform".

ACTION OR SYMPTOM	TASK TO PERFORM
ACR after spin loop	"Spin Loop" on page 47
Boxed devices	"Device Boxing" on page 65
Cancel key	"Cancel Action" on page 62
Cause codes	"DPS Device Messages - Problem Cross Reference" on page 82
Channel path recovery	"Channel Path Recovery" on page 113
CHPID alert	"Alerts" on page 125
Dasd ERP	"Recognizing a Write Inhibit Condition" on page 87
DCCF	"Disabled Console Communication Facility" on page 59
DCCF messages	"Responding to Messages Issued Through DCCF" on page 61
DCCF responses	"Responding to Messages Issued Through DCCF" on page 61

Figure 1. Cross Reference Table (Part 1 of 3)

ACTION OR SYMPTOM	TASK TO PERFORM
Device boxed	"Device Boxing" on page 65
Diagnostic procedures	"Wait State Diagnostic Procedures" on page 19
Disabled loop	"Disabled Loop" on page 46
Disabled wait	"Disabled Wait States" on page 7
Display device number from subchannel number	"PD01" on page 20
Display device number from UCB address	"PD02" on page 21
DPS devices	"Dynamic Pathing" on page 79
DPS device handling	"Handling Dynamic Pathing Devices" on page 79
DPS operational procedures	"Handling Dynamic Pathing Devices" on page 79
DPS cross reference	"DPS Device Messages - Problem Cross Reference" on page 82
DPS array out-of-sync	" Recognizing DPS Array Out-of-Sync" on page 80
DPS array resync.	"Recovering a 3990/3380 Out of Sync Condition" on page 81
Enabled loop	"Enabled Loop" on page 43
Enabled wait	"Enabled Wait States" on page 33
GRS reconfiguration	"GRS Ring Reconfiguration" on page 119
GRS recovery	"Recovering from GRS Ring Disruption" on page 121
Hot I/O	"Hot I/O" on page 101
Hot I/O messages	"Hot I/O Message - IOS111A" on page 105
Hot I/O recognition	"Recognizing Hot I/O" on page 101
Hot I/O wait states	"Handling Hot I/O Wait States" on page 107
Instruction trace	"Instruction Trace" on page 51
I/O hang	"I/O Hang Conditions" on page 117
IML control unit	"Handling Dynamic Pathing Devices" on page 79
Loop	"Loops" on page 43

Figure 2. Cross Reference Table (Part 2 of 3)

ACTION OR SYMPTOM	TASK TO PERFORM
Loop	"Loops" on page 43
Loop recording	"Instruction Trace" on page 51
Missing interrupt (MIH)	"Missing Interrupts" on page 69
Missing interrupt messages	"Missing Interrupt Handler Messages" on page 69
Page data set	"Page Data Set Volume Error" on page 99
Resynchronize DPS arrays	" Recognizing DPS Array Out-of-Sync" on page 80
Spin loop	"Spin Loop" on page 47
Spin loop handling	"Spin Loop" on page 47
Spin loop responses	"Handling Wait State 09X" on page 50
Spin loop time out	"Spin Loop" on page 47
Start pending	"Handling Message IOS071I" on page 70
Unconditional reserve U/R	"Unconditional Reserve" on page 97
Wait state	"Disabled Wait States" on page 7
Wait state codes	"Disabled Wait States" on page 7
Write inhibit	"Write Inhibit" on page 87
Write inhibit handling	"Handling Write Inhibit Condition" on page 87
Write inhibit messages	"Messages Issued During Write Inhibit Processing" on page 87
Write inhibit removal	"Removing a Write Inhibit Condition" on page 88

Figure 3. Cross Reference Table (Part 3 of 3)

MESSAGE	TASK TO PERFORM
IEA466E PATH PERMANENT I/O ERROR	"Write Inhibit" on page 87
IEA467E PATH WRITE INHIBITED FOR WRITES	"Write Inhibit" on page 87
IEA468E WRITE INHIBITED PATH ENCOUNTERED	"Write Inhibit" on page 87
IEA469E PATH HAS BEEN VARIED OFFLINE	"Write Inhibit" on page 87
IEA469E PATH CANNOT BE VARIED OFFLINE	"Write Inhibit" on page 87
IEF281I ddd NOW OFFLINE DEVICE IS BOXED	"Device Boxing" on page 65
IOS004I IOS RECOVERY FAILURE	"Handling Message IOS004I" on page 116
IOS062E ERROR ON CHANNEL PATH-STOP SHARING SYSTEMS	"Handling Message IOS062E" on page 113
IOS070E ddd,MOUNT PENDING	"Handling Message IOS070E" on page 69
IOS071I	"Handling Message IOS071I" on page 70
IOS075E	"Handling Message IOS075E" on page 71
IOS076E	"Handling Message IOS076E" on page 71
IOS077E	"Handling Message IOS077E" on page 71
IOS100I DEVICE ddd BOXED	"Device Boxing" on page 65
IOS101I DEVICE ddd BOXED	"Device Boxing" on page 65
IOS102I DEVICE ddd BOXED	"Device Boxing" on page 65
IOS102I DEVICE ddd BOXED OPERATOR REQUEST	"Hot I/O" on page 101
IOS104I DEVICE ddd BOXED UNCOND RESERVE FAILED	"Device Boxing" on page 65
IOS105I DEVICE ddd BOXED BY UNCOND RESERVE PROCESS	"Device Boxing" on page 65

Figure 4. Message Cross Reference Table (Part 1 of 3)

MESSAGE	TASK TO PERFORM
IOS106E VARY ddd OFFLINE TO JES3	"Device Boxing" on page 65
IOS109E HOT I/O RECOVERY INITIATED FOR DEV ddd	"Hot I/O" on page 101
IOS109E HOT I/O RECOVERY INITIATED FOR DEV ddd	"Hot I/O" on page 101
IOS109E HOT I/O RECOVERY INITIATED FOR DEV ddd	"Hot I/O" on page 101
IOS203I CHANNEL PATH yy SUCCESSFULLY RECOVERED	"Hot I/O" on page 101
IOS110A IOS HAS DETECTED HOT I/O ON DEVICE ddd	"Hot I/O Message - IOS110A" on page 103
IOS111A IOS HAS DETECTED HOT I/O ON DEVICE ddd	"Hot I/O Message - IOS111A" on page 105
IOS112A IOS HAS DETECTED HOT I/O ON DEVICE ddd	"Hot I/O Message - IOS112A" on page 106
IOS113W IOS RECOVERY FAIL- URE-RESERVES MAY BE LOST	"Handling Message IOS113W and Wait State 113" on page 116
IOS162A CHPID XX ALERT	"Malfunction Alert - IOS162A" on page 126
IOS163A CHPID XX ALERTRS	"Configuration Alert - IOS163A" on page 125
IOS202I CHANNEL PATH yy FORCED OFFLINE	"Hot I/O" on page 101
IOS202I CHANNEL PATH cc FORCED OFFLINE	"Channel Path Recovery" on page 113
IOS203I CHANNEL PATH cc SUCCESSFULLY RECOVERED	"Channel Path Recovery" on page 113
IOS427A component FAILURE REPLY WITH UR,BOX OR NOOP	"Message IOS427A" on page 98
IOS428I ddd,cc, RECOVERED THROUGH CHANNEL PATH zz	"Message IOS428I" on page 99
IOS429I ddd NOT RECOVERED THROUGH ALT CHANNEL PATH	"Message IOS429I" on page 99

Figure 5. Message Cross Reference Table (Part 2 of 3)

MESSAGE	TASK TO PERFORM
ANOTHER SYSTEM	
IOS450E ddd,cc text PATH TAKEN OFFLINE	" Recognizing DPS Array Out-of-Sync" on page 80
IOS451I ddd, BOXED, text	" Recognizing DPS Array Out-of-Sync" on page 80
IOS452I ddd,cc text	" Recognizing DPS Array Out-of-Sync" on page 80
ISG022E Disrupted GRS	"Recovering from GRS Ring Disruption" on page 121
ISG023E GRS Disrupted	"Recovering from GRS Ring Disruption" on page 121

Figure 6. Message Cross Reference Table (Part 3 of 3)

2.0 Disabled Wait States

A disabled wait state is a wait state in which the system will accept no Machine Check, External, or I/O interrupts (it is disabled for interrupts). A disabled wait state is characterized by the following:

- No input is accepted at the master console.
- A message is sent to the system console and the processor controller alarm is sounded when the PCE detects the loading of a disabled wait PSW.
- The disabled wait message can be re-displayed by pressing the VIEWLOG key.

The message has the form:

```
                                                                    (62103)
************************* PRIORITY  MESSAGE ********************************
*                                                                           *
*             CPy has entered disabled wait.                                *
*                  PSW = 000A0000 00000nnn                                  *
*                                                                           *
* Intended Console: System                                                  *
*                                                                           *
* Detailed Information: The processor has loaded a wait PSW                 *
*                       which is disabled for all interrupts.               *
*                                                                           *
* System Action: None. The processor remains in the operating               *
*                state but is not executing instructions.                   *
*                                                                           *
* User Action: Refer to operating system message and wait codes             *
*              publication for recommended action.                          *
*                                                                           *
*****************************************************************************
```

```
The PSW has the form:  000A0000 00000nnn
                              p
```

In the PSW, the digit marked by the 'p' indicates that the system is in a wait state (bit 14 is on), and nnn' is the wait state code.

Some disabled wait state PSWs contain extra information and have the form:

```
PSW=000A0000 00xx0nnn
                pp
```

The digits marked by 'pp' may contain:

- A CP identifier, in the case of a spin loop Wait09X, for example.
- A reason code, in the case of a Wait055, for example.

Disabled wait states are used:

- To terminate MVS when the hardware or MVS detects an unrecoverable error (this is a non-restartable wait).
- To communicate to the operator a condition that requires operator action when normal communication through the MVS operator console is not possible (this is a restartable wait).

The Disabled Wait States Codes Reference Table, shown in Figure 7 through Figure 16, can be used as a quick reference chart for the operator to handle disabled wait states. The contents of this table are based on *MVS/ESA System Codes*. The table has been simplified and updated for the 3090 Processor Complex, but it should be used only by the operators; system programmers should refer to *MVS/ESA System Codes* for a full description.

For specific situations where the operator action is more complicated and requires not only one, but a sequence of operations, a set of procedures is given in the pages following the reference table. The procedures are named PDxx and are described under "Wait State Diagnostic Procedures" on page 19.

WAIT STATE	REASON	ACTION
002	HW failure during IPL	Try again, if problem persists, call CE.
003	HW failure during IPL (IPL device)	Check for IPL device enabled or try to IPL from a different device.
004	HW failure during IPL	Try again, if problem persists, call CE. Isolate the failing unit using procedure "PD01" on page 20.
005	HW failure during IPL (unit failure)	Make sure the IPL pack is ready and re-IPL the system. If IPL continues to fail try from your alternate IPL volume. See "PD01" on page 20.
006	I/O error reading SYS1.NUCLEUS at IPL	Call system programmer to check if the data set SYS1.NUCLEUS is not in secondary extents. Also, refer to "PD09" on page 28.
007	No console available (NIP)	Check consoles. Check IOGEN or MVSCP definition of consoles. Refer to "PD11" on page 31.
00A	No SYS1.LINKLIB in catalog	Call system programmer.
00B	Master Scheduler ABEND	Try again and print the dump that was taken by the system. If second try is unsuccessful take a SADUMP and call the system programmer.
00C	User error	Notify system programmer.
00D	Master Scheduler ABEND	Try again. If unsuccessful, take a SADUMP and notify the system programmer.
00E	User error	Check that the alternate nucleus selection was correct in the Load Parameter field. If problem persists, call the system programmer.
00F	User error (No IPL text on volume)	Correct the IPL address and try again.
013	System error	Take a SADUMP and try to re-IPL.
014	System error	Take a SADUMP and try to re-IPL.
015	Hardware problem (3092) during NIP	Re-IPL and notify hardware support.

Figure 7. Disabled Wait State Codes Table (Part 1 of 10)

WAIT STATE	REASON	ACTION
016	Hardware problem (3092) during NIP	Re-IPL and notify Hardware support.
017	Hardware problem during IPL (unit check)	Isolate the failing unit using "PD01" on page 20 and re-IPL.
019	User or Hardware error	Often the result of pressing the START key. This causes the non-IPL online processor to enter WAIT STATE 019. It is not necessary to re-IPL. Continue IPL procedure and the waiting processors will be started automatically by MVS/SP V2 and V3.
01B	Slip trap match (restartable)	Notify system programmer and follow his instructions or your predefined installation procedure. Either restart the waiting CP or take a SADUMP and re-IPL the system.
01C	System error	Take a SADUMP and re-IPL.
020	Hardware error (3092)	Take a SADUMP and re-IPL. Notify hardware support. Check the processor controller. Try to do a switch-over or IPL. If this does not work, partition the machine and use the side with a good 3092.
021	I/O error on console at IPL	Check the security key on the master console. Check the IOGEN or MVSCP definition of the master console.Try to re-IPL. If unsuccessful, switch off the master console and IPL using the alternate console. Also, refer to "PD11" on page 31.
022	User or hardware error Duplexed page Primary and secondary devices not ready	Verify that the correct volume is mounted. Register 7 contains the UCB address of the verified device. Use "PD02" on page 21 to check the VOLSER, and re-IPL.

Figure 8. Disabled Wait State Codes Table (Part 2 of 10)

WAIT STATE	REASON	ACTION
023	System error	Take a SADUMP and re-IPL.
024	System or hardware error	Take a SADUMP and re-IPL. If unsuccessful, check that the Read/Write switch on all system DASD devices is set to R/W. Notify the system programmer.
025	Duplicate Nucleus entry point during IPL	Notify system programmer and take a SADUMP.
028	Invalid I/O configuration identifier specified	Re-IPL with valid I/O configuration identifier in the second and third digits in the Load Parameter field on the OPRCTL or SYSCTL frames of the system console.
029	TOD clock in error (NIP)	Depress 'TOD ENABLE' and 'ALT' during IPL until first IPL message is received.
02D	User Error (Accessing MSS during NIP)	Take a SADUMP and notify the system programmer. Do not access any MSS volumes during NIP.
02E	Hardware error on paging data sets	Notify the system programmer who will allocate new paging space. Run EREP.
030	Abend during NIP	Take a SADUMP and re-IPL. Notify the system programmer.
031	User error, no UCB for IPLdevice	If possible, mount the IPL pack on a device you know to be SYSGENed and re-IPL. If not possible or still unsuccessful, take a SADUMP and notify the system programmer.
032	User, module missing in NUCLEUS	Record the complete PSW, take a SADUMP. and notify the system programmer.
033	I/O error during NIP	Try to re-IPL. If unsuccessful, record the complete PSW and notify the system programmer.
035	Entry point in Nucleus not found during IPL	Notify the system programmer and take SADUMP.

Figure 9. Disabled Wait State Codes Table (Part 3 of 10)

WAIT STATE	REASON	ACTION
037	User or hardware error	Record preceding messages, take a SADUMP, and notify the system programmer.
038	Not enough real storage to IPL	Check the configuration and notify the system programmer.
039	User error (Volume error at IPL)	Take a SADUMP and notify the system programmer.
03A	User error during CLPA	Record preceding messages and notify the system programmer.
03B	Module not found in LPA	Record preceding messages and notify the system programmer.
03C	User, page space shortage	Increase space for page space and re-IPL. The messages that precedes this wait code specifies which page space (COMMON, or LPA) was too small.
03D	Not enough real storage for CSA	Check the configuration and notify the system programmer. Probably the CSA is too large.
03E	User error, page space shortage during IPL	Notify system programmer and re-IPL after increasing the available page space.
03F	User error (Invalid invocation of a NIP function)	Notify the system programmer and take a SADUMP.
040	User or system error (ABEND during NIP)	Record the full PSW, take a SADUMP, and notify the system programmer.
044	Machine check during NIP	The logical address of the CPU is in bits 40-47 of the PSW. Re-IPL and, if error persists, configure the failing CPU offline. That will require a power-on-reset. Report the problem to your hardware CE.
045	User or system error during IPL	Notify system programmer and take a SADUMP.
046	User or system error during NIP	Notify system programmer and take a SADUMP.

Figure 10. Disabled Wait State Codes Table (Part 4 of 10)

WAIT STATE	REASON	ACTION
04A	TOD clock error	Restart the target CP. Press the 'TOD ENABLE' and 'ALT' keys at the system console for several seconds and IPL will continue.
050	Hardware error (multiple ACR)	Take a SADUMP, re-IPL, and run EREP.
051	Software error during ACR	Take a SADUMP, re-IPL, and run EREP.
052	Hardware error during ACR	Take a SADUMP, re-IPL, and run EREP.
053	SQA has been exhausted	Notify system programmer.
054	Nucleus member error	Reason code in bits 40-43 of PSW. Notify the system programmer.
055	Module not found in SYS1.NUCLEUS	Reason code in bits 40-43 of PSW. Most usual reason codes are: RC=01 - Dat-off nucleus module not found. Ensure Load Parameter first digit is correct. RC=02 - Dat-on nucleus module not found. Ensure second and third Load Parameter digits are correct. RC=03 - IPL information table not found (IOSIITXX) RC=04 - Module list table not found Notify system programmer to provide correct member(s) in SYS1.NUCLEUS.
059	User or system error during IPL	Notify the system programmer and take a SADUMP.
05C	User or hardware error during IPL	Take a SADUMP and re-IPL. If problem persists, notify system programmer.
05D	User or hardware error during NIP	Take a SADUMP and re-IPL. If the problem persists, notify the system programmer.
05E	Hardware error during NIP	Restore the master catalog to the proper volume. Try to re-IPL. If problem persists, notify the system programmer.

Figure 11. Disabled Wait State Codes Table (Part 5 of 10)

WAIT STATE	REASON	ACTION
05F	User error during NIP	Check SYSCATxx in NUCLEUS and re-IPL.
060	System error	Re-IPL with CLPA.
061	ASM detected TOD clock error	Correct the TOD clock, and re-IPL the system.
062	Reserved device in channel path recovery	STOP all sharing systems and restart the waiting CP. Completion of recovery is signalled by message IOS201E or by wait state code 114. See "Handling Wait State 062" on page 114.
063	User or system error	Take a SADUMP and notify the system programmer.
064	System error during NIP	Check Read/Write switch on DASD devices (must be on). Record full PSW contents. Take a SADUMP and notify the system programmer.
064-3	Restart during NIP	Probably RESTART Key depressed accidentally instead of TOD key. Re-IPL.
064-4	Machine Check during NIP	Refer to procedure "PD10" on page 30.
065	System or user error	Take a SADUMP and notify system programmer.
06C	Hardware error (channel)	Remove the CHPID indicated in storage location X'414' using procedure "PD05" on page 24. Run EREP.
06F	Hardware error (paging device)	Use procedure "PD06" on page 25 to recover. See also "Page Data Set Volume Error" on page 99.
070	Not enough real storage	Check configuration to ensure enough on-line storage. Re-IPL with more real storage if possible; otherwise, notify system programmer.

Figure 12. Disabled Wait State Codes Table (Part 6 of 10)

WAIT STATE	REASON	ACTION
071	Not enough virtual storage	Notify the system programmer.
072	User error	Notify the system programmer.
073	Hardware error (missing interrupt during IPL)	Bits 40–43 of the PSW contain reason code. If RC=01, the IPL program is waiting for an I/O interrupt (may be caused by a hardware error – device or control unit – or a reserve on the SYSRES issued by a sharing system). IF RC=02, the IPL program is waiting for an external interrupt (may be from the service processor). In both cases: try to IPL again. Contact hardware support if unsuccessful.
074	Error in IPL logic	Reason code is bits 36–43 of the PSW. Take a SADUMP, notify the system programmer, and run EREP.
075	User error during IPL	Notify the system programmer. Record the full PSW. Reason code is in bits 36–43 of the PSW.
076	User error during IPL	Take a SADUMP, notify the system programmer.
077	User error during IPL	Notify the system programmer.
078	I/O error on master catalog	Try to IPL again and notify the system programmer.
079	I/O configuration incompatible with system code	Re–IPL with different I/O configuration, matching the MVS/XA release.
081	User error during IPL	Take a SADUMP, notify the system programmer.
083	Software error	Stop all processors. Bits 40–47 of the PSW contain the reason code. Take a SADUMP and re–IPL the system. Notify the system programmer.
084	Software error	Bits 40–47 of the PSW contain the reason code. Take a SADUMP, re–IPL the system, notify the system programmer, and run EREP.
085	User error during IPL	Re–IPL with the CLPA option.

Figure 13. Disabled Wait State Codes Table (Part 7 of 10)

WAIT STATE	REASON	ACTION
09x	x=(1–E) spin loop timeout	Use the procedures described in "Spin Loop" on page 47 to handle the spin loop.
0A1	Excessive spin loop condition	All recovery actions have been exhausted. Notify system programmer.Take a SADUMP and re–IPL.
0E0	Hardware error (SIGP during IPL)	Try to re–IPL. If the error persists, try to locate the failing CPU and to IML in a PP configuration without the side that contains that CPU. See procedure "PD03" on page 22.
0E1	Hardware error during reconfiguration	Notify the system programmer and the hardware support personnel.
0E3	User error during IPL	Notify the system programmer.
0E7	Hardware error (processor controller	Partition the machine and proceed on the good side. Call hardware support.
0E8	Software error during NIP	Bits 32–47 of the PSW contain the reason code. Take a SADUMP and notify the system programmer. Re–IPL.
101	Common area shortage (system)	Take a SADUMP and notify the system programmer. Re–IPL with a bigger SQA specification.
102	Real storage shortage for SQA	Take a SADUMP and notify the system programmer. Re–IPL.
104	Software	Take a SADUMP, re–IPL the system, and run EREP.
110	Hot I/O (Non DASD)	See "Handling Hot I/O Wait States" on page 107. Run EREP.
111	Hot I/O (Non–res. DASD)	See "Handling Hot I/O Wait States" on page 107. Run EREP.

Figure 14. Disabled Wait State Codes Table (Part 8 of 10)

WAIT STATE	REASON	ACTION
112	Hot I/O (Res. DASD)	See "Handling Hot I/O Wait States" on page 107. Run EREP.
113	Channel path recovery error	Notify the system programmer of possible data integrity exposure. Refer to "Handling Message IOS113W and Wait State 113" on page 116.
114	System recovered from channel path error	Refer to "Handling Wait State 114" on page 115.
115	Page data set unavailable	See "PD04" on page 23.
116	MIH on page device detected during Restart	See "PD07" on page 26.
200	User error	Record the PSW, save the preceding messages and notify the system programmer.
201	System error	Record the PSW with reason code in bits 32–47. Restart the target CP in wait ('RESTART CPx').
202	System error	Record the reason code using "PD08" on page 27. Report the error to the system programmer and restart.
A00	System error	Record preceding message IEA802W. Take a SADUMP. Re-IPL and run EREP.
A01	Hardware error MCH threshold reached	Re-IPL. Run EREP and notify hardware support.
A18	User or hardware error	Check that all paging devices are ready and at the right address, and restart. If no obvious error is found, take a SADUMP and re-IPL.
A19	Hardware error (channel subsystem lost)	Run EREP and call hardware support.
A20	System error	Take a SADUMP. Notify the system programmer. Try to re-IPL without the FLPA parameter.
A21	System error	Take a SADUMP and notify the system programmer. Try to re-IPL without the MLPA or FLPA parameter. Record message IAR003W.

Figure 15. Disabled Wait State Codes Table (Part 9 of 10)

WAIT STATE	REASON	ACTION
A22	Wait because another processor is in recovery	The system resolves this wait state automatically. No operator action required.
A23	Error during MCH	Take a SADUMP, re-IPL ,and run EREP.
A24	Loop during MCH	Take a SADUMP, re-IPL and, run EREP.
A26	Invalid machine check code	Take a SADUMP, re-IPL and, run EREP.
A27	Hardware error (one CP)	Processing continues on other processors. This wait state does not affect the other CPUs in the complex. Run EREP.
A28	Error during MCH	Take a SADUMP, re-IPL and, run EREP.
A29	Error during system termination	Take a SADUMP, re-IPL and, run EREP.
A2A	User error	Take a SADUMP and notify the system programmer.
CCC	Quiesce performed	Restart the waiting CP when you want to end quiesce.

