



RMF – The Latest and Greatest

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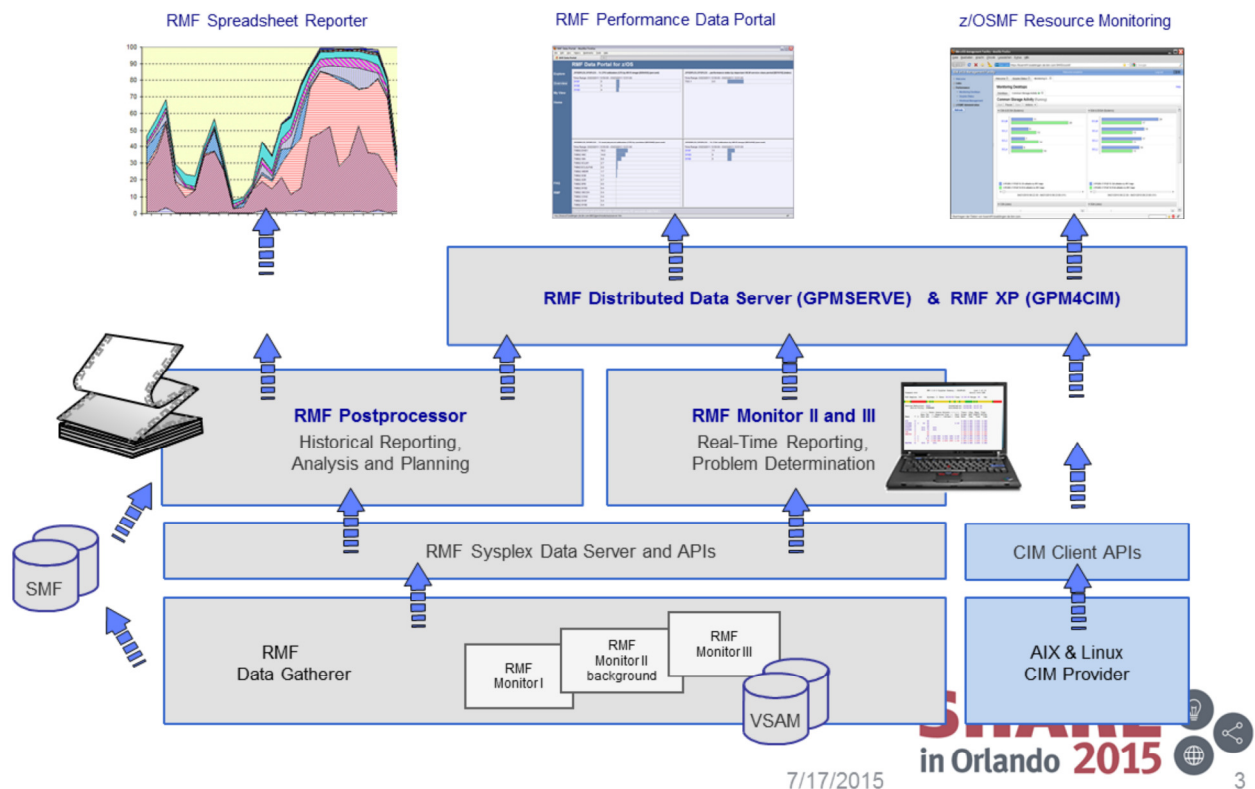
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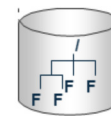
RMF Product Overview



- z/OS Resource Measurement Facility (RMF) is an optional priced feature of z/OS. It supports installations in performance analysis, capacity planning, and problem determination. For these disciplines, different kinds of data collectors are needed:
 - Monitor I long term data collector for all types of resources and workloads. The SMF data collected by Monitor I is mostly used for capacity planning and performance analysis
 - Monitor II snap shot data collector for address space states and resource usage. A subset of Monitor II data is also displayed by the IBM SDSF product
 - Monitor III short-term data collector for problem determination, workflow delay monitoring and goal attainment supervision. This data is also used by the RMF PM Java Client and the RMF Monitor III Data Portal
- Data collected by all three gatherers can be saved persistently for later reporting (SMF records or Monitor III VSAM datasets)
- While Monitor II and Monitor III are realtime reporters, the RMF Postprocessor is the historical reporting function for Monitor I data
- One of the key components for the sysplex wide access of Monitor III data is the RMF Distributed Data Server (DDS). Beginning with RMF for z/OS 1.12, DDS supports HTTP requests to retrieve RMF Postprocessor data from a selection of RMF Postprocessor reports. Since the requested data are returned as XML document, a web browser can act as Data Portal to RMF Postprocessor data.
- Since z/OS 1.12 there's another exploiter of the RMF DDS data: The z/OSMF Resource Monitoring plugin of the z/OS Management Facility.
- RMF for z/OS 1.13 enhances the DDS layer with a new component:
 - RMF XP is the new solution for Cross Platform Performance Monitoring
 - Provides a seamless performance monitoring for all operating systems running on the IBM zEnterprise BladeCenter Extension.

RMF Enhancements at a Glance

- IBM z13 Support
 - RMF Statistics for Simultaneous Multithreading (SMT)
 - Extended ICSF Measurements for Crypto Express5S
 - Support for LPARs with up to 4TB Real Storage
- SCM I/O Adapter Performance Reporting
 - Statistics for EADM Subchannel Activities
 - Performance and Thruput on SCM Card Level
- PCIE Activity Reporting
 - z/OS V2.1 Postprocessor PCIE reporting
 - Additional Measurements for PCIe attached RoCE and zEDC Devices
 - z/OS V2.2 Monitor III PCIE Report
- z/OS V2.2 Monitor III Job Resource Consumption Reporting
 - CPU, I/O and Storage Consumption Data at a Glance
 - Detailed Statistics for Job related GQSCAN Activities
- z/OS V2.2 zFS Reporting Enhancements
 - Sysplex-wide Statistics for zFS Usage and Performance
 - Improved zFS Data Gathering Performance
 - Additional zFS Statistics for Shared File System environments
- z/OSMF Resource Monitoring
 - Historical Reporting & Spreadsheet Export
- The zEvent Mobile Application
 - Receive Push Messages based on critical System Events
 - Access to RMF Data Portal and z/OSMF Resource Monitoring



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In accordance with the availability of new z/OS releases and new hardware functionality, the capabilities of RMF are enhanced consecutively. With the availability of the IBM z13 servers, RMF provides first day support for a couple of notable hardware features.

- Comprehensive Statistics for Simultaneous Multithreading (SMT)
- Extended ICSF Measurements for Crypto Express5S
- Support for LPARs with up to 4TB Real Storage

Storage Class Memory – aka Flash Memory – is a new tier within the memory hierarchy of the zSeries family.

RMF provides detailed usage statistics for Storage Class Memory related operations by means of a new Monitor III SCM Activity report.

Together with the z EC12 server family two new types of PCIe cards have been introduced:

- The new z Enterprise Data Compression (zEDC) Express offering provides low-cost data compression for z/OS system services and applications
- Shared Memory Communication via Remote Direct Memory Access (SMC-RDMA or SMC-R) is a zEC12 feature that provides high performance CPC to CPC communication (similar than Hipersockets for LPAR to LPAR Communication)
- The existing Postprocessor PCIE Report has been extended with additional measurements
- With z/OS V2R2 RMF a complete new Monitor III PCIE Report allows to keep track of PCIe related operations in online mode

The Monitor III Job Usage Report complements the Monitor III reporting suite with detailed statistics about address space resource consumption.

- The top resource consumers in terms of CPU, I/O and Storage can now be identified at a glance
- The report can serve as an excellent starting point for further drill-down and analysis
- Job related GQSCAN activities have been invisible in the past. With the new report detailed statistics with regard to GQSCAN usage can now be obtained

RMF z/OS 2.2 introduces new Monitor III Sysplex reports to monitor sysplex-wide z/OS Distributed File system (zFS) usage and performance.

z/OSMF Resource Monitoring is the strategic state-of-the-art frontend for RMF Monitor III performance data. Quite recently the following features have been added:

- Collect and display historical performance data on individual metric group level
- Export the data contained in the dashboards in CSV format for later usage in a spreadsheet

Last not Least the zEvent Mobile Application:

- This mobile App is currently under development and all details and capabilities – including the application name – are subject to change
- In a nutshell the app provides the following two main features to system administrators and performance analysts:
 - Receive push messages based on critical system events instantly
 - Access to the RMF Data Portal and z/OSMF Resource Monitoring anywhere and every time

RMF z13 Support - Overview

- RMF is enhanced to monitor performance of logical zIIP cores and their threads configured in a Simultaneous Multithreading (SMT) environment on z13. **OA44101**
- RMF provides new measurements for PCIe-attached RoCE and zEDC devices on z13:
 - Supports new z13 10GbE shared RoCE (SR-IOV) express feature **OA44524**
- RMF support for Crypto Express5S (CEX5) card and new ICSF service measurements: **OA43493**
 - RSA Digital Signature Generate and Verify callable services
 - ECC Digital Signature Generate and Verify callable services
 - AES MAC Generate and Verify callable services
 - FPE Encipher, Decipher and Translate callable services
- RMF support for LPARs with up to 4 TB real storage. **OA44503**
- RMF support for z13 IBM Integrated Coupling Adapter (ICA SR) that provides PCIe based short-distance coupling links of type CS5 **OA44502**



- RMF z13 Toleration support for z/OS 1.10 and 1.11 **OA45890**
- RMF z13 Toleration support for z/OS 1.12 and 1.13 **OA45833**

OA45890

OA45833

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With various new function APARs, RMF exploits the new functionality of the IBM z13:

- **OA44101:** RMF support for the Simultaneous Multithreading (SMT) environment on z13 PTF available for z/OS 2.1
- **OA44524:** RMF PCIE enhancements for RoCE and zEDC devices on z/OS 2.1.
- **OA43493:** RMF support for the Crypto Express5S (CEX5) card and new ICSF service measurements.
The support is available for z/OS 1.13 and z/OS 2.1.
- **OA44503:** RMF support for z/OS 2.1 LPARs on z13 with up to 4TB real storage.
- **OA44502:** RMF support for z13 IBM Integrated Coupling Adapter (ICA SR) that provides PCIe based short-distance coupling links of type CS5.
PTFs available for z/OS 1.13 and z/OS 2.1.

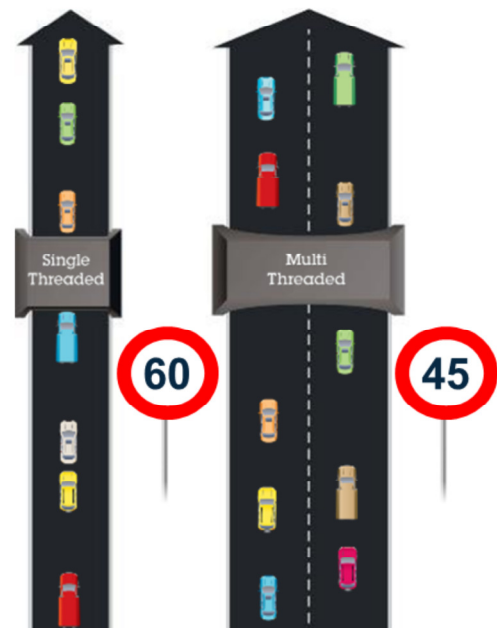
RMF toleration support for IBM z13:

- **OA45890:** z13 toleration for z/OS 1.10 and z/OS 1.11
- **OA45833:** z13 toleration for z/OS 1.12 and z/OS 1.13

z13 - Simultaneous Multithreading (SMT)

- “Simultaneous multithreading (SMT) permits multiple independent threads of execution to better utilize the resources provided by modern processor architectures.”*
- With z13, SMT allows up to two instructions per core to run simultaneously to get better overall throughput
- SMT is designed to make better use of processors
- On z/OS, SMT is available for zIIP processing:
 - Two concurrent threads are available per core and can be turned on or off
 - Capacity (throughput) usually increases
 - Performance may in some cases be superior using single threading

*Wikipedia®



Note: Speed limit signs for illustration only

Simultaneous multithreading (SMT) allows two active instruction streams (threads) per core, each dynamically sharing the core's execution resources. SMT will be available in IBM z13 for workloads running on the Integrated Facility for Linux (IFL) and the IBM z Integrated Information Processor (zIIP).

SMT utilizes the core resources more efficiently: When a thread running on a core encounters a cache miss and can no longer make progress, the core switches to run a different thread that is ready to execute.

Each thread runs slower than a non-SMT core, but the combined 'threads' throughput is higher. The overall throughput benefit depends on the workload.

Basic idea of the SMT approach: better exploitation of processor resources without cloning all peripheral components of a physical CPU, e.g. Cache, Register(?)

The SMT mode might not be suited for single threaded workloads (typically batch workloads).

Highway example: More overall throughput on a physical core, but speed on the individual lane is lower:

- As always, administration and switching of two lanes causes overhead
- Threads must share the peripheral processor resources, queueing and waiting cycles can occur

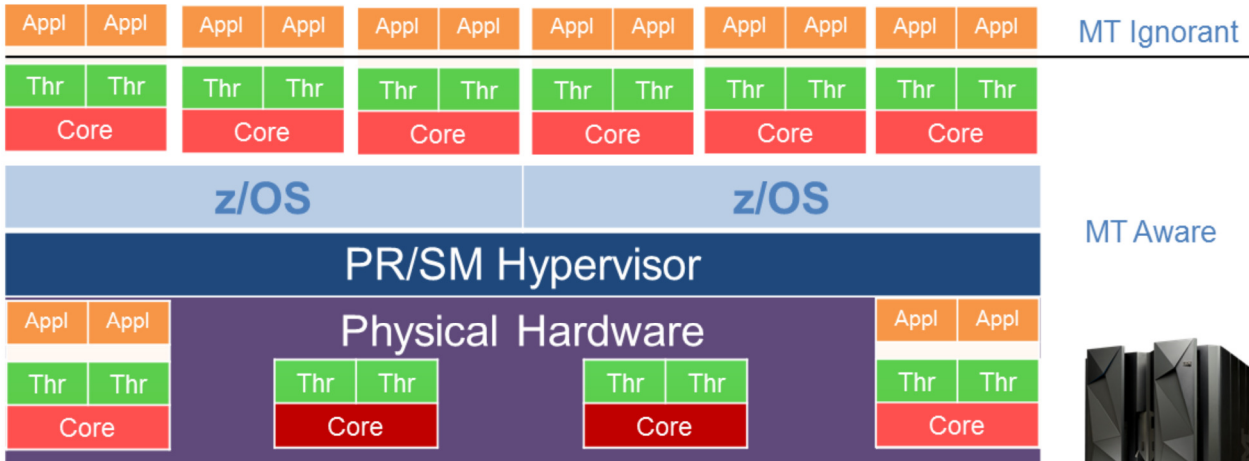
Altogether, since with SMT more logical processing units are available, SMT helps to slow down the demand for processor resources.

Potential migration problem from zEC12 to z13: in case of single threaded workloads it is not recommended to turn on MT-2 mode.

But the overall throughput in MT-1 mode on z13 is always better than on zEC12 even though the processor speed has decreased.

This is achieved by other architectural optimizations, e.g. cache etc.

z13 –SMT Exploitation



- SMT Aware OS informs PR/SM that it intends to exploit SMT
 - PR/SM can dispatch any OS core to any physical core
 - OS controls the whole core – must follow rules
 - Maximize core throughput (Drive cores with high Thread Density [2])
 - Maximize core availability (Meet workload goals using fewest cores)
- SMT is transparent to applications
- LOADxx and IEAOPTxx parmlib options to enable SMT on z/OS:
 - LOADxx: PROCVIEW **CORE|CPU**
 - IEAOPTxx: MT_ZIIP_MODE={1 | 2}

- The use of SMT mode can be enabled on an LPAR by LPAR basis via operating system (OS) parameters
- Once the OS switches to SMT mode, the only way back to single thread (ST) mode is via a disruptive action (re-activate the partition or re-IPL it).
- With the SMT enabled mode it is possible to dynamically switch between MT-1 (multi thread) and MT-2 mode for the processor types that support MT-2
- z/OS introduces new options for the LOADxx and IEAOPTxx parmlib members that are used to enable/disable SMT support and specify the MT mode of a processor class:
 - LOADxx parmlib option PROCVIEW CORE|CPU enables/disables SMT for the life of the IPL
 - PROCVIEW CORE on z13 enables SMT support
 - IPL required to switch between PROCVIEW CPU and CORE
 - New IEAOPTxx parameter to control the MT mode for zIIP processors
 - MT_ZIIP_MODE=1 specifies MT-1 mode for zIIPs (one active thread per online zIIP core)
 - MT_ZIIP_MODE=2 specifies MT-2 mode for zIIPs (two active threads per online zIIP core)
 - When PROCVIEW CPU is specified the processor class MT mode is always 1
 - SET OPT=xx operator command allows to switch dynamically between MT-1 and MT-2 mode
 - MT-2 mode requires HiperDispatch to be in effect
 - z/OS SMT Terminology:
 - z/OS logical processor (CPU) → Thread
 - A thread implements (most of) the System z processor architecture
 - z/OS dispatches work units on threads
 - In MT mode two threads are mapped to a logical core
 - Processor core → Core
 - PR/SM dispatches logical core on a physical core
 - Thread density 1 (TD1) when only a single thread runs on a core
 - Thread density 2 (TD2) when both threads run on a core

z13 - z/OS SMT Metrics

- Capacity Factor (CF)
 - How much work core actually completes for a given workload mix at current utilization - relative to single thread
 - MT-1 Capacity Factor is 1.0 (100%)
 - MT-2 Capacity Factor is workload dependent
- Maximum Capacity Factor (mCF)
 - How much work a core can complete for a given workload mix at most
- Core Busy Time
 - Time any thread on the core is executing instructions when core is dispatched to physical core
- Average Thread Density
 - Average number of executing threads during **Core Busy Time** (Range: 1.0 - 2.0)
- Productivity
 - Core Busy Time Utilization (percentage of used capacity) for a given workload mix
 - Productivity represents capacity in use (**CF**) relative to capacity total (**mCF**) during **Core Busy Time**.
- Core Utilization
 - Capacity in use relative to capacity total over some time interval
 - Calculated as **Core Busy Time x Productivity**

Actual MT-2 Efficiency

Estimated max MT-2 Efficiency



% Used MT-2 Core Capacity during Core Busy Time

% Used MT-2 Core Capacity during Measurement Interval

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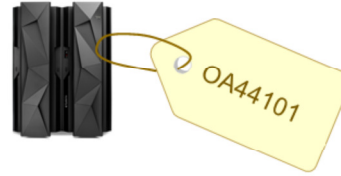
z/OS SMT introduces several new metrics to describe how efficiently the core resources could be utilized and how efficiently they are actually utilized.

