



DFSMS Advanced: **PDSE** Diagnostics and Recovery

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Agenda

- How PDSE externalizes problems.
- PDSE's had a problem, now what?
- Identifying and solving the problem:
 - Tools
 - 0F4's
 - Hangs
 - Corruption







What is a PDSE?

- PDSE: <u>Partitioned DataSet Extended</u>
- A PDSE is a collection of directory and data pages
- At V2R1 there are 2 dataset formats V1 and V2 PDSEs
- PDSE server consists of one or two address spaces (SMSPDSE and SMSPDSE1)
- The SMSPDSE(1) address spaces serve client access requests for PDSE datasets
- Under the hood SMSPDSE(1) also manages PDSE serialization and buffering





How PDSE Externalizes Problems

- ABENDS
 - 0F4
 - 0Cx
 - 878
- IGW messages
 - 38A/31I
 - 702l
 - 007E/077E
- CSV031I







0F4 Abends

- Indicate a PDSE "Logic Error"
 - In other words something unexpected happened
- RC (Reg 15) is not very useful
- RSN (Reg 0) tells us where the error occurred and what the error was
 - Errors can percolate up the calling chain
 - Many error codes may be issued from the same place in code







Reading the 0F4 Dump Title

- CompID
 - DF115 = PDSE
 - DF104 = FAMS
- CSECT + offset
- PTF number
- ABEND code
- Return code
- Reason code

COMPID=DF115, CSECT=IGWDAV00+10C4, MAINT ID=UA69488, ABND=0F4, RC=0000024, RSN=01188022





Checking the Error Information

- Check Reg 0 for the reason Code
- Check Reg 15 for the return code

Time of Error Information

PSW: 07541000 8000000 0000000 08251698 Instruction length: 02 Interrupt code: 000D Failing instruction text: 58F05048 0A0DB219 0000A788





Reason Code Translation Reason Code Format: XX YY ZZZZ Component Code Reason Code Module ID





Reason Code Translation Example

RSN: 150BC008

This error generally the result PDSE corruption due to being shared outside the SYSPLEX

How it's broken down:

15 = SubComp = PDSE BMF IO Control
0B = Module ID = IGWBIEX1
C008 = Reason = RSNS_IO_ERROR_DIRECTORY







IGW Messages and Meanings

- IGW038A and IGW031I
 - Indicates a PDSE latch or lock has been held for longer than the PDSE Monitor's set duration
- IGW702I
 - IEBPDSE (The PDSE Validation Tool) completion message
 - Indicates that IEBPDSE did not complete RC 0
 - IGW701I is the successful completion message







IGW Messages and Meanings





IGW Messages and Meanings Cont'd

- IGW007E and IGW077E
 - SMSPDSE and SMSPDSE1 address space failures respectively
 - IGW007E will require an IPL to recover
 - IGW077E may be recoverable via the PDSE1,ACTIVATE command







IGW Messages and Meanings Cont'd

CSV031I

LIBRARY {SEARCH | ACCESS} FAILED FOR MODULE *mod*, RETURN CODE *xx*, REASON CODE *reason-code*, DDNAME *ddname*

- Not a PDSE message
- RC and RSN code are percolated from PDSE
- A "canary" for PDSE corruption



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OCx ABENDs

0C4 ABENDs

- Generally due to a bad pointer
- Variety of causes
- Expect an APAR
- OC1 ABENDs
 - Very rare
 - Some 0C1's are diagnostic branches to a 0h







So, PDSE has just had a problem...





DON'T PANC



Step 1: Identify the Problem

- Start narrow by defining the symptoms
- What are we experiencing?
 - A 0F4 dump?
 - Many 0F4 dumps?
 - IGW messages?
 - Processing hangs?
 - Dataset corruption?
 - CPU/Storage consumption?







Step 2: Gather Doc!