Figure 16. Disabled Wait State Codes Table (Part 10 of 10)

3.0 Wait State Diagnostic Procedures

This chapter describes diagnostic procedures for wait state problems.

Use of the Al TCP Frame

The diagnostic procedures may involve displaying storage, the PSW, or the general purpose registers to obtain information. The following should be noted:

1. When operating in LPAR mode, ensure that the system console is displaying the partition you want to alter. Enter the service language command:

   ```
   SETLP lpname
   ```

   to display the partition you want to use.

2. It is not possible to use the Display function (ALTCP frame) if the CP is in the Load or disabled wait state. In this case, the PA frame and VIEWLOG key may be helpful, or it may be possible to display storage using another CP that is not in the Load or disabled wait state.

3. Early in an IPL, before the virtual storage address translation tables have been set up, use the following options to display storage:

   'A2 B2' (Display Real Storage)

   When the IPL is complete, storage in the address range X'000'-X'FFF' may be displayed using either option 'A2 B2' (Display Real Storage) or 'A2 B3' (Display Primary Virtual Storage), since the virtual and real addresses are the same.

4. If all processors are in a disabled wait state, you can display storage to obtain diagnostic information by invoking the ØPRCTL frame and selecting option 'O3' (SYSRESET).

   Note: A system reset causes the status of the subchannels to be reset in the Channel Subsystem. An IPL is necessary afterwards. This may be useful in the case of a WAIT02E to help isolate the failing paging device.

PD01

THIS PROCEDURE PROVIDES THE DEVICE NUMBER FROM THE SUBCHANNEL NUMBER

The subchannel number is found at location X'B8' (184) in virtual storage. This procedure should be used for the following wait states:

WAIT004
WAIT005
IPL Enabled Wait (Steps 1-9)

Procedure

1. At the system console, invoke the ALTER/DISPLAY frame with:

   'F ALTCP'

2. When the ALTCP frame is displayed, specify the number of a CP that is not in the Load or disabled wait state.

3. Enter:

   'A2 B2' (Display Real Storage)

4. Enter:

   'B8' at 'Address(hex) =>'

5. Note the data starting at storage location X'B8'. Record or print the first four bytes 'yyyyyyyy': Out of those bytes, the last two (addresses X'BA' and X'BB') contain the subchannel number.

6. Invoke the IOPD frame by entering:

   'F IOPD' or by selecting 08 on the INDEX0 frame.

7. When frame IOPD-00 is displayed, select 'A5' (Device Configuration).

8. Enter the subchannel number found above (at addresses X'BA' and X'BB').

9. Frame IOPD-50 is displayed (Device Configuration Display).

   This frame contains, for the selected subchannel number, the device number, the unit address, and the installed channel paths.

10. Determine the failing path to the device using the IOPD option A3. Observe the LPUM field to determine the last path used.

11. Use the service language commands to vary all but one path to the IPL volume offline (include the supposedly failing path).

12. Attempt to IPL again.

13. It may be necessary to remove the device from the configuration.

PD02

THIS PROCEDURE LOCATES THE DEVICE NUMBER FROM A GIVEN UCB ADDRESS

The UCB address is found in general register 7.

This procedure should be used for the following wait state:

WAIT022

Procedure

1. At the system console, invoke the ALTER/DISPLAY frame with:

   'F ALTCP'

2. When the ALTCP frame is displayed, specify the number of a CP that is not in the Load or disabled wait state.

3. Enter:

   'A2 B5' (Display General Registers)

4. Print the frame or write down the contents of register 7, which contains the UCB address: X'aaaaaaaa'.

5. Enter:

   'A2 B3' or just 'B3' to display the general registers (since display mode is already in effect).

6. Enter:

   'aaaaaaaa' (the UCB address obtained above) at 'Address(hex) =>'

   This displays the actual UCB. At offset X'0D' there are three bytes, that contain the EBCDIC representation of the device number. At offset X'1C' there are six bytes, that contain the EBCDIC representation of the VOLSER that is supposed to be at that device number.

7. Verify that the correct volume is mounted and restart the system.

PD03

THIS PROCEDURE LOCATES THE FAILING CPU ADDRESS IN CASE OF SIGP FAILURE WAIT STATES

This procedure should be used for the following wait state:

WAIT0E0

Procedure

1. At the system console, press the VIEWLOG key.
2. Locate the message:

   '0C0x CPy SIGP FAILED .....'
3. CPy is the failing CP.

PD04

THIS PROCEDURE HELPS YOU LOCATE THE PAGING DEVICE NUMBER, AND TO RESTART THE SYSTEM IN SOME WAIT STATE SITUATIONS

The address of the error information area is found at location X'40C' in main storage.

This procedure should be used for the following wait state:

WAIT115

Procedure

1. At the system console, invoke the ALTER/DISPLAY frame with:

   'F ALTCP'

2. When the ALTCP frame is displayed, specify the number of a CP that is not in the Load or disabled wait state.

3. Enter:

   'A2 B3' (Display Primary Virtual Storage)

4. Enter:

   '40C' at 'Address(hex) =>'

5. Print the frame or write down the contents of location 40C ('aaaaaaaa'), which is the address of the error information area.

6. Enter:

   'aaaaaaaa' (the contents of location X'40C' obtained above) at 'Address(hex) =>'

   This displays the contents of the error information area:

   - Offset X'4-7' contains the wait state code.
   - Offset X'10' contains the reason code in hex:

     X'80' = The pack mounted contains a different volume label from the one that was mounted at IPL time.
     X'40' = Intervention required for the specified device.
     X'20' = Device not operational.
     X'10' = Permanent I/O error.

   - Offset X'12-13' contains the device number.

7. If the reason code is X'80', verify that the proper pack is mounted and enter RESTART at the system console.

8. If the reason code is X'40', ready the device and enter RESTART at the system console.

9. If the reason code is X'10' or X'20', verify that the channel and the control unit are in normal state and enter RESTART at the system console.

PD05

THIS PROCEDURE HELPS YOU LOCATE THE CHANNEL PATH IN ERROR, REMOVE THAT CHANNEL PATH, AND RESTART THE SYSTEM IN SOME WAIT STATE SITUATIONS

The CHPID in error is found at location X'414' in main storage.

This procedure should be used for the following wait state:

WAIT06C

Procedure

1. At the system console, invoke the ALTER/DISPLAY frame with:

   'F ALTCP'

2. When the ALTCP frame is displayed, specify the number of a CP that is not in the Load or disabled wait state.

3. Enter:

   'A2 B3' (Display Primary Virtual Storage)

4. Enter:

   '414' at 'Address(hex) =>'

   to get the id of the channel path in error.

5. Display the channel configuration frame by entering:

   'F CHNCFA' or by selecting option 04 from the INDEX0 frame.

6. Enter:

   'CHPID xx OFF'

   where 'xx' is the CHPID in error.

7. Enter:

   'RESTART CPx'

   where CPx is the CP in wait state.

8. At the MVS operator console, enter:

   'CF CHP(xx),OFFLINE,UNCOND'

   for the defective CHPIDxx.

PD06

THIS PROCEDURE HELPS YOU LOCATE THE PAGING DEVICE ADDRESS, AND TO RESTART THE SYSTEM IN SOME WAIT STATE SITUATIONS

The address of the error information area is found at location X'40C' in main storage.

This procedure should be used for the following wait state:

WAIT06F

Procedure

1. At the system console, invoke the ALTER/DISPLAY frame with:

   'F ALTCP'

2. When the ALTCP frame is displayed, specify the number of a CP that is not in the Load or disabled wait state.

3. Enter:

   'A2 B3' (Display Primary Virtual Storage)

4. Enter:

   '40C' at 'Address(hex) =>'

5. Print the frame or write down the contents of location 40C ('aaaaaaaa'), which is the address of the error information area.

6. Enter:

   'aaaaaaaa' (the contents of location X'40C' obtained above) at 'Address(hex) =>'

   This gives you the contents of the error information area:

   - Offset X'0-1' contains the channel path identifier
   - Offset X'2-3' contains the device number

7. Verify that the device is owned by the system.

8. Depress the STOP key.

9. Enter:

   'A1 B3' (Alter Primary Virtual Storage)

10. Enter:

    '30E' at 'Address(hex) =>'

11. Move the cursor to location X'30E' and enter one of the following recovery codes:

    00 = Retry to access the device without any recovery. If the problem persists, the wait state code '06F' is re-issued.
    01 = Recover access to the device through an alternate path. Because of data integrity exposure, quiesce any other system that has access to this device BEFORE entering X'01'.
    02 = Force the device offline.

12. After entering the above, restart the waiting CP by entering:

    'RESTART CPx'

PD07

THIS PROCEDURE HELPS YOU LOCATE THE PAGING DEVICE ADDRESS, AND TO RESTART THE SYSTEM IN SOME WAIT STATE SITUATIONS

The device number of the failing paging device is found at location X'40C' in main storage.

This procedure should be used for the following wait state:

WAIT116

Procedure

1. At the system console, invoke the ALTER/DISPLAY frame with:

   'F ALTCP'

2. When the ALTCP frame is displayed, specify the number of a CP that is not in the Load or disabled wait state.

3. Enter:

   'A2 B3' (Display Primary Virtual Storage)

4. Enter:

   '40C' at 'Address(hex) =>'

5. Print the frame or write down the contents of location X'40C' ('aaaaaaaa'), which gives the device number of the failing paging device.

6. Verify that the device is ready and restart the waiting CP with:

   'RESTART CPx'

PD08

THIS PROCEDURE HELPS YOU LOCATE THE REASON CODE SUPPLIED FOR A WAIT202

The reason code is found at location X'40C' in main storage.

This procedure should be used for the following wait state:

WAIT202

Procedure

1. At the system console, invoke the ALTER/DISPLAY frame with:

   'F ALTCP'

2. When the ALTCP frame is displayed, specify the number of a CP that is not in the Load or disabled wait state.

3. Enter:

   'A2 B3' (Display Primary Virtual Storage)

4. Enter:

   '40C' at 'Address(hex) =>'

5. Print the frame or write down the contents of location X'40C' ('0000800x' or '0000fccc'). Report this information to the System Programmer.

PD09

THIS PROCEDURE HELPS YOU LOCATE THE CAUSE OF AN I/O ERROR FOR A WAIT006

This procedure should be used for the following wait state:

WAIT006

A WAIT006 may indicate a hardware problem on a CHPID used to access the SYSRES device during IPL.

The following messages may be issued at the hardware system console:

```
LOAD failed. Interface control check.              (35712)
LOAD failed. Channel or device status not valid    (35710)
```

Procedure

1. At the system console, invoke the IOPD frame: 'F IOPD'
2. When frame IOPD-00 is displayed, select option 'A5' (Device Configuration).
3. Enter the device number of the Load address (SYSRES device).
4. Note the installed channel paths to the device.
5. At the service console, display the Interface Control Check Index frame (Figure 17):

   'F IFCC'

```
                                                    07 NOV 88  13:39:33
                    INTERFACE CONTROL CHECK INDEX                <IFCC>

  A= SELECT LOG (1-50)

    1. 01 NOV 88 13:36:17.18 CHPID62
    2. 01 NOV 88 13:35:13.79 CHPID62      B= DISPLAY
    3. 29 OCT 88 00:03:24.13 CHPID2B       X1. CHPID LOG
    4. 28 OCT 88 02:16:22.62 CHPID2B       X2. INTERFACE TRACE
    5. 27 OCT 88 22:50:59.01 CHPID2B       X3. CSAR TRACE
    6. 27 OCT 88 04:56:47.34 CHPID62
    7. 27 OCT 88 04:56:45.63 CHPID62
    8. 27 OCT 88 04:56:44.67 CHPID62
    9. 03 SEP 88 22:36:17.38 CHPID62
   10. 23 AUG 88 12:15:17.16 CHPID63      C= SELECT
   11. 23 AUG 88 12:15:17.57 CHPID63     -> 1. ALL CHPIDS
   12. 23 AUG 88 12:15:17.02 CHPID63        2. SPECIFIC CHPIDS
   13. 14 JUN 88 03:08:17.44 CHPID5C
   14. 14 JUN 88 03:08:17.35 CHPID5C
   15. 14 JUN 88 03:08:17.28 CHPID5C


  MORE DATA ABOVE AND BELOW: PRESS BKWD OR FWD.                    (59885)

 COMMAND ==>
```

Figure 17. IFCC Frame

6. The frame displays a log of the Interface Control Checks.
7. If an IFCC is recorded for one of the CHPIDs to the SYSRES at the time of the WAIT006, at the system console, enter the command:

   'CHPID cc OFF'

   where 'cc' is the CHPID with the IFCC.
8. Try to re-IPL without the failing CHPID.

PD10

THIS PROCEDURE HELPS YOU IDENTIFY THE CAUSE OF A MACHINE CHECK FOR A WAIT064-4

This procedure should be used for the following wait state:

WAIT064-4 (PSW = 000A0000 00040064)

A WAIT064-4 indicates a Machine Check interrupt was received during NIP processing. One possible cause is that an I/O interrupt was received from a device that has not been defined in the IOCP. In this case, the Channel Subsystem cannot present an I/O interrupt since there is no subchannel associated with the device, and so it presents a Machine Check interrupt.

Another cause of WAIT064-4 is changing the state of a resource during the MVS IPL. Do ***not*** do the following during an MVS IPL:

- If running under VM/XA host, do ***not*** attach, detach or define any I/O device during the MVS IPL.
- If running in LPAR mode, do ***not*** configure online or offline any CHPIDs to the logical partition in which MVS is being IPLed.

If these occur during NIP, a WAIT064-4 is loaded.

Procedure

1. At the system console, press the VIEWLOG key, and look for a message of the form:

```
INTERRUPTION FROM DEVICE NOT IN IOCDS. CHPID=6C, UA=E4.  (25197)
```

2. Check that the correct IOCDS is in use.
3. Report this problem and the full text of the message to the CE and the System Programmer.

PD11

THIS PROCEDURE HELPS YOU RESOLVE WAIT007 AND WAIT021

This procedure should be used for the following wait state:

WAIT007 (PSW = 000A0000 00000007)
WAIT021 (PSW = 000A0000 00000021)

A WAIT007 indicates that no console was available during NIP.

A WAIT021 indicates that an I/O error occurred on the main console following an I/O operation.

Procedure

1. Using the installation console configuration diagram, locate the master and first alternate consoles, and the control units.

2. WAIT021.

   Using the ALTCP frame on the hardware system console, for the target IPL processor, use the following commands:

   ```
   F ALTCP  - select CP
   A2 B2
   address 'B0'
   ```

   to display location X'B8'-'BB' to obtain the Subchannel ID of the last I/O interrupt (X'BA-BB' has the SID). This ***may*** indicate the device's ***subchannel number*** where MVS wrote the 'Specify System Parameters' message .

   Use the IOPD frame to determine the device number associated with this subchannel.

   Use frame IOPD option A5 to determine the device number.

   Use the customer's configuration diagrams to determine the device type.

   If the device number represents a VTAM CTCA, use the service language command 'CHPID cc OFF', to vary the associated CHPID to the VTAM CTCA offline, and re-IPL

3. Check the following:

   - Console security switch should be set in the correct position (if not, this is a typical case for a WAIT021).
   - Consoles powered on - check the display power on indicator.
   - Coax cables connected - use the test/normal switch and check the coaxial cable.
   - No Sub-Channel available;

     Use 'F IOPD' option A5 and the device number, to determine whether the device is supported (ES/3090 Basic Mode); or supported and in the logical partition (ES/3090 LPAR Mode).

     Check whether the correct IOCDS is used when a subchannel is not available to support the device. Also check the IOCP input.

     For LPAR Mode only: When a device does not have a subchannel allocated to the target logical partition, the following message is displayed on the system console.

     ```
     REQUESTED DATA NOT DEFINED FOR LOGICAL PARTITION xxxx      (60761)
     ```

   - Channels available

Use IOPD frame option A5 and the device number to determine the paths defined to that device and use the CHNCFA frame to determine the state of the CHPIDs.

- Control unit powered on - check the control unit power indicators.
- Control unit online - check the control unit online/offline switch.
- Control unit IMLed - re-IML the control unit.
- Console UCB online - check for any I/O generation changes.
- Check for 'coax patch panel' changes.

4.0 Enabled Wait States

An enabled wait state exists when MVS finds no work to dispatch in the system. This may be a normal state, when the system is idle for example, or it may be a symptom of a problem.

Typically, line 24 of the system console will appear as shown in Figure 18 during an enabled wait state.

```
ITSC-POK   0 ..W. 1 ..W. 2 ..W. 3 ..W. 4 ..W. 5..W.      PSW1  Operating
```

Figure 18. Hardware System Console Line 24

Prior to placing a processor into a ***disabled*** wait state, MVS has detected a problem. MVS loads a coded, disabled wait state PSW to indicate the cause of the problem to the operator. Refer to "Disabled Wait States" on page 7. In an ***enabled*** wait state, MVS is not aware of a problem, even though one may exist, and the PSW has the form:

```
PSW =  070E0000 00000000
```

This is called the 'no-work wait' or 'dummy wait', because MVS loads this PSW when there is no work to dispatch in the system.

One of the characteristics of an enabled wait state is that communication with the operating system is still possible through the master console.

Check at the system console to determine whether the system is really in a wait or if a high priority job is looping. For that purpose, one of the SAD frames should be set up to display the utilization of all CPUs.

Also, check for outstanding replies to messages. Enabled wait states usually indicate that the system is waiting for:

- Work

  A problem in a subsystem - for example, JES2 - may prevent new work from starting. If MVS/ESA appears to be responding to commands, the subsystems should be investigated.

- Operator action or response

  An outstanding operator response may cause a bottleneck.

- Missing interrupt

  If a paging device has a missing interrupt condition, the operator may not be made aware of the problem because some system communications routines are pageable. In this case, the system may enter an enabled wait state.

- A system resource

  When a lengthy, unexplained enabled wait state occurs, and you believe there is work for the system to do, the availability of system resources should be checked.

  - Enqueue Lockout

    Critical system resources may be enqueued and not released. The components not freeing the resources should be investigated. GRS and RMF can be used to display resource contention.

- Missing Resources

  Critical system resources may have been removed during previous error recovery. For example, during Unconditional Reserve recovery a critical DASD path may have been taken offline.

  CONFIG members should be set up to reflect all critical system resources:

  - Processors
  - Storage - expanded and central
  - CHPIDs
  - Critical DASD devices and paths

It can be difficult to determine the cause of an enabled wait state, since the problem may not be immediately visible to the operator. There are, however, some things you can do to help determine the cause of a wait.

Procedures

Two procedures are provided :

1. PROCEDURE 1: For a system already IPLed.
2. PROCEDURE 2: For a particular enable wait state during IPL operations.

Procedure 1 - System already IPLed

1. Issue:

   'D R,L'

   to check for outstanding operator action. Ensure all DDR swap requests are resolved, and all requests to bring offline devices online (outstanding message IEF238D) are satisfied.

2. Issue:

   'D M=CONFIG(xx)'

   to check for any missing critical resources.

3. Issue:

   'D A,L'

   to see if there is ready work waiting to execute.

   Look for a job step name of STARTING, which indicates that the system has not successfully completed initiation of the step.

4. Issue:

   'D U'

   to see whether there is any critical device busy (BSY), mount pending (MTP), or not ready (NRD).

5. Issue:

   'D GRS,C'

   to display resource contention.

6. Using RMFMON, issue 'SENQ' and 'SENQR' to see whether there is enqueue contention. You can also use RMF Monitor III for that purpose (ENQ, ENQR, or ENQJ options).

7. If possible, check through the SYSLOG for any indications of a problem:

   - Storage shortage messages

- Subsystem resource shortages (VTAM buffers, or JES2 spool, for example)
- I/O error messages (indicating loss of devices, paths, CHPIDs)

8. At the system console, invoke the SAD frame to display CPU utilization. If available, display processor utilization by storage key to determine whether a specific subsystem is causing the problem.
9. At the system console, display the SAD frame showing 'HI' CHPID utilization.
10. At the system console, display the system console log by pressing the VIEWLOG key. Scroll through the log looking for error messages, or other indications of a problem. Try to scroll back to when the system was last IPLed. or to a time when the system was last known to be running successfully, that is, performing normal work.
11. If, after doing the above, you are still unable to determine the cause of the wait state, take a dump of the master scheduler by issuing:

    'DUMP COMM=(dumpt title)'

    Reply 'U' to message IEE094D

    This reply causes the SDATA default options to be taken for the Master Scheduler address space.
12. After the dump has completed, use the restart facility to invoke MVS/ESA system diagnostics. Issue:

    'F SYSCTL'

    at the system console.

    Enter 'C1' and reason code '1'.

    When the Restart function with Reason 1 is invoked from the SYSCTL frame on the system console, MVS/ESA checks:

    a. The Missing Interrupt Handler message queue and, if missing interrupt conditions exist for paging devices, the system notifies the operator through message:

    ```
    IOS116A MIH CONDITION PENDING ON PAGING DEVICE ddd
    ```

    b. The system non-dispatchability indicator.

    c. The WTO buffer usage.
13. If all the above fails, take a stand-alone dump and re-IPL the system.

Procedure 2 - Enabled Wait During IPL

MVS/ESA may be waiting for the operator's response to message :

```
IEA101A SPECIFY SYSTEM PARAMETERS
```

This situation occurs when this message is issued on a device that is not located near the operator.

Use the procedure in "PD01" on page 20 steps 1 through 9 to help you locate the device where the message may have been issued.

After determining the device number from the procedure in "PD01" on page 20 , use the installation configuration diagrams to determine the device type of the device that presented the last I/O interrupt.

If the device number represents a VTAM CTCA, use the hardware system console command :

```
CHPID cc OFF
```

to vary the associated CHPID to the VTAM CTCA offline. This will allow you to re-IPL without interference from the VTAM CTC and enable you to attempt to locate the IPL/NIP console being used.

This is a common IPL problem. When the master console that the operator expects to be used is found to be unavailable by MVS, MVS selects another console.

5.0 IPL

IPL time is a very sensitive period. Problems encountered at IPL time may be more difficult to diagnose; since the full recovery facilities of MVS are not yet available.

In this guide, we deal with these problems in three groups:

1. ***Wait States***

   When a problem occurs and the system enters a wait state.

   Disabled Wait States and Enable Wait States are discussed in the previous chapters, and procedures are provided to help to recover from some of them.

2. ***Messages***

   When a problem occurs and a message is issued at the console. In this chapter, the following messages are described:

   - IOS120A - DASD contention during pathing
   - IEA120A - DASD contention during reading VOLSER
   - IEA212A - duplicate VOLSER detection
   - IEA317A - unable to locate required data set
   - IOS000I - I/O error

3. ***No Message or Wait State***

   No wait state or console messages are provided for guidance when a problem occurs. This means that some hardware may be involved.

Using Figure 19 try to determine what point in time during the IPL process the problem occurs.

