

IBM Education Assistant (IEA) for z/OS V2R3

RMF: zHyperwrite Support Stage 2

Agenda

- Trademarks
- Session Objectives
- Overview
- Usage & Invocation
- Interactions & Dependencies
- Installation
- Migration Considerations
- Exploitation Considerations
- Session Summary
- Appendix

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Trademarks

- See url <http://www.ibm.com/legal/copytrade.shtml> for a list of trademarks.
- Additional Trademarks:
 - None

Session Objectives

- **Explain purpose/usage of RMF update**
 - RMF zHyperwrite Support Stage 2

Overview

- IBM zHyperwrite (DB2 Log Write acceleration)
 - IBM zHyperwrite enables DB2 to perform parallel log writes to PPRC primary and secondary volumes (defined in a subchannel set other than 0)
 - Reduction of response time and throughput improvement
 - Benefit percentage varies with distance
- Problem Statement
 - In previous releases, RMF only reported on devices defined in subchannel set 0
 - With OA42068 (z/OS 2.1) and OA40977 (z/OS 1.13 and 1.12), support was added to RMF Monitor I, II, and III to report on PPRC Primary devices and LCUs, where the devices are defined in a subchannel set other than 0
 - With OA45985 (z/OS 2.1), SMF 74 subtype 1 was enhanced to provide RMF users with performance data for PPRC Secondary devices that are defined in a subchannel set other than 0 and are eligible for read/write activity (zHyperwrite)
 - However, full RMF support (Postprocessor, Mon III, DDS, ...) is required
 - Furthermore, IBM zHyperwrite allows scenarios where the same four-digit device number can be active more than once in a z/OS system which implies that reporting of four-digit device numbers is not sufficient anymore.

Overview

- Solution
 - Complete the RMF solution by supporting IBM zHyperwrite environments and five-digit device numbers across all RMF monitors and reporting components
 - RMF Postprocessor Device Activity, Shared Device Activity, Cache Activity, and PAGESP reports
 - Monitor I data gathering option DEVICE(NMBR(...))
 - RMF Postprocessor control statements REPORTS and SYSRPTS
 - Monitor II report commands and data gathering options DEV and DEVV
 - Monitor II DEV, DEVV, LLI, PGSP, and SENQR reports
 - Monitor III DEVR, DEVT, CACHDET, DSNJ, DSNV, and JOB reports
 - Data collection of more than 65535 active devices in SMF 74 subtype 1
 - the subchannel set id is stored in SMF 74 subtypes 5 and 8 as well as in SMF 75 and SMF 79 subtypes 6 and 11
 - ERBSMFI and ERB2XDGS option parameters
 - In general, five-digit device numbers have the format *sdddd* where *s* represents a subchannel set id between 0 and 3 and *dddd* represents the “old” four-digit device number
- Benefit / Value
 - RMF provides users with 5-digit device numbers incl. the subchannel set ID
 - Full RMF monitoring & reporting capability in IBM zHyperwrite environments

Usage & Invocation

- RMF Postprocessor Cache Subsystem Activity report is enhanced to display 5-digit device numbers in report sections
 - Top-20 Device Lists
 - Cache Subsystem Device Overview
 - Cache Device Activity

▼ Top-20 Device Lists

Device List by DASD I/O Rate

Volume Serial	Device Number	Subsystem ID	Caching Status	%I/O of Total	I/O Rate	Cache Hit Read Rate
PMOSMA	04C28	4C00	Active	2.9	6.2	2.6
PMOSM5	04C04	4C00	Active	9.7	20.5	18.8
DEN7P1	04532	4500	Active	10.3	1.0	0.3
DEN7P4	05632	5600	Active	16.3	0.9	0.3
DEN7P3	05532	5500	Active	13.2	0.9	0.3
DEN7P2	04632	4600	Active	25.2	0.8	0.3
COBD01	0D800	D800	Active	96.5	4028	4021
SCLS29	05D1C	5D00	Active	0.5	8.1	7.6
MVSTG4	041AD	4100	Active	9.6	50.3	50.0
OMP6P2	0566A	5600	Active	5.6	0.3	0.1
PMOSM8	04C2B	4C00	Active	4.7	9.8	9.4

Cache Subsystem Device Overview

Volume Serial	Device Number	Extent Pool ID	Caching Status
*ALL			
*CACHE-OFF			
*CACHE			
SYST10	02180	0003	Active
SYST11	02181	0003	Active
SYSSXB	02182	0003	Active
SYSSXC	02183	0003	Active
FR2184	02184	0003	Active

▼ Cache Device Activity for Volume Serial SYST10

Storage Subsystem Descriptor

Subsystem : 2107-01 Physical CU-ID : 2185 Subsystem ID : 2180 Type-Model : 2107-9A2
 Volume Serial : SYST10 **Device Number : 02180** Extent Pool ID : 0003

Cache Device Status

Caching : Active DASD Fast Write : Active Pinned Data : None Duplex Pair : Not established

Cache Device Activity

Total I/O Count : 0		Total Hit Ratio : N/A		Cache I/O Count : 0		Cache Hit Ratio : N/A		Cache
Cache I/O Request Category	↕ Read Count	↕ Read Rate	↕ Read Hits	↕ Read Hits Rate	↕ Read Hit Ratio	↕ Write Count		
Normal	0	0.0	0	0.0		0		
Sequential	0	0.0	0	0.0		0		
CFW Data	0	0.0	0	0.0		0		
Total	0	0.0	0	0.0		0		