Is there any possibility to control the efficiency of the SMT mode?

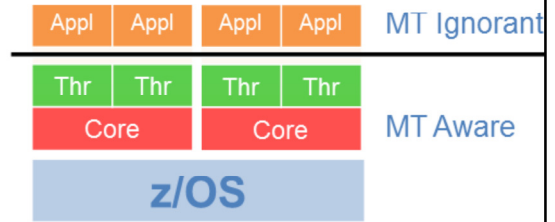
Can I keep track of the actual speed on the 2 lanes compared to the possible maximum speed?

- The capacity factor (CF) is calculated from the number of executed instructions on both threads and the actual number of processing cycles that have been executed on the core. Usually the CF in MT-2 mode should be higher than 1.0 (except in special cases of single threaded workloads)
- The maximum capacity factor (mCF) can be achieved in case both threads are working together with maximum efficiency and no waiting cycles at all. Both, CF and mCF are subject of change: while the CF can change rapidly from interval to interval, the mCF changes are occurring slowly over time
- Core Busy Time is a metric on core level. The logical core must be dispatched on a physical core and at least one thread must be in execution state
- Average Thread Density represents the average number of executing threads during Core Busy Time
- Productivity indicates how well the available core resources have been exploited. It is calculated from the relation of CF and mCF during Core Busy Time
- Core Utilization indicates how well my workload is suited for MT-2 mode. Since Productivity can never reach 100% the value is always below the Core Busy Time

z13 – RMF and SMT



- RMF enhanced with new metrics to monitor MT-2 efficiency and core utilization
- Re-Interpret the meaning of exiting RMF metrics:
 - CPU metrics on core granularity (e.g. APPL%/EAPPL%)
 - CPU metrics on thread granularity (e.g. MVS BUSY%)
 - SMT updates in RMF Documentation
 - Enhanced metrics descriptions
 - General terminology:
 - „Processor“ → logical Core
 - „logical Processor“ → Thread
 - MT-1 Equivalent Time
 - z/OS CPU time consumed by work units (TCBs, SRBs) provided in terms of MT-1 equivalent time
 - Time it would have taken to run same work in MT-1 mode
 - Reflected in all RMF metrics reporting CPU consumption of workloads as CPU times or service units



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The RMF support for SMT provides new SMT related metrics to allow capacity planning and performance analysis in SMT environments.

RMF supports SMT environments by extending the

- Postprocessor CPU activity report
- Monitor III CPC capacity report
- Overview Conditions based on SMF 70.1

RMF new function APAR OA44101 provides the SMT support for z/OS 2.1.

The architecture introduced with SMT requires a reinterpretation of existing RMF metrics:

- CPU metric data can now be on core or thread level granularity
- z/OS charges CPU time consumed by work units (TCBs, SRBs) in terms of MT-1 equivalent time. The MT-1 equivalent time is the time it would have taken to run the same work in MT-1 mode. All RMF metrics reporting CPU consumption of workloads as CPU time or service units reflect MT-1 equivalent time.

How can RMF help to monitor MT-modes efficiently:

- A couple of new MT related metrics are introduced
- Some existing metrics must be reinterpreted

First of all we need to distinguish between CPU metrics on core granularity and metrics on thread granularity.

Core metrics are collected from the Diagnose and HISMT interfaces while thread level metrics are extracted from the PCCA and LCCA control blocks (internal OS view).

A comprehensive description can be found in the updated RMF V2R1 documentation.

In general, RMF does NOT report the measured wallclock times, but so called MT-1 equivalent times.

Hence, it is guaranteed that the reported CPU times and service units can be compared between the z13 systems and its predecessors.

Theoretically the MT-2 mode raw times would be lower than the equivalent times (due to better throughput on 2 lanes).

But this is readjusted since RMF divides the retrieved time values through the maximum capacity factor (mCF).

z13 – SMT: Postprocessor CPU Activity Report



- PP CPU activity report displayed in “old” format when SMT is inactive
- PP CPU activity report provides new metrics when SMT is active
 - MT Productivity and Utilization of each logical core
 - Multi-Threading Analysis section displays MT Mode, MT Capacity Factors and average Thread Density
- One data line in PP CPU activity report represents one thread (CPU)
 - CPU NUM designates the logical core
- Some metrics like TIME % ONLINE and LPAR BUSY provided at core granularity only



CPU ACTIVITY											
z/OS V2R1		SYSTEM ID CB8B				DATE 02/02/2015				INTERVAL 15.00.004	
		RPT VERSION V2R1 RMF				TIME 11.00.00				CYCLE 1.000 SECONDS	
---CPU---		TIME %				--- MT % ---		LOG PROC		--I/O INTERRUPTS--	
NUM	TYPE	ONLINE	LPAR BUSY	MVS BUSY	PARKED	PROD	UTIL	SHARE %		RATE	% VIA TPI
0	CP	100.00	68.07	67.94	0.00	100.00	68.07	100.0	HIGH	370.1	13.90
1	CP	100.00	46.78	46.78	0.00	100.00	46.78	52.9	MED	5.29	16.93
...											
TOTAL/AVERAGE			8.66	54.17		100.00	8.66	152.9		375.3	13.95
A	IIP	100.00	48.15	41.70	0.00	85.84	41.33	100.0	HIGH		
B	IIP	100.00	38.50	32.81	0.00	85.94	33.09	100.0	HIGH		
...											
TOTAL/AVERAGE			29.48	23.23		86.47	25.39	386.7			
----- MULTI-THREADING ANALYSIS -----											
CPU TYPE	MODE	MAX CF		CF	AVG TD						
CP	1	1.000		1.000	1.000						
IIP	2	1.485		1.279	1.576						

MT-2 core capacity used:
MT Core Productivity
x TIME % LPAR BUSY

Productivity of logical core while
dispatched to physical core

The CPU Activity section reports on logical core and logical processor activity. For each processor, the report provides a set of calculations that are provided at a particular granularity that depends on whether multithreading is disabled (LOADxx PROCVIEW CPU parameter is in effect) or enabled (LOADxx PROCVIEW CORE parameter is in effect).

If multithreading is disabled for a processor type, all calculations are at logical processor granularity.

If multithreading is enabled for a processor type, some calculations are provided at logical core granularity and some are provided at logical processor (thread) granularity. The CPU Activity section displays exactly one report line per thread showing all calculations at logical processor granularity. Those calculations that are provided at core granularity are only shown in the same report line that shows the core id in the CPU NUM field and which is representing the first thread of a core.

The following calculations are on a per logical processor basis when multithreading is disabled and on a per logical core basis when multithreading is enabled

- Percentage of the interval time the processor was online
- LPAR view of the processor utilization (LPAR Busy time percentage)
- Percentage of a physical processor the logical processor is entitled to use
- Multithreading core productivity (only reported when multithreading is enabled)
- Multithreading core utilization (only reported when multithreading is enabled)

The following calculations are on a per logical processor basis regardless whether multithreading is enabled or disabled:

- MVS view of the processor utilization (MVS Busy time percentage)
- Percentage of the online time the processor was parked (in HiperDispatch mode only)
- I/O interrupts rate (general purpose processors only)
- Percentage of I/O interrupts handled by the I/O supervisor without re-enabling (general purpose processors only)

The PROCVIEW CPU/CORE setting determines the content of the CPU report.

In case of CORE, new columns on CPU resp. thread level have been added.

The efficiency of MT-2 mode for zIIP engines can be monitored by means of a new MULTI-THREADING ANALYSIS section.

Remark: Since Parking is executed on core level, thread level reporting doesn't make sense. However, the values are extracted from local MVS control blocks for the home partition.

z13 – SMT: Monitor III CPC Report



MT Mode and Productivity for zIIP processors



RMF V2R1 CPC Capacity Line 1 of 50
 Samples: 60 System: CB88 Date: 02/02/15 Time: 11.00.00 Range: 60 Sec
 Partition: CB88 2964 Model 731
 CPC Capacity: 3935 Weight % of Max: 50.1 4h Avg: 138 Group: N/A
 Image Capacity: 1777 WLM Capping %: 0.0 4h Max: 177 Limit: N/A
 MT Mode IIP: 2 Prod % IIP: 80.9

Partition	--- MSU ---	Cap	Proc	Logical	Util %	- Physical	Util % -
Def	Act	Def	Num	Effect	Total	LPAR	Effect Total
*CP			390			0.8	43.7 44.5
CB8B	0 192	NO 10.0	15.0	15.1	0.0	4.8	4.9
CB8D	0 134	NO 15.0	7.0	7.0	0.0	3.4	3.4
CB8E	0 330	NO 14.0	18.4	18.6	0.1	8.3	8.4
CB88	0 182	NO 14.0	10.2	10.3	0.0	4.6	4.6
C05	0 140	NO 14.0	7.9	7.9	0.0	3.5	3.6
C06	0 150	NO 14.0	8.4	8.4	0.0	3.8	3.8
LP1	0 507	NO 4.0	100	100	0.0	12.9	12.9

SMT mode enabled:
 Processor data at logical core granularity

SMT mode disabled:
 Processor data at logical processor granularity



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RMF Monitor III CPC report displays performance data for all partitions belonging to the CPC

If multithreading is enabled the processor data is reported at logical core granularity, otherwise processor data is reported at logical processor granularity

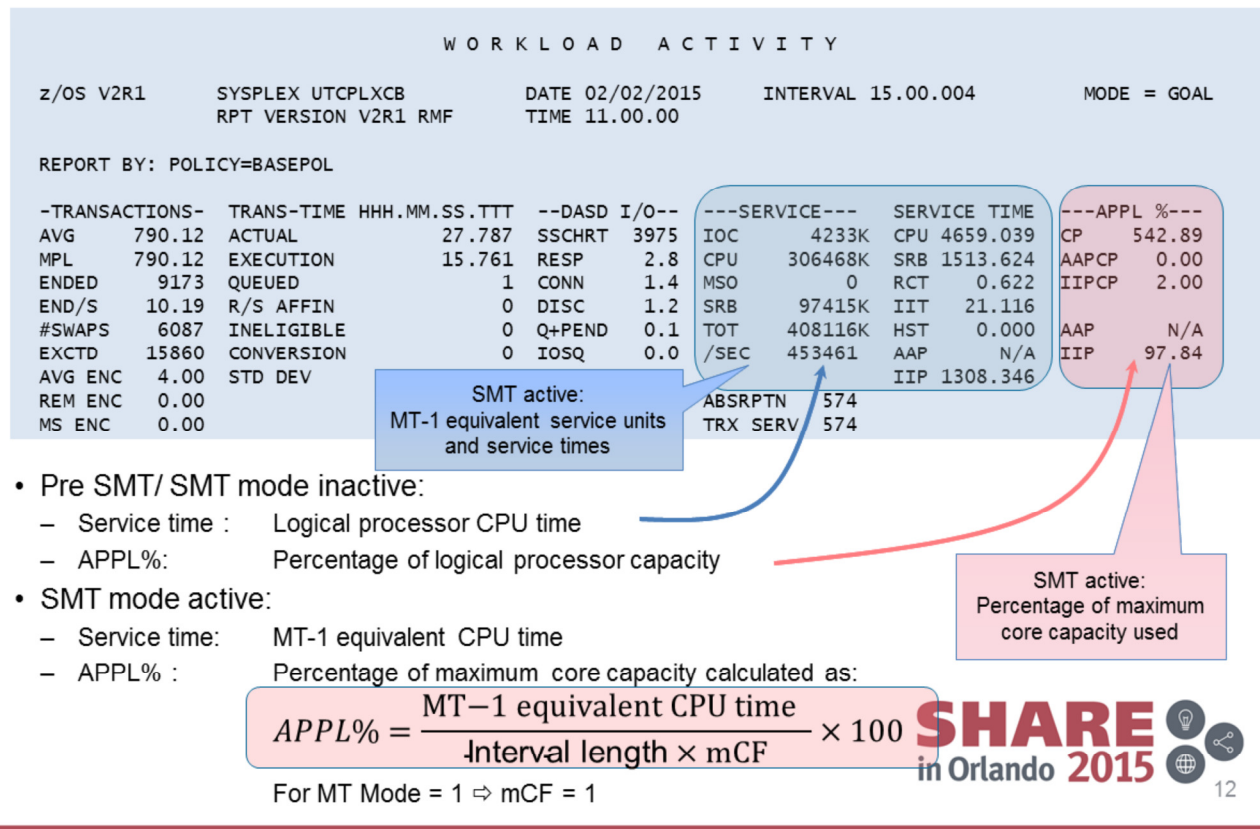
The report header is enhanced with the information about MT Mode and Productivity for the zIIP processors.

Additional SMT metrics are available as hidden report header fields:

- Multi-Threading Maximum Capacity Factor for IIP
- Multi-Threading Capacity Factor for IIP
- Average Thread Density for IIP

These hidden report header fields can be displayed, if the CPC report is invoked in the RMF Data Portal for z/OS web browser frontend.

z13 – SMT: Postprocessor Workload Activity Report



The RMF Postprocessor Workload Activity report (WLMGL) reports the CPU time used by a workload in units of service times and service units. The APPL% metric shows the percentage of logical processor capacity used by the workload.

With active SMT mode, the service time charged to the workload is based on the MT-1 equivalent CPU time (the CPU time that would have been used in MT-1 mode) . Service units are calculated from MT-1 equivalent CPU time, too.

The APPL% now represents the percentage of maximum core capacity used by the workload.

MT-2 APPL% numbers can continue to be used to understand relative core utilization in a given interval, or at times of comparable Maximum Capacity Factors. However, the Maximum Capacity Factor (mCF) needs to be considered when comparing APPL% across different workloads or times with different mCF values.

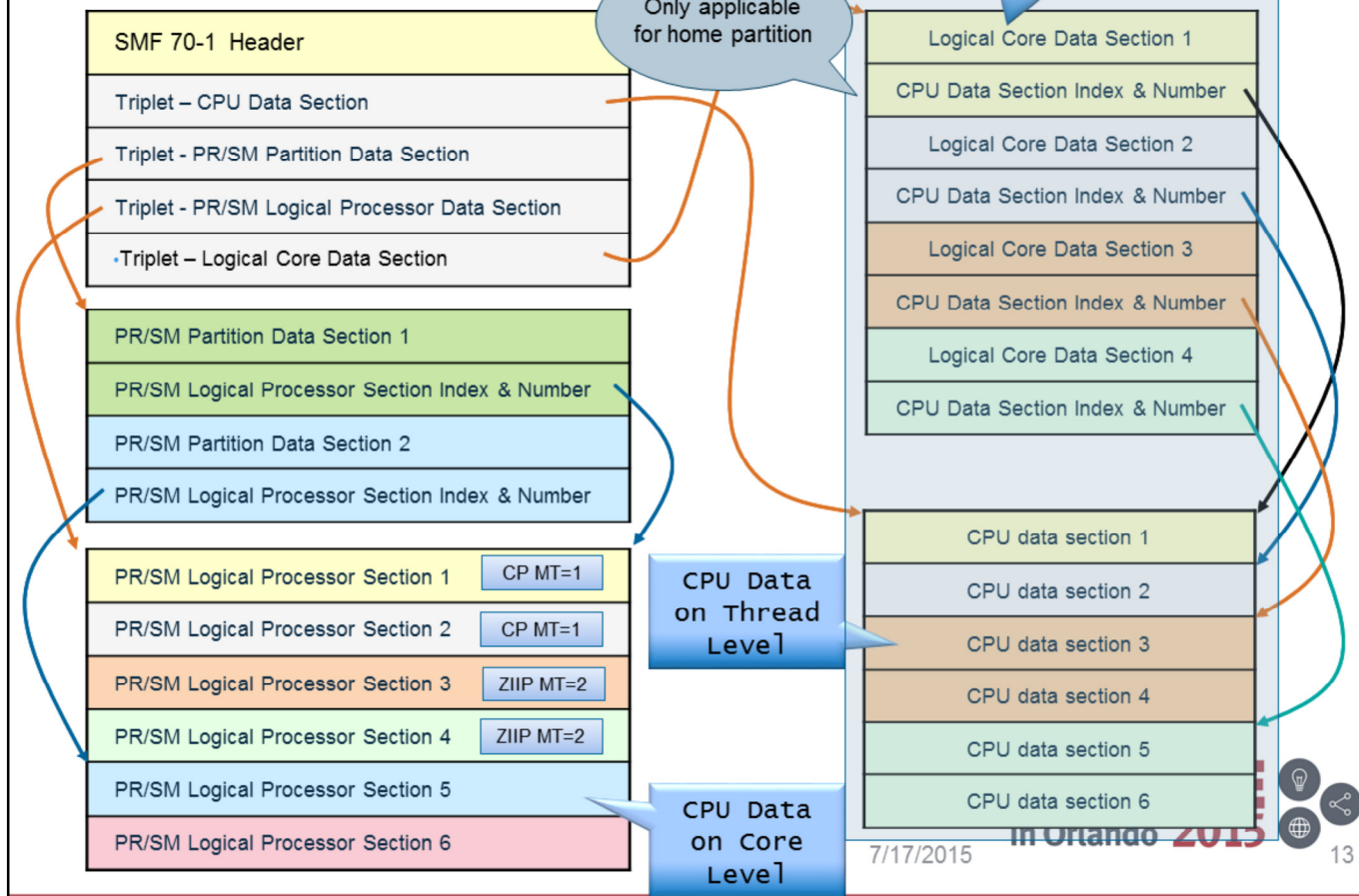
If multithreading is disabled for a processor type, an mCF of 1 is used for the APPL% calculation so that the calculation is the same as before introduction of SMT.