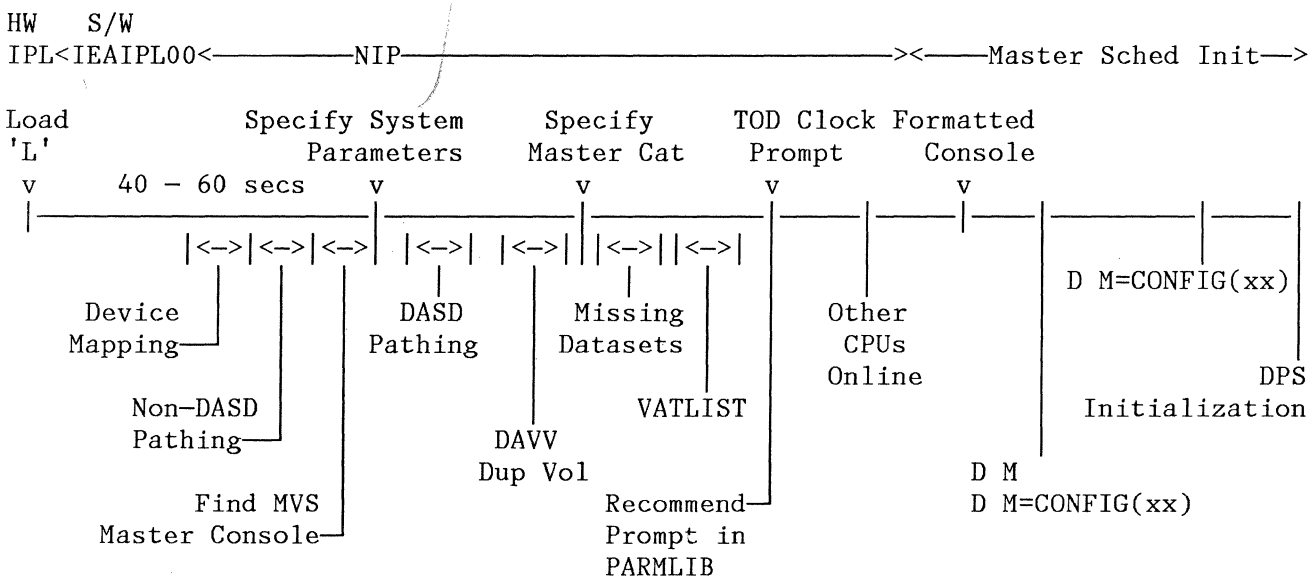


Figure 19. IPL Flow Diagram

If the IPL problem occurs between when the IPL function was invoked, and when the message 'Specify System Parameters' is displayed, then one approach is to remove everything from the configuration except the essential IPL DASD and console elements, which are:

- The system residence volume
- ***One*** channel path to the IPL volume
- One console
- A channel path to the console

If all else fails, configure all channel paths other than those required for the console and the system residence volume offline, and retry the IPL.

IOS120A - Shared DASD (DASD Contention)

During DASD path verification (pathing), it is possible that when MVS attempts to do the pathing I/O operation to a device, that device may be 'busy' (actively working) with another system at the time.

The pathing I/O operation is timed (since the Missing Interrupt Handler is not initialized at this stage in the IPL), and if after 1.5 seconds the I/O operation has not completed, the following message is issued:

```
IOS120A DEVICE ddd SHARED. REPLY 'CONT' OR 'WAIT'.
```

If the operator replies 'CONT' to message IOS120A, the device or path is placed offline by MVS.

If the operator replies 'WAIT' to message IOS120A, the IPL process will not proceed until the I/O interrupt for the pathing operation is received from the device.

If the same contention is experienced during DAVV (Direct Access Volume Verification) processing, where MVS reads the volume label from the DASD device, the following message is issued:

```
IEA120A DEVICE ddd VOLID NOT READ. REPLY 'CONT' OR 'WAIT'.
```

If the pathing I/O operation times out, but the device is not generated as 'SHARED' or 'SHAREDUP', then the operator is not notified, and the device will be placed offline.

Summary

	Device Busy on Sharing System	Device Not Busy on Sharing System
PATHING OPERATION		
Generated as shared	IOS120A message	OK – device/path online
Generated non–shared	Continue without Device	OK – device/path online
READ VOLUME LABEL		
Generated as shared	IEA120A message	OK – device/path online
Generated non–shared	Continue without Device	OK – device/path online

The fact that the device is found busy by the IPLing system may occur as a result of:

- Contention

  The device may be in use by a sharing system at the time this system is being IPLed.

- Outstanding Error Recovery

  The device may have a stuck allegiance' as a result of the answer to message IOS427A, that occurred during a previous IPL session, (on this system or on any other sharing system), to which the operator replied BOX or NOOP.

- Current Errors

  If a problem exists on an interface, an I/O operation can take up to 16 seconds to timeout. However, NIP only waits 1.5 seconds, and so will time out first, thinking that a busy condition exists.

- Bad IOCDS

  If this IPL uses a new IOCDS, incorrect definitions relating to the device may cause IOS120A messages to be displayed.

If the device related to message IOS120A is not needed for a successful IPL operations, reply CONT to the message. Otherwise, the recovery (if possible) depends on what the cause is:

- Contention

  Go to other systems and determine the status of the device involved by entering the D U command .

- Error Recovery

  The operator should not have replied BOX or NOOP to message IOS427A. Refer to "Unconditional Reserve" on page 97 for a description of the IOS427A message.

  Contact your hardware service personnel.

- Current Errors

  Use the IFCC frame at the service console. Determine if any IFCC has occurred on the CHPID to the device related to the IOS120A message. If there are two or more paths to the device, use the service language command:

```
CHPID cc OFF
```

to remove the affected CHPID from the configuration; then re-IPL.

- Suspected Bad IOCDS

  Repeat the IPL and if the same problem occurs and there appears to be no other reason for contention, and a new IOCDS is in use, try to IPL using the old IOCDS. If the old IOCDS works, call your system and hardware support to investigate. Your old IOCDS may not support the devices getting the IOS120A messages.

IEA212A - Duplicate Volumes

After DASD pathing is complete, MVS performs DAVV (Direct Access Volume Verification) processing which includes reading the volume label of each online DASD device and updating the UCB, for each device, with the corresponding volume label information.

If more than one device is found to have the same volume label, the following message is issued:

```
IEA212A DUPLICATE VOLUME volser D, xxx or yyy  REPLY DEVICE ADDR
```

If a second device is found to have the same volume label as the system residence volume, the following message is issued:

```
IEA212A DUPLICATE SYSRES volser D, xxx  REPLY DEVICE ADDR
```

In both cases, the operator must specify a volume to be dismounted before the IPL process can proceed.

- When the latter condition is detected, message IEA212A asks the operator to dismount the volume that is not the IPL volume (You do not have a choice of which volume to dismount).

  Reply to message IEA212A:

  ```
  R 0,ddd
  ```

  The following message should be issued:

  ```
  IEA313I DEVICE ddd DISMOUNTED
  ```

- When a duplicate volume condition is detected, the operator can choose which volume to dismount.

  Refer to the 'required volumes' list of the installation to determine which of the duplicate volumes should be dismounted.

  Reply to message IEA212A:

  ```
  R 0,ddd
  ```

  The following message should be issued:

  ```
  IEA313I DEVICE ddd DISMOUNTED
  ```

IEA317A - Unable to Find a Data Set

During the initialization process, the required system data sets are located using the volume information in the catalog. If a volume with the VOLID listed in the catalog for a particular data set was not found, and that data set is required during NIP, then the following message may be issued:

```
IEA317A SPECIFY UNIT FOR ssss.yyyyyyyy ON vvvvvv OR CANCEL
```

This message indicates that when MVS attempted to locate data set 'ssss.yyyyyyyy' using the volume pointer in the master catalog, no volume 'vvvvvv' had previously been read during DAVV.

- Refer to your installation's Volume-id to 'Device Number' cross-reference list to determine which device number is labelled 'vvvvvv'.
- Respond to message IEA317A with the device number (xxx) using :

  ```
  R 00,xxx
  ```

- After entering the response, the following message might be issued:

  ```
  IEA318I UNIT UNACCEPTABLE
  IEA317A SPECIFY UNIT FOR ssss.yyyyyyyy ON vvvvvv OR CANCEL
  ```

- This message indicates that MVS has not read a volume label of vvvvvv on device number xxx.
- Determine the problem by accessing the device:
  - Is there at least one online CHPID to the required device?

    Find the CHPIDs defined for the device using the IOPD frame option A5.

    Check the CHPID availability for the current physical partition using the CHNCFA frame.

    If a subchannel is not available to support the device, check your installation information if the correct IOCDS has been selected.
  - In LPAR mode, use the IOPD frame option A5 and the device number, to determine if the device is supported and in the logical partition.

    When a device does not have a subchannel allocated to the target logical partition, you will see the message:

    ```
    REQUESTED DATA NOT DEFINED FOR LOGICAL PARTITION xxxx     (60761)
    ```

    Determine the channels associated with the device in the IOCP input or the installation configuration diagrams and use the LPCHNA frame to determine which logical partition currently owns the CHPIDs. A logical partition must have at least one CHPID associated with a device online, in order to then have a subchannel for the device allocated to a logical partition.
  - Is the control unit path operational?

    Check that the control unit is powered.

    Check that the control unit is enabled to the interface.

    If the control unit interface path is switched through a 3814, check the switching unit settings.
  - For 3380 DLS or DLSE devices, check whether the device 'Enable/Disable Switch' is in the 'Enable' position.
  - Is the device in a 'Ready' state?
  - Was a previous IOS120A message for this device number replied to with a response of 'CONT'? If a response of 'CONT' was used and the volume is required, you will have to re-IPL.
  - This problem can also be caused by replying incorrectly to the following message:

    ```
    IEA347A SPECIFY MASTER CATALOG
    ```

    Confirm with the installation's system/technical people what the correct master catalog reply should be.

IOS000I - SYSRES in Read/Only Mode

It is not until towards the end of the IPL process that MVS attempts to ***write*** to the system residence volume. All I/O up to this point has involved reading the system residence volume.

MVS attempts to write to SYS1.LOGREC and issues message IOS000I when SYS1.LOGREC resides on the system residence volume, and that drive is in read-only mode. This problem can occur on devices that support physical Read/Write switches.

The following message is issued:

```
IOS000I ddd,1D,WRI,cc,0E40,
```

This is an indication that it is not possible to write to the device. Check the Read/Write switch setting for those devices that provide Read/Write switches as an operator control.

6.0 Loops

A loop is an endless execution of a sequence of instructions. Loops tie up the system and can prevent the execution of other tasks. The operator can stop the loop by cancelling the looping job.

Typically, line 24 of the system console will appear as shown in Figure 20 during an enabled wait state.

```
ITSC-POK   0 .... 1 .... 2 .... 3 .... 4 .... 5....      PSW1  Operating
```

Figure 20. Hardware System Console Line 24

One characteristic of a loop is that the wait indicator is off (observe the status line on the system console)

If the operator console is locked out, and at least one CP stays at 100% utilization on the SAD frame the loop is probably a ***disabled*** loop. On a system operating in LPAR mode, the SAD frame will reflect activity greater than the assigned activity weight for the normal value of the processors. See "Disabled Loop" on page 46 for further information on disabled loops.

If MVS accepts commands from the operator console, then the loop is probably an ***enabled*** loop. The SAD frame may show higher than normal CP utilization, but probably not 100% and probably not confined to one CP. See "Enabled Loop", below, for further information.

Enabled Loop

During an enabled loop, communication with MVS through the operator console is still possible. (With a disabled loop, the operator console is locked out).

If an application program is looping, the job's specified TIME parameter should cause the system to cancel it after an appropriate interval. If a subsystem (VTAM, JES2, IMS, CICS, for example) is looping, use the appropriate procedures for those components.

Procedure

Use the following procedure to recover from an enabled loop:

1. Identify the looping job or component as follows:

   a. If TSO is active, use RMFMON ARD, or ASRM, to identify the job that is using CPU time heavily with little or no I/O activity.

   b. For systems with SDSF installed, use the SDSF 'DA'(Display Active) option and observe what CPU percentage is being used by each job.

      The value shown represents a percentage of the total processor complex power. Therefore, if a job running on an IBM ES/3090 600S is using the power of one processor, SDSF will show 16% CPU utilization. The same job would show 25% on an IBM ES/3090 400S and 50% on an IBM ES/3090 200S. So, based on what processor complex you have, you should investigate any case where the percentage shown represents approximately the power of one processor.

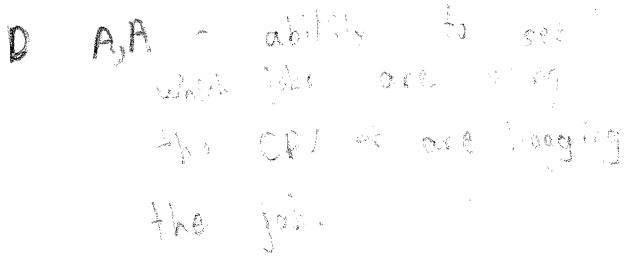
      The approximate percentage shown by SDSF if the job is using the power of one processor (systems in SI mode) is shown below:

ES/3090–600S	16J
ES/3090–500S	20J
ES/3090–400S	25J
ES/3090–300S	33J
ES/3090–280S	50J
ES/3090–200S	50J

The values shown for Uniprocessor models 100S, 120S, 150S, and so on, may be anywhere between a few percent and 99%, but would tend to show 90%+ for a greater number of times if displayed when the job is in a loop.

c. At the system console, invoke the SAD frame displaying CPU utilization by storage key. The various subsystems use different storage keys. For example, a loop in VTAM may be identified if the SAD frame shows a high processor utilization in storage key 6.

d. If you can not use RMFMON, enter 'D A,A' at regular intervals. Compare the field labelled CT (CPU Time) for all the jobs in the system. A job that is looping will show large changes in that field, perhaps as much as the time interval you use between display commands. This technique is not practical when there are a large number of address spaces in the system; therefore, it is recommended that you always have access to a monitor such as RMF.



2. When reasonably sure that a job is looping, enter:

   CANCEL jobname,DUMP

   to terminate the job.

3. If the cancel does not work, then enter:

   FORCE jobname,ARM

   to terminate the job.

   Note: If it is not possible to recognize the looping job using the methods listed above, or if the Cancel or Force command does not resolve the loop, continue with the next step to invoke the Restart facility at the system console.

4. Invoke the SYSCTL frame (Figure 21) at the system console.

   If operating in LPAR mode, from the system console, enter:

   ```
   SETLP lpname
   ```

   where 'lpname' is the logical partition name.

5. Stop the looping processor (identified on SAD frame) by entering the service language command 'STOP CPn'.

   Note: It may not always be possible to identify the processor that a job is looping in (this also applies when operating in LPAR mode and the loop is in a 'shared' logical partition). Because the loop is enabled, the job may be interrupted and re-dispatched on ***any*** processor at any time..

6. Identify the CP in the disabled loop by entering 'Tn', where 'n' is the CP number. The loop may be dispatched on a different processor after the SAD frame display is terminated. Therefore, use the indicators on the system status line to verify the target processor.

7. Select option 'C1' on the SYSCTL frame to invoke the restart facility.

8. When prompted, select restart reason '0'. The following message is issued:

   ```
   IEA500A RESTART INTERRUPT DURING jobname stepname
           ASID=aaaa MODE=mmmm PSW=xxxxxxxx xxxxxxxx
           REPLY RESUME TO RESUME INTERRUPTED PROGRAM
           OR ABEND TO ABEND INTERRUPTED PROGRAM
   ```

   This message identifies the task that was active at the time the restart was invoked. However, there is no guarantee that the task identified in the message is the one in the loop. If you suspect this is not the looping job, reply 'RESUME' and invoke restart once more. Eventually, it will be evident which job is looping.

9. A reply of 'ABEND' terminates the task with a completion code of '071'.

   Under some circumstances, message IEA500A may not be issued and the current task may be abended with completion code 071 immediately.

```
                                                    06 JUL 88   15:10:05
                    SCP MANUAL CONTROL (ESA/370 MODE)          (SYSCTL)

  A= INITIALIZE SYSTEM CONTROL PROGRAM            T= TARGET CP
    1. LOAD UNIT ADDR : ....                       X0. CP0    -> 3. CP3
    2. LOAD PARM(A/N) : .........                  X1. CP1       X4. CP4
    3. INITIATE SCP INITIALIZATION                 X2. CP2       X5. CP5


  B= INITIALIZE STANDALONE DUMP                    R= RATE CONTROL
    AUTO STORE STATUS = ON                        -> 1. PROCESS
    1. LOAD UNIT ADDR : ....                         2. I-STEP
    2. INITIATE STANDALONE DUMP
                                    ------------RESTART REASONS---------
                                   0 - ABEND CURRENT PROGRAM
  C= RESTART                       1 - PERFORM MVS SYSTEM DIAGNOSTICS
 -> 1. INITIATE RESTART
       REASON(A/N) : 0


  D= INSTRUCTION ADDRESS TRACE
    1. START ADDRESS TRACING

 15:09:28 CP3 RESTARTED

COMMAND ==>
                                  3 ....                  PSW3    OPERATING
```

Figure 21. SYSCTL Frame

Disabled Loop

If one processor is looping in a disabled state, it is not be able to respond to a SIGP from another processor. In a non-uniprocessor environment, a disabled loop on one CP usually results in a ***Spin Loop Timeout***. Recovery from a spin loop is described in "Spin Loop" on page 47 .

Procedure

If a disabled loop occurs without spin loop detection, (for example, in a single CP environment), the following procedure can be used to recover:

1. Invoke Instruction Address Trace, if required (not supported in LPAR mode).

   Note: Instruction Trace is not available in LPAR mode.

   If the cause of the problem is not already known, the Instruction Trace (also known as 'Loop Recording') facility of the processor controller may be used to gather a trace of the looping instructions before proceeding with recovery actions.

   Instruction trace is non-destructive and does not impair the chances of recovery afterwards, so it is recommended as a valuable tool for subsequent problem diagnosis. Refer to "Instruction Trace" on page 51 .

   Note: The instruction trace takes approximately 90 seconds per online CP.

2. Invoke the SYSCTL frame (Figure 21) at the system console.

   If operating in LPAR mode, at the system console, enter:

   ```
   SETLP lpname
   ```

   where 'lpname' is the logical partition name.

3. Select option 'C1' on the SYSCTL frame to invoke the restart facility.

4. When prompted, select restart reason '0'.

   As a result, the following message appears at the MVS console:

   ```
   IEA500A RESTART INTERRUPT DURING jobname stepname
           ASID=aaaa MODE=mmmm PSW=xxxxxxxx xxxxxxxx
           REPLY RESUME TO RESUME INTERRUPTED PROGRAM
           OR ABEND TO ABEND INTERRUPTED PROGRAM
   ```

5. At the MVS console, reply 'ABEND' to the message.

   There is no point in replying 'RESUME', since the loop will continue indefinitely. Since the loop is disabled, no task other than the looping task can be dispatched on the CP.

   A reply of 'ABEND' terminates the looping task with a completion code of 071.

   Note: Under some circumstances, the message may not be issued and the current task may be abended with completion code 071 immediately.

6. After the looping task has been terminated, normal operation is resumed. If the Instruction Address facility was used to trace the loop, issue a 'DUMP' command at the MVS console so that the loop trace data is captured in a dump data set for later processing by the System Programmer. (The loop recording data is not retrieved for the Abend 071 dump).

Spin Loop

A spin loop occurs when one processor in a multiprocessor environment is unable to communicate with another processor, or requires a resource currently held by another processor. The processor that has attempted communication is the 'detecting' or 'spinning' processor. The processor that has failed to respond is the 'disabled' or the 'failing' processor.

When communication is not successful within a given time, an excessive spin loop timeout condition exists. The detecting processor then initiates recovery processing for the condition.

MVS processing for excessive spin loop conditions provides recovery without any interaction with the operator. The default order in which the system takes action is SPIN, ABEND, TERM, and ACR. If the same spin loop reoccurs, the system will take the next action. When a particular excessive spin loop has been resolved, any new spin loop causes the sequence of automatic recovery actions to start with SPIN and proceed through the sequence again. An installation can change the order of the actions, except the first one, that the system takes.

- ***SPIN*** - continues spinning for another time interval.
- ***ABEND*** - terminates the current unit of work on failing CP but allows the recovery routines to retry.
- ***TERM*** - terminates the current unit of work on the failing CP and does not allow the recovery routines to retry.
- ***ACR*** - invokes ACR to take the failing CP offline
- ***OPER*** - issues message IEE331A via DCCF, and processes the operator reply.

When the system initiates any of the default or specified recovery actions, it issues message IEE178I to inform the operator. This message is strictly for information and the operator need not take any action.

In a normal environment, the IBM supplied defaults for the system are sufficient. In a test environment, however, you might want to specify that other actions be taken.

Member EXSPATxx

Member EXSPATxx of SYS1.PARMLIB allows you to specify the action or actions to be taken, as well as the spin time duration, if the excessive spin is detected for one of the following.

- RISGNL RESPONSE
- LOCK RELEASE
- SUCCESSFUL BIND BREAK
- RESTART RESOURCE
- ADDRESS SPACE QUIESCE
- INTERSECT RELEASE

Spin loops caused by a SIGP failure are not supported by actions specified in the EXSPATxx member. For hardware related errors that formerlv caused message IEA490A, the system immediately initiates ACR processing.

If the cause of a persistent excessive spin is not resolved by the sequence of recovery actions, the system puts itself into a non-restartable '0A1' wait state. To avoid this possibility both TERM and ACR should be specified as two of the actions to be taken.

Handling Message IEE331A

If an installation wants the operator to control the recovery actions, it can specify OPER in the EXSPATxx parmlib member. When the OPER action is reached in the recovery sequence, the system issues message IEE331A. If a response to message IEE331A is not received after 125 seconds, the message is written to the system console and the operator can respond through the SCPMSG frame. If the message cannot be written to any console, MVS loads a restartable wait state (Wait09x) for the spin loop situation.

Figure 22 shows the possible reasons for the spin loop and the recommended responses for handling the various forms of message IEE331A.

```
IEE331A PROCESSOR (y) IS IN AN EXCESSIVE DISABLED SPIN LOOP
        WAITING FOR (— msg insert —). REPLY U OR SPIN TO CONTINUE
        SPIN, REPLY ABEND TO TERMINATE WORK ON PROCESSOR(x) WITH
        RETRY, REPLY TERM TO TERMINATE WORK ON PROCESSOR(x) WITHOUT
        RETRY, OR STOP PROCESSOR(X) AND REPLY ACR. (AFTER STOPPING
        THE PROCESSOR, DO NOT START IT)
```

MSG INSERT	WAIT STATE	ACTION 1	ACTION 2	ACTION 3	ACTION 4
RISGNL RESPONSE	091	SPIN	ABEND	TERM	ACR
LOCK RELEASE	092	SPIN	ABEND	TERM	ACR
RESTART RESOURCE	N/A	SPIN	ABEND	TERM	ACR
ADDR. SPACE TO QUIESCE	095	SPIN	ABEND	TERM	ACR
CPU IN STOPPED STATE	096	START STOPPED CPand SPIN			
INTERSECT RELEASE	097	SPIN	ABEND	TERM	ACR
OPERATOR INTERVENING	099	START STOPPED CPand SPIN			
SUCCESS. BIND BREAK	09E	SPIN	ABEND	TERM	ACR

Figure 22. Actions for Message IEE331A and Wait State Codes

Procedure

To recover from a spin loop, proceed as follows:

1. Respond to message IEE331A according to installation procedures. If none exist, use the table in Figure 22 to determine the response.

2. Before replying 'ACR', at the system console enter:

   ```
   STOP CPn
   ```

   where 'n' is the failing CP.

   If operating in LPAR mode, at the system console first enter:

   ```
   SETLP lpname
   ```

   where 'lpname' is the logical partition name. This ensures that the logical processor to be stopped is in the correct logical partition.

3. After replying to message IEE331A, restore normal console operations at the MVS console by performing the CANCEL action (ALT and PA2).

4. Notify the System Programmer. Useful information about the environment at the time the excessive spin loop condition was detected is recorded in SYS1.LOGREC.

5. If ACR is used in response to message IEE331A:

   a. The active job on the processor in the spin loop is terminated with Abend 0F3.

   b. The completion of ACR is indicated by one of the following messages:

      ```
      IEA858E ACR COMPLETE CPU NOW OFFLINE
      IEA858E ACR COMPLETE CPU NOW OFFLINE, PHYSICAL VARY FAILED
      ```

The text 'PHYSICAL VARY FAILED' indicates that the processor is logically offline, but still physically online. This message may be issued if the processor was not taken offline because the service processor was busy at the time the request was made. If you want to take the processor offline physically, enter the 'CONFIG CPU(n),OFFLINE' command.

Note: In LPAR mode, it is not possible to configure the processor physically offline.

c. The processor that is configured offline may be configured back online, since there is most probably no hardware failure associated with the spin loop reported in message IEE331A. The cause was most likely software, and the failing job has been terminated with Abend 0F3.

Handling Wait State 09X

When the spin loop timeout message cannot be issued at any console (operator or system console), MVS may load a restartable disabled wait state '09X'.

Procedure

To recover from wait state 09X, proceed as follows:

1. At the system console, press the 'VIEW LOG' key and look for the priority message that shows the system entering the disabled wait state. It will be of the form:

```
********************** PRIORITY  MESSAGE ******************************
*                                                                      *
*             CPy has entered disabled wait.                           *
*                  PSW = 000A0000 004x009n                             *
*                                                                      *
* Intended Console: System                                             *
*                                                                      *
```

   CPy is the processor detecting the excessive spin condition, and is ***NOT*** the failing processor (the processor with the problem).