Usage & Invocation

- RMF Postprocessor Device Activity report is enhanced to display 5-digit device numbers

▼ Direct Access Device Activity											
Total Samples : 900		IODF Name Suffix : 00		IODF Creation Date : 10/18/2016		IODF Creation Time : 12.23.29		Configuration State : Activate			
Storage Group	Device Number	Device Type	Number of Cylinders	Volume Serial Number	Available PAV Devices	HyperPAV	LCU Number	Device Activity Rate	Average Response Time	Average IOS Queue Time	Average CMR Delay
	↓↑	↓↑	↓↑	↓↑	↓↑	↓↑	↓↑	↓↑	↓↑	↓↑	↓↑
	02180	33909	10017	SYST10	1		0017	0.000	0.000	0.000	0.000
	02181	33909	10017	SYST11	1		0017	0.000	0.000	0.000	0.000
XTEST	02182	33909	10017	SYSSXB	1		0017	0.008	0.402	0.000	0.000
XTEST	02183	33909	10017	SYSSXC	1		0017	0.001	0.256	0.000	0.000
	02184	33909	10017	FR2184	1		0017	0.000	0.000	0.000	0.000
	02185	33909	10017	FR2185	1		0017	0.036	0.308	0.000	0.024
	02186	33909	10017	FR2186	1		0017	0.000	0.000	0.000	0.000
	02187	33909	10017	FR2187	1		0017	0.000	0.000	0.000	0.000

Field Heading	Meaning
DEV NUM	The five-digit hexadecimal device number that identifies a physical I/O device. The first digit represents the ID of the subchannel set to which the I/O device is physically configured.

Usage & Invocation

- Enhanced RMF Monitor I Data Gathering option DEVICE
 - specifies whether or not device activity is to be measured
 - You can request device activity by specifying all devices within one or more classes, and, optionally, one or more specific devices.

DEVICE(*types*) | NODEVICE

- Possible types:
 - Any device class
 - Storage groups
 - One or more device numbers in the form

(*[s]*aaaa }

{NMBR} (*[s]*aaaa,*[t]*bbbb:*[u]*zzzz)/NONMBR

(*[s]*aaaa,*[t]*bbbb,... }

NMBR requests specific device numbers, where aaaa, bbbb, and zzzz each represent hexadecimal 4-digit device numbers and s, t, and u each represent an optional 1-digit subchannel set ID. You can omit leading zeros. If the subchannel set ID is omitted data gathering for devices configured to any subchannel set is requested

- Example: DEVICE(NMBR(10288,10291))
requests monitoring of devices 0288 and 0291 configured to subchannel set 1

Usage & Invocation

- Enhanced RMF Postprocessor Control Statement REPORTS
 - Specifies the reports to be generated by the Postprocessor for a single system
 - You can request device activity by specifying all devices within one or more classes, and, optionally, one or more specific devices.

DEVICE(suboption1[,suboption2,...]) | NODEVICE

- Possible suboptions:
 - Any device class
 - Storage groups
 - A device number in the form NMBR(nmbr1,nmbr2) where nmbr1 and nmbr2 are four or five-digit hexadecimal numbers in the format [s]dddd. The first digit s represents an optional subchannel set ID. If the subchannel set ID is omitted data reporting for devices 0dddd, 1dddd, 2dddd, and 3ddd is requested.
- Example: REPORTS(DEVICE(COMM,NMBR(12180,12183:12185,2188)))
generates activity data for all communication devices as well as for devices 2180, 2183, 2184, 2185 configured to subchannel set 1 and devices 2188 configured to any subchannel set

Usage & Invocation

- RMF Postprocessor Shared Device Activity report is enhanced to display 5-digit device numbers

▼ Shared DASD Activity												
Total Samples												
Average : 900			Maximum : 900			Minimum : 900						
Device Number	Device Type	Volume Serial Number	Device Status	PAV	SMF System ID	IODF Suffix	LCU Number	Device Activity Rate	Average Response Time	Average IOS Queue Time	Average CMR Delay	Average Device Busy Delay
02180	33909	SYST10			*ALL			0.003	0.256	0.000	0.000	0.000
			Online		SYSE	00	0017	0.000	0.000	0.000	0.000	0.000
			Online		SYSF	00	0017	0.003	0.256	0.000	0.000	0.000
			Online		S4	00	0017	0.000	0.000	0.000	0.000	0.000
02181	33909	SYST11			*ALL			0.000	0.000	0.000	0.000	0.000
			Online		SYSE	00	0017	0.000	0.000	0.000	0.000	0.000
			Online		SYSF	00	0017	0.000	0.000	0.000	0.000	0.000
			Online		S4	00	0017	0.000	0.000	0.000	0.000	0.000
02182	33909	SYSSXB			*ALL			0.059	0.287	0.000	0.002	0.000
			Online		SYSE	00	0017	0.008	0.366	0.000	0.000	0.000
			Online		SYSF	00	0017	0.008	0.347	0.000	0.018	0.000
			Online		S4	00	0017	0.043	0.263	0.000	0.000	0.000
02183	33909	SYSSXC			*ALL			0.003	0.171	0.000	0.043	0.000
			Online		SYSE	00	0017	0.001	0.256	0.000	0.128	0.000
			Online		SYSF	00	0017	0.001	0.128	0.000	0.000	0.000
			Online		S4	00	0017	0.001	0.128	0.000	0.000	0.000

Field Heading	Meaning
DEV NUM	The five-digit hexadecimal device number that identifies a physical I/O device. The first digit represents the ID of the subchannel set to which the I/O device is physically configured.