- Initial PDSE doc gathering comes down to 4 items
 - 1. An SVCDump including the PDSE[1] address space
 - 2. SYSLOG/OPERLOG
 - 3. LOGREC/RAW EREP
 - 4. DSS physical dump of the affected dataset





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Step 2 Cont'd

- For dumps, gather:
 - The SVC Dump (for multiple, start with the first)
 - SYSLOG and LOGREC covering the incident
- For hangs, gather:
 - A console dump of the PDSE[1] address space
 - SYSLOG and LOGREC starting prior to the incident
- For corruption, gather:
 - The SVC Dump (for multiple, start with the first)
 - SYSLOG and LOGREC starting prior to the incident
 - A DSS Physical dump of the dataset

*See APPENDIX for JCL and Parameters





Step 2 Cont'd

- DO NOT SUPPRESS 0F4 Dumps
- DO NOT SUPPRESS IGW038A messages







Step 3: Call L2

• Shameless L2 plug!















Solving the Problem



Tools of the Trade

- IPCS
 - IP ST (IP STATUS)
 - SMSXDATA
 - Q
 - AS
 - MSGS
 - POOLS
- IEBPDSE PDSE Validation Tool







IP STATUS

- Gives a quick overview of the error
- For PDSE 0F4s the most important are the registers
 - Return Code in REG 15
 - Reason Code in REG 0

Time of Error	Information	
PSW: 075C100 Failing inst	0 8BF686F0 Instruction ler ruction text: 58F05048 0A0DE	ngth: 02 Interrupt code: 000D 3219 0000A788
Breaking even	nt address: 00000000_0000000	00
AR/GR 0-1	008FE050/0000000_13F2FE1E	0000000/00000000_040F4000
AR/GR 2-3	00000000/00000000000000000000000000000	00000000/00000000_7B923268
AR/GR 4-5	00000000/00000E4_00007703	00000000/00000000_7B925D18
AR/GR 6-7	00000000/00000000178923060	00000000/00000000_00FDC0D8
AR/GR 8-9	00000000/00000000000000000000000000000	00000000/00000000_7B923268
AR/GR 10-11	00000000/00000000_7B9262D0	0000000/0000000_00000000
AR/GR 12-13	00000000/00000000000000000000000000000	00000000/0000000017B9261E0
AR/GR 14-15	00000000/00000000_8BF686E2	0000000/00000000_0000024
Home ASID: 0 PKM: 8040	009 Primary ASID: 0009 AX: 0001	Secondary ASID: 0009 EAX: 0000





VERBX SMSXDATA 'f(func) jobname(job) comp(comp)'

- 'comp' stands for component within PDSE
 - Many components with reports
 - CLM contains the most important
- 'f' stands for function
 - Q = Quick view of error TCB
 - AS = Address spaces summary







FSMS verbexit processing ritle:COMPID=DF115,CSECT=IGWLHA10+244E,DATE=02/20/12,MAINTID=UA64274 ,ABND=0F4,RC=000000024,RSN=13F2FE1E SN:: unction=Q ump compatible with IGWFPMAN version:HDZ1C10 Primary Asid:0009 Secondary Asid:0009 PSATOLD:008FAE88 Looking for SSF thread by Register 13:789261E0 FVSA:78923040 Asid:0009 SMSPDSE1 FVSP:7B926190 IGWFCPER <<<<<input FVSP FVSP:7B924EE0 IGWLHA10 FVSP:7B924438 IGWLHA00 Displaying Recovery FVSA associated sequences FVSA:73C26040 Asid:0009 SMSPDSE1 FVSP:73C284B8 IGWFDDMP FVSP: 73C27A80 IGWFCLRR FVSP: 73C27828 IGWFERTR FVSP:73C27438 IGWFEFRR Looking for SSF thread by Control Reg15:7F6E3388 Linkage Stack Tcbs Description-----IGWFCPER: IGWLHA10: IGWLHA00 -----Tcb: 0



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VERBX SMSXDATA 'f(AS) jobname(SMSPDSE[1]) comp(CLM)'