2. Determine the failing processor from bits 40-47 of the disabled wait state PSW (refer to the priority message shown above). The sixth byte of the PSW contains the logical id, in the form of '4x' (x = CP number) of the processor causing the spin loop.

   For example, if CP3 failed and wait state '092' was entered on another CPU, the PSW would look like

   000A0000 00430092

3. According to the installation recovery option, proceed with the 09X wait state recovery, as indicated below. If operating in LPAR mode, before proceeding with the recovery actions, ensure that the correct logical partition is targeted by entering the following command at the system console:

   SETLP lpname

4. If your recovery option is:

   a. SPIN, proceed as indicated in step 14

   b. ABEND, proceed as indicated in steps 5 to 12, and 14

   c. TERM, proceed as indicated in steps 5 to 12, and 14

   d. ACR, proceed as indicated in steps 5 to 16

5. At the system console, enter:

   'F ALTCP'

6. Select CPy (CPy being the CP indicated in the disabled wait state message; that is, NOT the failing CP, but the detecting CP).

7. Press the STOP key.

8. Enter:

   'A1 B3' (Alter Primary Virtual Storage)

9. Then enter:

   '30E' at 'Address(hex) = >'

10. Move the cursor to location X'30E' and type the one of the following restart codes:

    'CC' (to initiate ABEND)

    'BB' (to initiate TERM)

    'AA' (to initiate ACR)

11. Press ENTER.

12. Press the START key.

13. Stop the failing processor by entering 'STOP CPx' on the system console.

14. Restart CPy by entering:

    'RESTART CPy'

    on the system console.

15. At this time, the failing CP (CPx) is taken offline by ACR, and normal console communication is restored. The job that was active on CPx at the time is terminated with Abend 0F3.

    The completion of ACR is indicated by one of the following messages:

    ```
    IEA858E ACR COMPLETE CPU NOW OFFLINE
    IEA858E ACR COMPLETE CPU NOW OFFLINE, PHYSICAL VARY FAILED
    ```

    The text 'PHYSICAL VARY FAILED' indicates the processor is logically offline, but still physically online. This message may be issued if the processor was not taken offline because the service processor was busy at the time the request was made. If you want to take the processor offline physically, enter the 'CONFIG CPU(n),OFFLINE' command.

    Note: In LPAR mode, it is not possible to configure the processor physically offline.

16. The processor taken offline during ACR processing should be configured back online. Enter

    'CF CPU(x),ONLINE'

Instruction Trace

An instruction trace can be best used to trace a disabled loop. Tracing enabled loops usually causes the loop trace table to become filled with information not in the loop (such as instructions from tasks that interrupt your looping program during the trace).

Note: You cannot initiate an instruction trace from the SYSCTL frame in LPAR mode.

You can record a loop by selecting the instruction trace option (D1) on the SYSCTL frame on the system console. This facility records 982 instruction-counter values for each CP traced. After the loop trace option has completed recording, the processors are left in the state they were in when instruction trace was selected.

The recording function stops all processors and traces all online CPs, starting with the target CP. It is not possible to trace only one processor, and once the tracing is started, it cannot be interrupted until all CPs have been traced.

The instruction tracing function takes about 90 seconds per CP. Therefore, on an ES/3090 Model 600E, tracing disrupts system operation for approximately eight to nine minutes.

While instruction tracing is in progress, all consoles (both system console and MVS/SP V2 and V3 consoles) are locked out. (The MVS/SP V2 and V3 consoles are locked out because the CPs are stopped during the tracing.)

The loop data is retrieved by subsequent SVCDUMPs or stand-alone dumps. If the tracing is done in PP mode, retrieve the trace data through the DUMP command or stand-alone dump before merging, or the information may be lost.

After the instruction trace is completed, the operator can issue a console DUMP command to retrieve the trace data. Both the instruction tracing and the dynamic dumping functions are non-destructive; that is, they will not abnormally terminate the interrupted unit of work, and normal processing can continue afterwards. If the loop appears to continue, it may be worthwhile to request a RESTART Option 0 to terminate the looping job. In case of disabled loops, reply ACR to message IEE331A. The trace data will be available in the stand-alone dump, if the operator requests it, after the loop recording is complete.

Procedure

To trace a loop use the following procedure:

1. Select the SYSCTL frame (Figure 23) at the system console: 'F SYSCTL'.
2. Start loop tracing by selecting: 'D1' (Start Address Tracing).

   During loop tracing, progress messages are written to the system console:

```
INSTRUCTION-ADDRESS TRACE IN PROGRESS.                        (62118)
INSTRUCTION-ADDRESS TRACE IS STARTED ON CP3.                  (62119)
INSTRUCTION-ADDRESS TRACE IS IN PROGRESS ON CP3. COUNT=100.   (62120)
INSTRUCTION-ADDRESS TRACE ON CP3 IS COMPLETED.   COUNT=982.   (62121)
INSTRUCTION-ADDRESS TRACE IS STARTED ON CP4.                  (62119)
```

   When instruction tracing is complete, the following message is written to the system console:

```
INSTRUCTION-ADDRESS TRACE IS COMPLETED FOR ALL CPS.           (62122)
```

3. Save trace and storage by taking either an SVC dump or a stand-alone dump.

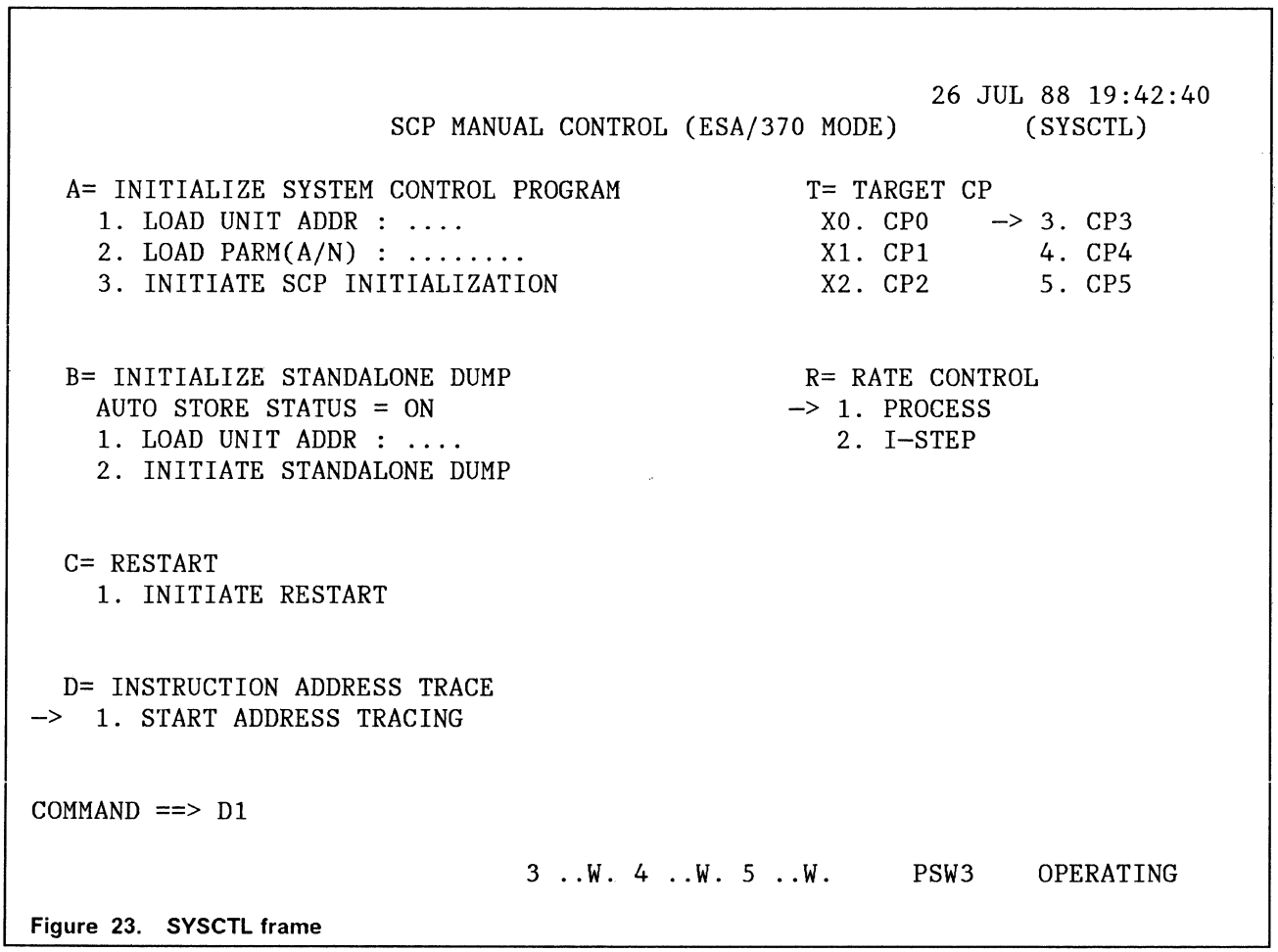


Figure 23. SYSCTL frame

7.0 Loss of MVS Consoles

The MVS console is one of the most critical devices in an installation. The loss of one or all consoles attached to a system does not cause the system to fail; however, the inability of the operator to restore the use of a console may lead to an unnecessary IPL.

Loss of Master Console

The master console function may be transferred to any other available physical console by one of the following means:

- Automatically by MVS. When an I/O error is detected on the current master console, the function is switched to the next console in the ring.
- As a result of the operator pressing the EXTERNAL INTERRUPT key on the system console when a master console exists.
- As a result of the operator issuing the command:

```
VARY ddd, MSTCONS
```

Switching the master console function causes the following messages to be displayed on the new Master Console.

```
IEE143I CONSOLE SWITCH   REASON= reason
        OLD=console NEW=console


IEE129I CONSOLE SWITCH, OLD= oldconsole
        NEW=newconsole  REASON= reason
```

Procedure

To restore a console, proceed as follows:

1. A reason of ***IOER*** indicates that an I/O error occurred on the old console. A reason of ***EXT*** indicates that the EXTERNAL INTERRUPT key was pressed. To determine the current state of the lost console, enter the following command:

   ```
   D U,,,nnn,1
   ```

   where 'nnn' is the device number of the lost console.

2. Correct the error condition on the old console if the reason was IOER.
3. The master console function can be returned to the old console with the following commands.
   a. VARY ddd,ONLINE (if not already online)
   b. VARY ddd,CONSOLE
   c. VARY ddd,MSTCONS
4. Message IEE143I and IEE129I with REASON=VMST will be displayed on the new master console.

Loss of All Consoles

A 'no console' condition exists when MVS is unable to locate a console for communication with the operator. This condition may occur as a result of a hardware failure on a device or control unit or inadvertent use of the EXTERNAL INTERRUPT key.

At IPL time a 'no console' condition results in a WAIT007. During normal operation, MVS continues processing, and alerts the operator by sounding the alarm and displaying a priority message on the system console. The message is hardware EC dependent and may not look exactly as the one shown below:

```
                                                                    (64400)
**************************PRIORITY MESSAGE*********************************
*                                                                           *
*                                                                           *
*                                                                           *
*                  Operator console not operational                         *
*                                                                           *
*                                                                           *
* Intended Console : System                                                 *
*                                                                           *
* Detailed Information: The SCP is unable to send messages to any           *
*                       I/O device specified as an operator                 *
*                       console.                                            *
*                                                                           *
* System Action: The audible alarm is sounded and the system waits          *
*                for operator intervention.                                 *
*                                                                           *
* User Action: Identify the cause of trouble with the SCP                   *
*                                                                           *
*                                                                           *
* ***************************************************************************
```

The EXTERNAL INTERRUPT key can be used during this condition to allow a controlled master console switch to a device that is:

- Online.
- Generated as a console.
- Not allocated (to TSO, for example) at the time the 'no console' condition occurred.
- Generated correctly and does not cause checks to occur when it is initially used.

Procedure

To recover from the loss of all consoles, proceed as follows:

1. Determine the problem with the consoles and correct it.
2. Press the ENTER key on the intended master console.
3. Press the EXTERNAL INTERRUPT key on the system console.

   If operating in LPAR mode, before pressing the EXTERNAL INTERRUPT key, enter:

   ```
   SETLP lpname
   ```

   where 'lpname' is the logical partition name.

4. Press the ENTER key on the master console if necessary. Normal operation will be resumed at the master console.

5. Restore the other consoles to the normal configuration. Use the following commands to bring all other consoles online:

```
VARY ddd,ONLINE
VARY ddd,CONSOLE
```

6. Display the current status of all active consoles by using the command:

```
D C,A
```

7. Set up console specifications.

Note: If you cannot recover from a 'no consoles' condition, a WTO buffer shortage eventually occurs.

8.0 Disabled Console Communication Facility

The Disabled Console Communication Facility (DCCF) is a facility used by MVS to communicate with the operator when a condition requiring immediate operator intervention is detected. MVS sends the message to the operator console (MVS master or first alternate console). if no response is received within 125 seconds, then the message is sent to the system console

Note: Most messages are routed to the system console after timing out; however, one exception is message:

```
IEA502I RESTART REASON COULD NOT BE OBTAINED FROM SYSTEM CONSOLE
```

If no response to message IEA502I is received after 125 seconds, restart reason 0 is assumed, and the current unit of work may be terminated with Abend 071. The system resumes normal processing.

In most cases, when DCCF is running, nothing else can take place in the system (the system is disabled). Therefore it is essential to resolve the DCCF condition as quickly as possible. The situations where DCCF is used, include the following:

- Hot I/O (refer to "Hot I/O" on page 101)
- Unconditional reserve recovery (DASD IFCC) on a device with a page data set (refer to "Page Data Set Volume Error" on page 99).

Recognizing DCCF

A DCCF situation is easy to recognize because:

- A single console, either the master console or its first alternate, is cleared and a single message is displayed at the top. At the bottom of the screen, a reply field is written in the form 'R 0,_'. An example of a message is shown in Figure 24.
- In most DCCF situations, no other I/O activity is apparent in the system. (The other consoles do not accept input.) The exception is during Restart DCCF processing, when the system is enabled and communication is possible through other consoles.

If, for any reason, the master console or its first alternate is not available, or if, within 125 seconds, no reply is entered to a message that has been sent to the master or first alternate console, the message is routed to the system console. When the DCCF message is written to the system console, priority message 64400 (Operator console not operational) is displayed and the audible alarm is sounded. Pressing the ENTER key on the system console restores the previous frame and the following message is displayed:

```
SCP messages are pending. Invoke or REFRESH the SCPMSG frame. (35201)
```

To invoke the SCP Message Facility frame, the 'F SCPMSG' command must be issued. An example of the frame is shown in Figure 25.

```
IEE127I THE FOLLOWING MESSAGE IS ISSUED THROUGH DISABLED CONSOLE FACILITY
IOS110A IOS HAS DETECTED HOT I/O ON DEVICE ddd (NON-DASD). THE LAST
        INTERRUPT FROM THIS DEVICE WAS ON CHANNEL PATH xx. THE SCD
        IS AT aaaaaaaa. THERE ARE nn DEVICES WITH HOT I/O ON CHP xx.

        ENTER ONE OF THESE REPLIES TO TELL IOS HOW RECOVERY IS TO
        BE HANDLED:

        NONE  THIS REPLY TELLS IOS THAT (1)THE OPERATOR DID NOT PHYSICALLY
              REMOVE ANY DEVICE OR CONTROL UNIT (HE MAY OR MAY NOT HAVE
              RESET THE DEVICE) AND (2) IOS SHOULD NOT REMOVE ANY DEVICE
              AND NOT ATTEMPT ANY CHANNEL RECOVERY.

        DEV   THIS REPLY TELLS IOS TO LOGICALLY REMOVE (BOX) THE DEVICE.
              (THE OPERATOR MAY OR MAY NOT HAVE PHYSICALLY REMOVED THE DEVICE)

        CU    THIS REPLY TELLS IOS THAT THE OPERATOR PHYSICALLY REMOVED THE
              CONTROL UNIT. THE REPLY MUST INCLUDE THE NUMBER OF EACH DEVICE
              ON THE CONTROL UNIT. FOR EXAMPLE, IF DEVICES 25E, 250 THRU 257
              REPLY:  CU,250:257,25E
                           OR
                      CU,25E,250:257

        CHP,K THIS REPLY TELLS IOS (1) TO ATTEMPT RECOVERY FOR THE CHANNEL
              PATH NAMED IN THE MESSAGE, AND (2) IF RECOVERY IS SUCCESSFUL,
              TO KEEP THE CHANNEL PATH ONLINE.

        CHP,F THIS REPLY TELLS IOS TO FORCE THE CHANNEL PATH OFFLINE.

  R 0,
```

Figure 24. Message IOS110A

The cursor is positioned on line 23 when the frame is displayed. Sometimes, it is necessary to enter ES/3090 hardware Service Language Commands on line 23 before responding to the message. For example, if there was a need to STOP a CP prior to entering the response, you would issue the 'STOP CPn' Service Language Command on line 23 first. The response to the message must be made on line 21, therefore, if there is no ES/3090 Service Language Command to enter, position the cursor on line 21 by use of the TAB key.

Note: There is no 125-second timeout for the reply to a message on the system console. The message stays pending until a reply is entered.

```
                                                  28 OCT 87  12:28:44
                              SCP MESSAGE FACILITY                (SCPMSG)


  IEE127I THE FOLLOWING MESSAGE IS ISSUED THROUGH DISABLED CONSOLE FACILITY
  IOS110A IOS HAS DETECTED HOT I/O ON DEVICE ddd (NON-DASD). THE LAST
          INTERRUPT FROM THIS DEVICE WAS ON CHANNEL PATH xx. THE SCD
          IS AT aaaaaaaa. THERE ARE nn DEVICES WITH HOT I/O ON CHP xx.

  ENTER ONE OF THESE REPLIES TO TELL IOS HOW RECOVERY IS TO BE HANDLED.

  NONE  —THIS REPLY TELLS IOS THAT (1)THE OPERATOR DID NOT PHYSICALLY
     REMOVE ANY DEVICE OR CONTROL UNIT (HE MAY OR MAY NOT HAVE RESET
     THE DEVICE) AND (2) IOS SHOULD NOT REMOVE ANY DEVICE AND NOT
     ATTEMPT ANY CHANNEL RECOVERY.
  DEV   —THIS REPLY TELLS IOS TO LOGICALLY REMOVE (BOX) THE DEVICE.
     (THE OPERATOR MAY OR MAY NOT HAVE PHYSICALLY REMOVED THE DEVICE.)
  CU    —THIS REPLY TELLS IOS THAT THE OPERATOR PHYSICALLY REMOVED THE
     CONTROL UNIT. THE REPLY MUST INCLUDE THE NUMBER OF EACH DEVICE ON
  IEE126I COMPLETE TEXT OF MESSAGE IOS110A CANNOT BE DISPLAYED

 RESPONSE: ..........................................................

 USE THE RESPONSE FIELD TO REPLY TO SCP MESSAGES.                (35137)

COMMAND ==>
                                  3 ..W. 4 .... 5 ..W.   PSW3   OPERATING
```

Figure 25. SCPMSG Frame

Responding to Messages Issued Through DCCF

Handling DCCF requires special care because of the following conditions:

- ***DCCF Lockout***

  Interrupts at other terminals on the same control unit as the master or alternate console can make it impossible to enter a response to the message from the master or its first alternate console.

  In DCCF mode, MVS accepts interrupts only from the console where the message has been written. If TSO users on screens attached to the same control unit present interrupts (by depressing the ENTER key several times), they lock out the operator's response. This will result in a DCCF timeout.

  Be aware of this situation if your installation does not have the master console and its alternate attached to dedicated control units.

  Correction of this situation is to configure the MVS consoles as documented in *IBM ES/3090 Complex Systems Recovery and Availability Configuration Considerations*, thereby preventing a DCCF lockout condition in the first place.

- ***DCCF Timeout***

  If the message is not answered within 125 seconds after its appearance at the master or first alternate console, it is routed to the system console. There is no timeout for the reply to a message on the system console; the message remains pending until a reply is entered.

- ***Restartable Wait States***

  A disabled restartable wait state is loaded only if the operator reply to the message cannot be presented through the MVS master or alternate consoles, or the system console; that is, when all other attempts to communicate with the operator have failed.

  A response is still required from the operator, and recovery from the restartable wait state involves the operator entering his response into an area of main storage. MVS retrieves the operators response when the CP is restarted from the wait state.

  Refer to "Disabled Wait States" on page 7 for a description of disabled wait state recovery.

Figure 26 gives a cross reference between the most common messages and the corresponding disabled wait state codes.

Message	*Restartable Wait State Code*	*Reason*
IEE331A	091, 092, 095, 096, 097, 099 09E	Software error (Spin Loop)
IOS110A IOS111A IOS112A	110 111 112	Hot I/O non-DASD, non-DPS Hot I/O non-reserved DASD or non-assigned DPS Hot I/O reserved DASD or assigned DPS
IOS427A	06F	Channel or CU problem on string containing page data set
IOS062E IOS113W IOS201E	062 113 114	Channel path recovery
IEA500A IEA501A IEA502I	n/a n/a n/a	Restart Reason 0 Restart Reason 1
IOS115A IOS116A IOS109E	115 116 n/a	Page data set problem Missing Interrupt on page device
IEE082I	CCC	QUIESCE command entered
IEA367A	202	Console services
IGF957A	n/a	Machine Check Handler
IEE601E	n/a	Software Error (Spin Loop)

Figure 26. Messages Issued through DCCF

Cancel Action

Often, after replying to the message from the master console or its first alternate, the following message is issued:

```
IEE128A PERFORM THE CANCEL ACTION TO RESTORE THE NORMAL DISPLAY
```

This can cause some confusion since most displays do not have a key marked 'CANCEL'. The PA2 key performs the CANCEL action, restores the screen, and clears the entry area.

9.0 Device Boxing

Device boxing is forcing a device offline in such a way, that current and future I/O operations are terminated with a permanent I/O error, and that no new allocations to the device can be made. The device is marked Pending Offline and will go offline as soon as soon as the last allocation is freed. The UCB is marked 'boxed'.

Device boxing takes place:

- Following a channel path error, if the last path to a device is lost.
- Following a channel path error, if a reserve on the device is lost.
- Following a *VARY ddd,OFFLINE,FORCE* command for the device.
- Following a *CF CHP(cc),OFFLINE,FORCE'* command if the last path to the device is removed.
- When the resource required to access the device becomes unavailable or is no longer available (for example, taking a CHPID by using the system console).
- As a result of replying 'BOX' to message IOS427A during Unconditional Reserve recovery (Refer to "Unconditional Reserve" on page 97).
- If Unconditional Reserve recovery failed.
- When a hot I/O condition was detected on the device, and the recovery action selected (either by default or by the operator) was 'BOX' (refer to "Hot I/O" on page 101).
- If the initialized state of a subchannel changes outside the control of MVS, and the device is still in use by MVS or a user.

While a device is boxed:

- No further I/O operations can be performed to the device. (Any I/O operation request fails with a permanent I/O error.)
- No new allocation for the device is accepted.
- The device is marked PENDING OFFLINE and goes into offline status when the following conditions occur, in the following order:

  1. The device is no longer allocated to any job.
  2. Allocation processing allocates any device in the system.

It is very important to understand that in the case of shared DASD devices, a boxed device is boxed only to the system that originated the boxing. The device is still accessible from other systems. This situation may lead to incorrect (or incomplete) data on the DASD volume. Such a situation must be reported to the owner of the data on the boxed DASD.

A DASD device that was offline (either boxed or not) will have its volume serial number read by the vary online operation. This information is placed into the UCB as part of the vary online process, providing there are no out-of-line conditions such as a duplicate volume.