Usage & Invocation

- Enhanced RMF Postprocessor Control Statement SYSRPTS

- Specifies the Sysplex reports to be generated by the Postprocessor
- You can request whether the Shared Device Activity report should be generated or not

SDEVICE(suboption[,suboption]...[,suboption]) | NOSDEVICE

- Possible suboptions:
 - Device class DASD or TAPE
 - NMBR(list) - Specifies a list of devices to be included in the report or a range of device numbers defined by the lowest and the highest number, separated by a colon
 - EXNMBR(list) - Causes the Postprocessor to suppress reports for the device or devices with the device numbers specified
 - You can specify as many device numbers as you like. Each element in the list can be: A four or five-digit device number in the format [s]dddd. The first digit s represents an optional subchannel set ID. If the subchannel set ID is omitted device activity reporting is suppressed for devices 0dddd, 1dddd, 2dddd, and 3dddd.
- Example: SYSRPTS(SDEVICE(EXNMBR(02180,02183:02184)))
generates activity data for devices numbers other than devices 2180, 2183, 2184 configured to subchannel set 0

Usage & Invocation

- RMF Postprocessor Page Data Set Activity report is enhanced to display 5-digit device numbers

RMF Postprocessor Interval Report [System SYSF] : Page Data Set Activity Report

RMF Version : z/OS V2R3 SMF Data : z/OS V2R3

Start : 10/20/2016-11.14.34 End : 10/20/2016-11.29.34 Interval : 14:59:999 minutes Cycle : 1000 milliseconds

▼ Page Data Set and SCM Usage

Samples : 900

Page Space Type	Volume Serial	Device Number	Device Type	Slots Allocated	Slots Used Min	Slots Used Max	Slots Used Avg	Bad Slots	% In Use	Page Transfer Time	Number IO Requests	Pages Transferred
PLPA	SYSFPP	044C4	33903	71999	16217	16217	16217	0	0.00	0.000	2	2
COMMON	SYSFPP	044C4	33903	35999	37	37	37	0	0.00	0.000	0	0
LOCAL	SYSFP1	045C4	33909	1802699	0	0	0	0	0.00	0.000	0	0
LOCAL	SYSFP2	046C4	33909	1802699	0	0	0	0	0.00	0.000	0	0
SCM	N/A	N/A	N/A	0	0	0	0	0	0.00	0.000	0	0

- RMF Monitor II Device Activity reports DEV and DEVV are enhanced to display 5-digit device numbers

- The *DEV Report Option* panel now allows users to specify a single 5-digit device number and a list or range of 5-digit device numbers

- The *DEVV Report Option* panel now allows users to specify a single 5-digit device number

```

RMF Monitor II - Device Activity Options - Single Device
Specify one of the options below. To exit press END.
Volume      ==> _____ Specify a volume serial number.
Device Number ==> 02180 Specify a hexadecimal device number.

```

Usage & Invocation

- If RMF Monitor II detects more than 65535 active devices in a IBM zHyperwrite environment
 - RMF Monitor II Device background session writes error message ERB439I
 - RMF Monitor II Device Activity report DEV displays error message ERBA092I

RMF - DEV Device Activity

Line 1 of 1792

Command ==> _

Scroll ==> CSR

CPU= 1/ 1 UIC=4392 PR= 0

System= S4 Total

11:23:25	I=57%	DEV				ACTV	RESP	IOSQ	-DELAY-	PEND	DISC	CONN	%D	%D	
STG	GRP	VOLSER	NUM	PAV	LCU	RATE	TIME	TIME	CMR	DB	TIME	TIME	TIME	UT	RV
		SYST10	02180	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
		SYST11	02181	1	0017	0.043	.294	.000	.01	.00	.128	.000	.166	0	0
XTEST		SYSSXB	02182	1	0017	0.001	.256	.000	.00	.00	.128	.000	.128	0	0
XTEST		SYSSXC	02183	1	0017	0.009	.384	.000	.03	.00	.153	.000	.230	0	0
		FR2184	02184	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
		FR2185	02185	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
		FR2186	02186	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
		FR2187	02187	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
		FR2188	02188	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
		FR2189	02189	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
		FR218A	0218A	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
		FR218B	0218B	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
		FR218C	0218C	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
		FR218D	0218D	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
		FR218E	0218E	1	0017	0.000	.000	.000	.00	.00	.000	.000	.000	0	0
XTEST												128	0	0	
XTEST												128	0	0	
XTEST												128	0	0	
XTEST		SYSSX4	02303	1	0018	0.001	.256	.000	.00	.00	.128	.000	.128	0	0

Incomplete data. Data of too many devices requested.

- User is recommended to specify a device number range that does not encompass more than 65535 devices, e.g. 00000:0FFFF

Usage & Invocation

- Enhanced RMF Monitor II Report Command DEV
 - specifies data reporting for a table report on device activity

DEV option

- Possible options:
 - A device class, one or more volume serial numbers, one or more storage group names
 - One or more device numbers:
 - `{([s]aaaa)}`
 - `{NUMBER} ({[s]aaaa,[t]bbbb:[u]zzzz})/NONMBR`
 - `{N} ({[s]aaaa,[t]bbbb,...})`

where aaaa, bbbb, and zzzz each represent hexadecimal 4-digit device numbers and s, t, and u each represent an optional 1-digit subchannel set ID. You can omit leading zeros. If the subchannel set ID is omitted data reporting for devices configured to any subchannel set is requested.
- Example
DEV N(02183:12183))
specifies data reporting for devices 2183 to FFFF configured to subchannel set 0 and devices 0000 to 2183 configured to subchannel set 1