	Latch Name	Holder	Waiter(s)
1.	IGWASRB(7FF93380)+18	(81)0032:008BD4E0	(76)0032:0089D030 (84)0032:008BDBE8 (82)0032:008BD7E8 (77)0032:0089D1C8 (79)0032:008AE380 (79)0032:008AE380
2.	IGWHTAB(7FF9F000)+38	(41)0009:008F0900	(16)00032.000HE0F0 (16)0009:008F9E00 (13)0009:008FF230 (595)0200:008FF230
3.	IGWHTAB(7FF9F000)+48	(41)0009:008F0900	(14)0009:008FA1D0 (81)0032:008BD4E0 (34)0009:008F6CF0 (33)0009:008F6E88 (32)0009:008F7190 (61)0009:008EA3B0 (26)0009:008E8360
4.	IGWHTAB(7FF9F000)+58	(41)0009:008F0900	(1530)02BE:008CA7B8 (1242)0257:008FF260
5.	IGWHTAB(7FF9F000)+60 IGWHTAB(7FF9F000)+70	(41)0009:008F0900 (41)0009:008F0900	(1295)0270:008FF260 (1243)0259:008CA488



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VERBX SMSXDATA 'f(POOLS) jobname(SMSPDSE[1])'

• Max to the bottom for the important parts

- ADOVE	vtente Tet	ge al Size of the Pool	TotColle	InlineCollin	Fired	EPwat	Kan	Decemintion
	*****	at_size_or_the_root	****	****	FIXED kakakakakaka	kikakakakak	***	**************************************
	45	47,185,920	245745	186334	NO	YES	50	IGWHL3B STORAGE POOL
	4	4,194,304	20164	4412	NO.	YES	50	IGWAJB STORAGE POOL
	44	46,137,344	262108	197644	NO	YES	50	IGWLRE STORAGE POOL
23 -	4	4.194.384	400	110	NO	YEC	50	ICUNLID Clobal Lock State trace
	33	2,214,592,512	540672	521	NO	YES	50	DFP BMF PAGE BUFFER POOL
	24	25,165,824	524280	521	NO	YES	50	DFP BMF BCB POOL
	41	42,331,010	200010	191029	110	1EO	00	JEDH DSC FOOL FOR FUB
	59	61,865,984	38645	198	NO	NO	50	JCDM DSC POOL FOR FIB
	326	341.835.776	213530	186129	NO	NO	50	JCDM DSC POOL FOR FIB DREFD

- TotCells = Allocated storage in cells
- InUseCells = In use storage in cells





IEBPDSE

- The PDSE validation tool
 - 1.13 and above
 - Use the highest available version if possible
 - 1.13 and 2.1 versions are NOT identical Do not expect identical results
 - Works on both V1 and V2 datasets











0F4 ABENDs

PDSE Logic Errors



Step 1: Getting the reason code

IP ST [REGS]

CPU STATUS: PSW=07540000 80000000 00000000 06ACAAFA (Running in PRIMARY, key 5, AMODE 31, DAT ON, SUPERVISOR STATE) Disabled for PER ASID(X'0009') 06ACAAFA. IGWDLAC0+BAFA IN EXTENDED PLPA ASCB68 at FC0780, JOB(GUDB2035), for the home ASID ASXB68 at BFD860 and TCB68E at B99E88 for the home ASID HOME ASID: 0044 PRIMARY ASID: 0009 SECONDARY ASID: 0044 General purpose register values 0 - 10000000000160D5476 000000000_040F4000 000000000 000000000 000000000_00002DFC 00000000_000000000 00000000.000000000 000000000000FE0CF0 - 00000000_06ACC968 10-11 00000048 00FF0C80 12-13 00000000_06ACA270 0000000017EB510B8 00000000_00000020 14-15 00000000_86ACAAF0

- Try and identify the reason code
 - In this case: JCDM_NO_LSSM_RECORD







Step 2: Get the calling sequence







Step 3: Now What!?