The following messages are examples of device boxing for DASDs:

```
IOS100I DEVICE ddd BOXED/FORCED OFFLINE, LAST PATH cc LOST
IOS102I DEVICE ddd BOXED/FORCED OFFLINE, OPERATOR REQUEST
IOS102I DEVICE ddd BOXED/FORCED OFFLINE, PERMANENT ERROR, RESERVE LOST
IOS152E DEVICE ddd BOXED BY SUBCHANNEL RECOVERY, DEVICE STATE UNKNOWN
IOS153E DEVICE ddd,BOXED STATE, NOW AVAILABLE FOR USE
IOS451I ddd BOXED, RESERVE LOST
IOS451I ddd BOXED, NO ONLINE OPERATIONAL PATHS
IOS451I ddd BOXED, DISBAND AND REGROUP OF PATH GROUP FAILED
IEF281I ddd NOW OFFLINE/DEVICE IS BOXED
```

Boxed devices may be varied online as follows:

- A device that is boxed and offline can be brought back online with the 'VARY ddd,ONLINE' command.
- A device that is boxed but still online, cannot be used. It can be made operational with the command 'VARY ddd,ONLINE, UNCOND'.

  This form of the command should only be used under the direction of your systems support personnel.

Procedure

To recover a boxed device, proceed as follows:

1. In most cases, the operator should make the boxed device offline to all sharing systems.
2. The cause for the boxing must be determined, and any required hardware repair actions taken.

   In the case of a broken device, the device must be repaired before proceeding with step 3..

   In the case of a broken control unit, the device should only be used over the other (good) control unit paths. The broken control unit may be repaired at a later time. Proceed to step 3..

   In the case of a broken channel, the device should only be used over other (good) channel paths. The broken channel may be repaired at a later time. Proceed to step 3..
3. To bring the device online to allow your systems support personnel to verify the data on the boxed device, proceed with one of the following:

   a. If the device is offline and boxed (F-BOX), vary the device online using the following command:

      ```
      VARY ddd,ONLINE
      ```

   b. If the device is allocated and boxed (A-BOX), determine who is allocated to the device using the following command:

      ```
      D U,,ALLOC,ddd,1
      ```

      Use your installation procedures to unallocate users of the device. (You may have to cancel jobs or TSO users.)

      If it is not possible to unallocate all users of the device (for example, a system task), then proceed to step c. on page 67.

      If necessary, use your installation's deallocation procedure (for example, 'S DEALLOC'), to cause the device to go offline.

      Vary the device online, using the following command:

      ```
      VARY ddd,ONLINE
      ```

For a boxed allocated device, the above procedure is the preferred method for bringing the device online, as it allows the device to be taken offline before it is brought back online. This causes MVS to perform VOLSER verification and path validation.

Proceed to step 4. to verify the data on the volume.

c. A device that is allocated and boxed, but not offline, may be brought online under the direction of your system support personnel, using the following form of the Vary command:

```
VARY ddd,ONLINE,UNCOND
```

Note: When this form of the command is used to bring the device online, VOLSER verification is not performed.

4. Verify or repair the data if necessary, or at least notify the owners of data on the volume. If a potential data integrity problem exists, your systems support personnel must check the data before the device is placed online to any system for starting productive work.

The following tools may (among others) be used to verify data:

- LIST VTOC for VTOC
- IDCAMS with DIAGNOSE option for VSAM catalogs
- IDCAMS with VERIFY option for VSAM data sets

10.0 Missing Interrupts

Missing Interrupt Conditions

A missing interrupt condition exists when an interrupt is expected, but fails to occur within a specified time. The time interval varies according to device type and installation specifications.

The default time intervals are 15 seconds for DASD devices, 3 minutes for other device types (except MSS) and 12 minutes for MSS devices. These values are specified in the IECIOSxx member of SYS1.PARMLIB. Figure 27 shows the default specifications.

```
MIH DASD=00:15
MIH INTERVAL=03:00
MIH 3330V=12:00
MIH 3851=12:00
MIH DEV=none          DEV and TIME (as a group) can be used to
MIH TIME=none         alter the interval for selected device numbers.
```

Figure 27. Default Parameters for Missing Interrupt Detection

MVS/ESA allows the display and setting of missing interrupt times with two commands:

```
D IOS,MIH,TIME=ALL                -display all MIH times and settings
SETIOS MIH,DASD=00:15             -set DASD MIH time to 15 seconds
SETIOS MIH,DEVICE=2A,TIME=03:00   -set MIH time to 3 minutes for 2A0
```

The MVS Missing Interrupt Handler (MIH) notifies the operator when an expected interrupt fails to occur within the specified time. Several conditions can lead to a missing interrupt:

- An outstanding mount for a tape or a DASD device.
- An I/O request that has been initiated by the software but has not completed in the I/O subsystem.

If an expected interrupt does not occur in the allotted time, the MIH initiates recovery actions and informs the operator before system performance is severely impacted.

The operator is notified of an MIH situation through the messages defined in the following section.

Missing Interrupt Handler Messages

The messages in this section correspond to missing interrupt situations. The messages are described in detail and the description suggests the appropriate operator action.

Handling Message IOS070E

```
IOS070E ddd, MOUNT PENDING
```

MIH has detected a mount pending condition for device ddd.

Procedure

1. Use the D R,L command and mount the required volume.

2. Ready device ddd and issue the VARY ddd,ONLINE command.

Handling Message IOS071I

```
IOS071I ddd,cc,jjj,text

Where  ddd = Device Number
       cc  = Channel Path ID
       jjj = Jobname
       text= One of the following
```

- **Missing Channel and Device End**

  If the missing interrupt is occurring for a DASD device, the cause may be contention, that is preventing the device from reconnecting. Refer to "MIH Diagnostic Procedures" in Figure 32 on page 75

- **Missing Device End**

  Procedure

  1. Check the device for hardware error indications.
  2. If you just finished rewinding a tape or mounting a volume, issue a 'VARY ddd,ONLINE' to simulate a device end.

- **Halt or Clear Subchannel Interrupt Missing**

  Procedure

  1. These messages usually indicate hardware errors. For these errors, the MIH issues a 'CLEAR SUBCHANNEL' instruction to the device. If the problem persists, try to force the device offline and report the error to the service representative.
  2. If the device is a 3851 MSS, this situation might not be a problem; therefore, no recovery action is taken by the MIH.
  3. Check SYS1.PARMLIB member IECIOSxx. Missing Halt Subchannel interrupts be recognized if this value is set too low.

- **Idle With Work Queued**

  The error is usually software, but can be hardware. The system has work queued to the device, but the Channel Subsystem has no I/O request active for that device.

  Determine if any error recovery situations have recently occurred at the device/s or CHPIDs to the device.

  The Missing Interrupt Handler resets the device and passes an I/O request to the channel. Refer to "MIH Diagnostic Procedures" in Figure 29 on page 72

- **Start Pending**

  Procedure

  1. If message IOS071I is followed by message IOS452I (ddd,xx) OPERATIONAL PATH ADDED TO PATH GROUP, refer to "MIH Diagnostic procedures in Figure 30 on page 73
  2. The first thing you should do is to try to understand the reason for the message. In a shared system environment the 'START PENDING' message does not necessarily indicate an error condition; it could mean one system owns a DASD actuator exclusively and the other system is trying to access the same disk. If the message is repeated many times, there may be a problem and operator intervention might be needed.

3. For repeated 'START PENDING' messages, first determine whether the device is shared with one or more other systems. If it is not shared, there is probably a hardware error on the device. If the device is shared, there might be a contention problem caused by one of the sharing systems. Refer to Figure 28 on page 72

Handling Message IOS075E

```
IOS075E ddd RECURRING MIH CONDITION FOR THIS DEVICE
```

MIH processing is trying to recover a previous missing interrupt situation by issuing a CLEAR SUBCHANNEL instruction to reset the device, but due to hardware problems, the device or the condition was not reset.

If you verify that this condition is not a result of a shared systems contention as described in Figure 31 on page 74 , vary the device offline as follows:

VARY ddd,OFFLINE,FORCE

Handling Message IOS076E

```
IOS076E ddd,pp,jjj,text
```

The format of this message is identical to that of message IOS071I, and it is issued in the following situations:

- A clear subchannel interrupt is missing.
- The MIH exit routine for the 3851 indicated that the device is not to be reset.

If the device is not a 3851 (MSS), vary the device offline using the FORCE operand.

If it is a 3851, check the device. If it has an unrecoverable problem, and a backup MSC is available, use the clear switch. If there is no error indication, do nothing and wait for the operation to complete.

Handling Message IOS077E

```
IOS077E ddd,pp,jjj,text
```

This message is similar to message IOS071I and indicates a recurring situation. Normally, it accompanies message IOS075E.

Types of Missing Interrupt	Actions	Corrections
Mount Pending	D R,L D U,,,ddd,1	Mount required VOL V ddd,online
Idle With Work Queued	D U,,,ddd,1	Refer to Figure 29
MIH and DPS Out of Sync	-	Refer to Figure 30
Start Pending	-	Refer to Figure 31
Missing CE/DE	-	Refer to Figure 32
Missing DE (only)	non DASD	Refer to text
Missing HSCH	-	Notify hardware support
Missing CSCH	-	Notify hardware support

Figure 28. MIH Diagnostic Procedures DASD - General

Symptom

Idle With Work Queued

- Reported detection:

  IOS071I ddd,xx,jjjjjjj, IDLE WITH WORK QUEUED

  or the following, if problem is recurring:

  IOS071E ddd,xx,jjjjjjj, IDLE WITH WORK QUEUED

- Causes

Software	- Probably MVS software problem. - May occur after VM bounce.

- Actions

MVS console	- Address space dump for 'jjjjjj' MVS Commands: DUMP COMM=(operator dump name) R n,ASID=(a),SDATA=(NUC,SQA,TRT).
MVS console	- System console logs.
EREP	- Event Report.

Figure 29. MIH Diagnostic Procedures DASD - Idle With Work Queued

```
Symptom
-------------------------------------------------------------------------
MIH and DPS out of sync -
-------------------------------------------------------------------------

              - Reported detection.
                The following messages when reported one after
                another for the same device is considered to be a
                DPS out of sync condition.
                IOS071I ddd,yy,xxxxxxx,START PENDING
                IOS452I (ddd,xx) OPERATIONAL PATH ADDED TO PATH GROUP

              - Causes
                   Channel          - Incorrect use of CHNCFA frame.
                                      Channels should be configured
                                      off/on using MVS CF command
                                      when MVS is active.
                   Control Unit     - Wrong use of CU enable/disable
                                      switches - MVS VARY PATH
                                      commands should be used first.
                                      Control Unit IML.
                   3814 switch      - Switching of DASD interface on
                                      3814 prior to use of MVS
                                      VARY PATH command.
                   3814 switch      - Switching of control unit remote
                                      disable/enable switch function
                                      on 3814 prior to use of MVS
                                      'VARY PATH' command.
                   Control Unit     - Broken DPS array.
              - Actions
                   MVS console      - Save the MVS console log for
                                      the hardware CSR.
                   EREP             - Print out a EREP report for:
                                      Events
                                      DASD OBR
                                      DASD Unsupported records.
              - Corrections
                   D M=CHP(cc)        Determine control unit device
                                      address range on reported DPS
                                      out of sync path.
                   D M=DEV(ddd)       Determine all paths to
                                      device that had DPS out of sync.
                   V PATH(ddd-ddd,cc),online
                                      See on which 'path' (CHPID)
                                      other devices report:
                                      'Operational path added to
                                      path group'.
                   D M=CHP(cc)        Determine all devices
                                      configured online to the DPS
                                      out of sync path.
                   V PATH(ddd-ddd,cc),online
                                      Vary path online for all DPS
                                      devices shown online to the
                                      DPS out of sync CHPID.
                                      Note. Avoid varying online
                                      paths that may already be
                                      offline, they may be offline
                                      for other reasons.
                   Check other sharing systems (for case of IML or
                                      interface switch cause).
```

Figure 30. MIH Diagnostic Procedures DASD - DPS Out of Sync

```
Symptom
-------------------------------------------------------------------------
Start Pending
-------------------------------------------------------------------------
Note. If the following message also appears:
 IOS452I (ddd,cc) OPERATIONAL PATH ADDED TO PATH GROUP
refer to Figure 30.

              - Reported detection.
                IOS071I ddd,yy,xxxxxxx,START PENDING
                IOS071I ddd,**,*MASTER*,START PENDING
              - Causes
                   Reserve           - Lock out from another system
                   Contention        - Device - Port - Cont - CU - Ch,
                                       contention from other devices.
                                       See Figure 34 on page 77.
                   Outstanding       - Recovery on other systems in
                   Recovery            progress, not complete or
                                       elected not to be done.
                   IOCP              - Split Control Unit definition.
                   HW                - Device - Control - Interface.
                   Limitation

              - Actions
                   D M=CONFIG(xx)      Check for correct configuration
                                       on MIH detecting system.
                   DS P,ddd,16         DEVSERV Paths command.
                   D U,,,dd0,16|32     For ALL systems sharing
                                       DASD observe - R - P - BSY status.
                                       Observe range of devices to check
                                       for interaction/contention.
                   D U,,ALLOC,ddd,1    On reserving (R) or busy (BSY)
                                       devices, find JOB user/s.
                   D R,L               On other systems, look for
                                       outstanding recovery - (i.e.
                                       previous message IOS427A)
                   D GRS,C             Find reserving JOB, using
                                       GRS ring or OEM equivalent
                   RMFMON              SENQR (or PF9) on all systems
                                       to find the reserving JOB.
                   OEM S/W Products    Observe dynamic display
                   IOCP list           when no contention.

              - Corrections
                   Vary online         Return missing resources to
                                       configuration
                   Cancel Job/user     For reserve or contention -
                                       check with schedule.
                   Perform Recovery    For outstanding messages.

                   Check RMF reports   For reserve or contention -
                                       check 'pending or disconnect'
                                       times. (System Programmer).
                   Change schedule     Change JOB schedule.
                   Check Data set      Check dataset placement.
                   IOCP                Correct CU Macro.
                   GRS                 RNL setup (resource name list).
```

Figure 31. MIH Diagnostic Procedures DASD - Start Pending

Symptom

Missing CE/DE

- Reported detection.

  IOS071I ddd,cc,jjjjjjj,Missing CE/DE

- Causes

Contention	- Device - Port - Cont - CU - Ch, contention from other devices. See Figure 34.
Incomplete recovery	- Check other systems
HW Limitation	- Device - Control - Interface

- Actions

Vary online resources	Return missing resources to configuration.
V dd0-ddd,ONLINE	Vary on range of devices which may be effected by DPS array out of sync.
D M=CONFIG(xx)	Check for correct configuration.
DS P,ddd,l6	DEVSERV Paths command.
D U,,,dd0,16|32	For all systems sharing DASD observe - BSY status.
D U,,ALLOC,ddd,1	On busy (BSY) devices, find JOB user/s.

- Corrections

Cancel Job/user	For contention - check with schedule.
Check RMF reports	For contention - check 'disconnect' times.
Change schedule	Change JOB schedule.

Figure 32. MIH Diagnostic Procedures DASD - Missing CE/DE

```
Missing Interrupt Handler Recovery Actions
```

When a missing interrupt condition has been detected:

- STSCH to determine the progress of the Channel Program
- HSCH to stop the operation currently in progress
- STSCH to determine the current state of the Channel Program
- CSCH to clear indicators in the UCW
- Issue one of the following messages:

  IOS071 START PENDING
  IOS071 MISSING CHANNEL END AND DEVICE END
  IOS071 IDLE WITH WORK QUEUED
- Write MIH EREP record
- Call DPS Validation

  SNID to determine the state of the DPS array

  SPID to correct the array

  Issue one of the following messages:

  IEA722 OPERATIONAL PATH ADDED TO PATH GROUP

  IEA722 NOT OPERATIONAL PATH TAKEN OFFLINE

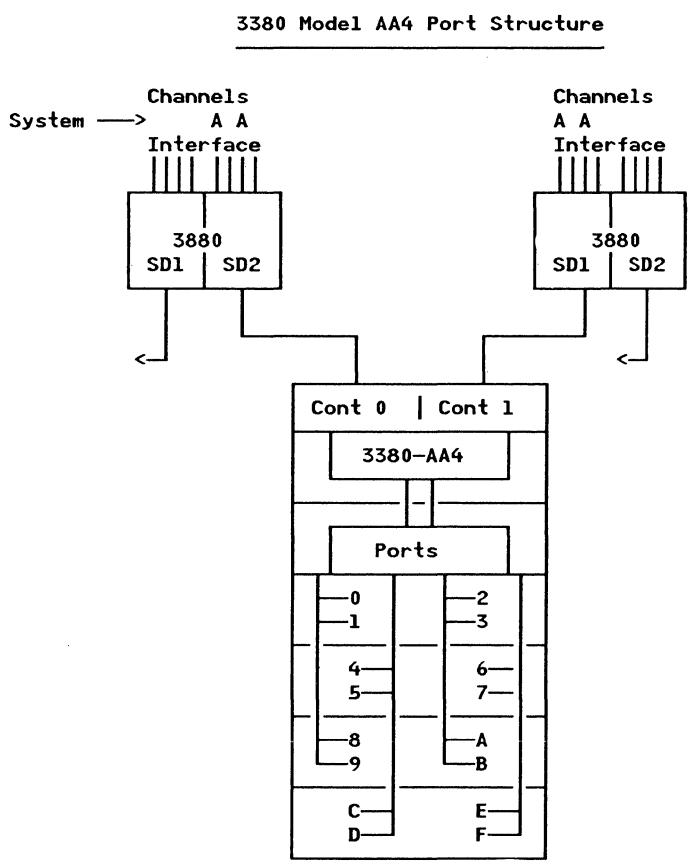
  or

  IOS452 OPERATIONAL PATH ADDED TO PATH GROUP

  IOS452 NOT OPERATIONAL PATH TAKEN OFFLINE

  Write EREP record for 'out of sync' condition
- Redrive original I/O request

Figure 33. MIH Recovery Actions (DPS DASD)



Devices 0,1,8,9 share the same port

Devices 4,5,C,D share the same port

Devices 2,3,A,B share the same port

Devices 6,7,E,F share the same port

Figure 34. 3380 Model AA4 Port Structure

11.0 Dynamic Pathing

Dynamic pathing devices are a class of I/O devices (currently 3380s and 3480s) that contain information in their controllers and storage directors about the systems to which they are attached. The information, that describes the paths leading to the devices from the various connected systems, is set up during the IPL process of any system connected to the device and can be changed by issuing MVS commands (such as VARY and CONFIG). The paths coming from the same system to the device together make up a path group.

When a 3380 device is reserved to a system or a 3480 device is assigned to a system, there is an indication in the DPS Array information.

Handling Dynamic Pathing Devices

You may have a need to change the hardware configuration of DPS devices. This change can require removal or addition of paths by switching through switching units such as a 3814, enabling or disabling control unit interface switches, and so on. Improper handling of these situations can cause the control information stored in the DPS Array to become invalid or out of sync. This situation may also lead to losing a Reserve (3380) or an Assignment (3480).

In general, observe the following rules when changing the configuration of DPS devices:

- When removing a channel path to the devices you should:

  1. Take all the channel paths offline logically by varying the path offline to all the devices dependent upon it.

     Use the MVS command(s):

     ```
     VARY PATH(ddd-ddd,cc),OFFLINE
     ```

  2. When the path is offline, remove the path physically by switching it at the 3814 or disabling the interface switches.

- When adding a path to DPS devices, use the reverse procedure; namely:

  1. Enable the path to the device physically.

  2. Use MVS commands to vary the path online logically.

If possible, never enable or disable control unit interfaces, re-IML control units, or power control units or DPS devices down without first issuing the correct MVS command to remove the devices and their paths from the system. If one of the above conditions does, nevertheless, happen, you must ensure that the DPS arrays are re-synchronized before continuing to use those devices. Issuing a 'Vary Path' command to a device or range of devices on a path will cause 'DPS Validation' to be invoked on the device or range of devices.

DPS Validation will automatically rebuild the DPS arrays on DPS devices (DASD and tape) that it determines are out-of-sync. The exception to this is when DPS Validation determines that a Reserve to a DASD device may be lost, in which case DPS Validation will 'Box' the device, and, in the case of tapes, if an Assignment has been lost, DPS Validation will again Box the device. Refer to "Device Boxing" on page 65 .

Recognizing DPS Array Out-of-Sync

If the DPS array for 3380/3480 devices becomes invalid ('out of sync'), MVS (when notified) attempts to rebuild the DPS array information automatically by using DPS Validation.

The following message indicates that MVS has detected a possible out-of-sync condition, and therefore, MVS will invoke DPS Validation.

```
IOS071I DEVICE ddd ....  START PENDING
```

The following message indicates successful DPS Validation.

```
IOS203I CHANNEL PATH xx SUCCESSFULLY RECOVERED
```

The following message indicates recovery of a DPS out of sync condition:

```
IOS452I ddd,cc OPERATIONAL PATH ADDED TO PATH GROUP
```

Proceed to recover other device paths on this CHPID.

If the DPS Validation routine detects an error in the path during its process, the path is taken offline. One of the following messages will be generated:

```
IOS001E ddd INOPERATIVE PATH cc
IOS450E ddd,cc NOT OPERATIONAL PATH TAKEN OFFLINE
IOS450E ddd,cc PERMANENT I/O, PATH TAKEN OFFLINE
```

In some situations, the device may be boxed because:

- There is no available path to the device. The following message is generated:

  ```
  IOS451I ddd BOXED, NO ONLINE OPERATIONAL PATHS
  ```

- A reserve (or assign) that was indicated in the DPS Array has been lost. One of the following messages is generated:

  ```
  IOS451I ddd BOXED, RESERVE LOST
  IOS451I ddd BOXED, ASSIGN LOST
  ```

- The process of removing (disbanding) the path group for the device and rebuilding (regrouping) it failed. In this case, no more I/O operations can be performed to the device. The following message is displayed:

  ```
  IOS451I ddd BOXED, DISBAND AND REGROUP OF PATH GROUP FAILED
  ```

Procedure

If some path went offline or a device was boxed during the DPS validation process, check that:

- The 3880/3480 was IMLed correctly.
- The 3990/3880/3480 has the interface(s) enabled.
- The device was correctly switched.

If any one of the above conditions does not exist, fix the problem, and recover with the VARY PATH/DEVICE ONLINE commands.

In other cases, the error is probably a hardware error.

Recovering a 3990/3380 Out of Sync Condition

When the 3990 experiences a system-resetting event, its DPS arrays may be invalid. The 3990 notifies the operating system using Reset Notification on the next I/O operation down the affected path. MVS then initiates channel path recovery that includes DPS Validation to rebuild the arrays. The following message is displayed to indicate successful recovery, without deviation from what the Path Available Mask indicated.

```
IOS203I CHANNEL PATH xx SUCCESSFULLY RECOVERED
```

Procedure

To recover from a 3990/3380 out of sync condition, proceed as follows:

1. When DPS Validation finds a deviation or errors, the corresponding messages are displayed.
2. Use 'D M=CHP(xx)' to determine the affected range.
3. Use 'DS P,ddd,n' to display the device configuration status.
4. Find the reason for reset notification. This might be a disabled interface, a 3814 switching problem, a CHPID being reconfigured using the system console, or a hardware error, among other causes.
5. Run EREP and contact the hardware service representative if required.
6. When the fault is corrected, vary the paths affected online with 'VARY PATH(ddd,cc),ONLINE' command.

Recovering a 3880/3380 Out of Sync Condition

The DPS validation for a Start Pending condition will validate only the devices that IOS has had a missing interrupt for. If the start pending is due to an array out of sync condition, other devices are most likely affected, since the cause is typically related to an action on an 3880 SD or channel path.

Depending on the device activity the system could take several minutes to several hours to validate and notify the operator of the problem.

While the arrays are out of sync, performance is impacted because of the loss of dynamic path reconnect. In addition the installation is exposed to a failure or operator action on another path that might then result in undetected loss of reserves (data integrity exposure) or boxing of the device.

It is therefore recommended that whenever a DPS array out-of-sync condition is detected for one device (as indicated by message IOS452I) the operator should initiate DPS Validation for the other devices. Refer to Figure 30 on page 73.

Recovering a 3480 Out of Sync Condition

The 3480 DPS can be inadvertently reset by:

- Disabling/enabling interfaces
- Incorrect device switching
- Power off/on and IML of the control unit

  Note: Certain 3480 hardware errors cause the Control Unit to be IML'd automatically.