Usage & Invocation

- Enhanced RMF Monitor II Report Command DEVV
 - specifies data reporting for a row report on a specific DASD device

DEVV option

- Possible options:
 - A volume serial number
 - A device number (NUMBER([s]dddd) or N([s]dddd))
To request I/O device activity for the specific device identified by a four-digit hexadecimal device number *dddd* and an optional subchannel set ID *s*. You can omit leading zeros. If the subchannel set id is omitted data reporting for device *dddd* configured to subchannel set 0 is requested.
- Example
DEVV N(2180)
specifies data reporting for device 2180 configured to subchannel set 0

Usage & Invocation

- RMF Monitor II Library List report LLI is enhanced to display 5-digit device numbers

RMF - LLI Program Library Information

CPU= 3/ 3 UIC= 65K PR= 0

----- Link Library List <CLR

DevNum	DevType	Volser	APF	Ext	Data set name
0400A	33909	23C267	Y	1	SYS1.LINKLIB
0400A	33909	23C267	Y	1	SYS1.MIGLIB
0400A	33909	23C267	Y	1	SYS1.CSSLIB
0400A	33909	23C267	Y	1	SYS1.SIEALNKE
0400A	33909	23C267	N	1	SYS1.SIEAMIGE
041AC	33909	MYSTG3	N	2	SYS1.ZMF.V220.SIEALNKE
0400A	33909	23C267	N	1	SYS1.CMDLIB
0400A	33909	23C267	N	1	SYS1.DFQLLIB
0400A	33909	23C267	N	1	SYS1.DGTLLIB
0400A	33909	23C267	N	1	SYS1.NFSLIBE
0400A	33909	23C267	N	1	SYS1.SADMMOD
0400A	33909	23C267	N	1	SYS1.SASMMOD1
0400A	33909	23C267	N	1	SYS1.SCCNCMP

- Specify parameter A to display the device number

LLI LNK,A

LLI APF,A

LLI LPA,A

Field Heading	Meaning
DevNum	Device number of the device on which the library is located. '?????' is shown if Monitor I is not active, or volume is not mounted.

Usage & Invocation

- RMF Monitor II Page Data Set Activity (PGSP) and System Enqueue Reserve (SENQR) reports are enhanced to display 5-digit device numbers

RMF - PGSP Page Data Set Activity Line 1 of 5

CPU= 2/ 2 UIC= 65K PR= 0 System= SYSF Total

S	VOLUME	DEV	DEV	%SLOTS	PAGE	I/O REQ	AVG PAGES		11:53:42
T	SERIAL	NUM	TYPE	IN USE	TRAN TIME	RATE	PER I/O V		DATA SET NAME
P	SYSFPP	044C4	33903	22.52	-----	-----	-----		PAGE.VSYSFPP.PLPA
C	SYSFPP	044C4	33903	0.10	-----	-----	-----		PAGE.VSYSFPP.COMMON
L	SYSFP1	045C4	33909	0.00	-----	-----	-----	Y	PAGE.VSYSFP1.LOCAL1
L	SYSFP2	046C4	33909	0.00	-----	-----	-----	Y	PAGE.VSYSFP2.LOCAL2
S	N/A	N/A	N/A	0.00	-----	-----	-----		N/A

RMF - SENQR System Enqueue Reserve Line 1 of 8

Command ==> Scroll ==> PAGE

CPU= 21 *** UIC=1641 PR= 0 System= RMF2 Total

16:15:14 SYSTEM ENQUEUE RESERVE REPORT									
JOBNAME	ASID	SYSTEM	REQ	VOLUME	DEV	RSV	MAJOR	MINOR	
KUHNMP6	56	RMF2	EO	RMFSM6	05B7D	OFF	SYSVTOC	RMFSM6	
KUHNMP5	55	RMF2	EO	RMFSMS	05B76	OFF		RMFSMS	
KUHNMP9	65	RMF2	EW	RMFSMS	05B76	OFF			
KUHNMP7	57	RMF2	EW	RMFSMS	05B76	OFF			
KUHNMPA	66	RMF2	EW	RMFSMS	05B76	OFF			
KUHNMPB	52	RMF2	EW	RMFSMS	05B76	OFF			
KUHNMP2	53	RMF2	EO	RMFSM3	05B78	OFF		RMFSM3	
KUHNMP8	64	RMF2	EW	RMFSM3	05B78	OFF			

Usage & Invocation

- RMF Monitor III Cache Detail report CACHDET is enhanced to display 5-digit device numbers

RMF V2R3 Cache Detail - SYSDPLEX Line 1 of 1555

Samples: 119 Systems: 3 Date: 10/21/16 Time: 11.59.00 Range: 120 Sec
CDate: 10/21/16 CTime: 11.57.56 CRange: 180 Sec