The WLMGL Report does not contain any new MT mode related metrics. It is a well suited example for the reinterpretation of existing metrics.

SMT in general has no effect on pricing or chargebacks:

- 4h MSU related measurements are not affected at all
- Pricing for CPU consumption on zIIP engines is not MSU related

z13 – SMT: SMF Record 70-1



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- The RMF SMT support enhances the SMF 70-1 record with SMT related fields.
- **CPU Control Data Section:**
 - Processor Class Maximum Capacity Factor Metrics:
 - SMF70MCF (CP), SMF70MCFs (ZIIP)
 - Processor Class Capacity Factor Metrics:
 - SMF70CF (CP), SMF70CFS (ZIIP)
 - Processor Class Average Thread Density Metric:
 - SMF70ATD (CP), SMF70ATDS (ZIIP)
- **PR/SM Partition Data Section:**
 - Maximum Thread Id and MT enabled (SMF70MTID)
- **PR/SM Logical Processor Data Section:**
 - MT inactive → section is on a per logical processor/CPU basis
 - MT active → section is on a per logical core basis
 - MT Idle Time (SMF70MTIT)
- With SMT active, there is no longer a 1:1 mapping between PR/SM Logical Processor data sections and CPU data sections. The PR/SM Logical Processor data sections now represent CPU data on logical Core level, the CPU data sections represent CPU data on logical thread level. To identify the CPU data sections belonging to a logical Core, a new Logical Core data section is introduced.

z13 – SMT: SMF Record 70-1...

SMF record type 70 subtype 1 – Logical Core data section

Offsets	Name	Len	Format	Description
0 0	SMF70_CORE_ID	2	Binary	Core identification.
2 2	SMF70_CORE_FLG	1	Binary	Logical Core Information Bit Meaning when Set 0 Core LPAR Busy time is valid. 1-7 Reserved.
3 3		1		Reserved.
4 4	SMF70_CPU_SKIP	2	Binary	The CPU data sections for this core are grouped together in the record. To get to the first CPU data section associated with this logical core, skip over the number of CPU data sections specified by this field, starting at the first CPU data section in the record.
6 6	SMF70_CPU_NUM	2	Binary	Number of CPU data sections for this core. This value represents the number of threads that are active on this core.
8 8	SMF70_PROD	4	Binary	Multithreading core productivity numerator. Divide this value by 1024 to get the multithreading core productivity. A zero value is reported if the core was not configured ONLINE for the complete interval. If SMF70_CPU_NUM is greater than 1, the core productivity represents the percentage of how much work the core resources accomplished while dispatched to physical hardware over the maximum amount of work the core resources could have accomplished while dispatched to physical hardware.
12 C	SMF70_LPAR_BUSY	4	Binary	Multithreading core LPAR Busy Time in milliseconds. This field is valid if bit 0 of SMF70_CORE_FLG is set.

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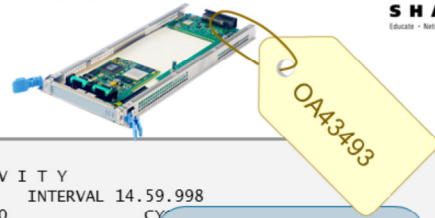
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- A new **Logical Core data section** is added to the SMF record 70 subtype 1 when the SMT is active (LOADxx PROCVIEW CORE parameter is in effect).
- The SMF 70 Subtype 1 Individual Header Extension is extended by a new triplet that describes the new Logical Core data sections.

Logical Core Data Section Fields:

- SMF70_CPU_SKIP and SMF70_CPU_NUM can be used to identify the CPU data sections with the thread data of a logical core:
 - Navigate to first CPU on core via a number of CPU data sections to skip (SMF70_CPU_SKIP)
 - Number of CPU data sections for this core (SMF70_CPU_NUM)
- Core Productivity Metric (SMF70_PROD)
- Core LPAR Busy Metric (SMF70_LPAR_BUSY)

z13 - Support of Crypto Express5S Card



0493

CRYPTO HARDWARE ACTIVITY											
z/OS V2R2			SYSTEM ID TRX2			DATE 02/01/2014			INTERVAL 14.59.998		
			RPT VERSION V2R2 RMF			TIME 11.00.00			CY		
----- CRYPTOGRAPHIC CCA COPROCESSOR -----											
----- TOTAL ----- KEY-GEN -----											
TYPE	ID	RATE	EXEC TIME	UTIL%	RATE						
CEX5C	0	2.15	227.8	48.9	2.15						
----- CRYPTOGRAPHIC PKCS11 COPROCESSOR -----											
----- TOTAL ----- OPERATIONS DETAILS -----											
TYPE	ID	RATE	EXEC TIME	UTIL%	FUNCTION	RATE	EXEC TIME	UTIL%			
CEX5P	1	446.5	0.243	8.3	ASYM FAST	274.3	0.175	2.4			
					ASYM GEN	0.00	0.000	0.0			
					ASYM SLOW	120.3	0.405	5.3			
					SYMM COMPLETE	0.00	0.000	0.0			
					SYMM PARTIAL	51.89	0.398	0.6			
----- CRYPTOGRAPHIC ACCELERATOR -----											
----- TOTAL ----- ME-FORMAT RSA OPERATIONS ----- CRT-FORMAT RSA OPERATIONS -----											
TYPE	ID	RATE	EXEC TIME	UTIL%	KEY	RATE	EXEC TIME	UTIL%	RATE	EXEC TIME	UTIL%
CEX5A	2	1335.5	0.151	30.3	1024	678.2	0.225	14.2	544.4	0.145	5.8
					2048	0.00	0.000	0.0	22.6	0.465	4.8
					4096	0.00	0.000	0.0	90.3	0.378	5.5
----- ICSF SERVICES -----											
----- ENCRYPTION ----- DECRYPTION ----- HASH ----- PIN -----											
RATE	SDDES	TDES	AES	SDDES	TDES	AES	SHA-1	SHA-256	SHA-512	TRANSLATE	VERIFY
SIZE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
----- MAC ----- AES MAC ----- RSA DSIG ----- ECC DSIG ----- FORMAT PRESERVING ENCRYPTION -----											
RATE	GENERATE	VERIFY	GENERATE	VERIFY	GENERATE	VERIFY	GENERATE	VERIFY	ENCIPHER	DECIPHER	TRANSLATE
SIZE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Crypto Express5 Card reported with same set of measurements as Crypto Express4

Additional ICSF service statistics

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Crypto Express5 Card reported with same set of measurements as Crypto Express4

Additional ICSF service statistics

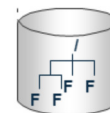
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- RMF new function APAR OA43493 introduces the RMF support of the Crypto Express5S feature on the z13
- In detail, RMF collects and reports performance measurements for operations executed on Crypto Express5S CCA coprocessors (CEX5C) , PKCS11 coprocessors (CEX5P) and accelerators (CEX5A).
- The crypto measurements are stored to SMF 70 subtype 2 data sections:
 - CEX5C measurements are stored in the Cryptographic Coprocessor data section,
 - CEX5P measurements are stored in the Cryptographic PKCS11 Coprocessor data section and
 - CEX5A measurements are stored in the Cryptographic Accelerator data section.
- The Postprocessor Crypto Activity report provides the crypto measurements from the SMF 70 subtype 2 data sections in the corresponding report sections.
- The ICSF SERVICES report section displays request rates for the new ICSF activities:
 - RSA Digital Signature Generate callable services
 - RSA Digital Signature Verify callable services
 - ECC Digital Signature Generate callable services
 - ECC Digital Signature Verify callable services
 - AES MAC Generate callable servies
 - AES MAC Verify callable servies
 - FPE Encipher callable services
 - FPE Decipher callable services
 - FPE Translate callable services
- With new function APAR OA43493 the RMF support is available for z/OS V1.13 and z/OSV2.1.

RMF Enhancements at a Glance

- IBM z13 Support
 - RMF Statistics for Simultaneous Multithreading (SMT)
 - Extended ICSF Measurements for Crypto Express5S
 - Support for LPARs with up to 4TB Real Storage
- SCM I/O Adapter Performance Reporting
 - Statistics for EADM Subchannel Activities
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- PCIE Activity Reporting
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- z/OSMF Resource Monitoring
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 - Receive Push Messages based on critical System Events
 - Access to RMF Data Portal and z/OSMF Resource Monitoring



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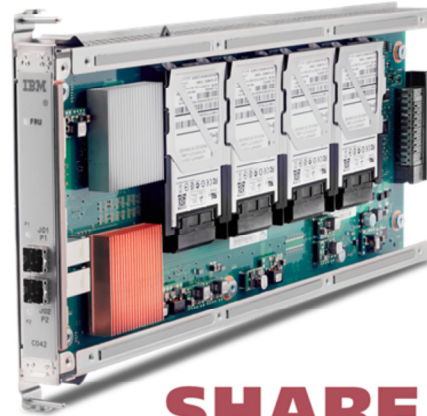
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z/OS 2.2 - SCM I/O Adapter Performance Reporting



- New tier within the memory hierarchy of the zSeries family
- Also denoted as Flash Memory
- Delivers fast Solid State Drive (SSD) technology
- Integrated on PCI Express attached RAID 10 Cards
 - Packaged as two card pair
 - Each card holds 1.4 TB of memory per mirrored card pair
 - Maximum value of four card pairs delivers up to 5.6 TB of memory
- Assign Flash Memory to partitions like Main Memory
 - Flash memory allocation panel on the SE
 - Amount of memory initially online to a partition
 - Can be adjusted dynamically per command



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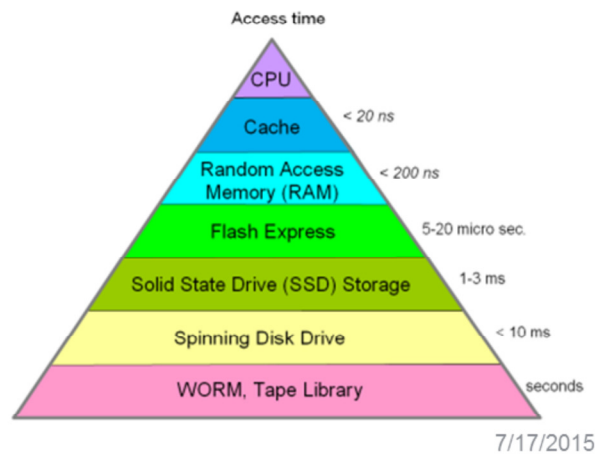
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- Storage Class Memory (SCM) is a new type of memory that can be classified between main storage and auxiliary storage.
- It can be associated with a certain kind of Solid State Drive (very fast) and it is also denoted as *Flash Memory*
- Caution: The abbreviation SCM is also used for Single Chip Module ☺

z/OS 2.2 - SCM I/O Adapter Performance

- Designed for improved paging performance
- Compelling addition to traditional auxiliary storage
- Supports Pageable Large Pages, e.g. with DB2 and Java workloads
- Eliminates delays from SVC or standalone dump processing
- Provides overflow capability for MQSeries list structures



- Flash Memory is exploited by the z/OS Paging Subsystem. Hence it basically provides an extension of the auxiliary storage with an excellent performance.
- Significant benefit can be achieved when a high amount of paging data is affected. This applies especially for Pageable Large Pages of 1 MB Pages.
- High virtual memory is primarily exploited by DB2 and Java workloads. Hence, installations running those workloads should consider to benefit from Flash Express.
- Beyond high performance paging Flash Express can also supply accelerated SVC and standalone dump processing
- The Coupling Facility can exploit SCM as overflow capacity for list structure data. This functionality can be used by MQSeries to avoid structure-full conditions.
- The Flash Express technology is way faster than SSD technology. It provides access times within the microsecond range.

EADM Subchannels

- I/O is managed by Extended Asynchronous Data Mover subchannels (EADM)
- Similar to standard I/O subchannels, but no channel path or device number assigned
- Created automatically at IPL time
- Not tied to a particular device, no association between subchannel and SCM card pair
- Any EADM subchannel can be used to access on any SCM card assigned to the LPAR



- When z/OS needs to read or write data from Storage Class Memory, it creates a new type of channel program and issues a SSCH to a special subchannel called an Extended Asynchronous Data Mover (EADM) subchannel. EADM subchannels are similar to I/O subchannels where you can issue I/O instructions such as SSCH to run channel programs and receive I/O interrupts. However, they do not have channel paths or device numbers assigned, and they are not defined in the I/O configuration. They are created automatically at IPL time.
- Unlike I/O subchannels, which are tied to a particular device, there is no association between an EADM subchannel and a storage increment or SCM card pair. Any EADM subchannel can be used to access storage on any SCM card assigned to the LPAR. The EADM subchannel is simply a certain kind of vehicle for accessing Storage Class Memory.

z/OS 2.2 - SCM Data Gathering

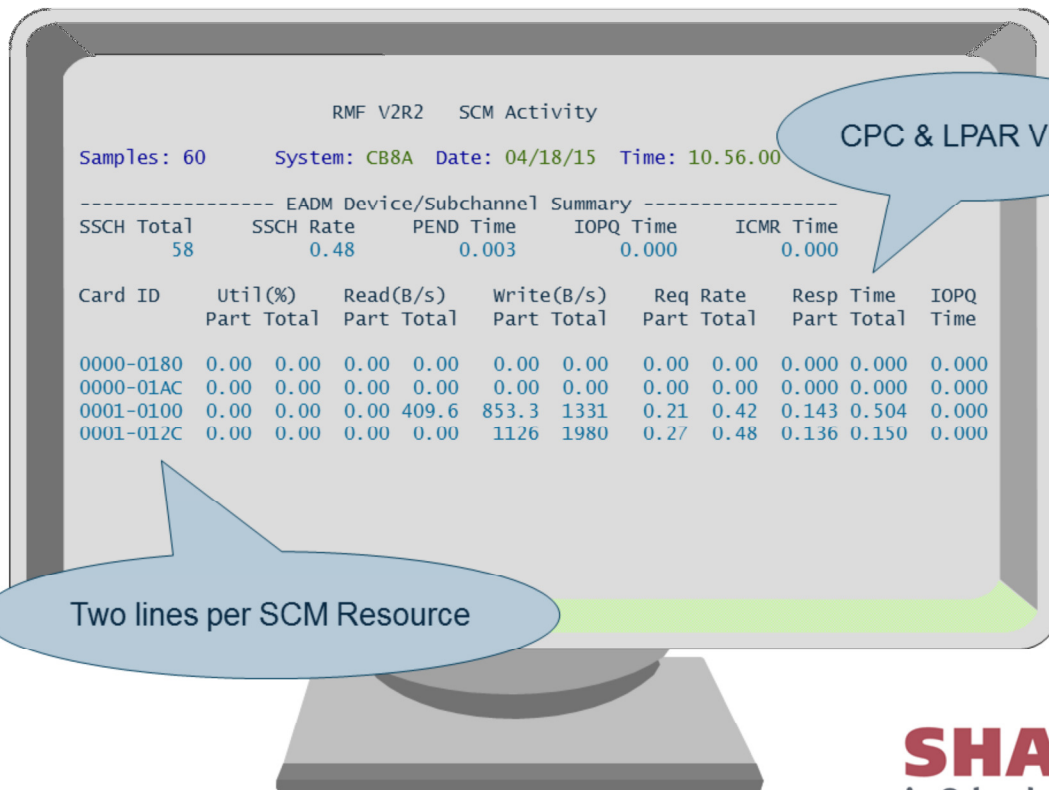
- RMF Monitor III Data Gatherer collects SCM performance statistics frequently
- SCM performance data is written to the new SMF 74 subtype 10 record
- New Monitor III data gatherer option SCM | NOSCM

```
/* **** */
/* NAME:          ERBRMF04                               */
/* DESCRIPTION:    PARMLIB MEMBER WITH RMF MONITOR III GATHERER OPTIONS */
/*               (ALL OPTIONS ARE SET TO DEFAULTS)          */
/* **** */
CYCLE(1000)          /* SAMPLE EVERY SECOND (1000 MSEC) */
DATASET(STOP)        /* NO DATASET SUPPORT                */
DATASET(NOSWITCH)     /* APPEND TO LAST NON-FULL DATASET   */
DATASET(WHOLD(7))    /* CONTROLS BUFFER PAGES IN STORAGE */
MINTIME(100)         /* LENGTH OF MINTIME                 */
NOOPTIONS            /* DO NOT DISPLAY OPTIONS            */
RESOURCE(*JES2,JES2) /* SPECIFIES JES STARTED TASK NAME   */
NOSTOP               /* RUN UNTIL OPERATOR ISSUES STOP    */
SYNC(00)             /* MINTIME SYNCHRONIZATION           */
...                  /*                                     */
PCIE                  /* ACTIVATE PCIE DATA GATHERING     */
SCM                   /* ACTIVATE SCM DATA GATHERING      */
ZFS                   /* ZFS DATA GATHERING               */
```