If the Channel Subsystem selects a drive using the reset interface the 3480 will present unit check. The message following could be displayed

```
IOS000I ddd,cc,ASE,DB,0200,,**, label,jobname
        01485045000000200040(33E4000000000000)0002(00000000)

The code 'ASE'(assigned elsewhere) is issued as a result of the
3480 sense bytes.
```

Procedure

1. Use the DEVSERV command to subsystem status.'DS P,ddd,8|16'
2. Correct the fault.
3. Use the 'Vary PATH(ddd-ddd,cc),online' command to call DPS Validation.
4. The following messages should be displayed.

```
IEE302I PATH(ddd,cc) ONLINE

IOS452I (ddd,cc) OPERATIONAL PATH ADDED TO PATH GROUP
```

5. Use the DEVSERV PATH command to display the status.

DPS Device Messages - Problem Cross Reference

The Cause Codes in Figure 35 provide an example of how cross-reference tables may be used to diagnose problems with 3380/3880 DPS devices.

Figure 35 describes some common problems encountered when operating 3380/3880 devices as well as sample procedures to handle them.

Figure 36 and Figure 37 provide a cross-reference of these problems and their related messages. They are intended to assist the operator in analyzing the console messages and in determining the possible failing components.

These tables do not describe all possible problem and message situations. Customers wishing to use this approach should expand and customize this section based upon their own hardware/software environment and recovery procedures.

Method of use

Compare the messages in Figure 36 and Figure 37 with the console messages. For each message, note the possible cause code, and then choose the 'best fit'.

Consider the following examples. You receive the following messages:

```
IOS001E ddd,INOPERATIVE PATH(s) pp
IEA466I PERMANENT IO ERROR, FAULT CODE=xxxx
IEA469E PATH(ddd,pp) HAS BEEN VARIED OFFLINE
IOS428I ddd,pp, HAS BEEN RECOVERED THROUGH CHANNEL PATH zz
IOS450E ddd,pp NOT OPERATIONAL PATH TAKEN OFFLINE
IOS444I DYNAMIC PATHING NOT REMOVED FROM DEVICE ddd/FROM PATH(ddd,pp)
```

If you look in the tables (Figure 36 and Figure 37) you will find:

- IOS001E matches cause code 1
- IEA466I matches cause code 1
- IEA469E matches cause codes 1, 3
- IOS428I matches cause code 1
- IOS450E matches cause codes 1, 3
- IOS444I matches cause codes 1, 2, 3, 4, 5, 6, 8

From this, the conclusion is that the probable cause is cause 1 (Figure 35): an SD error with more than one path available.

Cause Code	Description	Operator action(s)
1	SD error > 1 path	Isolate failing SD for CE repair. May cause performance degradation. If only one remaining path, transfer critical applications to backup.
2	SD error last path	Isolate failing SD for CE repair. Identify and recover failing tasks.
3	CU error > 1 path	Isolate failing CU for CE repair. May cause performance degradation. If only one remaining path, transfer critical applications to backup.
4	CU error last path	Isolate failing CU for CE repair. Identify and recover failing tasks.
5	CHP error > 1 path	Isolate failing CHP for CE repair. May cause performance degradation. If only one remaining path, transfer critical applications to backup.
6	CHP error last path	Isolate failing CHP for CE repair. Identify and recover failing tasks.
7	CF CHP OFF last path	Check status of alternate paths, and vary online any paths that should be online. Otherwise, defer CF until alternate available.
8	CF CHP OFF, FORCE	Check status of alternate paths,and vary online any paths that should be online. Defer CF if possible; otherwise, recover any failing tasks.
9	CU BUSY with VARY or CF	Identify failing CU and system responsible. Consult local procedures for dealing with hung control unit.
10	DPS Array Out-of-Sync	Determine range of affected devices. Re-synchronize DPS Array information for all affected devices.

Figure 35. Cause Codes

MESSAGE	CAUSE CODE									
	1	2	3	4	5	6	7	8	9	10
IEA442E					X	X				
IEA447E			X	X						
IEA466I	X									
IEA469E	X	X								
IEE097I							X		1	
IEE100E								X		
IEE131D								X		
IEE133I									1	
IEE507D								X		
IEE541I							X			
IEE717D									X	
IEE756I									X	
ILR009E		1								
IOS000I	X	X		X						
IOS001E	X									
IOS050I	X				X	X				
IOS062E						X				

NOTE 1: Issued only in response to the CONFIG command.

Figure 36. Message/Cause Cross Reference (Part 1 of 2)

MESSAGE	CAUSE CODE									
	1	2	3	4	5	6	7	8	9	10
IOS071I								X		X
IOS100I								X		
IOS102I		X		X						
IOS104I		X								
IOS105I		X								
IOS115A		2								
IOS162A					X	X				
IOS201E						X				
IOS202I								X		
IOS203I					X	X				
IOS251I					X	X				
IOS427A	X				X	X				
IOS428I	X									
IOS429I	X				X	X				
IOS444I	X	X	X	X	X	X		X		
IOS450E	X		X							X
IOS451I		X		X						X
IOS452I										X

NOTE 2: Issued only when the device contains a PAGE data set.

Figure 37. Message/Cause Cross Reference (Part 2 of 2)

12.0 Write Inhibit

Recognizing a Write Inhibit Condition

MVS/ESA DASD Error Recovery Procedures (ERP) may fence a failing component on a path to prevent data corruption by invoking the write inhibit facility of the 3880 and 3990 storage director.

When a DASD I/O error occurs, the DASD ERP determines from the sense bytes which component is causing the error, and may write inhibit at one of the following levels:

1. Channel interface
2. Storage director
3. Controller

DASD ERP attempts to recover the failing I/O operation over an alternate path, if one exists. If the recovery is successful, the failing path is automatically varied offline.

Messages Issued During Write Inhibit Processing

The following messages indicate a Write Inhibit condition exists:

```
IEA467E PATH (ddd,cc) WRITE INHIBITED (type) FOR ALL WRITE OPERATIONS

IEA468E WRITE INHIBITED PATH (ddd,cc) ENCOUNTERED

IEA469E PATH (ddd,cc) HAS BEEN VARIED OFFLINE

IEA469E PATH (ddd,cc) CANNOT BE TAKEN OFFLINE
```

Handling Write Inhibit Condition

When a condition requiring Write Inhibit is detected, the following message is issued to the MVS operator console:

```
IEA467E PATH (ddd,cc) WRITE INHIBITED (type) FOR ALL WRITE OPERATIONS
```

The 'type' field in the message identifies the component for which the Write Inhibit condition has been established in the storage director. Three elements may be Write Inhibited:

- Channel Interface
  - Any write through the channel interface of that storage director is inhibited. Other control units on the same channel interface are not affected.
  - Only one interface to one system is affected.
  - Write operations to the affected devices can be done over another path to this storage director or through an alternate storage director, if available.

- Storage Director
  - Any write through that storage director is inhibited. All systems using that storage director are affected.
  - Write operations to the devices connected to that storage director can be executed through an alternate storage director, if available.
- DASD Controller
  - Any write through that Controller is inhibited.
  - All systems connected through the Controller are affected.
  - Write operations to the devices connected to that controller can be executed through the other controller of the head of string.

Any attempt to write through the inhibited element is denied and the following message is issued to the MVS operator console:

```
IEA468E WRITE INHIBITED PATH (ddd,cc) ENCOUNTERED
```

The message that follows depends on whether there are alternate paths available for the device, or not:

- If an alternate path is available, and if the write is successful through that alternate path, the failing path is taken offline and the following message is issued:

  ```
  IEA469E PATH (ddd,cc) HAS BEEN VARIED OFFLINE
  ```

- If no alternate path is available, the path is not taken offline, and the following message is issued:

  ```
  IEA469E PATH (ddd,cc) CANNOT BE TAKEN OFFLINE
  ```

Procedure

Handle a Write Inhibit condition as follows:

1. If the error persists, issue:

   'VARY PATH(ddd,cc),OFFLINE,UNCOND'

   to vary the path offline, assuming that the path is online but NOT allocated; otherwise, the command will fail.

2. Report a Write Inhibit condition to the service representative and have the failing component fixed before attempting to use it.

Removing a Write Inhibit Condition

Report a Write Inhibit condition to the service representative and have the failing component fixed before attempting to use it.

After the failing component has been repaired, the Write Inhibit condition can be removed in one of two ways:

1. Entering the ICKDSF "CONTROL ALLOWWRITE" Command.

   If this is not already available as a standard procedure in your installation, ask the system programmer to prepare a job to run the ICKDSF program (Release 7 or higher), using the CONTROL ALLOWWRITE command to re-enable the affected storage director(s) for write operations.

   This is the normal procedure by which a storage director is Write Allowed after repair.

2. IMLing the Storage Director.

The storage director may already have been IMLed by the CE as part of the repair action. Be careful: IMLing an active SD can lead to data integrity problems, so be sure that ***all*** paths from all sharing systems are offline to the storage director you intend to re-IML.

After successfully completing either of the above actions, vary online all the paths to all the devices on the write-inhibited DASD subsystem. Use the DEVSERV command to verify that all the paths are (logically) online.

You should perform the above procedure on all systems in the installation that are connected to the write-inhibited DASD subsystem.

Because CONTROL ALLOWWRITE operates on a device basis, if more than one storage director to the device is failing, all storage directors must be repaired or tested before the CONTROL ALLOWWRITE command is issued.

ICKDSF sends the CONTROL ALLOWWRITE command to every path to the selected device, whether the path is marked offline or not, except for reserved devices, in which case only the online paths are used. These are most probably not the paths that have to be reset, so the command will not be effective in removing the write inhibit condition.

To overcome this problem, choose several devices and run ICKDSF to them. The probability of finding all of them reserved is very low.

The sample JCL skeleton below causes the 3880 Storage Director attached to the 3380 volume with volume serial number xxxxxx to have its write inhibited indication removed:

```
//jobname   JOB  ...
//stepname  EXEC PGM=ICKDSF
//SYSPRINT  DD   SYSOUT=A
//DDNAME    DD   UNIT=3380,DISP=OLD,VOL=SER=vvvvvv
//SYSIN     DD   *
  CONTROL ALLOWR DDNAME(DDNAME)
/*
```

13.0 3990 Fencing

Service Information Messages (SIM)

Depending on the type of error condition, the 3990 DASD control unit may prevent the failing component from being used by the system. Preventing the use of the component is referred to as 'fencing'. Notification of the initial fencing is through the use of a 'SIM ALERT' message.

A SIM ALERT message (Figure 38) is displayed on the operator's console to notify the operators that a 3990 service information message (SIM) has been written to the error recording data set (ERDS).

The 3990 sends the SIM to the host system that issues the next I/O operation (this may be a different host system than the one that was performing the I/O operation when the SIM occurred).

When a SIM ALERT is displayed with a severity other than SERVICE, (Figure 39 and Figure 40) it is essential that you run an EREP exception report to get the additional information from the ERDS as quickly as possible.

If a repair action is not completed, the 3990 re-issues the SIM format sense data eight hours after the first SIM offload and then again eight hours after the second SIM offload to the host. After the last SIM offload to the host, the SIM format sense data is marked on the SIM log and the data is offloaded to the host for the final time whether a repair action is started or not.

```
IEA480 0cuu,xxxx,yyy ALERT, MT=mmmmmmm, SER=04aa-ddddddd, REFCODE=nnnn nnnn nnnn
            MVS SIM ALERT FORMAT

DMKDAD403I 0cuu,xxxx,yyy ALERT, MT=mmmmmmm, SER=04aa-ddddddd, REFCODE=nnnn nnnn nnnn
            VM/SP and VM/SP HPO SIM ALERT FORMAT

HCPERP403I 0cuu,xxxx,yyy ALERT, MT=mmmmmmm, SER=04aa-ddddddd, REFCODE=nnnn nnnn nnnn
            VM/XA SIM ALERT FORMAT
```

Figure 38. SIM Alert Format Message Examples for MVS and VM Environments

Message Field	Description
0cuu	Identifies the channel/unit address of the failing storage control.
xxxxx	Identifies the Failing component. SCU specifies the fault occurred in the non cache portion of the storage control. CACHE specifies the fault occurred in the cache or portion of the storage control.
yyyyyyy	Identifies the severity of the failure. The severity can be ACUTE, SERIOUS, MODERATE, or SERVICE.
MT=mmmmmmm	Identifies the machine type and model number.
SER=04aa-ddddddd	Identifies the serial number of the failing unit.
REFCODE= nnnn nnnn	Identifies the reference code that the service representative will need to repair the fault.

Figure 39. MVS and VM SIM Alert Fields

Failing Component	Severity: SERVICE	Severity: MODERATE	Severity: SERIOUS	Severity: ACUTE
SCU	A service-related fault occurred that does not affect storage path operation.	A storage cluster temporary error threshold has been exceeded, but both storage paths are operational.	A permanent error occurred on one storage path. One storage path remains operational.	A permanent error occurred on both storage paths in this cluster.
CACHE	A cache or nonvolatile storage temporary error threshold has been exceeded, but the storage resource is operational.	A permanent error occurred on 1 of 4 cache or nonvolatile storage access paths.	A permanent error occurred on 2 of 4 cache or nonvolatile storage access paths.	A permanent error disabled cache or nonvolatile storage.

Figure 40. Meaning of the SIM Alert Field by Failing Component

Types of Fencing

The 3990 modifies and enhances the fencing of the 3880 as follows:

- Fence channel

  When either a non-resetable error or error threshold exceeded condition occurs, the channel is fenced from that storage path. If the error occurs on both paths, the channel is fenced from the entire storage cluster (in both DLS and DLSE modes).

- Fence storage path

  This fence is similar to the fence storage director operation of the 3880, and replaces it. However, note the following differences:

  - In DLSE mode, there are two paths in a storage director (cluster), so it is much less likely that a fault will cause an entire storage director (cluster) to be fenced.
  - Some errors that do not cause a 3880 or a 3990 storage path in DLS mode to fence cause a 3990 storage path in DLSE mode to fence, if a threshold of these errors is exceeded and the other storage path in the storage director (cluster) is operational.

- On a 3990 Model 3, some cache errors cause a storage path to be fenced so that the rest of the storage paths in the subsystem can continue to use the cache.

- Fence the device from a storage path in DLSE mode

  A device is fenced from a storage path if there is an alternate path to a device within the storage director and a threshold of errors that appear to be path related is exceeded on that device.

DEVSERV PATH Message

The DEVSERV PATH command is used to display the channel and storage path status for a device. Because the DEVSERV PATH is already a lengthy console display, the fence display line will be included only when a fence is detected.

Message IEE459I below includes the indications shown when one or more channel paths, storage paths, or devices have been fenced.

A complete description of the message can be found in MVS/ESA System Messages, Vol 2.

```
IEE459I 22.16.30 DEVSERV PATHS  023
UNIT DTYPE M CNT VOLSER  CHPID=PATH STATUS
 120,3380J,O,000,PS3803,  05=+   45=+
 ** FENCE yyyyyyyy     xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
 121,3380J,O,000,CB3800,  05=+   45=+
 ** FENCE yyyyyyyy     xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
 122,3380J,O,000,CF3811,  05=+   45=+
 ** FENCE yyyyyyyy     xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
 123,3380J,A,001,PRV004,  05=+   45=+
 ** FENCE yyyyyyyy     xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx
************************* SYMBOL DEFINITIONS ******************************
A = ALLOCATED                      + = PATH AVAILABLE
O = ONLINE

    Where  yyyyyyyy = STORAGE PATH or CHANNEL or DEVICE

    Where  xxxxxxxx...= 4 bytes of the path status for each
                        storage path (0,1,2 and 3)


    Bytes 0-3: STATUS OF STORAGE PATH 0
      BYTE DEFINITION
       0   STORAGE PATH STATUS
      BIT DEFINITION
        0   1 = BYTES 1-3 contain valid values; 0 = SP not installed
        1   Device attaches through this storage path
        2   1 = BYTES 1-3 invalid; 0 = SP disabled
        3   Device permanently fenced from this SP (4-way)
        4   Command received on this path
       5-7  ID of channel requesting status; 0=CH A, 1=CH B, etc
      BYTE
        1   BIT map of channels configured in this cluster
        2   BIT map of channels enable/disable switches
        3   BIT map of channels fenced from this storage path
      4-7:  STATUS OF STORAGE PATH 1
            The byte definitions are the same as for bytes 0-3 for storage path 0
            but apply to storage path 1.
     8-11:  STATUS OF STORAGE PATH 2
            The byte definitions are the same as for bytes 0-3 for storage path 0
            but apply to storage path 2.
    12-15:  STATUS OF STORAGE PATH 3
            The byte definitions are the same as for bytes 0-3 for storage path 0
            but apply to storage path 3.
```

Unfencing

We suggest that you have the service representative review and repair the hardware error first before removing the fence.

Types of Unfencing for 3990s in DLSE Mode include:

- Channel fence

  Do one of the following:

  - Use ICKDSF to unfence the channel.
  - Press the Restart switch. This should be done only by authorized personnel, following procedures approved by the installation.
  - For certain conditions, the service representative may determine that it is appropriate to power the cluster off, then on again to remove the fence.

- Storage path fence

  Do one of the following:

  - Use ICKDSF to unfence the storage path.
  - Press the Restart switch. This should be done only by authorized personnel, following procedures approved by the installation.
  - For certain conditions, the service representative may determine that it is appropriate to power the cluster off, then on again to remove the fence.

- Device fence

  Do one of the following:

  - Use ICKDSF to unfence the storage path.
  - Press the Restart switch. This should be done only by authorized personnel, following procedures approved by the installation.
  - For certain conditions, the service representative may determine that it is appropriate to power the cluster off, then on again to remove the fence.

Types of unfencing for 3990s in DLSE/DLS Mode include:

- MVS Path Vary

  Use the MVS VARY PATH command.

- DASD controller fence

  The 3990 also attempts to unfence the controller if one of the actions to unfence the storage path is taken. The controller repair action unfences the controller.

- Write inhibit

  Use ICKDSF to reset the Write Inhibit. Refer to "Write Inhibit" on page 87.

  The 3990 also resets the Write Inhibit if one of the actions to unfence a storage path is taken.

  Write Inhibit channel is reset if a system reset is received on the channel.

Note: Each installation should document the operational procedures for using the Restart switch. We suggest you review and modify as appropriate your procedures for unfencing and using the Restart switch.

ICKDSF CLEARFENCE Command

Maintenance is required on the failing storage control the failing device, or both. After the failing unit has been repaired, use ICKDSF CONTROL command with the CLEARFENCE parmameter to clear the condition for the path. This action clears all paths to all devices on the subsystem. The specified device can be any device on the subsystem.

The following job skeleton shows the use of the CLEARFENCE command:

Example
```
//jobname   JOB  ....
//stepname  EXEC PGM=ICKDSF
//SYSPRINT  DD   SYSOUT=*
//DDNAME    DD   UNIT=3380,DISP=OLD,VOL=SER=vvvvvv
//SYSIN     DD   *
  CONTROL CLEARFENCE DDNAME(DDNAME)
```

14.0 Unconditional Reserve

Unconditional Reserve is a channel command used during some MVS/ESA recovery situations to break a hung allegiance between a device and a channel path. It is used for DASD devices and control units that do not permit use of the 'Reset Allegiance' command, or, in cases where the Reset Allegiance command has not managed to break the allegiance. For example, if a storage director fails while data transfer is in progress between a device and the channel through that storage director or storage path, then an allegiance is maintained that prevents the device from being accessed over any other channel path. That is, the device appears 'busy' to any attempt to access it.

MVS/ESA initiates unconditional reserve processing without operator intervention providing a data integrity exposure does not exist. When a malfunction is detected during an I/O operation to a DASD device, such as an interface control check, and this device is reserved by the detecting system, the system processes the Unconditional Reserve. The operator is notified of the result by one of the following messages:

```
IOS428I - when recovery is successful -
IOS429I - when recovery is unsuccessful -
```

When MVS/ESA detects a hung allegiance and is unable to determine whether there is an integrity exposure, it issues message IOS427A during the recovery process.

MVS/ESA issues this message only when all of the following conditions exist:

- An IFCC has occurred during an I/O operation to a DASD device that may have resulted in the device now maintaining allegiance (that is, the device may not be accessible to the detecting or sharing systems); and
- The DASD device in error recovery has been specified as 'shared ' ; and
- The DASD device in error recovery is ***not*** reserved on the detecting system; and
- MVS is unable to determine the reserve status of the device on other systems. Under normal circumstances, MVS/ESA retrieves information about the device (including whether it is reserved) from the DPS arrays in the DASD/control unit.

If the above conditions exist, MVS/ESA requests the recovery option from the operator through message IOS427A before issuing the Unconditional Reserve, so as to prevent breaking an allegiance that may be genuinely held by another system.

The messages discussed in the following sections may be issued by MVS/ESA.

Message IOS427A

```
IOS427A ddd,cc, component FAILURE.  REPLY WITH UR, BOX OR NOOP.
```

Where:

```
ddd         = Device number
cc          = Channel path id
component   = One of the following:
                                  Channel Path
                                  Control Unit
```

The possible responses to message IOS427A are:

- **UR** =

  This reply should be the preferred option if the device is not in use by sharing systems, or if data integrity is not important,

  Unconditional Reserve recovery action is attempted and therefore a device that has maintained allegiance to the broken path may have its allegiance to the broken path reset.

  In a shared environment, this reply can steal the reserve condition from another system if the correct recovery procedure is not followed prior to replying with UR, and therefore, data integrity may be impaired.

- **BOX**

  All the I/O requests to the device are posted complete with an error, which may result in job termination. The net result is that the device may appear busy to the other systems - that is, as message IOS071I START PENDING.

- **NOOP**

  The Unconditional Reserve recovery code is not executed, and therefore the response may result in not clearing an allegiance condition. The net result is that the device may appear busy to further I/O operations:

  - To the other paths on this system (issuing IOS427A)
  - To the other systems - that is, as message IOS071I START PENDING.

  If the same error persists, the message is presented again. If other types of errors are generated by the failing component, the path or device should be taken offline.

Procedure when Replying 'UR'

1. Quiesce all sharing systems and system images in the case of a complex operating in LPAR mode.

   Issue the following MVS command:

   ```
   QUIESCE
   ```

   Wait for the quiesced system to enter a wait state 'CCC'.

2. Reply UR to message IOS427A on the detecting system.

   Wait for message IOS428I or IOS429I to be issued.

3. Restart all sharing systems.

Message IOS428I

```
IOS428I ddd,cc, HAS BEEN RECOVERED THROUGH CHANNEL PATH zz
```

Where:

ddd = Device number
cc = Channel path id
zz = Channel path id

This message is issued when Unconditional Reserve processing has successfully recovered the device through channel path 'zz'. Unconditional processing was initiated either as a result of the operator responding 'UR' to message IOS427A, or automatically when the system detected a hardware condition associated with device 'ddd' and the device was reserved to the detecting system.

This message ***may*** indicate a hardware failure along channel path 'cc', and should be reported to the service representative.

Message IOS429I

```
IOS429I ddd,cc, COULD NOT BE RECOVERED THROUGH AN ALTERNATE
                CHANNEL PATH
```

Where:

ddd = Device number
cc = Channel path id

This message is issued when Unconditional Reserve processing was not able to recover device 'ddd' through an alternate channel path. Unconditional processing was initiated either as a result of the operator responding 'UR' to message IOS427A, or automatically when the system detected a hardware condition associated with device 'ddd' and the device was reserved to the detecting system.

The Unconditional Reserve processing was unsuccessful in recovering the device through an alternate channel path for one of the following reasons:

1. No alternate channel paths were available for the device.
2. All alternate channel paths were unsuccessful in recovery.
3. The Unconditional Reserve command is not supported by the DASD hardware associated with the device.
4. No Unconditional Reserve was requested.

This message ***may*** indicate a hardware failure along channel path 'cc', and should be reported to the service representative.

Page Data Set Volume Error

If an I/O error condition requiring Unconditional Reserve recovery occurs on a device containing a page data set, IOS performs Unconditional Reserve processing through the use of DCCF:

```
IOS427A ddd,cc, component FAILURE. REPLY WITH UR, BOX OR NOOP.
```

Where 'ddd' is the device number, and 'cc' is the channel path.

Note: All MVS processing may be suspended until the operator replies to this message.

The possible replies are:

- **UR** = MVS uses the Unconditional Reserve.