Volume	/Num	SSID	I/O %	I/O Rate	Hit %	Cache Read	Hit DFw	Rate CFw	- DASD Total	I/O Stage	Seq Rate	Asynch Rate
TSACDS	05A43	5A00	65.0	367.4	99.8	365.9	0.6	0.0	0.8	0.8	3.2	0.0
DWECDS	05BD3	5B00	11.5	347.5	99.1	344.0	0.5	0.0	3.1	3.1	1.8	0.0
SYSSMF	04D18	4D00	73.8	344.1	100	25.8	318.3	0.0	0.0	0.0	0.0	130.0
MT4CDS	04AC3	4A00	34.7	283.7	99.9	282.7	0.6	0.0	0.4	0.4	1.8	0.0
DWDCD1	05BBF	5B00	8.8	267.1	100	199.0	68.0	0.0	0.1	0.1	0.0	0.0
SYSLIB	04A20	4A00	31.3	255.4	100	145.5	109.8	0.0	0.0	0.0	0.8	0.3
DWELIB	05BD0	5B00	8.3	249.6	100	232.0	17.5	0.0	0.0	0.0	0.0	0.1
DWCCDS	05BB3	5B00	8.1	244.3	99.5	242.3	0.8	0.0	1.2	1.2	0.9	0.0
SAYCDS	05B93	5B00	7.8	234.8	99.6	232.2	1.6	0.0	0.9	0.9	1.9	0.0
DWDCDS	05BC3	5B00	7.5	226.4	99.3	224.1	0.8	0.0	1.6	1.6	0.5	0.0
TSAHB1	04FDB	4F00	77.1	220.9	99.9	220.2	0.6	0.0	0.1	0.1	20.1	0.0
DWEHB2	0D71A	D700	21.9	209.1	100	209.1	0.0	0.0	0.0	0.0	20.4	0.0
SAYHB2	0D7A6	D780	45.4	190.0	100	160.6	29.4	0.0	0.0	0.0	20.3	64.2
PAXCDS	04BB3	4B00	14.0	185.1	99.9	184.2	0.7	0.0	0.2	0.2	0.0	0.0
MT5CDS	04B63	4B00	13.4	177.2	99.9	176.2	0.9	0.0	0.2	0.2	0.7	0.0
TRXCDS	04B43	4B00	13.3	175.9	99.5	173.7	1.3	0.0	0.9	0.9	2.8	0.0
DWBLIB	05BA0	5B00	5.6	170.6	100	109.8	60.8	0.0	0.0	0.0	0.0	0.1
IRDLIB	05B50	5B00	5.4	164.1	100	58.7	105.4	0.0	0.0	0.0	0.0	1.9
DWCHB2	0D716	D700	17.0	162.5	100	162.3	0.1	0.0	0.0	0.0	20.3	0.0
SAYSA1	05C7D	5C00	30.9	157.9	100	157.8	0.1	0.0	0.0	0.0	0.0	0.0
DWDHB1	0D717	D700	16.3	156.4	99.9	155.6	0.7	0.0	0.1	0.1	20.3	0.2
DWFCD3	05B83	5B00	4.8	145.6	99.6	144.4	0.6	0.0	0.6	0.6	0.3	0.0
MT4HB1	05F4C	5F00	23.0	142.6	99.9	142.5	0.0	0.0	0.1	0.1	5.7	0.0
MVSLIB	04100	4100	27.8	130.4	100	129.7	0.7	0.0	0.0	0.0	0.0	0.0
MVSTG3	041AC	4100	27.4	128.9	100	128.9	0.0	0.0	0.0	0.0	0.0	0.0
COHLIB	04B10	4B00	9.7	128.3	100	111.5	16.8	0.0	0.0	0.0	0.0	0.0
TRXHB3	05FF4	5F00	20.4	126.3	100	93.8	32.5	0.0	0.1	0.1	20.4	0.0
DWBSM3	05BA7	5B00	4.1	125.1	100	4.7	120.4	0.0	0.0	0.0	0.0	0.0
DSFSM6	05B39	5B00	3.9	119.4	95.6	110.0	4.1	0.0	5.3	5.3	33.5	0.1
DWFHB1	0D71B	D700	12.4	118.6	100	118.0	0.6	0.0	0.0	0.0	20.1	0.0
DWACDS	04B93	4B00	18.9	118.5	99.0	116.6	0.7	0.0	1.1	1.1	0.6	0.0
PAXHB1	0D792	D780	27.5	115.1	99.9	114.0	1.0	0.0	0.1	0.1	20.3	0.0

Command -----> F1=HELP F2=SPLIT F3=END F4=RETURN F5=RFIND F6=TOGGLE F7=UP F8=DOWN F9=SWAP F10=BREF F11=FREF F12=RETRIEVE

Scroll ==> CSR

Field Heading	Meaning
/Num	<p>The five-digit hexadecimal device number that identifies a physical I/O device. The first digit represents the ID of the subchannel set to which the I/O device is physically configured.</p> <p>If a four-digit device number is displayed, the device statistics were collected on a remote system where no subchannel set information was available.</p>

Usage & Invocation

- RMF Monitor III Device Resource Delays (DEVR) and Device Activity Trend (DEVT) reports are enhanced to display 5-digit device numbers

RMF V2R3						Device Resource Delays						Line 1 of 4			
Samples: 119		System: SYSF				Date: 10/21/16		Time: 11.59.00		Range: 120		Sec			
Volume /Num	S/PAV	Act Rate	Resp Time	ACT %	CON %	DSC %	PND %	Reasons	DEV/CU Type	Jobname	C	Service Class	USG %	DLY %	
SYSDXA	S	1.1	0.6	0	0	0	PND	0	33903	XCFAS	S	SYSTEM	1	0	
058C2	1								2107						
SYSSM4	S	1.3	0.5	0	0	0	PND	0	33909	RMFGAT	S	SYSSTC	1	0	
04D03	1								2107						