SCM Data
collected by
default

- Data gathering option SCM / NOSCM was added to RMF Monitor III that can be used to control data collection SCM related activities
- Default value SCM is set in shipped PARMLIB member ERBRMF04
- SCM performance data is written to the new SMF 74 subtype 10 record
- Currently no RMF Postprocessor Report is provided for the SMF 74.10 record
- Third party tools can be used for after-the-facts analysis of SMF 70.10 data (e.g. MXG, EPV Technologies, SMF4U)

z/OS 2.2 - Monitor III SCM Activity Report



RMF V2R2 SCM Activity

Samples: 60 System: CB8A Date: 04/18/15 Time: 10.56.00

----- EADM Device/Subchannel Summary -----

SSCH	Total	SSCH Rate	PEND Time	IOPQ Time	ICMR Time
	58	0.48	0.003	0.000	0.000

Card ID	Util(%)	Read(B/s)	Write(B/s)	Req Rate	Resp Time	IOPQ Time
	Part Total	Part Total	Part Total	Part Total	Part Total	Part Total
0000-0180	0.00	0.00	0.00	0.00	0.000	0.000
0000-01AC	0.00	0.00	0.00	0.00	0.000	0.000
0001-0100	0.00	0.00	409.6	853.3	0.21	0.143
0001-012C	0.00	0.00	1126	1980	0.27	0.150

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The Monitor III SCM Activity report consists of two sections:

- Header section with global EADM subchannel statistics
- Tabular section with performance and thruput statistics on SCM Card level

The EADM subchannel activities are balanced by the system and no tuning is not appliccable for this kind of resource. Hence, the report provides just the accumulated statistics for all subchannels, no statistics on subchannel level.

One SCM Card which is plugged into the PCIe I/O drawer is also denoted as SCM resource.

Since one SCM resource can hold two internal cards, the tabular part of the SCM Activity report shows two lines per SCM resource.

In other words, the term *Card ID* consists of a prefix which identifies the SCM resource and a suffix which identifies the internal card.

The card mirrors are not visible in any way on the SCM Activity report.

The SCM card statistics are available for the local partitions as well as for the entire CPC.

z/OS 2.2 - RMF Data Portal SCM Activity Report



http://hostname:8803/gpm/rmf3.xml?report=SCM&resource=_sysid,MVS_IMAGE

RMF Data Portal for z/OS Home Explore Overview My View ? RMF

20150706114600

RMF Report [CB8A,MVS_IMAGE] : SCM (Storage Class Memory)

Time Range: 07/06/2015 11:46:00 - 07/06/2015 11:47:00

SSCH Rate: 0.07 Total Number of SSCH: 4 Ending Time: 2146964 Avg IOP Queue Time: 0.000

Avg Initial Cmd Response Time: 0.000

Sort Rows

Card ID	Util% (LPAR)	Util% (Total)	Read B/Sec (LPAR)	Read B/Sec (Total)	Write B/Sec (LPAR)	Write B/Sec (Total)	Request Rate (LPAR)	Request Rate (Total)	Avg Response Time (LPAR)	Avg Response Time (Total)	Avg IOP Queue Time (Total)	Requests (LPAR)	Requests (Total)
0001-0100	0.00	0.00	136.5	136.5	68.27	273.1	0.05	0.10	0.256	0.213	0.000	3	6
0000-0180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0	0
0000-01AC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0	0
0001-012C	0.00	0.00	68.27	136.5	0.00	0.00	0.02	0.03	0.128	0.256	0.000	1	2

Fields not available in ISPF Report

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- The statistics of the Monitor III SCM ISPF Report are available also by means of the Monitor III Data Portal without limitations.
- The SCM Report can be selected from the report list and basically all report columns can be displayed in the browser window.

z/OS 2.2 - RMF Distributed Data Server: SCM Metrics



Sysplex

MVS Image

I/O Subsystem

:

SCM

SCM_Card

Processor

Storage

Enqueue

Operator

Subsystems

CPC

LPAR

Coupling Facility

CF Structure

Resource	New metric
SCM	<ul style="list-style-type: none"> ▶ # of SSCH ▶ function pending time ▶ initial command response time ▶ IOP queue time ▶ SSCH rate
SCM (by card) SCM_CARD	<ul style="list-style-type: none"> ▶ % partition utilization ▶ % total utilization ▶ average partition response time ▶ average total response time ▶ average total IOP queue time ▶ partition byte read rate ▶ partition byte write rate ▶ partition request rate ▶ total byte read rate ▶ total byte write rate ▶ total request rate

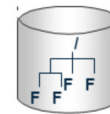
- The RMF DDS Resource Model represents a composition of resources that can exist in a Parallel Sysplex environment
 - MVS_IMAGE is a child resource of resource SYSPLEX
 - I/O_SUBSYSTEM is a child resource of resource MVS_IMAGE
 - Child resource SCM is added to resource I/O_SUBSYSTEM
 - Child resource SCM_CARD is added to resource SCM

A variety of metric values that are related to resource types SCM and SCM_CARD can be requested from the RMF Distributed Data Server (DDS)

- Alternatively, the browser based version of the report can be requested from the RMF Distributed Data Server (DDS) by using the following URL: http://hostname:8803/gpm/rmf3.xml?report=SCM&resource=,sysname,MVS_IMAGE

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zEC12 - Data Compression Express



- The z Enterprise Data Compression (zEDC) Express offering provides a low-cost data compression to z/OS system services and applications.
- Compression can be requested on
 - Dataset level via COMPACTION option in the SMS data class
 - System level via COMPRESS parameter in SYS1.PARMLIB(IGDSMSxx)
- Exploiters will see the following benefits
 - Reduced disk space
 - Increased performance for reading and writing compressed data
- The zEDC is implemented as a Peripheral Component Interconnect Express (PCIe) device that can be installed on zEC12 GA2, zBC12 and z13.
- The compression function is provided via FPGA firmware. Other functions (also denoted as personality) may follow.
- You can install up to eight devices in a single machine where each device is sharable by up to 15 LPARs.



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IBM zEnterprise Data Compression capability and zEDC Express

The growth of data that needs to be captured, transferred, and stored for large periods of time is not relenting. On the contrary, software-implemented compression algorithms are costly in terms of processor resources, and storage costs are not negligible either.

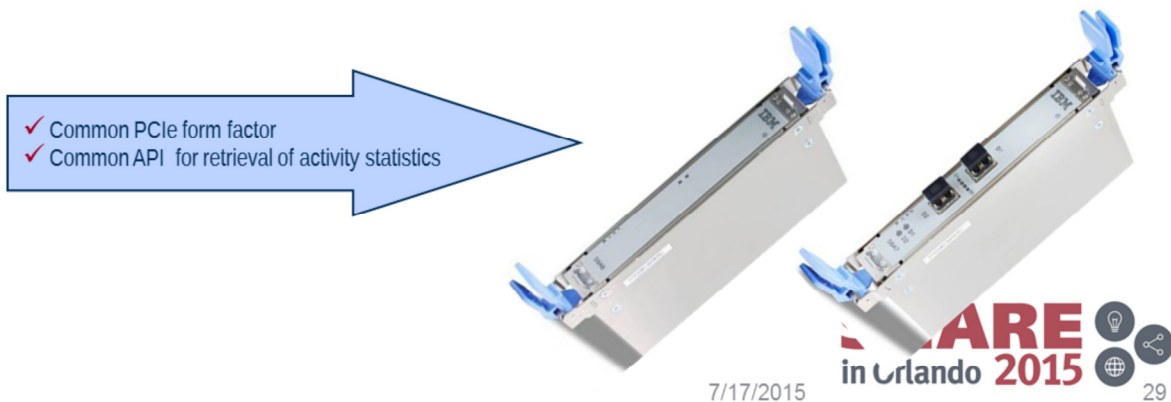
The zEDC Express, an optional feature exclusive to z13, zEC12 and zBC12, addresses that problem by providing hardware-based acceleration for data compression and decompression.

The z/OS V2R1 *IBM zEnterprise Data Compression* acceleration capability uses the *zEDC Express* feature. It delivers an integrated solution to help reduce CPU consumption, optimize performance of compression-related tasks, and enable more efficient use of storage resources, while providing a lower cost of computing and also helping to optimize the cross-platform exchange of data.

zEC12 - Shared Memory Communication



- Shared Memory Communication via Remote Direct Memory Access (SMC-RDMA or SMC-R) is a zEC12 and z13 feature that provides high performance CPC to CPC communication
- SMC-R actually offers the benefits of HiperSockets across processor boundaries. It takes advantage of high speed protocols and direct memory placement of data.
- SMC-R is totally transparent to applications.
- SMC-R is implemented as a Peripheral Component Interconnect Express (PCIe) device, also denoted RoCE adapter card (RDMA over Converged Ethernet)



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10GbE RoCE Express

The 10 Gigabit Ethernet (10GbE) RoCE Express feature uses Remote Direct Access Memory over Converged Ethernet, and can provide fast memory-to-memory communications between two CPCs. It is transparent to applications.

Use of the 10GbE RoCE Express feature might help reduce consumption of CPU resources for applications that use the TCP/IP stack (such as IBM WebSphere® accessing a DB2 database). It might also help reduce network latency with memory-to-memory transfers by using Shared Memory Communications - Remote Direct Memory Access (SMC-R) in z/OS V2R1.

HiperSockets

The *HiperSockets* function is an integrated function of the CPC that provides users with attachments to up to 32 high-speed virtual local area networks with minimal system and network overhead.

HiperSockets is a function of the virtualization Licensed Internal Code (LIC) and provides LAN connectivity across multiple system images on the same CPC by performing memory-to-memory data transfers in a secure way. The HiperSockets function eliminates having to use I/O subsystem operations and having to traverse an external network connection to communicate between logical partitions in the same CPC. Therefore, HiperSockets offers significant value in server consolidation by connecting virtual servers and simplifying the Enterprise network.

Improved functions of HiperSockets (also available on zEC12, zBC12, z196, and z114) include the ability to integrate in the *intraensemble data network (IEDN)*, and support for bridging to z/VM virtual switches.

z/OS - Obtain PCIe Information by Command

- Use the console command **D PCIE** for general status information

PCIE Started Task

```
D PCIE
IQP022I 12.06.02 DISPLAY PCIE 970
PCIE      0013 ACTIVE
PFID  DEVICE TYPE NAME      STATUS  ASID  JOBNAME  PCHID  VFN
0001  Hardware Accelerator  ALLC   0014  FPGHWAM  0380  0001
0020  10GbE RoCE           ALLC   00DE  VTAM     038C
0021  10GbE RoCE           CNFG   0000  0380
0011  Hardware Accelerator  ALLC   0014  FPGHWAM  05C4  0001
```

PCIE Function ID

Owner Name

Physical Channel Identifier

Virtual Function Number

- Use the console command **D PCIE,PFID=xxx** for adapter details

```
D PCIE,PFID=001
IQP024I 12.10.53 DISPLAY PCIE 521
PCIE      0013 ACTIVE
PFID  DEVICE TYPE NAME      STATUS  ASID  JOBNAME  PCHID  VFN
0001  Hardware Accelerator  ALLC   0014  FPGHWAM  0380  0001
CLIENT ASIDS: NONE
Application Description: ZEDC Express
Device State: Ready
Adapter Info - Relid: 000000 Arch Level: 03
                Build Date: 06/28/2013 Build Count: 03
```

Additional info: Obtain PCIe Information via API

IQPINFO – Obtain PCIe Information

- The IQPINFO service provides PCIe related information, including any performance statistics
- The service is described in
MVS Programming: Authorized Assembler Services Reference
- The response data area of the IQPINFO service is mapped by the macros
IQPYPERF PCIe Performance Data Return Area
IQPYPFMB PCIe Function Measurement Block

z/OS V2.1 - RMF Postprocessor PCIE Activity Report



- RMF Monitor III Data Gatherer collects PCIe performance statistics frequently and writes new SMF Record Type 74 Subtype 9
- The new RMF Postprocessor PCIE Activity Report provides detailed information about PCIe Express based functions.
Currently supported functions are:
 - z Enterprise Data Compression (zEDC)
 - Shared Memory Communication via RDMA (SMC-R)
- New suboption PCIE | NOPCIE for Postprocessor REPORTS option
- Only available in XML format

RMF Postprocessor Duration Report [System SYSB] : PCIE Activity Report

RMF Version : z/OS V2R1 SMF Data : z/OS V2R1

Start : 11/14/2013-17.45.00 End : 11/14/2013-18.00.00 Interval : 000:15:00 hours

RoCE

Basic PCIe Metrics, e.g.
PCI Load/Store and DMA
Operations

General PCIE Activity

Function ID	Function PCHID	Function Name	Function Type	Function Status	Owner Job Name	Owner Address Space ID	Function Allocation Time	PCI Load Operations Rate	PCI Store Operations Rate	PCI Store Block Operations Rate	Refresh PCI Translations Operations Rate	DMA Address Space Count	DMA Read Data Transfer Rate	DMA Write Data Transfer Rate
0010	03BC	10GbE RoCE	15B31003	Allocated	VTAM	002A	900	0.921	9499	0	0.104	1	1993	21.8
0040	05EC	10GbE RoCE	15B31003	Allocated	VTAM	002A	900	0.923	9544	0	0.104	1	3434	12.6

- The PCIe performance data is collected by RMF Monitor III and stored in the new SMF 72 subtype 9.
- There is no RMF data gathering option. Data gathering is controlled by the SMF 72-9 setting in the active SMF parmlib member ERBSMFxx. Use TYPE/NOTYPE in the SMFPRMxx parmlib member to enable/disable the data gathering.
- Specify suboption PCIE in the RMF Postprocessor REPORTS control statement to create the new Postprocessor PCIE Activity Report.
- The PCIE Activity Report is only available in XML format.
- XML report can be created and displayed
 - via RMF Data Portal (SMF data from SMF buffer only)
 - via Spreadsheet Reporter (any SMF source)
- There is another option to display the SDELAY report in a web browser:
 - Download the XML output created by the RMF Postprocessor JOB to the toolkit directory provided with the RMF Postprocessor XML Toolkit
 - Open the report in the toolkit directory with your web browser.
- The PCIE Activity Report has up to three sections
 - General PCIE Activity section
 - Measurements for all PCIe functions
 - Data rates for PCI operations transferring data blocks from z/OS to the PCIe function
 - Direct memory access (DMA) read/write counters
 - Hardware Accelerator Activity section
 - Common accelerator request statistics: Queue Time, Execution Time and Request Rate
 - Hardware Accelerator Compression Activity
 - Measurements for zEDC
 - Compression related statistics:
 - Number of compressed bytes in and out
 - Number of decompressed bytes in and out
 - Buffer usage

z/OS V2.1 - RMF Postprocessor PCIE Activity Report



▼ General PCIE Activity

Function ID	Function PCHID	Function Name	Function Type	Function Status	Owner Job Name	Owner Address Space ID	Function Allocation Time	PCI Load Operations Rate	PCI Store Operations Rate	PCI Store Block Operations Rate	Refresh PCI Translations Operations Rate	DMA Address Space Count	DMA Read Data Transfer Rate	DMA Write Data Transfer Rate
00A0	03C0	Hardware Accelerator	1014044B	Allocated	FPGHWAM	0012	14400	0	0.054	0	<0.01	1	21.8	21.2
00B0	0500	Hardware Accelerator	1014044B	Allocated	FPGHWAM	0012	14400	0	0.054	0	<0.01	1	1.19	1.19

zEDC

Common Request Statistics across all Personalities (Compression and future Personalities)

▼ Hardware Accelerator Activity

Function ID	Time Busy %	Request Execution Time	Std Dev for Request Execution Time	Request Queue Time	Std Dev for Request Queue Time	Request Size	Transfer Rate Total
00A0	0.002	27.7	4.77	462	70.0	69.6	0.056
00B0	0.002	28.6	5.07	487	39.8	69.6	0.059

Compression related Statistics

▼ Hardware Accelerator Compression Activity

Function ID	Compression Request Rate	Compression Throughput	Compression Ratio	Decompression Request Rate	Decompression Throughput	Decompression Ratio	Buffer Pool Size	Buffer Pool Utilization
00A0	0.140	0.008	5.03	0.665	0.008	0.198	15360	0
00B0	0.139	0.008	5.03	0.713	0.008	0.198	15360	0