- Open a PMR, a 0F4 means something's gone awry and L2 should look at it
- Repeated 0F4's on access of the same dataset can indicate corruption







Hangs

PDSE Resource Serialization Issues





Step 1: IGW038A Messages

 IGW038A messages indicate that there is a PDSE resource that has been held longer than the PDSE monitor's set duration time

IGW038A Possible PDSE Problem(s) (SMSPDSE Recommend issuing V SMS,PDSE,ANALYSIS

 Issuing the suggested ANALYSIS command produces an IGW031I report



Step 1: IGW031I Messages



- ++ Unable to latch ASRBULCH:00000007F050560 Latch:00000007F050578 Holder(0008:009F75D0) Holding Started Task:SMSPDSE
- ++ Unable to latch ASRBULCH:00000007F050640 Latch:00000007F050658 Holder(0008:009F6AD0) Holding Started Task:SMSPDSE
- ++ Unable to latch ASRBULCH:00000007F0503A0 Latch:000000007F0503B8 Holder(00E5:009AEE88) Holding Started Task:TREED12

-----data set name-----SYS2.SOMETHING.LOADLIB

SYS2.SOMETHING.LOADLIB 01-SYSQ01-000109 ++ Unable to latch HL1b:00000007FF62E40 Latch:00000007FF62E50 Holder(0008:009F6CF0) IGWLHPRG Holding Started Task:SMSPDSE

-----vsat-----

PDSE ANALYSIS End of Report(SMSPDSE)



- ANALYSIS examines both LATCHes and LOCKs
- Global LOCKs serialize between systems
- Local LOCKs serialize within a system
- LATCHes serialize internal structures within a system





Step 1: Reading the Trends

- The PDSE monitor runs every 90 seconds by default
 - A single IGW038A message is OK
 - Can be tripped in a busy system
 - Repeating messages every ~2min generally indicates a problem







Step 2: Get a Dump

- Using the V SMS, PDSE[1], MONITOR, DUMPNEXT makes getting a good dump easy
- Alternately taking a console dump of both PDSE address spaces works well
 - Make sure to get the involved PDSE ASID
- If there are unresponded messages to a system
 - Take a console dump from that system as well
 - Again, make sure to get the involved PDSE ASID





Step 3: Finding the Root of the Hang

- Do we have a real hang?
 - Is it a single holder?
 - Are holders changing?
 - Are the IGW038A message ongoing?
- Changing holders can indicate processing delays but not necessarily a real hang
 - Check CPU utilization
 - CPU starvation can cause delays with jobs releasing PDSE resources



Step 4: We have a real hang, now what? (it'd be boring if we didn't!)

- Finding the key latch
- IGW031I report is not what we need....
- AS report to the rescue!

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Latcl ****	n Summary *******	****	****	*****
1. 2.	Latch Name IGWASRB(7F04DE00)+18 IGWHL1B(7FF62E40)+10	Holder (35)0008:009F6CF0 (35)0008:009F6CF0	Waiter(s) (34)0008:009F6E88 (402)00E5:009AEE88	Latch Caller(s)
****	kakakakakakakakakakakakakakakakakakaka	a de de ale ale ale ale ale ale ale ale ale al	kakakakakakakakakakakakakakakakakakaka	estestestestestestestestestestestesteste
***	ka de ade ade ade ade ade ade ade ade ade	enter de selection d	k ale	e ale ale ale ale ale ale ale ale ale al
*****	kenkenkenkenkenkenkenkenkenkenkenkenkenk	en e	*****	e ale ale ale ale ale ale ale ale ale al
Tcb I	atch Summaru			
**	****		****	ententententententententententententente
	TCB	Held Latch(es)	Addatted Latch(es)	
34	0008:00956588		IGHASEB(7E04DE00)+18	The second s
35	0008:009F6CF0	IGHASEB(7E94DE99)+18		
35.	0008:009F6CF0	IGWASRB(7F04DE00)+18 IGWHL1B(7FF62E40)+10		
402.	00E5:009AEE88		IGWHL1B(7FF62E40)+10	





