

## 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



## Agenda

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



### **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 fourdigit 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

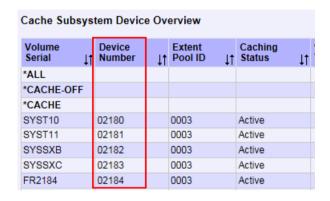
### Benefit / Value

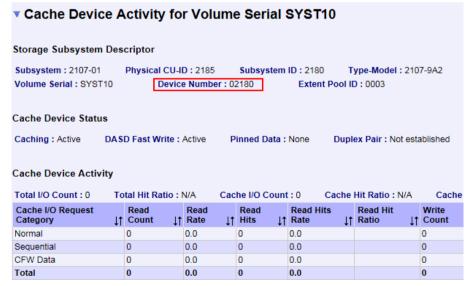
- RMF provides users with 5-digit device numbers incl. the subchannel set ID
- Full RMF monitoring & reporting capability in IBM zHyperwrite environments



- 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 I	▼ Top-20 Device Lists											
Device List by DASD I/O Rate												
Volume Serial ↓↑	Device Number	Į†	Subsystem ID ↓↑	Caching Status 1	%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					







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

▼ Dire	ct Ac	ces	S	Devic	е	Activity													
Total San	nples : 9	900		IODF Na	me	Suffix: 00		IODF Cre	atio	on Date: 10/18/	2016 IOD	)F	Creation T	ime: 12.23	.29	Configur	ati	on State : Acti	vate
Storage Group	Dev Nur	nber	↓↑	Device Type	Į†	Number of Cylinders	Į†	Volume Serial Number	Į†	Available PAV Devices	HyperPAV	ľ	LCU Number ↓1	Device Activity Rate	Į†	Average Response Time		Average IOS Queue Time ↓↑	Average CMR Delay
	0218	80		33909		10017		SYST10		1		(	0017	0.000		0.000	0	0.000	0.000
	0218	81		33909		10017		SYST11		1		(	0017	0.000		0.000	(	0.000	0.000
XTEST	0218	82	Г	33909		10017		SYSSXB		1		(	0017	0.008		0.402	(	0.000	0.000
XTEST	0218	83		33909		10017		SYSSXC		1		(	0017	0.001		0.256	(	0.000	0.000
	0218	84	Г	33909		10017		FR2184		1		(	0017	0.000		0.000	(	0.000	0.000
	0218	85		33909		10017		FR2185		1		(	0017	0.036		0.308	(	0.000	0.024
	0218	86		33909		10017		FR2186		1		(	0017	0.000		0.000	(	0.000	0.000
	0218	87		33909		10017		FR2187		1		(	0017	0.000		0.000	(	0.000	0.000

Field Heading	Meaning
	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.



- 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



- 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



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

▼ Shar	ed DASI	D Activity															
Total San	ples																
Average:	900	Maxir	num : 900		Minimum	: 900											
Device Number	Device Type	Volume Serial ↓↑ Number	Device Status	<b>PAV</b> ↑ ↓↑	SMF System ID	IODI Suff	LCU Number	Į†	Device Activity Rate	Į†	Average Response Time	Į†	Average IOS Queue Time	Į†	Average CMR Delay	- 1	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
	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.



- 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



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

RMF P	ostpro	cess	or	Inte	rval R	epo	ort [S	ìу	sten	n S	SYS	F]	: Pa	ıg	e Da	ıta Se	t A	ctivity	Report
Start: 10/20/	1 : z/OS V2R3 2016-11.14.34	# End : 10	/20/2	016-11.29	9.34 Interval	: 14:5	9:999 mii	nute	s Cycle	: 10	00 millise	econ	nds						
· ·	Data Set	and So	CM	Usag	е														
Samples: 90																			
Page Space Type	Volume Serial	Device Numbe	↓1	Device Type	Slots Allocate	ed 1†	Slots Used Min	Ιt	Slots Used Max	ΙŤ	Slots Used Avg	ΙŢ	Bad Slots		% In Jse 11	Page Transfer Time	Į†	Number IO Requests	Pages Transferred
PLPA	SYSFPP	044C4	•	33903	71999	*1	16217	-	16217		16217	•	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
	OVOEDO	04604		33909	4000000		_				0		0	0	.00	0.000		0	0
LOCAL	SYSFP2	046C4		33909	1802699	•	0		0		0		U	U	.00	0.000		0	U



 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 5digit device number and a list or range of 5-digit device numbers

```
Volume ===>

Device Number ===>

Storage Group ===>
```