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- The General PCIE Activity section displays common hardware related statistics independent of the special purpose or type of card, e.g. Number of Load and Store operations.
- The Hardware Accelerator Activity section shows statistics which are common for all accelerator types of PCIE cards, e.g. Execution and queueing related metrics.
- Since the RoCE card is not an accelerator card, no statistics are applicable for this card type.
- The last section displays statistics related to the individual personality of the accelerator card. Hence, for the zEDC card we see compression related statistics in this section.
- Other personalities and hence additional personality related sections are subject of future extensions, e.g. a sort accelerator card might be a future candidate.

z13 - RMF PCIE Enhancements



- z13 introduces new PCIE performance measurements for RDMA-over-converged-ethernet (RoCE Express) and zEnterprise data compression (zEDC) devices
 - Existing DMA read/write measurements are replaced by new PCIE function type specific measurements
 - For RoCE Express devices, there are four new measurements
 - **Received-Bytes** No. of bytes received on the external ethernet interface
 - **Transmitted-Bytes** No. of bytes transmitted on the external ethernet interface
 - **Received-Packets** No. of packets received on the external ethernet interface
 - **Transmitted-Packets** No. of packets transmitted on the external ethernet interface
 - For zEDC devices, there are two new measurements
 - **Consumed-Work-Units** No. of work units processed by the PCI function
 - **Maximum Work Units** Maximum no. of work units that the PCI function is capable of processing per second
- With zEC12 / zBC12, the existing DMA Read/Write metrics are still maintained
 - **DMA Reads** No. bytes transferred from DMA address spaces to PCIE function
 - **DMA Writes** No. bytes transferred from PCIE function to DMA address spaces

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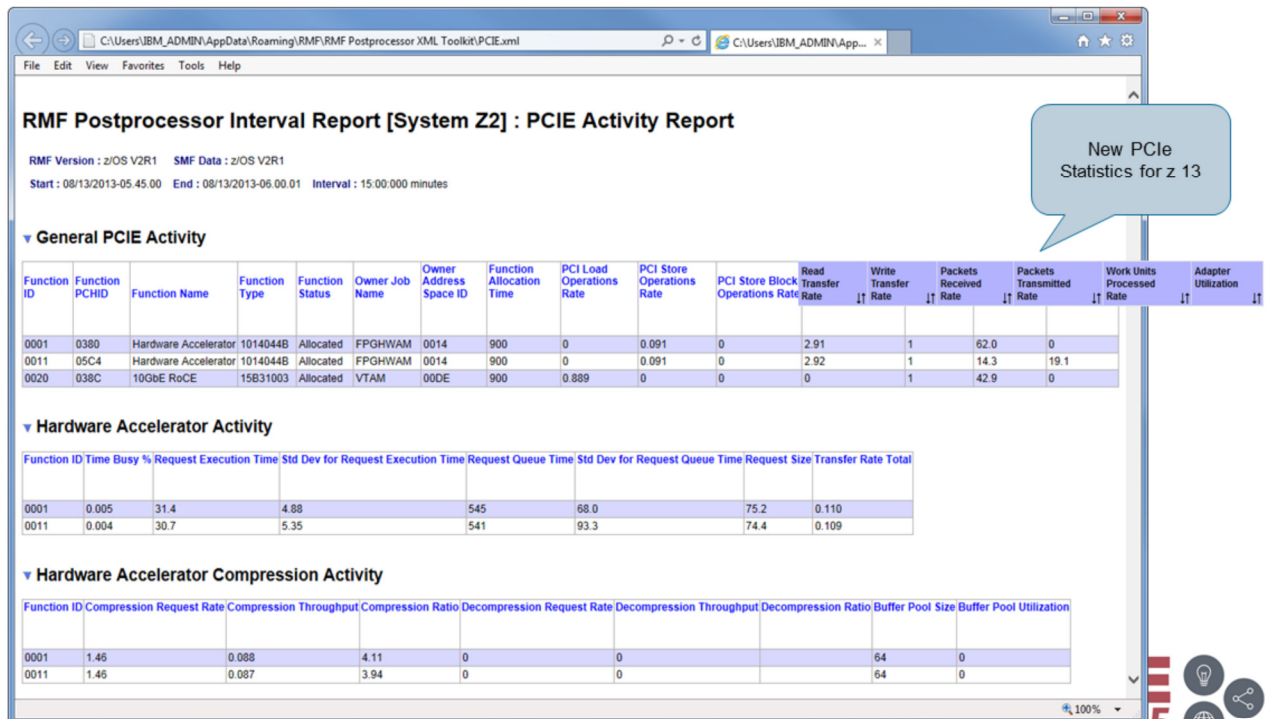
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RMF PCIE monitoring and reporting functionality is enhanced to support new measurements for PCIe-attached RoCE and zEDC devices configured on z13.

z13 - RMF Postprocessor PCIE Activity Report



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- Due to this architectural change with z13, PCIe Read and Write statistics can now be obtained independent of the DMA address space.
- The PCIe related throughput is now reported in terms of Byte Transfer Rates and additionally as Packet Rates.
- Since on z13 the actual number of processed work units as well as the theoretical maximum number of work units can be retrieved, the PCIe adapter utilization can be calculated and reported as well.

z/OS V2.2 – RMF Monitor III PCIE Activity Report



- RMF Monitor III Data Gatherer collects PCIe performance statistics frequently
- z/OS V2.1 introduced RMF Postprocessor PCIe Activity Report for after-the-facts analysis with SMF 74.9 data
- The new RMF Monitor III PCIe Activity Report provides detailed short-term information about PCIe Express based functions. Currently supported functions are:
 - z Enterprise Data Compression (zEDC)
 - Shared Memory Communication via RDMA (SMC-R)
- New Monitor III data gatherer option PCIE | NOPCIE



```

/*****
/* NAME:          ERBRMF04
/* DESCRIPTION:  PARMLIB MEMBER WITH RMF MONITOR III GATHERER OPTIONS
/*              (ALL OPTIONS ARE SET TO DEFAULTS)
/*****
CYCLE(1000)      /* SAMPLE EVERY SECOND (1000 MSEC)
DATASET(STOP)    /* NO DATASET SUPPORT
DATASET(NOSWITCH) /* APPEND TO LAST NON-FULL DATASET
DATASET(WHOLD(7)) /* CONTROLS BUFFER PAGES IN STORAGE
MINTIME(100)     /* LENGTH OF MINTIME
NOOPTIONS        /* DO NOT DISPLAY OPTIONS
RESOURCE(*JES2,JES2) /* SPECIFIES JES STARTED TASK NAME
NOSTOP           /* RUN UNTIL OPERATOR ISSUES STOP
SYNC(00)         /* MINTIME SYNCHRONIZATION
.....
VSAMRLS         /* ACTIVATE VSAM RLS GATHERING
OPD             /* ACTIVATE OMVS PROCESS DATA GATHERING
PCIE            /* ACTIVATE PCIE DATA GATHERING
ZFS             /* ACTIVATE ZFS DATA GATHERING
    
```

Default value PCIE set in shipped PARMLIB member ERBRMF04



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- New Monitor III PCIE Activity report allows short-term performance analysis of RoCE devices and zEDC hardware accelerators. Before z/OS 2.2, performance problems on PCIe devices and hardware accelerators could only be analyzed after the facts using SMF 74.9 / RMF Postprocessor, now RMF online monitoring can be used to identify performance problems on short notice when they appear.
- Users can control whether or not they want Monitor III to collect PCIE activity data by specifying data gathering option: PCIE | NOPCIE
- Default value PCIE is set in shipped PARMLIB member ERBRMF04

z/OS V2.2 – RMF Monitor III PCIE Activity Report



- Request the Monitor III PCIE Activity Report by selection **3** from the Primary Menu & selection **14** from the Resource Report Selection Menu or enter command: **PCIE** or **PCI**
- Metrics on the report main panel are independent of the type of the exploited hardware feature and reflect the activity of the z/OS system on which RMF data collection took place.

ISPF Report

Command ==>										RMF V2R2 PCIE Activity				Line 1 of 3			
														Scroll ==> CSR			
Samples: 300			System: TA2			Date: 02/18/15		Time: 22.20.00		Range: 300		Sec					

Function		Alloc - PCI Operations		Rate -		-Xfer Rate -											
ID	PCID	Type	Jobname	ASID	Status	Time%	Load	Store	Block	Refr	Read	Write					
006C	0204	zEDC	FPGHWAM	0013	Alloc	100	0	102	0	14.0							
007C	025C	zEDC	FPGHWAM	0013	Alloc	100	0	102	0	14.0							
00A2	013C	RoCE	VTAM390	002C	Alloc	100	0.113	5999	0	1.69	0.267	288					



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The Monitor III PCIE Activity Report can be used to investigate performance problems that are related to PCI Express based functions.

On the main panel, metrics are displayed that are independent of the type of the exploited hardware feature and reflect the activity of the z/OS system on which RMF data collection took place.

FIELD MEANINGS ... Comparable to PP report, on main panel ISPF panel only the most relevant performance measurements can be shown (restriction on 3270 panel size), but → next slide ...

z/OS V2.2 – RMF Monitor III PCIE Activity Report



- Additional metrics are displayed for **zEDC Accelerators** on pop-up panel HW Accelerator And Compression Activity

Command ==> RMF V2R2 PCIE Activity Line 1 of 3
Scroll ==> CSR

Samples: 300 System: TA2 Date:

ID	PCID	Type	Jobname	ASID	Status
006C	0204	zEDC	FPGHWAM	0013	Alloc
007C	025C	zEDC	FPGHWAM	0013	Alloc
00A2	013C	RoCE	VTAM390	002C	Alloc

RMF Hardware Accelerator And Compression Activity

Press Enter to return to the Report panel.

Function ID : 006C Alloc Time % : 99.7
Allocated : 22.03.22 on 02/18/15

Hardware Accelerator
Time Busy % : 0.286 Transfer Rate : 4.87

Request
Execution Time : 28.0 Std. Deviation: 8.07
Queue Time : 65.7 Std. Deviation: 140
Size : 47.6

Buffer Pool
Memory Size : 16 Utilization : 0

Request Rate : 102 Compression Decompression
Throughput : 2.91 0.437 0.009
Ratio : 2.79 0.652

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- No additional metrics, no pop-up panel for **RoCE devices**

If cursor is placed on one of the cursor sensitive fields *Function ID*, *Function PID*, or *Function Type*, additional metrics are displayed for **zEDC Accelerators** on pop-up panel HW Accelerator And Compression Activity

If cursor is placed on one of the cursor sensitive fields *Function ID*, *Function PID*, or *Function Type*, message "No additional information available" is displayed when selected PCIE function is a **RoCE device**

Alternatively, the browser based version of the report can be requested from the RMF Distributed Data Server (DDS) by using the following URL ... → see next slide

z/OS V2.2 – RMF Data Portal PCIE Activity Report



RMF Report - One Row [,SYSF,MVS_IMAGE] : PCIE (PCIE Activity)

Time Range: 05/04/2015 10:02:00 - 05/04/2015 10:03:00

Function Id	0022
Function PID	037C
Function Type	zEDC
Jobname	FPGHWAM
ASID	0012
Function Status	Alloc
% Alloc Time	100
Allocation Date	04/30/15
Allocation Time	16.02.43
Load Operations Rate	0
Store Operations Rate	0
Store Block Operations Rate	0
Refresh PCI Translations Operations Rate	0
Xfer Read Rate	0
Xfer Write Rate	0

HWA Time % Busy	0
HWA Transfer Rate	0
Request Execution Time	
Request Queue Time	
Request Size	
Request Execution Time StdDev	
Request Queue Time StdDev	
Compression Request Rate	0
Decompression Request Rate	0
Compression Throughput	0
Decompression Throughput	0
Compression Ratio	
Decompression Ratio	
Buffer Pool Memory Size	16
Buffer Pool % Utilization	
# DMA AS	1
HWA Type	zCompression
Received Packets Rate	
Transmitted Packets Rate	
Work Unit Rate	
Adapter Utilization	

http://hostname:8803/gpm/rmf3.xml?report=PCIE&resource=,sysid,MVS_IMAGE

RMF Data Portal for z/OS

Home

Explore

Overview

My View

?

RMF Report [,SYSF,MVS_IMAGE] : PCIE (PCIE Activity)

Time Range: 05/04/2015 10:02:00 - 05/04/2015 10:03:00

Function Id	Function PID	Function Type	Jobname	ASID	Function Status	% Alloc Time	Allocation Date	Allocation Time	Load Operations Rate
0022	037C	zEDC	FPGHWAM	0012	Alloc	100	04/30/15	16.02.43	0
0026	037C	zEDC	FPGHWAM	0012	Alloc	100	04/30/15	16.02.43	0
0029	03BC	zEDC	FPGHWAM	0012	Alloc	100	04/30/15	16.02.43	0
002C	03BC	zEDC	FPGHWAM	0012	Alloc	100	04/30/15	16.02.43	0

Sort Rows

ISPF Fields

Hyperlink to vertical View

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The statistics of the Monitor III PCIE ISPF Report are available also by means of the Monitor III Data Portal without limitations.

The PCIE Report can be selected from the report list and basically all report columns can be displayed in the browser window.

But due to the high number of report columns of you need to use the slider in order to see the rightmost columns as well.

As an alternative, you can also switch to the vertical report view to see all measurements for a selected device at a glance.

z/OS V2.2 – RMF Distributed Data Server: PCIE Metrics



Sysple

x MVS Image
I/O Subsystem
:
PCIE
PCIE_Function
Processor
Storage
Enqueue
Operator
Subsystems
CPC
LPAR
Coupling Facility
CF Structure

Resource	New metric
PCIE	<ul style="list-style-type: none"> ▶ ... by PCIE function
PCIE_Function	<ul style="list-style-type: none"> ▶ % allocation time ▶ % buffer pool utilization ▶ % time busy ▶ buffer pool memory size ▶ compression ratio ▶ compression request rate ▶ compression throughput ▶ decompression ratio ▶ decompression request rate ▶ decompression throughput ▶ received packets rate ▶ request execution time ▶ request execution time standard deviation ▶ request queue time ▶ request queue time standard deviation ▶ request size ▶ transfer rate ▶ transfer read rate ▶ transfer write rate ▶ transmitted packets rate ▶ work unit rate ▶ PCI adapter utilization ▶ PCI load operations rate ▶ PCI refresh operations rate ▶ PCI store block operations rate ▶ PCI store operations rate

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RMF Distributed Data Server (DDS) supports new resource types *PCIE* and *PCIE Function* to allow performance analysis of RoCE devices and zEDC hardware accelerators by DDS API exploiters

RMF DDS Resource Model represents a composition of resources that can exist in a Parallel Sysplex environment

- MVS_IMAGE is a child resource of resource SYSPLEX
- I/O_SUBSYSTEM is a child resource of resource MVS_IMAGE
- Child resource PCIE is added to resource I/O_SUBSYSTEM
- Child resource PCIE_FUNCTION is added to resource PCIE

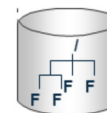
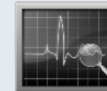
A variety of metric values that are related to resource types PCIE and PCIE_FUNCTION can be requested from the RMF Distributed Data Server (DDS)

The metrics are available as single valued metrics for the PCIE_FUNCTION resource and as list valued metrics for the PCIE resource.