  This option must be used with care since the Unconditional Reserve may steal the reserve ownership from sharing systems, but page data set volumes should normally be dedicated to a specific system; consequently, you can expect that no sharing system has a reserve on this device.

  Procedure when Replying 'UR'

  1. Quiesce all sharing systems and system images in the case of a complex operating in LPAR mode.

     Use the following MVS command:

     ```
     QUIESCE
     ```

     Wait for the quiesced system to enter a wait state 'CCC'.

  2. Reply UR to message IOS427A on the detecting system.

     Wait for message IOS428I or IOS429I to be issued.

  3. Restart all sharing systems.

- **BOX** = The device is boxed.

  The device is boxed and the page data is flagged bad. This means that all users with one page (or more) on this device Abend with a system code of 028. A 'VARY ddd,ONLINE' command does not reactivate the use of the page data set. A new IPL may not solve the problem. Maintenance service intervention may be required. This option is not recommended.

- **NOOP** = The I/O operation is retried.

  If the message recurs, check whether other devices on this path have similar problems (IOS427A or IOS050I channel detected error). If so, remove the failing path using VARY PATH(xxx,yy),OFFLINE for the device, or take the channel path offline using the command CF CHP(cc),OFFLINE.

If the message can not be issued, or if it times out, it will be written to the system console.

If the problem recurs or a restartable wait state '06F' is loaded, use procedure "PD06" on page 25 to recover.

15.0 Hot I/O

Hot I/O occurs when a possible hardware malfunction presents unsolicited status from a device to the Channel Subsystem for enabled subchannels that are not 'status pending'.

The Channel Subsystem presents the unsolicited status to MVS. MVS keeps track of the number of unsolicited status conditions presented, and when the number for the device exceeds the threshold value (default of 100, or user-assigned), MVS recognizes a Hot I/O condition.

The Hot I/O recovery actions to be used may be tailored by the installation in SYS1.PARMLIB member IECIOSxx.

It is possible to specify the following automatic recovery actions:

BOX force the device offline

CHP,K attempt channel path recovery

CHP,F force the channel path offline

OPER obtain recovery option from the operator through Hot I/O message

The following recovery actions are available to the operator in response to the Hot I/O DCCF message when the recovery option specified in PARMLIB member IECIOSxx is 'OPER'.

- Box the device
- Fence the control unit - boxing all devices on control unit
- Request channel path recovery
- Force the channel path offline

Recognizing Hot I/O

MVS notifies the operator of a Hot I/O by:

- Issuing one or more of the messages described in the following Hot I/O messages sections. Through the messages, the following information is communicated to the operator:
  - Which device, or range of devices, is causing the Hot I/O condition
  - Over which channel path the last interrupt occurred for the device
  - Whether any recovery action was requested
  - Whether any recovery action was attempted
  - The results of the recovery action
- Loading a restartable wait state.

If 'OPER' is specified, the recovery action for Hot I/O processing is obtained from the operator by issuing one of the following Hot I/O messages:

- IOS110A Hot I/O on Non-DASD device

- IOS111A Hot I/O on Non-Reserved DASD or Non-Assigned DPS device
- IOS112A Hot I/O on Reserved DASD or Assigned DPS device

Recovering from Hot I/O

This section describes how to respond to the various Hot I/O messages.

Hot I/O Message - IOS109E

Message IOS109E is issued to notify the operator that a Hot I/O condition has been detected, and that recovery is automatically initiated. The recovery action invoked is determined by the IECIOSxx specification.

The message has the following form:

```
IOS109E HOT I/O RECOVERY  option  INITIATED FOR DEVICE ddd,
        CHPID cc
```

'option' may be one of the following:

```
BOX
CHP,F
CHP,K
```

A subsequent message (one of those listed below) indicates the results of the Hot I/O recovery processing.

While no immediate operator response is required for message IOS109E, the operator should consider the impact of a recurring Hot I/O condition for that device on the system. If the Hot I/O condition is not cleared by the initial recovery action, the 'recursive' Hot I/O error recovery option is invoked.

Message - IOS102I

```
IOS102I DEVICE ddd BOXED, OPERATOR REQUEST
```

Procedure

This message (IOS102I) is issued following IOS109E when the automatic recovery action initiated for the detected Hot I/O condition is 'BOX'. The operator should:

1. Consider fencing the entire control unit by forcing offline the range of attached devices if this condition occurs for more than one device on a control unit.
2. Report the problem to the service representative.
3. Refer to "Device Boxing" on page 65. After the hardware problem has been corrected, the boxed device/s may be brought online using the following command:

   ```
   VARY ddd,ONLINE
   ```

   if being returned from an offline boxed state, or

   ```
   VARY ddd,ONLINE,UNCOND
   ```

   if being returned from an online boxed state.

The preferred method is to first take the device completely offline and then bring it back online.

Message - IOS202I

```
IOS202I CHANNEL PATH cc FORCED OFFLINE
```

Procedure

This message (IOS202I) is issued following IOS109E when the automatic recovery action initiated for the detected Hot I/O condition is 'CHP,F', or when channel path recovery, initiated as a result of specifying 'CHP,K', is unsuccessful. The operator should:

1. Refer to "Channel Path Recovery" on page 113 for a description of handling channel path recovery.
2. Report the problem, including the full text of the messages, to the service representative.
3. After the hardware problem has been corrected, recover the channel path by issuing the following command:

   CF CHP(cc),ONLINE

Message - IOS203I

```
IOS203I CHANNEL PATH cc SUCCESSFULLY RECOVERED –DEVICE IS: ddd|UNKNOWN
```

Procedure

This message (IOS203I) is issued following IOS109E when the automatic recovery action initiated for the detected Hot I/O condition is 'CHP,K' and the channel path recovery is successful.

If the Hot I/O condition is not cleared by the channel path recovery processing, the recursive Hot I/O error recovery option is invoked:

1. If the Hot I/O device is a console on the same control unit as the master console, box the device by using the following command:

   V ddd,OFFLINE,FORCE

2. If this condition occurs for more than one device on a control unit, the operator should consider fencing the entire control unit by forcing offline the range of attached devices.
3. Report the problem to the service representative.

Hot I/O Message - IOS110A

The message shown in Figure 41 is issued using DCCF.

This message is issued when a Hot I/O condition has occurred on a non-DASD, non-DPS device and either:

- The installation has indicated through PARMLIB that the operator should specify the recovery action for the device,

  or

- The Hot I/O condition has persisted, despite previous attempts at recovery.

Note that if the response to the message is not received within 125 seconds, a DCCF timeout occurs, and the message is written to the system console. (The Processor Controller alarm sounds to alert the operator.) The operator can then reply to the Hot I/O message from the SCPMSG frame of the system console.

Procedure

The operator should proceed as follows:

1. Refer to the installation's recovery procedures for the device indicated in the IOS110A message text.

   The appropriate recovery action for a particular device may vary from installation to installation depending on the configuration and use of the device.

2. Attempt to correct the problem by specifying the least-impacting recovery actions first.

   Reply with one of the following:

   NONE requests IOS to do no recovery

   DEV requests IOS to box the device

   CU requests IOS to box all devices in the range specified

   CHP,K requests IOS to attempt channel path recovery

   CHP,F forces the channel path offline

3. After the response has been received by MVS, MVS issues the message:

   PRESS CANCEL KEY TO RESTORE DISPLAY

   The PA2 key is the Cancel key on 3270 consoles.

```
IEE127I THE FOLLOWING MESSAGE IS ISSUED THROUGH DISABLED CONSOLE FACILITY
IOS110A IOS HAS DETECTED HOT I/O ON DEVICE ddd (NON-DASD). THE LAST
        INTERRUPT FROM THIS DEVICE WAS ON CHANNEL PATH xx. THE SCD
        IS AT aaaaaaaa. THERE ARE nn DEVICES WITH HOT I/O ON CHP xx.

        ENTER ONE OF THESE REPLIES TO TELL IOS HOW RECOVERY IS TO
        BE HANDLED:

        NONE  THIS REPLY TELLS IOS THAT (1)THE OPERATOR DID NOT PHYSICALLY
              REMOVE ANY DEVICE OR CONTROL UNIT (HE MAY OR MAY NOT HAVE
              RESET THE DEVICE) AND (2) IOS SHOULD NOT REMOVE ANY DEVICE
              AND NOT ATTEMPT ANY CHANNEL RECOVERY.

        DEV   THIS REPLY TELLS IOS TO LOGICALLY REMOVE (BOX) THE DEVICE.
              (THE OPERATOR MAY OR MAY NOT HAVE PHYSICALLY REMOVED THE DEVICE)

        CU    THIS REPLY TELLS IOS THAT THE OPERATOR PHYSICALLY REMOVED THE
              CONTROL UNIT. THE REPLY MUST INCLUDE THE NUMBER OF EACH DEVICE
              ON THE CONTROL UNIT. FOR EXAMPLE, IF DEVICES 25E, 250 THRU 257
              REPLY:  CU,250:257,25E
                           OR
                      CU,25E,250:257

        CHP,K THIS REPLY TELLS IOS (1) TO ATTEMPT RECOVERY FOR THE CHANNEL
              PATH NAMED IN THE MESSAGE, AND (2) IF RECOVERY IS SUCCESSFUL,
              TO KEEP THE CHANNEL PATH ONLINE.

        CHP,F THIS REPLY TELLS IOS TO FORCE THE CHANNEL PATH OFFLINE.

  R 0,
```

Figure 41. Hot I/O Message IOS110A

Hot I/O Message - IOS111A

The message shown in Figure 42 is issued using DCCF.

This message is issued when a Hot I/O condition has occurred on a non-reserved, or non-assigned DASD/DPS device and either:

- The installation has indicated through PARMLIB that the operator should specify the recovery action for the device,

  or

- The Hot I/O condition has persisted, despite previous attempts at recovery.

Note that if the response to the message is not received within 125 seconds, a DCCF timeout occurs, and the message is written to the system console. (The Processor Controller alarm sounds to alert the operator.) The operator can then reply to the Hot I/O message from the SCPMSG frame of the system console.

Procedure

The operator should proceed as follows:

1. Refer to the installation's recovery procedures for the device indicated in the IOS111A message text.

   The appropriate recovery action for a particular device may vary from installation to installation depending on the configuration and use of the device.

2. Attempt to correct the problem by specifying the least-impacting recovery actions first.

   Reply with one of the following:

   NONE requests IOS to do no recovery

   DEV requests IOS to box the device

   CHP,K requests IOS to attempt channel path recovery

   CHP,F forces the channel path offline

3. After the response has been received by MVS, MVS issues the message:

   PRESS CANCEL KEY TO RESTORE DISPLAY

   The PA2 key is the Cancel key on 3270 consoles.

```
IEE127I THE FOLLOWING MESSAGE IS ISSUED THROUGH DISABLED CONSOLE FACILITY
IOS111A IOS HAS DETECTED HOT I/O ON (DASD|ASSIGNABLE) DEVICE ddd. THE
        LAST INTERRUPT FROM THIS DEVICE WAS ON CHANNEL PATH xx. THE SCD
        IS AT aaaaaaaa. THERE ARE nnn DEVICES WITH HOT I/O ON CHP xx.

        ENTER ONE OF THESE REPLIES TO TELL IOS HOW RECOVERY IS TO
        BE HANDLED:

        NONE  THIS REPLY TELLS IOS THAT (1)THE OPERATOR DID NOT
              PHYSICALLY REMOVE ANY DEVICE OR CONTROL UNIT (HE
              MAY OR MAY NOT HAVE RESET THE DEVICE) AND (2) IOS
              SHOULD NOT REMOVE ANY DEVICE AND NOT ATTEMPT ANY
              CHANNEL RECOVERY.

        DEV   THIS REPLY TELLS IOS TO LOGICALLY REMOVE (BOX) THE
              DEVICE. (THE OPERATOR MAY OR MAY NOT HAVE PHYSICALLY
              REMOVED THE DEVICE.)

        CHP,K THIS REPLY TELLS IOS (1) TO ATTEMPT RECOVERY FOR THE
              CHANNEL PATH NAMED IN THE MESSAGE, AND (2) IF RECOVERY
              IS SUCCESSFUL, TO KEEP THE CHANNEL PATH ONLINE.

        CHP,F THIS REPLY TELLS IOS TO FORCE THE CHANNEL PATH OFFLINE.

R 0,..
```

Figure 42. Hot I/O Message IOS111A

Hot I/O Message - IOS112A

The message (IOS112A) shown in Figure 43 is issued using DCCF.

This message is issued when a Hot I/O condition has occurred on a reserved DASD device or an assigned DPS device and either:

- The installation has indicated through PARMLIB that the operator should specify the recovery action for the device,

  or

- The Hot I/O condition has persisted, despite previous attempts at recovery.

Note that if the response to the message is not received within 125 seconds, a DCCF timeout occurs, and the message is written to the system console. (The Processor Controller alarm sounds to alert the operator.) The operator can then reply to the Hot I/O message from the SCPMSG frame of the system console.

If you receive this message, the system is not able to recover from a hot I/O on a reserved shared device.

This is potentially a serious problem. Data integrity can be impaired if you choose to box the reserved device. Check to see what the situation of this device is on this and on the sharing systems. If the device contains critical data, vary it offline from the sharing systems before replying 'BOX'.

Procedure

The operator should proceed as follows:

1. Refer to the installations recovery procedures.
2. Attempt to correct the problem by specifying the least-impacting recovery actions first.

   Reply with one of the following:

   NONE requests IOS to do no recovery

   DEV requests IOS to box the device

   CHP,K requests IOS to attempt channel path recovery

   CHP,F forces the channel path offline
3. MVS will issue the message:

   PRESS CANCEL KEY TO RESTORE DISPLAY

   The PA2 key is the Cancel key on 3270 consoles.

```
IEE127I THE FOLLOWING MESSAGE IS ISSUED THROUGH DISABLED CONSOLE FACILITY
IOS112A IOS HAS DETECTED HOT I/O ON (RESERVED|ASSIGNED) DEVICE ddd. THE
        LAST INTERRUPT FROM THIS DEVICE WAS ON CHANNEL PATH xx. THE SCD
        IS AT aaaaaaaa. THERE ARE nnn DEVICES WITH HOT I/O ON CHP xx.

        ENTER ONE OF THESE REPLIES TO TELL IOS HOW RECOVERY IS TO
        BE HANDLED:

        NONE  THIS REPLY TELLS IOS THAT (1)THE OPERATOR DID NOT
              PHYSICALLY REMOVE ANY DEVICE OR CONTROL UNIT (HE
              MAY OR MAY NOT HAVE RESET THE DEVICE) AND (2) IOS
              SHOULD NOT REMOVE ANY DEVICE AND NOT ATTEMPT ANY
              CHANNEL RECOVERY.

        DEV   THIS REPLY TELLS IOS TO LOGICALLY REMOVE (BOX) THE
              DEVICE. (THE OPERATOR MAY OR MAY NOT HAVE PHYSICALLY
              REMOVED THE DEVICE.)

        CHP,K THIS REPLY TELLS IOS (1) TO ATTEMPT RECOVERY FOR THE
              CHANNEL PATH NAMED IN THE MESSAGE, AND (2) IF RECOVERY
              IS SUCCESSFUL, TO KEEP THE CHANNEL PATH ONLINE.

        CHP,F THIS REPLY TELLS IOS TO FORCE THE CHANNEL PATH OFFLINE.

R 0,..
```

Figure 43. Hot I/O Message IOS112A

Handling Hot I/O Wait States

When a Hot I/O condition is detected, MVS cannot proceed with recovery until a recovery action is specified. As mentioned above, MVS obtains the recovery action from PARMLIB, if one has been specified. If

'OPER' is specified, MVS requests the recovery action from the operator through the message. If the operator is not able to respond to the message, either because the response is locked out, or the time limit of 125 seconds expired, the message is written to the system console, the alarm is sounded, and the operator can respond there. Refer to "Disabled Console Communication Facility" on page 59 for a description of DCCF.

If communication with the MVS console ***and*** the system console fails, a restartable wait state is loaded on the possible that a restartable wait state is loaded on the CP where the Hot I/O condition was detected. This is the only way MVS is now able to obtain the correct recovery action from the operator.

Depending on the category of device with the Hot I/O condition, one of the following restartable disabled wait states are loaded (see "Disabled Wait States" on page 7):

WAIT 110 (corresponding to Hot I/O message IOS110A)

WAIT 111 (corresponding to Hot I/O message IOS111A)

WAIT 112 (corresponding to Hot I/O message IOS112A)

Note: The other processors may load a disabled WAIT A22. They are restarted automatically when the CP in the Hot I/O wait state is restarted.

Use the following procedure to locate the device number, to correct the error, and to restart the system if a wait condition (WAIT110, WAIT111, WAIT112) occurs.

Procedure

At the system console, do the following :

1. If operating in LPAR mode, enter 'SETLP lpname' where lpname is the name of the logical partition that has entered the disabled wait state that was indicated in the system console priority message.
2. Display the ALTER/DISPLAY frame, by issuing:

   F ALTCP

   from the system console, or by selecting 02 on the INDEX0 frame.
3. On the ALTCP frame (Figure 44), select the CP that detected the Hot I/O; that is, the CP in the WAIT11x (as indicated in the system console priority message for the 11x wait state).
4. Enter:

   A2 (Display)

   An arrow will appear in front of A2.
5. Then enter:

   B3 (Primary Virtual Storage)

   An arrow will appear in front of B3.
6. Then enter:

   40C at 'Address(hex) =>'

   and record the contents of location '40C' ('aaaaaaaa'), which is the address of the status collection data (SCD) area.

```
CP: 3                                                    07 NOV 88 15:42:40
                        ALTER / DISPLAY CP                        (ALTCP)

  A= FUNCTION                    ADDRESS  ----------------DATA----------------
    1. ALTER                        40C                                01B6F170
 -> 2. DISPLAY                      40C
                                    410  01B9C000 01B93B78 040C0000 81ED0E72
  B= FACILITY                       410
    1. REAL STORAGE KEY             420  070C0000 80FF4E0C 00000000 00000000
    2. REAL STORAGE                 420
 -> 3. PRIMARY VIRTUAL STG          430  00000000 00000000 00000000 00000000
    4. SECONDARY VIRTUAL STG        430
    5. GENERAL REGISTERS            440  00000000 00000000 00000000 00000000
    6. CONTROL REGISTERS            440
    7. FLOATING POINT REGS          450  00000000 00000000 00000000 00000000
    8. PREFIX REGISTER              450
    9. PSW                          460  00000000 00000000 070E0000 00000000
                                    460
                                    470  00FFFFFF FFF86000 00000000 00000000
                                    470

 ADDRESS(HEX) => 40C

 MORE DATA ABOVE AND BELOW: PRESS BKWD OR FWD.                        (124  )

COMMAND ==>

                                  3 ..W. 4 ..W. 5 ..W.     PSW3    OPERATING
```

Figure 44. ALTCP Frame (Part 1 of 4)

7. Using that result, enter:

   'aaaaaaaa' at 'Address(hex) =>' (Figure 45)

   to display the contents of the status collection data (SCD) area.

   The contents has the following meaning:

   - Offset X'4-5' = 2-byte device number (hex) of the Hot I/O device
   - Offset X'6' = 1-byte channel path (hex) of the CHPID over which the last Hot I/O interrupt occurred.

```
CP: 3                                                  07 NOV 88 15:42:40
                      ALTER / DISPLAY CP                        (ALTCP)

  A= FUNCTION                  ADDRESS  ----------------DATA----------------
    1. ALTER                   1B6F170  E2C3C440 08E06C90 9D899A30 BADBD204
 -> 2. DISPLAY                 781C170  S C D    ddddcc
                               1B6F180  00030000 40000000 0000006E 00000064
  B= FACILITY                  781C180
    1. REAL STORAGE KEY        1B6F190  00000000 01B6C7C8 00000000 00000000
    2. REAL STORAGE            781C190
 -> 3. PRIMARY VIRTUAL STG     1B6F1A0  00008000 00000000 00000000 00000000
    4. SECONDARY VIRTUAL STG   781C190
    5. GENERAL REGISTERS       1B6F1B0  00000000 00000000 00000000 00000000
    6. CONTROL REGISTERS       781C1B0
    7. FLOATING POINT REGS     1B6F1C0  00000000 00000000 00000000 00000000
    8. PREFIX REGISTER         781C1C0
    9. PSW                     1B6F1D0  00000000 00000000 00000000 00000000
                               781C1D0
                               1B6F1E0  00000000 00000000 00000000 00000000
                               781C1E0

  ADDRESS(HEX) => 1B6F170

  MORE DATA ABOVE AND BELOW: PRESS BKWD OR FWD.                    (124  )

COMMAND ==>

                                3 ..W. 4 ..W. 5 ..W.      PSW3     OPERATING
```

Figure 45. ALTCP Frame (Part 2 of 4)

8. Report the problem.
9. Then enter:

   30E at 'Address(hex) =>' to display location X'30E' in the PSA (Figure 46).
10. Stop all CPs (press ALT-STOP keys on the system console).
11. Then on the system console command line, enter:

    A1 (Alter)

    An arrow will appear in front of A1 (Figure 47).

    B3 (Primary Virtual Storage)

    An arrow will appear in front of B3.
12. Move the cursor to location X'30E' and type one of the following recovery options:

    '01' - Status is cleared, device remains online.
    '02' - Box the device.
    '04' - Try channel path recovery and, if unsuccessful, the channel path is taken offline.
    '05' - Force the channel path offline.

    Then press the ENTER key.

```
CP: 3                                                  07 NOV 88 15:42:40
                        ALTER / DISPLAY CP                      (ALTCP)

  A= FUNCTION                    ADDRESS  ----------------DATA----------------
 -> 1. ALTER                        30E                                  0000
    2. DISPLAY                      30E                                  02
                                    310  00000000 00000000 00000003 07F7E07F
  B= FACILITY                       310
    1. REAL STORAGE KEY             320  00000000 00000000 00000000 00000000
    2. REAL STORAGE                 320
 -> 3. PRIMARY VIRTUAL STG          330  00000000 00000000 00000000 00000000
    4. SECONDARY VIRTUAL STG        330
    5. GENERAL REGISTERS            340  00000000 00000000 00000000 00000000
    6. CONTROL REGISTERS            340
    7. FLOATING POINT REGS          350  00000000 00000000 00000000 00000000
    8. PREFIX REGISTER              350
    9. PSW                          360  00000000 00000000 00000000 00000000
                                    360
                                    370  00000000 00000000 00000B0E 0B0E0000
                                    370

  ADDRESS(HEX) => 30E

  MORE DATA ABOVE AND BELOW: PRESS BKWD OR FWD.                      (124  )

COMMAND ==>

                                  3 .MW. 4 .MW. 5 .MW.    PSW3 000A0000 80000110
```

Figure 46. ALTCP Frame (Part 3 of 4)

13. Start all CPs (press START key on the system console).
14. Restart the CP in wait.

    On the system console command line, type:

    RESTART CPn

```
CP: 3                                                  07 NOV 88 15:42:40
                      ALTER / DISPLAY CP                        (ALTCP)

  A= FUNCTION                    ADDRESS  ------------------DATA------------------
 -> 1. ALTER                        30E                                      0200
    2. DISPLAY                      30E
                                    310  00000000 00000000 00000003 07F7E07F
  B= FACILITY                       310
    1. REAL STORAGE KEY             320  00000000 00000000 00000000 00000000
    2. REAL STORAGE                 320
 -> 3. PRIMARY VIRTUAL STG          330  00000000 00000000 00000000 00000000
    4. SECONDARY VIRTUAL STG        330
    5. GENERAL REGISTERS            340  00000000 00000000 00000000 00000000
    6. CONTROL REGISTERS            340
    7. FLOATING POINT REGS          350  00000000 00000000 00000000 00000000
    8. PREFIX REGISTER              350
    9. PSW                          360  00000000 00000000 00000000 00000000
                                    360
                                    370  00000000 00000000 00000B0E 0B0E0000
                                    370

 ADDRESS(HEX) => 30E

 MORE DATA ABOVE AND BELOW: PRESS BKWD OR FWD.                      (124  )

COMMAND ==> RESTART CP3

                               3 ..W. 4 ..W. 5 ..W.    PSW3 000A0000 80000110
```

Figure 47. ALTCP Frame (Part 4 of 4)

16.0 Channel Path Recovery

Channel path recovery routines are invoked under the following circumstances:

- During processing of Hot I/O recovery options 'CHP,K' (attempt channel path recovery) and 'CHP,F' (force channel path offline).
- In response to a 'CF CHP(cc),OFFLINE,FORCE' command.
- After the Channel Subsystem reports a hardware malfunction on the channel path.
- As part of the recovery for the notification of a 'System Resetting Event' being sent from a device or control unit.