RMF V2R3 SYSDXA Activity Trend										Line 1 of 20			
Samples: 120		System: SYSF		Date: 10/21/16		Time: 11.59.00		Range: 120		Sec			
VolSer: SYSDXA		Number: 058C2		Type and CU-Type: 33903		2107							
Latest: 10/21/16 at 11.59.00		Range/Line: 120		Sec									
Earliest: 10/21/16 at 11.21.00		Total Range: 2400		Sec		00.40.00							
Time	S	--- Activity ---		ACT	CON	DSC	- Pending -	---	User	---	WFL		
		Rate	RspT	%	%	%	% Rsn. %	USG	DEL	TOT	%		
11.59.00	S	1.1	.001	.000	0	0	0	0.0	0.0	0.0	100		
11.57.00	S	1.0	.000	.000	0	0	0	0.0	0.0	0.0	0		
11.55.00	S	1.1	.000	.000	0	0	0	0.0	0.0	0.0	0		
11.53.00	S	1.1	.001	.000	0	0	0	0.0	0.0	0.0	0		
11.51.00	S	1.1	.001	.000	0	0	0	0.0	0.0	0.0	0		
11.49.00	S	1.1	.001	.000	0	0	0	0.0	0.0	0.0	100		
11.47.00	S	1.0	.001	.000	0	0	0	0.0	0.0	0.0	100		
11.45.00	S	1.1	.000	.000	0	0	0	0.0	0.0	0.0	0		
11.43.00	S	1.1	.001	.000	0	0	0	0.0	0.0	0.0	100		
11.41.00	S	1.1	.001	.000	0	0	0	0.0	0.0	0.0	100		
11.39.00	S	1.0	.001	.000	0	0	0	0.0	0.0	0.0	100		
11.37.00	S	1.1	.000	.000	0	0	0	0.0	0.0	0.0	0		
11.35.00	S	1.1	.001	.000	0	0	0	0.0	0.0	0.0	0		
11.33.00	S	1.1	.001	.000	0	0	0	0.0	0.0	0.0	0		
11.31.00	S	1.1	.001	.000	0	0	0	0.0	0.0	0.0	100		
11.29.00	S	1.0	.001	.000	0	0	0	0.0	0.0	0.0	100		
11.27.00	S	1.0	.000	.000	0	0	0	0.0	0.0	0.0	0		
11.25.00	S	1.1	.001	.000	0	0	0	0.0	0.0	0.0	100		
11.23.00	S	1.2	.000	.000	0	0	0	0.0	0.0	0.0	100		
11.21.00	S	1.1	.001	.000	0	0	0	0.0	0.0	0.0	0		

Usage & Invocation

- RMF Monitor III Data Set Delays – Job (DSNJ) and Volume (DSNV) reports are enhanced to display 5-digit device numbers

```

RMF V2R3 Data Set Delays - Job Line 1 of 1
Samples: 120 System: SYSF Date: 10/21/16 Time: 11.51.00 Range: 120 Sec
Jobname: RMFGAT EXCP Rate 0.4 Connect: 0%
ASID ----- Data Set Name ----- Volume Num DUSG% DDLY%
0118 RMF.MONITOR3.DATASET2.SYSF.DATA SYSSM4 04D03 1 0
  
```

```

RMF V2R3 Data Set Delays - Volume Line 1 of 1
Samples: 120 System: SYSF Date: 10/21/16 Time: 11.51.00 Range: 120 Sec
----- Volume SYSSM4 Device Data -----
Number: 04D03 Active: 0% Pending: 0% Average Users
Device: 33909 Connect: 0% Delay DB: 0% Delayed
Shared: Yes Disconnect: 0% Delay CM: 0% 0.0
PAV: 1
----- Data Set Name ----- Jobname ASID DUSG% DDLY%
RMF.MONITOR3.DATASET2.SYSF.DATA RMFGAT 0118 1 0
  
```

- RMF Monitor III Job Delay (JOB) report is enhanced to display 5-digit device numbers

```

RMF V2R3 Job Delays Line 1 of 1
Samples: 120 System: SYSF Date: 10/21/16 Time: 13.23.00 Range: 120 Sec
Job: XCFAS Primary delay: Waiting for DASD volume SYSDXA.
----- Volume SYSDXA Device Data -----
Number: 058C2 Active: 0% Pending: 0% Average Users
Device: 33903 Connect: 0% Delay DB: 0% Delayed
Shared: Yes Disconnect: 0% Delay CM: 0% 0.0
PAV: 1
----- Job Performance Summary -----
CX ASID Service P Cr WFL -Using% DLY IDL UKN --- % Delayed for --- Primary
S 0006 SYSTEM 1 90 6 2 1 0 93 0 1 0 0 0 0 0 0 SYSDXA
  
```

Usage & Invocation

- New SMF 74 subtype 1 logical record concept
 - One SMF 74 subtype 1 record can only hold up to 65535 ('FFFF'x) devices
 - Two-byte field SMF74DDN describes number of device data sections in SMF record
 - Sufficient for reporting of four-digit device numbers
 - One SMF 74 subtype 1 record written per device class
 - With zHyperwrite, the same four-digit device number can be active more than once in a z/OS system, e.g. devices 02080 and 12080
 - RMF now supports multiple SMF 74 subtype 1 logical records per device type
 - Existing SMF splitting concept is not affected and stays unchanged
 - Small records are still written
 - Example:

1st logical record holding 65535 device data sections but defined in different subchannel sets

1st (of 371) small logical record holding 177 device data sections

2nd (of 371) small logical record holding 177 device data sections

3rd (of 371) small logical record holding 177 device data sections

.....