RMF Enhancements at a Glance



- IBM z13 Support
 - RMF Statistics for Simultaneous Multithreading (SMT)
 - Extended ICSF Measurements for Crypto Express5S
 - Support for LPARs with up to 4TB Real Storage
- SCM I/O Adapter Performance Reporting
 - Statistics for EADM Subchannel Activities
 - Performance and Thruput on SCM Card Level
- PCIE Activity Reporting
 - z/OS V2.1 Postprocessor PCIE reporting
 - Additional Measurements for PCIe attached RoCE and zEDC Devices
 - z/OS V2.2 Monitor III PCIE Report
- z/OS V2.2 Monitor III Job Resource Consumption Reporting
 - CPU, I/O and Storage Consumption Data at a Glance
 - Detailed Statistics for Job related GQSCAN Activities
- z/OS V2.2 zFS Reporting Enhancements
 - Sysplex-wide Statistics for zFS Usage and Performance
 - Improved zFS Data Gathering Performance
 - Additional zFS Statistics for Shared File System environments
- z/OSMF Resource Monitoring
 - Historical Reporting & Spreadsheet Export
- The zEvent Mobile Application
 - Receive Push Messages based on critical System Events
 - Access to RMF Data Portal and z/OSMF Resource Monitoring



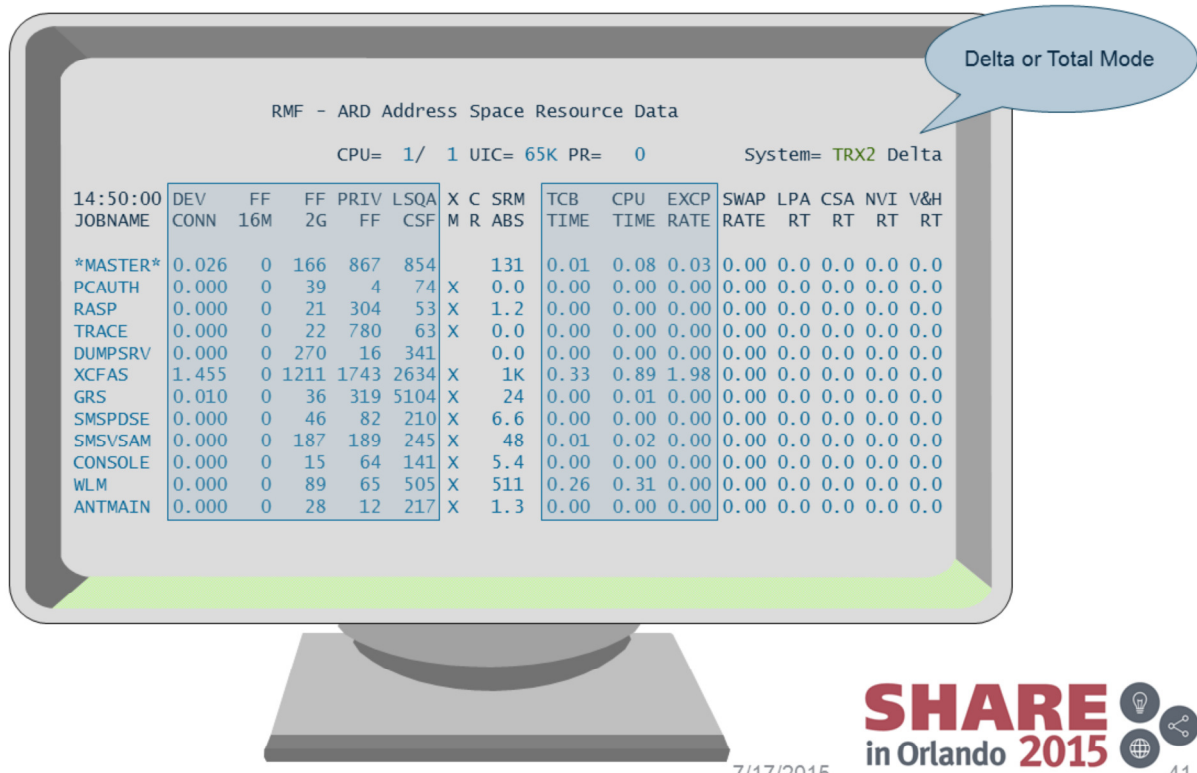
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Job Resource Consumption Reporting – Monitor II ARD Report



RMF Monitor II provides job related resource consumption by means of the following reports

- Address Space Resource Data
- Address Space State Data
- Address Space SRM Data

The data is reported on snapshot base for a certain interval (Delta mode) or it is accumulated for the entire life cycle of the address space (Total mode)

However, there is now comprehensive report for job related resource consumption, the data is spread on three different reports.

For this reason, with z/OS V2R2 RMF the new Monitor III Job Usage Report is introduced.

The ARD report gives information on the system resources that are used by an address space. The information provided in this report includes, for example, information on processor time, paging, and central storage.

The ARD report enables you to determine which jobs are creating performance problems.

From the Monitor II ARD Report, the following statistics are now also available in Monitor III

- Device Connect Time
- Fixed Frame Counts on Virtual Storage location level
- TCB Times and Total CPU Times
- EXCP Rates

Job Resource Consumption Reporting – Monitor II ASD Report

```

RMF - ARD Address Space State Data

CPU= 1/ 1 UIC= 65K PR= 0 System= TRX2 Delta

14:50:00
JOBNAME SRVCLASS P L S C R DP CS CS TAR X PIN TX SWAP WSM
              F   F   PR   F   TAR WSS M RT SC RV   RV

*MASTER* SYSTEM 1 NS FF 6353      0      0 0 0 0
PCAUTH    SYSTEM 1 NS FF 129      0 X 0 0 0 0
RASP      SYSTEM 1 NS FF 363      0 X 0 0 0 0
TRACE     SYSTEM 1 NS FF 872      0 X 0 0 0 0
DUMPSRV   SYSTEM 1 NS FF 583      0      0 0 0 0
XCFAS     SYSTEM 1 NS FF 7814     0 X 0 0 0 0
GRS       SYSTEM 1 NS FF 14.1K    0 X 0 0 0 0
SMSPDSE   SYSTEM 1 NS FF 4320     0 X 0 0 0 0
SMSVSAM   SYSTEM 1 NS FF 3310     0 X 0 0 0 0
CONSOLE   SYSTEM 1 NS FF 4477     0 X 0 0 0 0
WLM       SYSTEM 1 NS FF 29.0K    0 X 0 0 0 0
ANTMAIN   SYSTEM 1 NS FF 1511     0 X 0 1 998

```

The ASD report gives an overview of the current state of an address space. Basically, the report tells you where each address space is and what it is doing.

You can use the ASD report, for example, to determine which jobs are using large amounts of central storage or which jobs are being swapped excessively and why the swapping is occurring.

If you have a workload delaying your application, you can check the workloads dispatching priority (**DP PR**) on the ASD report, and change it if necessary.

From the Monitor II ASD Report, the following statistics are now also available in Monitor III

- Service Class and Service Class Period
- Dispatching Priority
- Central Storage Frame Counts

Job Resource Consumption Reporting – Monitor II ASRM Report

RMF - ASRM Address Space SRM Data

CPU= 1/ 1 UIC= 65K PR= 0 System= TRX2 Delta

14:33:58

JOBNAME	SRVCLASS	S	TRANS P	TRANS CUR	RES	TX CT	TX SC	TX CPU	TX MSO	TX IOC	TX SRB	SESS TOTAL
MASTER	SYSTEM	1	31:10	31:10:51	1	0	5183K	0	51347	17549K	22784K	
PCAUTH	SYSTEM	1	31:10	31:10:54	1	0	42	0	5	158	205	
RASP	SYSTEM	1	31:10	31:10:54	1	0	20855	0	0	172162	193017	
TRACE	SYSTEM	1	31:10	31:10:54	1	0	374	0	80	357	811	
DUMPSRV	SYSTEM	1	31:10	31:10:36	1	0	3296	0	2910	1711	7917	
XCFAS	SYSTEM	1	31:10	31:10:41	1	0	87313K	0	1181K	142.2M	230.7M	
GRS	SYSTEM	1	31:10	31:10:54	1	0	17289K	0	180	3351K	20640K	
SMSPDSE	SYSTEM	1	31:10	31:10:54	1	0	1111K	0	0	172760	1283K	
SMSVSAM	SYSTEM	1	31:10	31:10:41	1	0	3157K	0	2945	4832K	7992K	
CONSOLE	SYSTEM	1	31:10	31:10:54	1	0	3670K	0	2815	897165	4570K	
WLM	SYSTEM	1	31:10	31:10:41	1	0	70296K	0	910	13016K	83312K	
ANTMAIN	SYSTEM	1	31:10	31:10:41	1	1	217423	0	3360	49190	269973	
ANTAS000	SYSSTC	1	31:10	31:10:36	1	1	21204	0	2945	2657	26806	

The ASRM report gives an overview of the system resources that are used by an address space.

The report gives, for example, information on processor service, storage service, and I/O service.

The report enables you to determine which jobs are using which services and whether certain jobs are creating performance problems by making excessive use of system services.

From the Monitor II ASRM Report, the following statistics are now also available in Monitor III

- Service Class and Service Class Period
- Transaction Active Times
- Transaction Current Resident Times
- Transaction Counts

z/OS V2.2 – Monitor III USAGE Report

- Request the Monitor III USAGE Report by selection **1** from the Primary Menu & selection **4A** from the Overview Report Selection Menu or enter command: **USAGE [job_class, service_class]** or **USG**

Identify Top Resource Consumers at a Glance

RMF V2R2 Job Oriented Usage

Samples: 60 System: TRX1 Date: 04/18/15 Time: 10.56.00 Range: 60 Sec

Jobname	Service CX Class	--- I/O ---		--- CPU ---		- Storage -		----- QScan -----		
		Conn	EXCP	Total	TCB	Total	Fixed	Total	Resct	Time
XCFAS	S SYSTEM	0.446	1.97	0.25	0.11	7754	2384	0	0.0	0
BHBE	T TSOCLASS	0.103	3.90	0.07	0.07	21	623	1	0.0	2581
MASTER	S SYSTEM	0.042	0.00	0.02	0.00	6323	1107	0	0.0	0
SMF	S SYSTEM	0.028	0.00	0.00	0.00	900	210	0	0.0	0
CATALOG	S SYSTEM	0.027	0.17	0.03	0.03	1824	228	0	0.0	0
GRS	S SYSTEM	0.020	0.00	0.01	0.01	14136	451	0	0.0	0
JES2	S SYSSTC	0.010	0.38	0.03	0.02	9277	1041	0	0.0	0
NET	S SYSSTC	0.010	0.00	0.01	0.00	3050	138	0	0.0	0
DFSZFS	S SYSSTC	0.008	0.60	0.00	0.00	30660	499	0	0.0	0
OMVS	S SYSTEM	0.006	0.17	0.00	0.00	16098	356	0	0.0	0
SMS	S SYSSTC	0.004	0.93	0.00	0.00	548	89	0	0.0	0
PAGENT	SO SYSSTC	0.003	9.45	0.01	0.01	2978	18072	0	0.0	0
H7SPROC	SO SYSSTC	0.000	0.00	0.00	0.00	5125	183	0	0.0	0

The new Monitor III Job Usage Report provides a comprehensive overview about job related resource consumption.

The report is arranged accordingly to the primary resource categories:

- I/O
- CPU
- Storage

By default the report is sorted by descending I/O Connect Time

In the ISPF Version of the report the counts in the visible columns are related to the current Monitor III Range.

Furthermore the total accumulated counts (as applicable by means of the Monitor II Total Mode) are also stored in the Monitor III ISPF table.

Hence, those counts can also be made visible by using the Monitor III Format Table Definition Utility ERBRMFU.

In addition to the general resource consumption statistics, the new report displays statistics about job related QSCAN activities:

From the API perspective, QSCAN requests can be initiated by QGSAN macro or ISGQUERY REQINFO=QSCAN. (ISGQUERY REQINFO=QSCAN is the IBM recommended replacement of QSCAN)

The following counts are reported:

- QScan Total: Total requests is the accumulated number of QScan requests for the address space
- QScan Resct: Resct is the average number of resources returned by QScan requests for the address space
- Qscan Time: Time is the average QScan request time in microseconds for the address space

z/OS V2.2 – Monitor III USAGE Report: Cursor Sensitivity Targets

RMF V2R2 Job Oriented Usage

Samples: 60 System: TRX1 Date: 04/18/15 Time: 10.56.00 Range: 60 Sec

Jobname	Service CX Class	--- I/O ---		--- CPU ---		- Storage -		----- QScan -----		
		Conn	EXCP	Total	TCB	Total	Fixed	Total	Resct	Time
XCFAS	S SYSTEM	0.446	1.97	0.25	0.11	7754	2384	0	0.0	0
MASTER	S SYSTEM	0.042	0.00	0.02	0.00	6323	1107	0	0.0	0
SMF	S SYSTEM	0.028	0.00	0.00	0.00	900	210	0	0.0	0
CATALOG	S SYSTEM	0.027	0.17	0.03	0.03	1824	228	0	0.0	0
GRS	S SYSTEM	0.020	0.00	0.01	0.01	14136	451	0	0.0	0
JES2	S SYSSTC	0.010	0.38	0.03	0.02	9277	1041	0	0.0	0
NET	S SYSSTC	0.010	0.00	0.01	0.00	3050	138	0	0.0	0
DFSZFS	S SYSSTC	0.008	0.60	0.00	0.00	30660	499	0	0.0	0
OMVS	S SYSTEM	0.006	0.17	0.00	0.00	16098	356	0	0.0	0
SMS	S SYSSTC	0.004	0.93	0.00	0.00	548	89	0	0.0	0
PAGENT	SO SYSSTC	0.003	9.45	0.01	0.01	2978	18072	0	0.0	0
HZSPROC	SO SYSSTC	0.000	0.00	0.00	0.00	5125	183	0	0.0	0

In case of general resource contention, the Job Usage report can serve as an excellent starting point for further analysis and problem determination.

In this context the Monitor III Cursor Sensitivity feature can be used to drill-down problems efficiently.

z/OS V2.2 – RMF Monitor III USAGE Report



- The set of report options common to Monitor III address space related reports is applicable for the USAGE report
- Use RO command to filter by address space type or WLM service class

RMF Delay Report Options: USAGE Line 1 of 2

Command ==> Scroll ==> CSR

Change or verify parameters. To exit press END.
Changes will apply to DELAY, DEV, ENQ, HSM, JES, PROC, PROCU, STOR, STORC, STORF, STORM, USAGE and XCF.

Class ==> ALL Classes: ALL TSO BATCH STC ASCH OMVS

Service class ==> *ALL *ALL or one of available service classes below

Jobs ==> NO View job selection/exclusion panel next (YES NO)

Available Service classes

BTCHDEF	GPMSSERVE	OE	OMVSKERN	STCDEF	TSODEF	SYSTEM
SYSSSTC						

RMF Delay Report Options: USAGE Line 1 of 18

Command ==> Scroll ==> CSR

Select (S), exclude (X), or fill-in jobs for report. Press END.

Sel	Jobname	Sel	Jobname	Sel	Jobname	Sel	Jobname	Sel	Jobname
-									
S	*ALL		*MASTER*		ALLOCAS		ANTAS000		ANTMAIN
	APPC		ASCH		ASCHINT		AUXMON		AXR
	AXR04		BJAG		BKGE		BKGEDDSF		BLUCIUS
	BMAI		BPMU		BPX0INIT		CATALOG		CAZ0
	CBDQDISP		CEA		CFZCIM		CONSOLE		CSF

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The set of common report options for all Monitor III address space related reports will be applicable for the new USAGE report as well.

The RO command displays the Report Options panel which allows you to filter the report by address space type or WLM service class.

Once you specify **YES** in the *Jobs* input field, the Job Selection/Exclusion panel is displayed in order to filter the report by specific job names.

In addition, you can invoke the report directly by specifying an address space type or service class name as parameter (e.g. *USAGE S* or *USAGE SYSSSTC*).

z/OS V2.2 – RMF Data Portal Job Usage Report



RMF Report - One Row [TRX2,MVS_IMAGE] : USAGE

Time Range: 05/04/2015 19:15:00 - 05/04/2015 19:16:00

Jobname	DFSZFS
ASID (dec)	0036
Job Class	S
Job Class Ext	S
Service Class	SYSSTC
Period	1
Dispatching Priority	FE
Transaction Active Time	99:05:20
Transaction Resident Time	99:05:20
Transaction Count	2
Total Frames	31083
Fixed Frames	501
Fixed Frames High	470
Fixed Frames Above	31
Fixed Frames Below	0
Total Device Connect Time	27.20
Device Connect Time	0.006
EXCP Rate	0.60
Total CPU Time	19.44
CPU Time	0.00
Total TCB Time	16.37
TCB Time	0.00
QSCAN Requests	0
Specific QSCAN Requests	0
QSCAN Resource Count	0.0
QSCAN Resource Count Std.Dev	0.0
QSCAN Request Time	
QSCAN Request Time Std.Dev	

http://hostname:8803/gpm/rmf3.xml?report=USAGE&resource=,sysid,MVS_IMAGE

RMF Data Portal for z/OS Home Explore Overview My View

Sort Rows

RMF Report [TRX2,MVS_IMAGE] : USAGE (Job Oriented Usage)

Time Range: 05/04/2015 19:15:00 - 05/04/2015 19:16:00

Jobname	ASID (dec)	Job Class	Job Class Ext	Service Class	Period	Dispatching Priority	Transaction Active Time	Transaction Resident Time
MASTER	0001	S	S	SYSTEM	1	FF	99:24:20	99:24:20
XCFAS	0006	S	S	SYSTEM	1	FF	99:05:20	99:05:20
JES2	0052	S	S	SYSSTC	1	FE	99:05:20	99:05:20
CATALOG	0047	S	S	SYSTEM	1	FF	99:05:20	99:05:20
RMFGAT	0065	S	SO	SYSSTC	1	FE	99:05:20	99:05:20
GRS	0007	S	S	SYSTEM	1	FF	99:05:20	99:05:20
SMF	0030	S	S	SYSTEM	1	FF	99:05:20	99:05:20
SMS	0024	S	S	SYSSTC	1	FE	99:05:20	99:05:20
DFSZFS	0036	S	S	SYSSTC	1	FE	99:05:20	99:05:20
NET	0063	S	S	SYSSTC	1	FE	99:05:20	99:05:20
OMVS	0016	S	S	SYSTEM	1	FF	99:05:20	99:05:20
CONSOLE		S	S	SYSTEM	1	FF	99:05:20	99:05:20

Hyperlink to vertical View

ISPF Fields

Hyperlink to vertical View

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The new Monitor III USAGE report will be added to the standard reports which are available in XML format by means of the RMF Distributed Data Server.

Therefore all statistics of the Monitor III Job Usage ISPF Report are available also by means of the Monitor III Data Portal without limitations.

The USAGE Report can be selected from the report list and basically all report columns can be displayed in the browser window, also by using the following URL:

http://hostname:8803/gpm/rmf3.xml?report=USAGE&resource=,sysname,MVS_IMAGE

Sorting is possible in the RMF Data Portal: Just one click on the column header brings the job with the highest consumption count to the top.