Channel path recovery processing involves the use of the Reset Channel Path (RCHP) instruction, which causes the reserve status of devices to be lost, under the following conditions:

- When the channel path to be reset is the last path to a reserved DPS DASD device.
- When the channel path to be reset is a path to a reserved non-DPS DASD device.

In order to avoid 'reserve stealing' from other sharing systems while channel path recovery is in progress, the following message is issued:

```
IOS062E ERROR ON CHANNEL PATHS - STOP I/O REQUESTS FROM SHARING SYSTEMS
```

When sharing systems have been stopped, the operator replies to message IOS062E to indicate channel path recovery can proceed on the detecting system.

When the RCHP instruction is completed, channel path recovery processing attempts to re-establish reserves that were lost, and re-establishes the DPS arrays for DPS devices on the reset channel path.

When channel path recovery processing is complete, the operator is notified by the following message:

```
IOS201E START PROCESSORS STOPPED FOR MESSAGE IOS062E
```

and the sharing systems can be restarted.

Handling Message IOS062E

Procedure

Note that in LPAR mode, the START/STOP/RESTART SLCs and keys operate on the logical processors of the selected partition.

When message IOS062E is issued on the detecting system, proceed as follows:

1. Enter 'STOP' at the system console of each sharing system, or logical partition, in the case of LPAR mode.
2. Reply 'U' to message IOS062E on the detecting system.

   If the reply is not accepted because the console is locked out, check at the system console to determine whether a wait state '062' has been loaded. If so proceed to section "Handling Wait State 062" on page 114 otherwise proceed to the section "Handling Message IOS201E" on page 114.

Handling Wait State 062

If message IOS062E cannot be issued, or if it times out, a restartable wait state '062' is loaded on the detecting system.

Procedure

Note that in LPAR mode, the START/STOP/RESTART SLCs and keys operate on the logical processors in the selected partition.

1. Enter 'STOP' at the system console of each sharing system or logical partition in the case of LPAR mode.
2. Enter 'RESTART' at the system console on the detecting system (the system in the Wait062).

Handling Message IOS201E

When channel path recovery is complete, a request to restart the stopped sharing processors is issued using one of the following messages:

```
IOS201E START PROCESSORS STOPPED FOR MESSAGE IOS062E - RESERVES INTACT

IOS201E START PROCESSORS STOPPED FOR MESSAGE IOS062E - RESERVES LOST
```

Procedure

Note that in LPAR mode, the START/STOP/RESTART SLCs and keys operate on the logical processors in the target partition.

If the message indicates RESERVES INTACT proceed as follows::

1. Start all stopped sharing systems by pressing the START key at the system console of each sharing system or logical partition, in the case of LPAR mode.
2. Restart the detecting system by replying 'U' to message IEE125, which follows message IOS201E.

If the message indicates RESERVES LOST, reserve(s) cannot be reestablished:

1. Restart the detecting system by replying 'U' to message IEE125, which follows message IOS201E.

   The device(s) are boxed on the detecting system.

   The following messages may be issued indicating the state of devices:

   ```
   IOS444I DYNAMIC PATHING NOT REMOVED FROM DEVICE ddd
   IOS100I DEVICE ddd BOXED, LAST PATH cc LOST, CANNOT RE-RESERVE
   IOS000I ddd,**SIM,**,**06,,,volser,jjjj
   ```

   Jobs using the boxed devices may be Abended.

2. Notify the System Programmer.

   The device(s) should not be made available to sharing systems until after data integrity has been checked.

3. Start all stopped sharing systems by pressing the START key at the system console of each sharing system or logical partition, in the case of LPAR mode.

The state of the channel path after recovery is indicated by one of the following messages:

```
IOS202I CHANNEL PATH cc FORCED OFFLINE - DEVICE IS: ddd|UNKNOWN
IOS203I CHANNEL PATH cc SUCCESSFULLY RECOVERED - DEVICE IS ddd|UNKNOWN
```

Handling Wait State 114

If DCCF is not able to write message IOS201E, or if it times out, a restartable wait state '114' is loaded on the detecting system. The PSW indicates:

```
000A0000 00nn0114
```

where 'nn' contains one of the following values:

- '01'

  Reserves are intact. The system has successfully recovered the reserved devices.

- '02'

  Reserves are lost. The system has forced offline one or more devices reserved for the system.

Procedure

If reserves are intact, proceed as follows:

In LPAR mode: The START/STOP/RESTART SLCs and keys operate on the logical processors in the selected partition.

1. Start all stopped sharing systems by pressing the START key at the system console of each sharing system or logical partition, in the case of LPAR mode.
2. Restart the detecting system by entering 'RESTART' at the system console.

If reserves are lost, proceed as follows:

1. Restart the detecting system by replying 'U' to message IOS201E.

   The device(s) are boxed on the detecting system.

   The following messages may be issued indicating the state of devices:

   ```
   IOS444I DYNAMIC PATHING NOT REMOVED FROM DEVICE ddd
   IOS100I DEVICE ddd BOXED, LAST PATH cc LOST, CANNOT RE-RESERVE
   IOS000I ddd,**SIM,**,**06,,,volser,jjjj
   ```

   Jobs using the boxed devices may be abended.

2. Notify the System Programmer.

   The device(s) should not be made available to sharing systems until after data integrity has been checked.

3. Start all stopped sharing systems by pressing the START key at the system console of each sharing system or logical partition, in the case of LPAR mode.

The state of the channel path after recovery is indicated by one of the following messages:

```
IOS202I CHANNEL PATH cc FORCED OFFLINE - DEVICE IS: ddd|UNKNOWN
IOS203I CHANNEL PATH cc SUCCESSFULLY RECOVERED - DEVICE IS ddd|UNKNOWN
```

Handling Message IOS113W and Wait State 113

If, during channel path recovery processing, the Reset Channel Path (RCHP) instruction has released some reserved devices, and device recovery (re-establishing reserves) is incomplete when an unrecoverable software error occurs in the recovery code, the following message is issued:

```
IOS113W IOS RECOVERY FAILURE - RESERVES MAY HAVE BEEN LOST
```

IOS then loads a wait state 113. This wait state is not restartable and an IPL must be performed on this system.

Procedure

1. Notify the System Programmer.

   Reserved devices may have been released by channel path recovery and may have a data integrity problem, so data sets should be verified.

2. Refer to installation procedures. If none exist, take a stand-alone dump and re-IPL the system in the WAIT113.

Handling Message IOS004I

If an unrecoverable software error occurs during channel path recovery, but no reserved devices are involved, the recovery processing terminates with the following message:

```
IOS004I IOS RECOVERY FAILURE - AVAILABILITY OF I/O DEVICES UNKNOWN
```

The system continues processing, but if critical devices are not available for use, system performance may be degraded.

Procedure

1. Notify the System Programmer.

2. If other installation procedures fail, let the system complete as much work as possible, and schedule an IPL.

17.0 I/O Hang Conditions

I/O hang conditions may occur as a result of a channel path error or any other type of error that makes the channel path unavailable to an I/O device. Two types of hang condition are considered:

1. Storage Director hang - No device on any channel path through that storage director can be accessed.
2. Device hang - A device appears to be busy and cannot be accessed by any sharing system.

Recognizing I/O Hang Conditions

I/O hang conditions may be indicated by the following missing interrupt detection messages.

```
IOS071I ddd,START PENDING
IOS071I ddd,MISSING CHANNEL AND DEVICE END
```

Refer to Figure 31 and Figure 32 and if the problem cannot be resolved using these charts, use the following procedure.

An I/O hang condition can also be identified by using:

- The Device Status Display frame, as follows:
  1. At the system console enter 'F IOPD'.
  2. Enter 'A2' to select device status.
  3. Enter the CHPID in the proper field. The device or the range of devices in the hang condition can be identified by a long-lasting Pending Status (P).
- 3880 Operator Panel- status display

  The Status Pending light of the Storage Director indicates unfinished work between a specific channel path and a specific device. The storage director does not allow selection unless the channel or device connection is requested. The storage director responds to any other selection attempt with a control unit busy condition.

  Unless it is busy, the storage director requests service to clear pending status. Status is cleared when the signal is presented to, and accepted, by the channel.

  You can determine which system is causing the problem by looking at the Process and Wait lights on the 3880 Operator panel:

  - The Wait and Process lights blink on and off once per second to indicate the hung channel. The lights blink once for channel A, twice for channel B, and so on.
  - The blinking sequence is followed by a 5-second pause and is then repeated until the status pending hang condition is cleared.

Note: When the processor complex is operating in LPAR mode, the IOPD frames (except Channel Summary Status) are partition sensitive. Refer to IBM 3090 Operator Controls for the System Console,.

Handling I/O Hang Conditions

Procedure

To handle I/O hang conditions proceed as follows:

1. Try to vary the failing path offline:

   VARY PATH(ddd-ddd,cc),OFFLINE

   If the storage director is hung, the 'VARY PATH' command is likely to time out.

2. If the 'VARY PATH' command does not work, then try:

   CF CHP(xx),OFFLINE,FORCE

3. If unsuccessful, first vary ALL paths to all sharing systems offline and then do a manual I/O system reset for the channel path that caused the hang situation. This action can be tried to make the hung control unit available to the sharing systems. It should be used only in emergency situations.

   At the system console associated with the system that has the hung channel interface, issue the following command:

   IFRST cc

   where 'cc' is the CHPID to be reset. This command resets all storage directors attached to this CHPID.

   Note: Any reset can cause data integrity exposures if used on non-DPS devices, or on DPS devices without an active alternate path.

4. If the hang is still not cleared, reset the system, either by using option '03' (SYSTEM RESET) on the OPRCTL frame at the system console, or by IPLing. Both actions reset all channels.

5. If the I/O system reset from the system console cannot be executed, use the following alternative:

   a. POWER-ON RESET the ES/3090

   b. POWER OFF/ON the ES/3090

6. If a hung controller condition is resolved with an I/O System Reset, some DASD devices may have lost their reserved status and should not be made accessible to the sharing systems until data has been recovered.

7. If the CU is still in hang condition, an IML of the CU must be performed. IML of an active 3880 Storage Director without IPL of the attached host systems can lead to data integrity problems. (In this case, an active 3880 SD means one with channel paths online.)

18.0 GRS

Global Resource Serialization (GRS) is a component of every MVS/SP system. GRS allows DASD 'resources' such as data sets, catalogs, and so on, to be shared between the several systems that constitute a GRS Complex.

Sharing is done without having to issue a hardware reserve for the total volume from the requesting system, which only wants a small part of the volume (for example, a data set).

The systems in the GRS complex are connected by CTCs that form a GRS ring.

GRS commands ('Display GRS' and 'Vary GRS') are documented in MVS/ESA Operations: System Commands. GRS messages can be found in MVS/ESA Message Library: System Messages, Volume 1, and MVS/ESA Message Library: System Messages, Volume 2.

This chapter provides guidelines for:

- Reconfiguring a GRS ring
- Recovering from GRS ring disruption

GRS Ring Reconfiguration

It may be necessary to reconfigure a GRS ring for the following reasons:

- During partitioning of ES/3090 MP models when the 'IN-USE' CTC is using a CHPID attached to the 'off-going' side.
- When you have to isolate the 3088 for servicing.

In either case, it is also necessary to consider the other users of the 3088, which may include VTAM (NET), JES2/NJE, or JES3.

The following procedure is used to reconfigure the GRS ring:

1. Use the 'D GRS' command to determine the CTC device numbers of the 'IN-USE' and 'ALTERNATE' link(s) between this system and other systems in the GRS complex.

   This procedure allows the 'IN-USE' link and the 'ALTERNATE' link(s) attached to:

   - The off-going side (MP case), or
   - An IBM 3088 (IBM CE maintenance case)

   to be taken offline and another 'ALTERNATE' link to become the 'IN-USE' link.

2. Use the following commands, or customer documentation, to determine:

   - For partitioning, the CHPIDs used by the CTC's on this GRS system:

     ```
     D M=DEV(ddd)          where 'ddd' is a GRS CTC device
     ```

   - For maintenance, the address range of the IBM 3088 for which the CTC is just one of the addresses in the range. Use customer provided documentation.

3. Issue the following command against all ALTERNATE or QUIET CTCs connected to the off-going side of the processor (MP case) or the 3088 (maintenance case):

   ```
   V ddd,OFFLINE
   ```

where 'ddd' is the device number of the CTC,

This results in the CTC pending offline message:

```
MSGIEE794I ddd  PENDING OFFLINE
```

4. If the CTC to be taken offline is the 'IN-USE' CTC, then issue the following commands:

```
V GRS(sysname),QUIESCE
```

where 'sysname' in the name of the system to be quiesced.

```
V ddd,OFFLINE
```

where 'ddd' is the device number of the CTC that is connected to the off-going side.

This results in the CTC pending offline message:

```
MSGIEE794I ddd  PENDING OFFLINE
```

5. Issue the following:

```
S DEALLOC     or  account–dependent deallocation procedure
```

This results in the CTC being taken offline.

The following message is issued:

```
MSGISG047I CTC ddd  DISABLED
```

Note. If the CTC does not go offline, check for ENQ contention on resource 'SYSIEFSD'. The 'VARY OFFLINE' command may be enqueued behind another task whose 'Vary' operation cannot complete because of an outstanding global enqueue. The global enqueue cannot be resolved since GRS has now been quiesced. It may be necessary to first restart GRS, resolve the global enqueue, and then proceed with the command :

```
V GRS(sysname),QUIESCE
```

6. This item is an informational step.

Issue the command:

```
D GRS,LINK
```

to display the status of the GRS CTCs. The D GRS,LINK display should show that all the CTCs, that were previously labelled as 'IN-USE' or 'ALTERNATEs', attached to CHPIDs on the off-going side now have a status of 'DISABLED'.

7. If the command:

```
V GRS(sysname),QUIESCE
```

has been issued before (in a previous item).

Issue the following command:

```
V GRS(sysname),RESTART
```

where sysname is the system to be restarted, on any system to resume GRS communication to the target system. GRS will resume communication of global requests using a GRS CTC that is attached to a CHP on the on-going side.

8. Issue the following command to determine whether there are other users on the same 3088 from this system:

```
D U,,ALLOC,dd0,32|64
```

The resulting display will be in the form:

```
IEE106I  08.10.00  UNITS ALLOCATED  255
UNIT       JOBNAME    ASID
CC0        NET        00A
CC6        JES2       009
```

9. Use the relevant owning-subsystem commands to terminate allocation of the 3088 devices listed in the display.

10. Once all allocations to the 3088 address range devices have been terminated, the MVS command:

```
VARY ddd-eee,OFFLINE
```

may be issued to take all the 3088 devices offline.

Normal MP reconfiguration procedures may now be performed.

Warning- If an IBM 3088 is being removed for maintenance related reasons, it must be taken offline from all of its attached systems.

Note that when a GRS CTC device is later returned to use, as soon as it is brought online, it will be allocated to GRS. The following message will be issued:

```
ISG047I CTC ddd ENABLED
```

Recovering from GRS Ring Disruption

A GRS ring disruption may occur for one of the following reasons:

- A failure in one system in the ring which prevents that system from responding to other systems over the GRS CTC, including:
  - An operational problem (for example, processor stopped).
  - A customer configuration design problem (such as, device contention on the same CHPID as GRS CTC link).
  - A general software failure (for example, a disabled loop or Abend).
  - A hardware failure (for example, loss of CHPID or CTC).
- A software failure causing an Abend in the GRS code.

Ring Disruption Detection

GRS ring disruption may be indicated by the following messages:

```
*ISG023E GLOBAL RESOURCE SERIALIZATION DISRUPTED
         GLOBAL RESOURCE REQUESTORS WILL BE SUSPENDED
```

or

```
ISG046E CTC ddd DISABLED DUE TO HARDWARE|SOFTWARE ERROR CODE=rc

followed by:

ISG022E SYSTEM sysname DISRUPTED GLOBAL RESOURCE SERIALIZATION DUE TO
    COMMUNICATION FAILURE - GLOBAL RESOURCE REQUESTORS WILL BE SUSPENDED
```

or

```
ISG021I fc-rc ERROR IN GLOBAL RESOURCE SERIALIZATION FUNCTION

followed by:

ISG022E SYSTEM sysname DISRUPTED GLOBAL RESOURCE SERIALIZATION DUE TO
         SOFTWARE FAILURE - GLOBAL RESOURCE REQUESTORS WILL BE SUSPENDED
```

Ring Disruption Recovery

GRS RESTART requires greater than one-half of the systems in the original ring to be able to restart. This is true of all rings of three or more systems.

A disrupted GRS ring may be rebuilt using the command:

```
VARY  GRS(ALL),RESTART
```

A GRS ring may be rebuilt after a disruption in one of two ways:

1. Automatic restart

   Initiated by GRS automatically after detection of ring disruption. This is the recommended method of GRS RESTART. In this case, GRS internally issues the 'VARY GRS(xxx),RESTART' command.

2. Operator initiated restart

   Recommended only after automatic restart has failed to rebuild the ring. In this case, the operator issues the 'VARY GRS(sysname),RESTART' command from just ***one*** of the systems to each of the other systems.

Automatic Restart Considerations

When 'automatic restart' capability is specified for a system in the GRSCNFxx member of PARMLIB, that system, if capable, will automatically initiate restart processing (that is, attempt to rebuild the ring) after a GRS ring disruption has been detected.

In a GRS complex consisting of three or more systems, automatic restart may be specified for any system, but it is recommended that restart be always coded for the most critical system.

When it is possible to initiate GRS RESTART on multiple systems in the ring, either through automatic restart or operator-initiated restart, care must be taken that split rings (separate, independent GRS rings) do not form after a disruption.

Warning: It is recommended that following a ring disruption, GRS ***should*** be permitted to restart automatically; that is, without operator intervention. However, if GRS automatic restart fails to rebuild the ring, operator initiated restart is required. In that case, any system whose automatic restart capability failed to respond should be 'SYSTEM RESET' before the operator enters the 'VARY GRS(xxx),RESTART' command.

The following messages are displayed to indicate that automatic restart has been initiated by GRS:

```
          ISG024I SYSTEM sysname  INITIATED AUTO RESTART PROCESSING
INTERNAL VARY GRS(ALL),RESTART  CFA/CDD/077B8781/077B87A2/SCSDS/ISGBTC
              6C000028/98156101/.
```

The following messages are issued to indicate that the GRS ring is being rebuilt for ***each*** system that was in the ring at the time of the disruption:

```
ISG011I SYSTEM sysname  - RESTARTING GLOBAL RESOURCE SERIALIZATION
ISG013I SYSTEM sysname  - RESTARTED GLOBAL RESOURCE SERIALIZATION
```

Note that the systems programmer can specify the 'REJOIN' option for a system in the GRSCNFxx member of SYS1.PARMLIB. REJOIN(YES) allows the system to automatically rejoin the ring when it resumes processing, and no operator intervention is required. However, if the system programmer specified REJOIN(NO), the operator must bring the system back into the ring when the system resumes processing.

When a GRS ring disruption is caused by the failure of a system that must then be re-IPLed, that system must be purged from the GRS ring (by issuing the command 'VARY GRS(sysname),PURGE' from a system active in the GRS ring) before the system is re-IPLed.

Account procedures must take into consideration that the failed system may have been holding exclusive use of resources at the time of the failure, and that purging the system from the GRS ring may now cause a data integrity exposure. Once the system holding the resource is purged from the GRS complex, the resource then becomes available for use by other systems. However, at the time of the system failure, the resource update may not have been completed. The operator, following installation procedures, must decide whether it is necessary to cancel any jobs waiting for use of the resource, thereby preventing the potential for a data integrity problem.

Operator-initiated Restart Considerations

Have the GRS configuration diagram available for review during the recovery procedures.

When the operator enters the 'VARY GRS(sysname),RESTART' command, the following messages may be issued:

```
ISG026I SYSTEM sysname  MAY CREATE A SPLIT RING IF ANY OTHER GRS
        SYSTEM IS ACTIVE,  VERIFY THAT NO GRS SYSTEM IS ACTIVE
        BEFORE CONFIRMING RESTART
ISG027D CONFIRM RESTART - RING FOR SYSTEM sysname - REPLY NO OR YES
```

It is necessary to purge the disrupting system from the GRS complex, but prior to purging a disrupting system from the GRS complex, the operator should determine if there were any resources held exclusively by the disrupting system that were also being ENQ requested by any of the active systems. Issue the following command from any of the active GRS systems:

```
D GRS,C
```

Observe whether the disrupting system 'system name' appears in the contention display.

Account procedures must take into consideration that the failed system may have been holding exclusive use of resources at the time of the failure, and that purging the system from the GRS ring may now cause a data integrity exposure. Once the system holding the resource is purged from the GRS complex, the resource then becomes available for use by other systems. However, at the time of the system failure, the resource update may not have been completed. The operator, following installation procedures, must decide whether it is necessary to cancel any jobs waiting for use of the resource, thereby preventing the potential for a data integrity problem.

Now that a data integrity exposure has been prevented, purge the disrupting system from the GRS complex by issuing the following command from an active system:

```
V GRS(sysname),PURGE
```

Bring the disrupting system back into the GRS complex (IPL), after first having performed software failure recovery procedures, for example, by taking a SADUMP.

Refer to the GRS manuals to build (or rebuild) the GRS complex.

19.0 Alerts

Configuration Alert - IOS163A

Warning. Serious and prolonged performance degradation can result if this problem is not correctly resolved.

All occurrences of IOS163A messages must be addressed, and the causes correctly identified.

A configuration alert is a result of:

- An interrupt from a device for which there is no matching subchannel.

  or

- The IOCDS contained at least two IODEVICE macroinstructions (device definitions) for a specified device number, where each device number was assigned to a separate partition but they are currently configured in the same partition.

MVS informs the operator by message:

```
IOS163A CHPID nn ALERT, NO ASSOCIATED SUBCHANNEL FOR DEVICE
```

Procedure

To handle a configuration alert, proceed as follows:

1. Display the 3090 log at the system console by pressing the VIEW LOG key. Find the associated message.
2. Go to step 3 if the message is:

   ```
   INTERRUPT FROM DEVICE NOT IN IOCDS CHPID= nn UA=xx   (25197)
   ```

   Go to step 4 if the message is:

   ```
   xxxxxxxx xxxx xxxx on CHPID nn DUPLICATE EXISTING NUMBERS (51574)
   ```

3. This condition may occur when:

   - A device has been installed but not defined in the current IOCDS.
   - A device has been cabled or defined incorrectly.

   Whatever the cause of the mismatch, it represents a potentially serious performance situation. The first interrupt received by the Channel Subsystem is alerted to MVS through a machine check interrupt. MVS/SP V2 and V3 then reports this condition to the operator by message IOS163A.

   However, any subsequent interrupts are handled only by the Channel Subsystem an not reported to MVS. Continuous interrupts use up the resources of the Channel Subsystem and channel. Review the IOCDS and contact the hardware service representative.

4. Each device definition within a partition must have a unique device number. The IOCP reports the duplicate device numbers and the devices they represent. The IOPD frame can be used to show the device number and its corresponding channel paths for the specified partition. Contact the System Programmer.

This is caused if the CHPID paths supporting the duplicate device numbers are both brought into the same partition. Determine from the 3090 message 51574 which channel was brought into the configuration. Consider configuring this CHPID offline. Report this condition to the System Programmer.

Malfunction Alert - IOS162A

A malfunction alert is the result of a hardware error on a device, control unit, or channel which prevents the Channel Subsystem from recognizing the unit address of the device generating the interrupt. The Channel Subsystem generates a CRW (Channel Report Word) to inform MVS. Then MVS notifies the operator of the condition by issuing message:

```
IOS162A CHPID xx ALERT, UNSOLICITED MALFUNCTION ALERT
```

Procedure

Report the problem to your hardware service representative.

Whatever the cause of a malfunction alert, it represents a potentially serious performance degradation, and should be addressed immediately.

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