371th (of 371) small logical record holding 44 device data sections

2nd logical record holding up to 65535 device data sections but defined in different subchannel sets

1st (of nnn) small logical record holding up to 177 device data section

2nd (of nnn) small logical record holding up to 177 device data section

.....

Usage & Invocation

SMF record type 74 subtype 1 – Device Control Data Section				
Offsets	Name	Len	Format	Description
9 9	SMF74DMS	1	binary	Message flag Bit Meaning When Set 0 Message issued that SMS not available 1 SMS interface error 2 Too many devices per device class 2-7 Reserved.
11 B	SMF74SMF	1	binary	Logical SMF record flag Bit Meaning When Set 0 There are more logical SMF records for this device class 1-7 Reserved.
27 1B	SMF74LSN	1	binary	Logical SMF record sequence number within a device class. This number can be used by SMF record assembly programs to recognize conditions where logical SMF records of a device class are not sorted in chronological order.
28 1C		2		Reserved.

Usage & Invocation

SMF record type 74 subtype 5 – Cache Device Data Section				
Offsets	Name	Len	Format	Description
6 6	R745DFL4	1	binary	Flags. Bit Meaning when set 0 4-digit device address. 1 Reserved. 2-3 Subchannel set ID. 00 Subchannel set ID 0 01 Subchannel set ID 1 10 Subchannel set ID 2 11 Subchannel set ID 3 4-7 Reserved.

SMF record type 74 subtype 5 – Cache Device Data Section Extension				
Offsets	Name	Len	Format	Description
2 2	R745XSCS	1	binary	Subchannel set ID.
3 3		1		Reserved.

Usage & Invocation

SMF record type 74 subtype 8 – Raid Rank/Extent Pool Data Section

Offsets	Name	Len	Format	Description
3 3	R7451SCS	1	binary	Subchannel set ID.

SMF record type 74 subtype 8 – Enterprise Disk Control Data Section

Offsets	Name	Len	Format	Description
39 27	R748CSCS	1	binary	ID of the subchannel set which is physically configured to the device from which statistics are measured.
56 38	R748CFSC	1	binary	Subchannel set ID of failing device.
57 39		3		Reserved.

SMF record type 75 – Page Data Set Data Section

Offsets	Name	Len	Format	Description
59 3B	SMF75SCS	1	binary	Subchannel set ID. Valid only when bit 4 (Page space type SCM) of SMF75FL2 is not set.
60 3C		4		Reserved.

Usage & Invocation

SMF record type 79 – Monitor II Control Data Section

Offsets	Name	Len	Format	Description
4 4	R79LF2	1	binary	Flags 7 Incomplete device data due to too many active devices in the system.

SMF record type 79 – SENQR Data Section

Offsets	Name	Len	Format	Description
86 56	R796SCS	1	binary	Subchannel set ID.
87 57		1		Reserved.

SMF record type 79 – PGSP Data Section

Offsets	Name	Len	Format	Description
98 62	R79BSCS	1	binary	Subchannel set ID.
99 63		1		Reserved.

Usage & Invocation

- Enhanced programming interface ERBSMFI

- Monitor II allows exploiters to directly access SMF type 79 data from storage in real time through the ERBSMFI interface
- Eleven parameters can be passed by the caller to the ERBSMFI service and one parameter (parameter 8) specifies the report commands to be used for report generation, e.g. DEV N(02183:12183))
- Parameter 1 specifies the request type
 - New request type 6 added to ERBSMFI: Parameter list contains 11 parameters and indicates whether or not ERBSMFI should detect more than 65535 active devices and to provide return code 64 in register 15 (only if SMF 79 record subtype 9 is requested)
- Example:
DEV N(0000:FFFF))
Data reporting for devices 0000 to FFFF configured to any subchannel set is requested. If more than 65535 devices are active in the system, ERBSMFI passes back return code 64

Return Code	Description
64	ERBSMFI can not process data for more than 65535 devices. Specify a device number range in report command DEV which does not encompass more than 65535 devices, e.g. 00000:0FFFF.

Usage & Invocation

- Enhanced programming interface ERB2XDGS/ERB2XD64
 - RMF Sysplex Data programming services ERB2XDGS/ERB2XD64 can be used to request Monitor II data according to the specified SMF record type 79 subtype.
 - Parameter data_gatherer_parm specifies the Monitor II data gatherer parameters
 - SMF record type 79 and subtype 9 for device activity
 - dg_options specifies the report commands to be used for report generation, e.g. DEV N(02183:12183))
 - If device performance data for DASDs is requested in a IBM zHyperWrite environment, it is recommended to invoke ERB2XDGS multiple times with a device number range specified in dg_options that does not encompass more than 65535 devices, e.g. 00000:0FFFF
 - If ERB2XDGS requests performance data for more than 65535 devices (e.g. dg_options = DASD), only data for 65535 devices are passed back in the returned SMF type 79 subtype 9 record. This condition is indicated by return code 64 provided in field SRC at offset x'2C' in the ERB2XDGS/ERB2XD64 data section header for each SMF system ID

Field	Description
SRC	System return code. If performance data for more than 65535 DASD devices (e.g. dg_options = DASD) is requested in a IBM zHyperWrite environment, only performance data for a maximum of 65535 devices are passed to the data reduction exit routine. This condition is indicated by return code 64 provided in this field.

Usage & Invocation

- Monitor I messages not issued anymore

ERB438I ZZ: TOO MANY DEVICES FOR SMF RECORD 74, SUBTYPE 1

- New Monitor II messages

ERB439I INCOMPLETE DATA. DATA OF TOO MANY DEVICES REQUESTED.