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

```
RMF Monitor II - Device Activity Options - Single Device

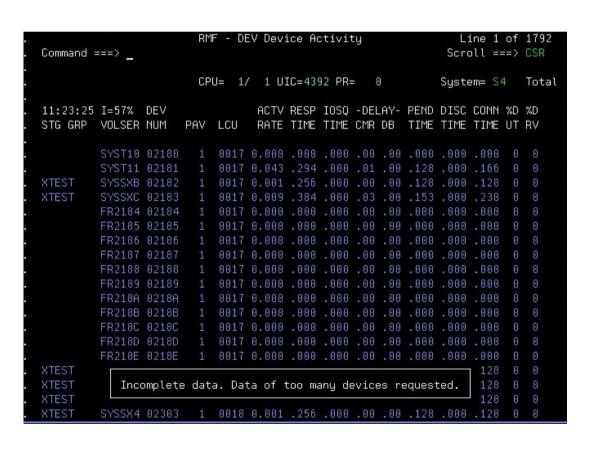
Specify one of the options below. To exit press END.

Yolume ===> _____ Specify a volume serial number.

Device Number ===> 02180 Specify a hexadecimal device number.
```



- 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



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



- 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:

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



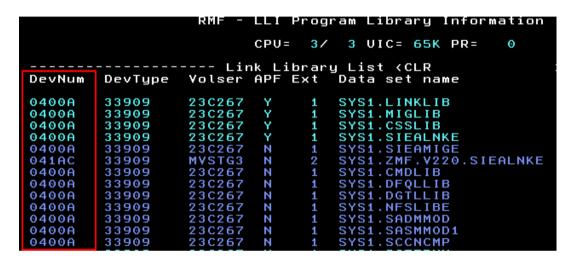
- Enhanced RMF Monitor II Report Command DEVV
  - specifies data reporting for a row report on a specific DASD device

**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



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



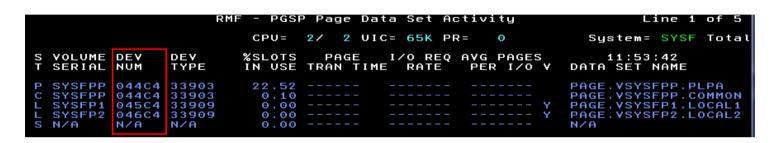
 Specify parameter A to display the device number

> LLI LNK,A LLI APF,A LLI LPA.A

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



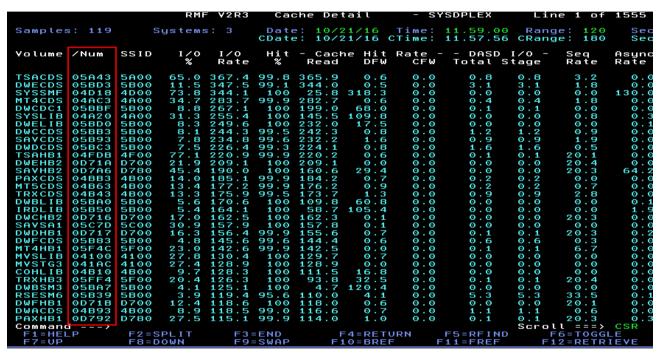
 RMF Monitor II Page Data Set Activity (PGSP) and System Enqueue Reserve (SENQR) reports are enhanced to display 5-digit device numbers



Command ===>	RMF	- SENQR Syst	em Enqueue Res	erve	Line 1 Scroll ===>	
		CPU= 21 ***	UIC=1641 PR=	0	System= RMF2	Total
16:15:14	SYSTEM EI	NQUEUE RESER	VE REPORT			
JOBNAME ASID	SYSTEM REQ	VOLUME DEV	RSV MAJOR	MINOR		
KUHNUMPS 55 KUHNUMP9 65 KUHNUMP7 57 KUHNUMPA 66 KUHNUMPB 52 KUHNUMP2 53	RMF2 E0 RMF2 EW RMF2 EW RMF2 EW RMF2 EW RMF2 EW	RMFSMS 05B7 RMFSMS 05B7 RMFSMS 05B7 RMFSMS 05B7 RMFSMS 05B7 RMFSMS 05B7	6 0FF 6 0FF 6 0FF 6 0FF 8 0FF	RMFSM6 RMFSMS		



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



Field Heading	Meaning
/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.
	If a four-digit device number is displayed, the device statistics were collected on a remote system where no subchannel set information was available.