But due to the high number of report columns you need to use the slider in order to see the rightmost columns as well. So, as an alternative, you can also switch to the vertical report view to see all measurements for a selected device at a glance.

Clicking on a jobname will display all the values for this job in one single view.

z/OS V2.2 – RMF USAGE Report: RMF Distributed Data Server Metrics



Sysple

X

MVS Image
I/O Subsystem
Processor
Storage
Enqueue
Operator
Subsystems
CPC
LPAR
Coupling Facility
CF Structure

Resource	New metric
MVS_IMAGE	<ul style="list-style-type: none"> ▶ transaction active time by job ▶ transaction resident time by job ▶ # transactions by job ▶ # QSCAN generic requests by job ▶ # QSCAN specific requests by job ▶ # QSCAN resources by job ▶ # QSCAN resources standard deviation by job ▶ QSCAN request time by job ▶ QSCAN request time standard deviation by job
STORAGE	<ul style="list-style-type: none"> ▶ # frames fixed below 16 MB by job ▶ # frames fixed above 16 MB by job ▶ # frames fixed above 2 GB by job
I/O_SUBSYSTEM	<ul style="list-style-type: none"> ▶ total device connect time by job ▶ connect time by job ▶ EXCP rate by job
PROCESSOR	<ul style="list-style-type: none"> ▶ total CPU time by job ▶ CPU time by job ▶ total TCB time by job ▶ TCB time by job

DDS metrics extracted from the Job USAGE Report



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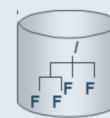
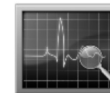
In addition a subset of the metrics contained in the USAGE report were added to the job related DDS metrics. Hence, these metrics are supported by the RMF Performance Data Portal and the z/OSMF Resource Monitoring GUI.

Since the Job Usage Report contains comprehensive address space related statistics, the new DDS metrics which are extracted from this report are spread across multiple resources.

RMF Enhancements at a Glance



- IBM z13 Support
 - RMF Statistics for Simultaneous Multithreading (SMT)
 - Extended ICSF Measurements for Crypto Express5S
 - Support for LPARs with up to 4TB Real Storage
- SCM I/O Adapter Performance Reporting
 - Statistics for EADM Subchannel Activities
 - Performance and Thruput on SCM Card Level
- PCIE Activity Reporting
 - z/OS V2.1 Postprocessor PCIE reporting
 - Additional Measurements for PCIe attached RoCE and zEDC Devices
 - z/OS V2.2 Monitor III PCIE Report
- z/OS V2.2 Monitor III Job Resource Consumption Reporting
 - CPU, I/O and Storage Consumption Data at a Glance
 - Detailed Statistics for Job related GQSCAN Activities
- z/OS V2.2 zFS Reporting Enhancements
 - Sysplex-wide Statistics for zFS Usage and Performance
 - Improved zFS Data Gathering Performance
 - Additional zFS Statistics for Shared File System environments
- z/OSMF Resource Monitoring
 - Historical Reporting & Spreadsheet Export
- The zEvent Mobile Application
 - Receive Push Messages based on critical System Events
 - Access to RMF Data Portal and z/OSMF Resource Monitoring



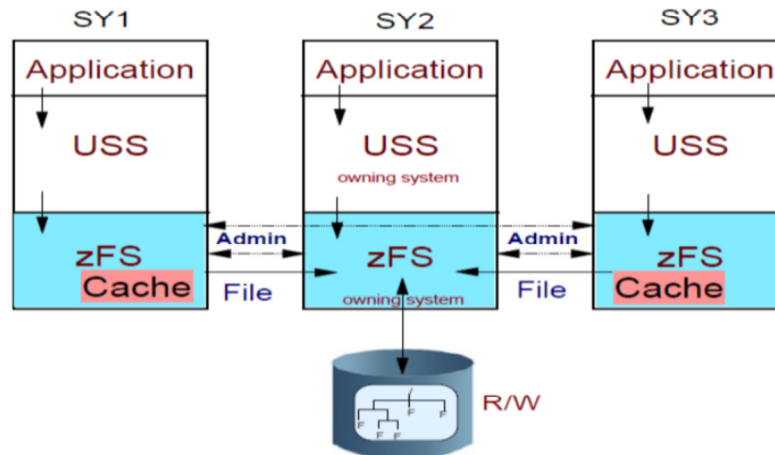
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z/OS 2.2 - zFS Reporting Enhancements



Rationale:

- Existing RMF Monitor III single system reports ZFSSUM and ZFSACT offered no possibility to monitor details of zFS related to sysplex awareness of zFS file systems.
- Some customers observed performance problems when gathering zFS performance data.

The existing RMF Monitor III zFS reports (introduced with z/OS 1.7) has some disadvantages:

- Since the reports are single system reports, it is not possible to monitor zFS activity in shared file system environments:
 - There is no sysplex wide view of zFS activity
 - There are no zFS statistics related to sysplex awareness of zFS file systems
- The current Monitor III data gatherer uses multiple zFS interface calls to collect the zFS data. In case of system environments with a larger number of zFS aggregates and file systems, performance problems were observed that caused delays in overall RMF Monitor III data gathering

RMF for z/OS 2.2 introduces new Monitor III zFS sysplex reports that allow to monitor shared file system environments effectively. The Monitor III zFS data gatherer uses a new zFS interface that reduces the number of zFS interface calls so that RMF zFS data gathering performance is improved.

z/OS 2.2 - zFS Reporting Enhancements

- z/OS V2.2 introduces three new Monitor III zFS reports:

- zFS Overview report
- zFS File System report
- zFS Kernel report

- Sysplex-wide data on:

- zFS response time / wait times
- zFS XCF activity
- zFS Cache activity
- zFS activity / capacity by File System

RMF Sysplex Report Selection Menu		
Selection ==>		
Enter selection number or command for desired report.		
Sysplex Reports		
1	SYSSUM	Sysplex performance summary (SUM)
2	SYSRTD	Response time distribution (RTD)
3	SYSWKM	Work Manager delays (WKM)
4	SYSENG	Sysplex-wide Enqueue delays (ES)
5	CFOVER	Coupling Facility overview (CO)
6	CFSYS	Coupling Facility systems (CS)
7	CFACT	Coupling Facility activity (CA)
8	CACHSUM	Cache summary (CAS)
9	CACHDET	Cache detail (CAD)
10	RLSSC	VSAM RLS activity by storage class (RLS)
11	RLSDS	VSAM RLS activity by data set (RLD)
12	RLSLRU	VSAM LRU overview (RLL)
13	ZFSOVW	zFS Overview (ZFO)
14	ZFSFS	zFS File System (ZFF)
15	ZFSKN	zFS Kernel (ZFK)

- Data helps to control the zFS environment according to

- Monitoring of zFS activity in Shared File System environments
- Tuning of Cache sizes
- Monitoring of File System Performance:
 - Discover Bottlenecks and
 - Balance File System I/O
- Capacity Control for File Systems

RMF for z/OS V2.2 introduces three new RMF Monitor III zFS reports:

- zFS Overview report
- zFS File System report
- zFS Kernel report

The new reports are sysplex reports.

They can be invoked from the RMF Sysplex Report Selection Menu or by following commands:

- **ZFSOVW** or **ZFO**: zFS Overview report
- **ZFSFS** or **ZFF**: zFS File System report
- **ZFSKN** or **ZFK**: zFS Kernel report

Gathering of zFS activity data is controlled by new Monitor III gatherer option:

NOZFS | **ZFS**

With z/OS V2.2 the zFS data gathering default is changed bck from NOZFS (Z/OS 2.1) to ZFS.

z/OS 2.2 – zFS Overview report



- Monitor III zFS Overview report (ZFSOVW) provides a summary of zFS activity, wait percentages and cache statistics on the current sysplex.
- Helps to discover bottlenecks and tune cache behaviour.

RMF V2R2		zFS Overview		- UTCPLXCB				Line 1 of 3	
Samples: 60		Systems: 3		Date: 04/21/15		Time: 05.02.00		Range: 60 Sec	
System	-----Wait%-----			-----User-----		Cache Activity		-----Metadata-----	
	I/O	Lock	Sleep	Rate	Hit%	Rate	Hit%	Rate	Hit%
CB8C	21.3	0.0	36.2	40.50	100	153.2	99.2	41.22	99.1
CB8D	0.0	0.0	9.2	3.500	100	16.05	100	19.80	99.8
CB86	6.8	0.0	0.1	5775	84.2	17238	87.7	59821	93.5

Fields in Monitor III zFS Overview report (ZFSOVW) :

System Name of the system running zFS.

Wait% The following Wait percentages are reported:

- I/O** Percentage of time that zFS requests had to wait for I/O completion.
- Lock** Percentage of time that zFS requests had to wait for locks.
- Sleep** Percentage of time that zFS requests had to wait for events.

Dashes (----) in these fields indicate that RMF is unable to calculate a reasonable value.

Cache Activity section

User The user file cache is for caching regular user files that are larger than 7K. The measured statistics have the following meanings:

- Rate** Total number of read and write requests per second made to the user file cache.
- Hit%** Percentage of read and write requests to the user file cache that completed without accessing the DASDs.

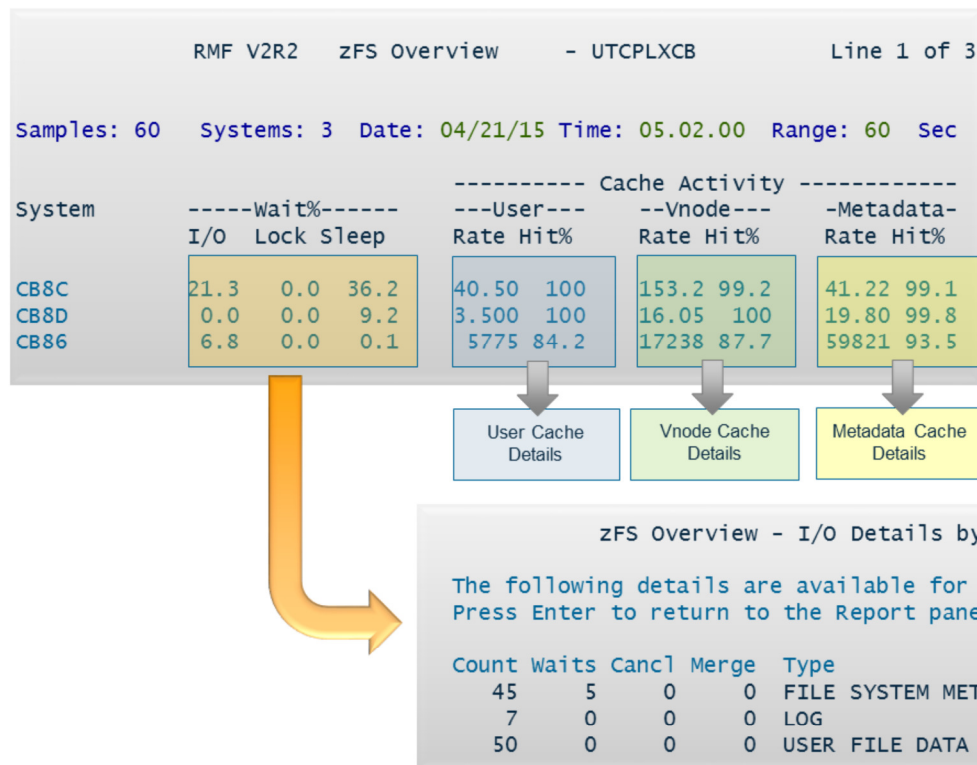
Vnode The vnode cache is used to hold virtual inodes. An inode is a data structure related to a file in the file system, holding information about the file's user and group ownership, access mode and type. The measured statistics have the following meanings:

- Rate** Number of read and write requests per second made to the vnode cache.
- Hit%** Percentage of read and write requests to the vnode cache that completed without accessing the DASDs.

Metadata The metadata cache is used for file system metadata and for files smaller than 7K. It resides in the primary z/FS address space. The measured statistics have the following meanings:

- Rate** Number of read and write requests per second made to the metadata cache.
- Hit%** Percentage of read and write requests to the metadata cache that completed without accessing the DASDs.

z/OS 2.2 – zFS Overview report : Cursor Sensitivity Targets



From the **zFS Overview Report**, you can navigate to a variety of detail information using cursor-sensitive control.

The following details pop-up panels can be displayed:

- **I/O Details by Type** pop-up panel from any value in the **Wait%** section.
- **User Cache Details** pop-up panel from any value in the **Cache Activity – User** section.
- **Vnode Cache Details** pop-up panel from any value in the **Cache Activity – Vnode** section
- **Metadata Cache Details** pop-up panel from any value in the **Cache Activity – Metadata** section

Fields in Monitor III ZFSOVW report I/O Details pop-up panel:

System	Name of the system running zFS.
Count	Total number of I/O requests of the indicated type.
Waits	Number of zFS requests waiting for an I/O completion of the indicated I/O type.
Cancel	Number of cancelled zFS requests during an I/O request of the indicated type, for example, a user tried to delete a file during a pending I/O to this file's metadata.
Merge	Number of merges of two I/O requests into a single request because of better performance.
Type	Type of the I/O request (I/O for metadata, log data or user file data).

z/OS 2.2 – zFS Overview Cache Details



zFS Overview - User Cache Details

The following details are available for system CB8C

Size	: 1385M	Storage fixed	: NO
Total Pages	: 3007K		
Free Pages	: 2997M		
Segments	: 0		

----- Read -----				----- Write -----					
Rate	Hit%	Dly%	Async Rate	Rate	Hit%	Dly%	Sched Rate	Read%	Dly%
27.00	100	0.0	23.73	13.50	100	0.1	0.850	66.7	0.0

----- Misc -----	
Page Reclaim Writes	: 0
Fsyncs	: 16

zFS Overview - Metadata Cache Details

The following details are available for system CB8C

Size	: 1024M	Storage fixed	: YES
Buffers	: 131K		

----- Requests -----			----- Misc -----	
Total	Rate	Hit%	Updates	
2473	41.22	99.1	407	
			Partial Writes	: 0

zFS Overview - Vnode Cache Details

The following details are available for system CB8C

Size	: 32768
------	---------

----- Vnodes -----					
Total	Size	Ext.#	Ext.Size	Open	Held
32768	224	32768	816	128	2119

----- Requests -----				
Total	Rate	Hit%	Alloc	Delete
9189	153.2	99.2	0	44

Cache statistics for 'regular' user files:

- Request rates, hit ratios, delays
- Storage statistics

Cache statistics for file system metadata (directory contents, file status information ...):

- Request rate, hit ratio
- Storage statistics

Cache statistics for file system related data structures (Vnodes):

- Request rate, hit ratio
- Vnode statistics

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Fields in Monitor III ZFSOVW report User Cache Details pop-up panel:

System	Name of the system running zFS.	
Size	Total number of pages in the user file cache.	
Total Pages	Number of zFS requests waiting for an I/O completion of the indicated I/O type.	
Free Pages	Total number of free pages in the user file cache.	
Segments	Total number of allocated segments in the user file cache.	
Storage fixed	Shows whether the size of the user file cache storage is fixed. If the zFS parameter user_cache_size is set to 'fixed', then zFS reserves real storage for use by zFS only. The 'fixed' option helps to improve performance during data access and can be applied if you have enough real storage available.	
Read Rate	Number of read requests per second made to the user file cache.	
Read Hit%	Percentage of read requests to the user file cache that completed without accessing the DASD.	
Read Dly%	Percentage of delayed read requests to the user file cache. A read request is delayed if it must wait for pending I/O, for example, because the file is in a pending read state due to asynchronous read ahead from DASD to the user file cache.	
Async Read Rate	Number of readaheads per second.	
Write Rate	Number of write requests per second made to the user file cache.	
Write Hit%	Percentage of write requests to the user file cache that completed without accessing the DASD.	
Write Dly%	Percentage of delayed write requests to the user file cache. The following reasons are counted as write request delays: Write wait: a write must wait for pending I/O. Write faulted: a write to a file needs to perform a read from DASD. If a write-only updates a part of a file's page, and this page is not in the user file cache, then the page must be read from DASD before the new data is written to the cache.	
Scheduled Write Rate	Number of scheduled writes per second.	
Read%	Percentage of read requests, based on the sum of read and write requests.	
Dly%	Percentage of delayed requests.	
Page Reclaim Writes	Total number of page reclaim writes. A page reclaim write action writes one segment of a file from the user file cache to DASD. Page reclaim writes are performed to reclaim space in the user file cache. If page reclaim writes occur too often in relation to the write rate, then the user file cache may be too small.	

Fsyncs Total number of requests for file synchronization (fsync) between user file cache and DASD.

z/OS 2.2 – zFS File System report



- Monitor III zFS File System report (ZFSFS) provides detailed measurements of zFS file system activity for single file systems in compatibility mode aggregates.
- Helps to monitor performance and capacity limits of file systems.