Step 5: Reading the AS Latch Report

- Track down the originating latch
- Note the TCB and ASID

1 stel	***************************************	*****		***************************************
****	***********	ale	energenergenergenergenergenergenergener	****
1. 2. *****	Latch Name IGWASRB(7F04DE00)+18 IGWHL1B(7FF62E40)+10 ************************************	Holder (35)0008:009F6CF0 (35)0008:009F6CF0 ************************************	Waiter(s) (34)0008:009F6E88 (402)00E5:009AEE88 **********************************	Latch Caller(s)
Tcb I	Latch Summary			
***	*****	*****	estestestestestestestestestestestesteste	*****
34.	TCB 0008:009E6E88	Held Latch(es)	AWaited Latch(es) IGMASBB(7E04DE00)+18	
35. 35.	0008:009F6CF0 0008:009F6CF0	IGWASRB(7F04DE00)+18 IGWASRB(7F04DE00)+18 IGWHL18(7EF62E40)+10		
402.	00E5:009AEE88		IGWHL1B(7FF62E40)+10	
			HL1B latches are	
			ALWAYS suspici	ous SHARE
Comple	te your session evaluations online	at www.SHARE.org/Anaheim-Eval		•••• in Anaheim



Step 6: Learn about the holder

- Is it still alive?
 - Orphaned latches have a holder that's gone
 - Live holders are generally waiting
 - Check for IGWLHSUS (SSF Suspend)
- Is it in the PDSE address space?
 - This can indicate more serious issues
 - Can lead to a queue of holders obtaining and hanging on the latch
 - Call L2





Step 7: Make sure the holder's dead

For holders NOT in the PDSE address space

- If the holder is dead: Good!
- If the holder is alive:
 - Get it out of the system
 - Cancel is the preferred option
 - Force if necessary
 - Recovery MAY resolve the latch on it's own







Step 8: FREELATCH



WARNING: The holder MUST be out of the system





The Aftermath

- Clearing resources may take a few minutes, wait for the next IGW038A message
- No Change:
 - Holder changed but still hung
 - PDSE1 restart (if applicable)
- Partial Clearing:
 - Get a new dump, repeat the process
 - Tasks may take 0F4's if a latch is freed out from under them
- Fully Cleared
 - PARTY!







Corruption

In-core and on DASD corruption





In-core or on DASD?

- In-Core Corruption
 - If the PDSE is accessable from other systems in the PLEX the corruption is in-core
 - Issue is in the PDSE index cache and the cache is local to each PDSE ASID
- Corrupt on DASD
 - Will fail on all sharing systems
 - IEBPDSE will fail to run RC 0





In-Core Corruption

- For either PDSE or PDSE1: V SMS,PDSE|PDSE1,REFRESH,DSN(dsname)[,VOL(volser)]
 - Throws out in-core index and re-loads from DASD

- PDSE1 only
 - V SMS, PDSE1, RESTART
 - [,QUIESCE(duration | 5) [,COMMONPOOLS(NEW BEUSE)
 - PDSE1 restart will re-load ALL index pages from DASD and reconnect





Corrupt on DASD

- Gather a PHY Dump of the dataset
 - See appendix for JCL
 - L2 has formatting tools to help determine how the dataset broke
- An IEBCOPY may correct minor index issues
- Recovering from the last backup is often the only way to recover





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Appendix

Parameters, Commands and JCL









- PDSE Console Dump Parameters
 COMM=(PDSE PROBLEM)
 JOBNAME=(*MASTER*, SMSPDSE*),
 SDATA=(PSA, CSA, SQA, GRSQ, LPA, LSQA, RGN, SUM, SWA, TRT, COUPLE
 ,XESDATA), END
- IGDSMSxx Parameters:
 - SMSPDSE1 restartable address space: PDSE_RESTARTABLE_AS(NO | YES)
 - PDSE Sharing Modes: PDSESHARING(EXTENDED|NORMAL)



Appendix: Parameters, Commands and JCL



• IEBPDSE JCL (1.13 and above only) //VALIDATE EXEC PGM=IEBPDSE //SYSPRINT DD SYSOUT=* //SYSIN DD DUMMY //SYSLIB DD DISP=SHR,DSN=INPUT.PDSE.BAD





Appendix: Parameters, Commands and JCL