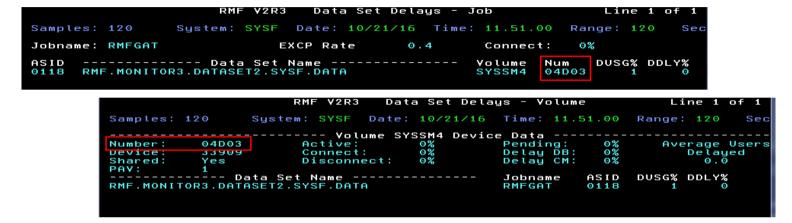
 RMF Monitor III Device Resource Delays (DEVR) and Device Activity Trend (DEVT) reports are enhanced to display 5-digit device numbers

```
Device Resource Delays
Samples: 119
Volume S/
/Num PAV
                     Resp ACT CON DSC PND %, DEV/Time % % % Reasons Type
                                                                                       USG DLY
                                                                             Service
                                                    DEV/CU
               Rate
                                                               Jobname
                                                                          C Class
SYSDXA
                                        0 PND
                                                  0 33903
                                                               XCFAS
                                                                          S SYSTEM
                                                    2107
SYSSM4 S
                                                    33909
                                                               RMFGAT
                                                                          S SYSSIC
```

	RMF V2	R3 S	SYSDXA	Activity T	rend	Line 1 of 20
Samples: 120	System: SYSF	Date:	10/21/	/16 Time: 1:	1.59.00 F	lange: 120 Sec
VolSer: Latest: Earliest:	SYSDXA Number: 10/21/16 at 11.5 10/21/16 at 11.2	9.00	Range/		33903 21 120 Sec 400 Sec	.07 00.40.00
Time S	Activity Rate RspT IosQ	ACT C	ON DSC	- Pending - % Rsn. %	User USG DEL	
11.59.00 S 11.57.00 S	1.1 .001 .000 1.0 .000 .000	0	0 0 0 0	o o	0.0 0.	
11.55.00 S	1.1 .000 .000	ŏ	0 0	ŏ	0.0 0.	
11.53.00 S	1.1 .001 .000	0	0 0	0	0.0 0.	
11.51.00 S 11.49.00 S	1.1 .001 .000 1.1 .001 .000	0	0 0	0 0	0.0 0. 0.0 0.	
11.49.00 S	1.0 .001 .000	ő	0 0	Ö	0.0 0.	
11.45.00 S	1.1 .000 .000	ŏ	ŏ ŏ	ŏ	0.0 0.	
11.43.00 S	1.1 .001 .000	ō	0 0	ō	0.0 0.	
11.41.00 S	1.1 .001 .000	0	0 0	0	0.0 0.	
11.39.00 S	1.0 .001 .000	0	0 0	O	0.0 0.	
11.37.00 S	1.1 .000 .000	0	0 0	0	0.0 0.	
11.35.00 S	1.1 .001 .000	0	0 0	<u> </u>	0.0 0.	
11.33.00 S	1.1 .001 .000	0	0 0	0	0.0 0.	
11.31.00 S	1.1 .001 .000	0	0 0	o O	0.0 0.	
11.29.00 S 11.27.00 S	1.0 .001 .000 1.0 .000 .000	0	0 0	0 0	0.0 0. 0.0 0.	
11.27.00 S	1.1 .001 .000	0	0 0	0	0.0 0.	
11.23.00 S	1.2 .000 .000	ĕ	0 0	8	0.0 0.	
11.21.00 S	1.1 .001 .000	ŏ	0 0	ŏ	0.0 0.	



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



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

```
Samples: 120
Job: XCFAS
                         Primary delay: Waiting for DASD volume SYSDXA.
                                      Volume SYSDXA Device Data
               058C2
                                                                                   0%
0%
0%
Number:
                                Active:
                                                                   Pending:
                                                                                             Average Users
Device:
               33903
                                Connect:
                                                                   Delay DB:
                                                                                                  Delayed
Shared:
                                Disconnect:
                               WFL -Using%- DLY IDL UKN ----

% PRC DEV % % % PRC D

90 6 2 4 % PRC D
                                                                  nmary -----
---- % Delayed for ---- Primar
PRC DEV STR SUB OPR ENQ Reason
O O SYSDXA
    ASID
```



- 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
......
```



SMF record type 74 subtype 1 - Device Control Data Section

Offset	s 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.



SMF reco	ord type 74 subt	ype 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.

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



SI	SMF record type 74 subtype 8 - Raid Rank/Extent Pool Data Section							
Of	fsets	Name	Len	Format	Description			
3	3 3 R7451SCS		1	binary	Subchannel set ID.			

SN	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.				

SN	SMF record type 75 - Page Data Set Data Section								
Off	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.				



SMF reco	SMF record type 79 - Monitor II Control Data Section							
Offsets Name		Len	Format	Description				
4 4	R79LF2	1	binary	Flags7 Incomplete device data due to too many active devices in the system.				

SN	SMF record type 79 - SENQR Data Section							
Offsets Name Len Format Description				Description				
86	56	R796SCS	1	binary	Subchannel set ID.			
87	57		1		Reserved.			

SN	SMF record type 79 – PGSP Data Section								
Off	sets	Name	Len	Format	Description				
98	62	R79BSCS	1	binary	Subchannel set ID.				
99	63		1		Reserved.				



- 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
	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.



- 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
	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.



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



Changed message documentation

#### 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.



### Monitor III Reporter Data Table ERBCADT3

Name	Т	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	Т	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	Т	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