Explanation:

The RMF data gatherer can not process data for more than 65535 devices.

System action:

RMF continues the session. For a display session, RMF produces a report then waits for the next display command. For a background session, RMF produces a report for all measurements taken within the interval. RMF continues all measurements.

User response:

Specify a device number range which does not encompass more than 65535 devices, e.g. 00000:0FFFF

ERBA092I Incomplete data. Data of too many devices requested.

Explanation:

The RMF data gatherer can not process data for more than 65535 devices.

System action:

RMF continues the session and waits for the next display command.

User response:

Specify a device number range which does not encompass more than 65535 devices, e.g. 0000:0FFFF

Usage & Invocation

- Changed message documentation

ERB464I ZZ:RC = rc[, failing device = *syyyy*]

Explanation: In case of a non-zero return code, the message text is extended by failing device = *syyyy*. The first digit *s* represents the ID of the subchannel set to which the I/O device is physically configured.

ERB467I ZZ:RC = rc[, failing device = *syyyy*]

Explanation:In case of a non-zero return code, the message text is extended by failing device = *syyyy*. The first digit *s* represents the ID of the subchannel set to which the I/O device is physically configured.

ERBA053I Device or LCU number contains incorrect characters.

User response: Specify a 1 to 5 hexadecimal characters device or a 1 to 4 hexadecimal characters LCU number.

ERBA054I Device or LCU number selection is not valid.

User response: You can enter a single number, a list of numbers, or a range of numbers.

- Format for device numbers

[*s*]aaaa

[*s*]aaaa,[*t*]bbbb,...

[*s*]aaaa,[*t*]bbbb:[*u*]zzzz

- Format for LCU numbers

aaaa

aaaa,bbbb,...

aaaa,bbbb:zzzz

where aaaa, bbbb, and zzzz represent 4-digit hexadecimal device numbers and *s*,*t* and *u* represent an optional 1-digit subchannel set ID.

Usage & Invocation

- Monitor III Reporter Data Table ERBCADT3

Name	T	Description of the variable	Report
CADPDEVN	N	Four-digit device number	Util
CADPDVN5	N	Five-digit device number	Yes

- Monitor III Reporter Data Table ERBDVRT3

Name	T	Description of the variable	Report
DVRPDEVN	N	Four-digit device number	Util
DVRPDVN5	N	Five-digit device number	Yes

- Monitor III Reporter Data Table ERBDNJT3

Name	T	Description of the variable	Report
DNJPDEVN	N	Four-digit device number	Util
DNJPDVN5	N	Five-digit device number	Yes

Interactions & Dependencies

- Software Dependencies
 - None
- Hardware Dependencies
 - In IBM zHyperwrite environments with more than 65535 DASD active devices, RMF reporting of 5-digit device numbers is required

Installation

- Full support is available for z/OS V2.3 RMF (HRM77B0)
- ERBSMFI and ERB2XDGS coexistence support is available for z/OS V2.2 RMF (HRM77A0) and z/OS V2.1 RMF (HRM7790) with SPE APAR OA48870

Migration Considerations

- No migration action required.
 - This line item is exploiting new hardware functionality in IBM zHyperwrite environments with more than 65535 DASD devices

Exploitation Considerations

- Application programs exploiting SMF 74 subtype 1 data in IBM zHyperwrite environments must handle the condition that performance data for more than 65535 devices are reported
 - If such a condition is indicated in the Device Control data section (SMF74SMF/SMF74LSN) of SMF 74 subtype 1, additional SMF record(s) must be processed by the application program if all devices of a device class are of interest to the program
- Application programs that are using RMF programming interfaces ERBSMFI or ERB2XDGS/ERB2XD64 in IBM zHyperwrite environments must handle the error condition that performance data for more than 65535 devices are available but cannot be reported in a single ERBSMFI or ERB2XDGS/ERB2XD64 invocation.
 - Such a condition is indicated
 - 1) by ERBSMFI return code 64 if request type 6 is specified in parameter 1
 - 2) return code 64 provided in field SRC at offset x'2C' in the ERB2XDGS/ERB2XD64 data section
 - Application programs can prevent these return codes by invoking ERBSMFI/ERB2XDGS multiple times with a device number range specified that does not encompass more than 65535 devices, e.g. DEV NUM(0:0FFFF) and DEV NUM(10000:1FFFF)

Session Summary

- Reporting of five-digit device numbers supported by all RMF components
- IBM zHyperwrite support
 - Activity data for more than 65535 active devices are written into multiple SMF 74 subtype 1 logical records
 - Logical SMF 74 subtype 1 records are handled by RMF Postprocessor
 - RMF Monitor III is enhanced to report device activity for more than 65535 devices
 - RMF Monitor II handling of more than 65535 active devices
 - New return codes passed back to ERBSMFI/ERB2XDGS exploiters
 - Monitor II ISPF/TSO/background session returns error message

Appendix

- RMF website: www.ibm.com/systems/z/os/zos/features/rmf
 - Product information, newsletters, presentations, ...
 - Downloads
 - RMF Spreadsheet Reporter
 - RMF Postprocessor XML Toolkit
- RMF email address: rmf@de.ibm.com
- Documentation and news:
 - RMF Report Analysis, SC34-2665
 - RMF User's Guide, SC34-2664
 - RMF Programmer's Guide SC34-2667
 - RMF Messages & Codes SC34-2666
 - PDF files can be downloaded from:
www.ibm.com/systems/z/os/zos/library/bkserv