RMF V2R2		zFS File System - UTCPLXCB					Line 1 of 568			
Samples: 60	Systems: 3	Date: 04/21/15	Time: 05.02.00	Range: 60	Sec					
----- File System Name -----										
	System	Owner	Mode	Size	Usg%	I/O Rate	Resp Time	Read %	XCF Rate	
APIRWW.DB2	*ALL	CB86	RW S	1320M	1.0	0.000	0.000	0.0	0.000	
NETVIEW.V6R1M0C.ZFS	*ALL	CB86	RW S	12M	49.8	0.000	0.000	0.0	0.000	
OMVS.CB8C.JAVATEST.OUTPUT.ZFS	*ALL	CB8C	RW S	9849M	0.3	0.000	0.000	0.0	0.000	
OMVS.CB8C.JAVATEST.ZFS	*ALL	CB8C	RW S	4932M	0.7	0.133	0.005	100	0.000	
OMVS.CB8D.JAVATEST.OUTPUT.ZFS	*ALL	CB8D	RW S	9849M	3.8	0.000	0.000	0.0	0.000	
OMVS.CB8D.JAVATEST.ZFS	*ALL	CB8D	RW S	13G	79.9	0.067	0.003	100	0.000	
OMVS.CB86.JAVATEST.OUTPUT.ZFS	*ALL	CB86	RW S	12G	0.3	0.000	0.000	0.0	0.000	

Fields in Monitor III zFS File System report (ZFSFS):

File System Name	File system name.
System	Name of the system connected to the file system. In the first data line for a file system, the name is '*ALL' to indicate that this line shows the SYSPLEX view of the data rather than a single system view.
Owner	Name of owning system.
Mode	Mount mode of the file system. Possible values are: RW mounted in read-write mode. RO mounted in read-only mode. NM not mounted. QS not available because the aggregate is quiesced. The mount mode is followed by an S if the file system is using zFS sysplex sharing (RWSHARE).
Size	Maximum logical size of the file system (in Bytes).
Usg%	Percentage of currently used space by the file system.
I/O Rate	The rate of read and write requests per second (directory and file) made by applications to this file system.
Resp Time	Average response time in milliseconds for read and write requests made by applications to this file system.
Read%	Percentage of read operations contained in 'I/O Rate'.
XCF Rate	The rate of read and write XCF calls per second to the server.

z/OS 2.2 – zFS File System report: Report Options



- The contents of the Monitor III ZFSFS report can be tailored by report options (use RO command on ZFSFS panel).
- Example: Detailed statistics for one file systems

```
RMF zFS File System Report Options                               Line 1 of 284

Change or verify parameters. To exit press END.
Changes will apply to the ZFSFS report.

Name   ==> OMVS.CB8D.JAVATEST.ZFS
Detail ==> YES          ALL or one of the available zFS file systems below
                        Show single system data (YES or NO) in ZFSFS report

                        Available zFS File Systems
OMVS.CB8C.JAVATEST.OUTPUT.ZFS
OMVS.CB8C.JAVATEST.TESTSUIT.ZFS
OMVS.CB8C.JAVATEST.ZFS
OMVS.CB8D.JAVATEST.ZFS
OMVS.CB8D.JAVATEST.ZFS
OMVS.CB8E.JAVATEST.ZFS
OMVS.CB8E.JAVATEST.ZFS

RMF V2R2   zFS File System - UTCPLXCB                               Line 1 of 5

Samples: 60   Systems: 3   Date: 04/21/15   Time: 05.02.00   Range: 60   Sec

----- File System Name -----
System      Owner    Mode    Size  Usg%   I/O    Resp  Read  XCF
              Rate    Time   %      Rate   Time  %     Rate
OMVS.CB8D.JAVATEST.ZFS
*ALL        CB8D      RW S    13G  79.9  0.067  0.003  100  0.000
CB8C        CB8D      RW S          0.0  0.000  0.000  0.0  0.000
CB8D        CB8D      RW S    13G  79.9  0.067  0.003  100  0.000
CB8E        CB8D      RW S          0.0  0.000  0.000  0.0  0.000
```

The Report Options panel for the zFS File System report allows you to specify options for this report.

Fields in Monitor III zFS File System report options panel:

Name Specify either ALL or the name of one of the zFS file systems available in the sysplex as shown in the **Available File Systems**, which provides a list of all zFS file systems that are currently defined to the sysplex. You can use an asterisk (*) as the last character of the file system name as a wild card.

When a wild card is used, all file systems whose names start with the specified character sequence before the asterisk are reported on, no matter which characters follow.

Detail Specify the desired level of detail in the zFS File System report:

NO The report contains summary data for the sysplex only.

YES The report contains data for the sysplex and all single systems.

If the list of file names is too long to fit on the first page, this report options panel can be scrolled up and down using function keys F7 and F8.

z/OS 2.2 – zFS File System report: Report Options



- Example: Using ALL for 'Name' and Details=YES, complete information for all file systems on all systems is provided.

RMF V2R2		zFS File System - UTCPLXCB				Line 1 of 1420			
Samples: 60	Systems: 3	Date: 04/21/15	Time: 05.02.00	Range: 60	Sec				
----- File System Name -----									
	System	Owner	Mode	Size	Usg%	I/O Rate	Resp Time	Read %	XCF Rate
APIRWW.DB2									
	*ALL	CB86	RW S	1320M	1.0	0.000	0.000	0.0	0.000
	CB8C	CB86	RW S		0.0	0.000	0.000	0.0	0.000
	CB8D	CB86	RW S		0.0	0.000	0.000	0.0	0.000
	CB86	CB86	RW S	1320M	1.0	0.000	0.000	0.0	0.000
NETVIEW.V6R1M0C.ZFS									
	*ALL	CB86	RW S	12M	49.8	0.000	0.000	0.0	0.000
	CB8C	CB86	RW S		0.0	0.000	0.000	0.0	0.000
	CB8D	CB86	RW S		0.0	0.000	0.000	0.0	0.000
	CB86	CB86	RW S	12M	49.8	0.000	0.000	0.0	0.000
OMVS.CB8D.JAVATEST.OUTPUT.ZFS									
	*ALL	CB8D	RW S	9849M	3.8	0.000	0.000	0.0	0.000
	CB8C	CB8D	RW S		0.0	0.000	0.000	0.0	0.000
	CB8D	CB8D	RW S	9849M	3.8	0.000	0.000	0.0	0.000
	CB86	CB8D	RW S		0.0	0.000	0.000	0.0	0.000
OMVS.CB8D.JAVATEST.ZFS									
	*ALL	CB8D	RW S	13G	79.9	0.067	0.003	100	0.000
	CB8C	CB8D	RW S		0.0	0.000	0.000	0.0	0.000
	CB8D	CB8D	RW S	13G	79.9	0.067	0.003	100	0.000
	CB86	CB8D	RW S		0.0	0.000	0.000	0.0	0.000

z/OS 2.2 – zFS File System report: Cursor Sensitivity Targets



RMF V2R2 zFS File System - UTCPLXCB Line 1 of 5

Samples: 60 Systems: 3 Date: 04/21/15 Time: 05.02.00 Range: 60 Sec

File System Name	System	Owner	Mode	Size	Usq%	I/O Rate	Resp Time	Read %	XCF Rate
OMVS.CB8D.JAVATEST.ZFS									
*ALL	CB8D	CB8D	RW S	13G	79.9	0.067	0.003	100	0.000
CB8C	CB8D	CB8D	RW S		0.0	0.000	0.000	0.0	0.000
CB8D	CB8D	CB8D	RW S	13G	79.9	0.067	0.003	100	0.000
CB8E									



zFS File System Details

File System Name : OMVS.CB8D.JAVATEST.ZFS
Mount Point : /CB8D/javatest

System : CB8D Owner : CB8D Mode : RW S

----- Read -----					----- Write -----				
Appl	Rate	Resp Time	XCF Rate	Aggr Rate	Appl	Rate	Resp Time	XCF Rate	Aggr Rate
---	0.067	0.003	0.000	0.000	---	0.000	0.000	0.000	204.8

Vnodes	:	3	USS held vnodes	:	2
Open objects	:	0	Tokens	:	3
User cache 4k pages	:	0	Metadata cache 8k pages	:	10
ENOSPC errors	:	0	Disk I/O error	:	0
XCF comm. failures	:	0	Cancelled operations	:	0

From the zFS File System Report, you can navigate to a variety of detail information using cursor-sensitive control. If you place the cursor on any of the lines with file system values, a pop-up window appears showing the details for this file system.

z/OS 2.2 – zFS Kernel report



- Monitor III zFS Kernel report (ZFSKN) provides measurements counting the calls made to zFS from z/OS UNIX and the average response time of zFS requests.
- Helps to monitor zFS Kernel performance and determine appropriate tuning options

RMF V2R2 zFS File System - UTCPLXCB							Line 1 of 3
Samples: 60 Systems: 3 Date: 04/21/15 Time: 05.02.00 Range: 60 Sec							
System Name	- Request Rate -		--- XCF Rate ---		- Response Time -		
	Local	Remote	Local	Remote	Local	Remote	
CB8C	54.18	219.7	0.000	3.417	0.017	0.140	
CB8D	9.150	49.52	0.000	0.150	0.149	2.996	
CB86	35298	577.5	0.000	46.95	0.610	3.453	

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Fields in Monitor III zFS Kernel report (ZFSKN):

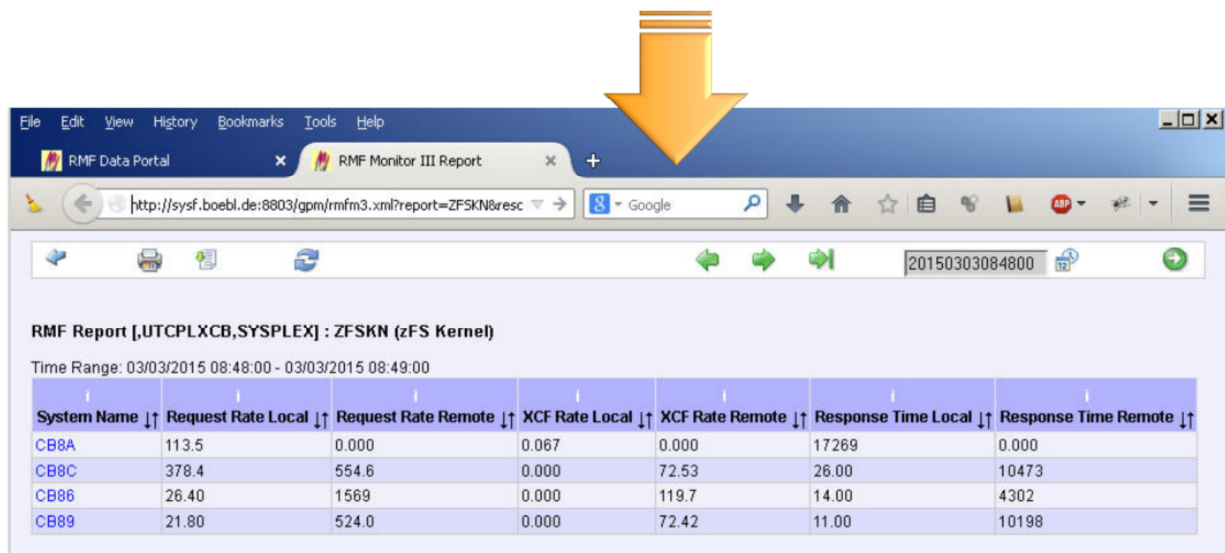
System Name	Name of the system running zFS. In the context of requests against file systems, this is the name of the requesting system.
Request Rate	Rate of zFS requests during the report interval for file systems which are locally and remotely owned. A file system is locally owned if the requesting system is also the owner of the file system. It is remotely owned if the owner of the file system is not the requesting system.
XCF Rate	Rate of zFS requests during the report interval requiring data from another system via XCF, both for locally and remotely owned file systems.
Response Time	Average time in milliseconds required for the completion of the zFS requests during the report interval for locally and remotely owned file systems.

z/OS V2.2 – RMF Data Portal ZFS Reports



- The browser based version of ZFSOVW, ZFSFS and ZFSKN can be requested from the RMF Distributed Data Server (DDS) by use of following URL (example is for ZFSKN):

<http://sysf.boebl.de:8803/gpm/rmf3.xml?report=ZFSKN&resource=„SYSPLEX“>



System Name	Request Rate Local	Request Rate Remote	XCF Rate Local	XCF Rate Remote	Response Time Local	Response Time Remote
CB8A	113.5	0.000	0.067	0.000	17269	0.000
CB8C	378.4	554.6	0.000	72.53	26.00	10473
CB86	26.40	1569	0.000	119.7	14.00	4302
CB89	21.80	524.0	0.000	72.42	11.00	10198



The new Monitor III ZFSOVW, ZFSFS and ZFSKN reports were added to the standard reports which are available in XML format by means of the RMF Distributed Data Server.

Therefore all statistics of the new Monitor III zFS ISPF reports are available also by means of the Monitor III Data Portal without limitations.

The zFS Reports can be selected from the list of full RMF reports that are available for the SYSPLEX resource and basically all report columns can be displayed in the browser window.

As alternative you can invoke a zFS report by use of following URLs :

ZFSOVW report: <http://hostname:8803/gpm/rmf3.xml?report=ZFSOVW&resource=„SYSPLEX“>

ZFSFS report: <http://hostname:8803/gpm/rmf3.xml?report=ZFSFS&resource=„SYSPLEX“>

ZFSKN report: <http://hostname:8803/gpm/rmf3.xml?report=ZFSKN&resource=„SYSPLEX“>

z/OS V2.2 – zFS Reporting enhancements: RMF Distributed Data Server Metrics



- All performance metrics from the new zFS sysplex reports are added to the ZFS resource in the DDS and are promoted to the SYSPLEX resource as well.

Sysplex
MVS Image
I/O Subsystem
zFS
Aggregate

RMF Data Portal for z/OS Home Explore Overview My View

Available metrics for: SYSF,OMVS.SYSF.ZOSMF.ZFS AGGREGATE

Metric description	Help	Id
% read (in I/O rate)	Explanation	8D4FE0
% space used	Explanation	8D5010
% used space	Explanation	8D2AE0
# cancelled operations	Explanation	8D5040
# disk I/O errors	Explanation	8D5070
# open objects	Explanation	8D50A0
# tokens	Explanation	8D50D0
# vnodes	Explanation	8D5100
# ENOSPC errors	Explanation	8D5130
# USS held vnodes	Explanation	8D5160
# XCF communication failures	Explanation	8D5190
# 4K pages in user cache	Explanation	8D51C0
# 8K pages in metadata cache	Explanation	8D51F0
aggregate read rate	Explanation	8D5220
aggregate write rate	Explanation	8D5250
application read rate	Explanation	8D5280
application read response time	Explanation	8D52B0

Full RMF Reports:

CACHDET	CACHSUM	CFACT	CFOVER	CFST	SPACED	SPACEG	SYSSUM	XCFGROUP	XCFOR
XCFSYS	ZFSFS	ZFSKN	ZFSOVW						

Available metrics for: ,SYSDPLEX,SYSPLEX

by aggregate	Explanation	Id
% read (in I/O rate) (sysplex) by aggregate	Explanation	8D4FF0
% read (in I/O rate) by aggregate	Explanation	8D5000
% space used (sysplex) by aggregate	Explanation	8D5020
% space used by aggregate	Explanation	8D5030
# cancelled operations (sysplex) by aggregate	Explanation	8D5050
# cancelled operations by aggregate	Explanation	8D5060
# disk I/O errors (sysplex) by aggregate	Explanation	8D5080
# disk I/O errors by aggregate	Explanation	8D5090

(Example is for AGGREGATE resource, a child of ZFS)

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The performance metrics for the new zFS sysplex reports were added to the zFS related DDS metrics. The metrics are associated to the Aggregate, ZFS and SYSPLEX resources of the DDS resource tree.

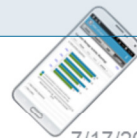
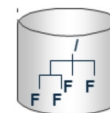
Basically the DDS is the data source for z/OSMF Resource Monitoring, the state-of-the-art graphical workstation frontend for RMF performance data.

All DDS metrics can be configured for continuous monitoring with z/OSMF in terms of metrics groups and dashboards. Hence, let's talk about z/OSMF Resource Monitoring and the most recent enhancements...

RMF Enhancements at a Glance



- IBM z13 Support
 - RMF Statistics for Simultaneous Multithreading (SMT)
 - Extended ICSF Measurements for Crypto Express5S
 - Support for LPARs with up to 4TB Real Storage
- SCM I/O Adapter Performance Reporting
 - Statistics for EADM Subchannel Activities
 - Performance and Thruput on SCM Card Level
- PCIE Activity Reporting
 - z/OS V2.1 Postprocessor PCIE reporting
 - Additional Measurements for PCIe attached RoCE and zEDC Devices
 - z/OS V2.2 Monitor III PCIE Report
- z/OS V2.2 Monitor III Job Resource Consumption Reporting
 - CPU, I/O and Storage Consumption Data at a Glance
 - Detailed Statistics for Job related GQSCAN Activities
- z/OS V2.2 zFS Reporting Enhancements
 - Sysplex-wide Statistics for zFS Usage and Performance
 - Improved zFS Data Gathering Performance
 - Additional zFS Statistics for Shared File System environments
- z/OSMF Resource Monitoring
 - Historical Reporting & Spreadsheet Export
- The zEvent Mobile Application
 - Receive Push Messages based on critical System Events
 - Access to RMF Data Portal and z/OSMF Resource Monitoring



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z/OSMF Resource Monitoring – Historical Reporting



Welcome x Resource Mon... x

Resource Monitoring

Dashboards Storage Soaker x

Storage Soaker (Running)

Start Pause Stop Save Actions ▾

▼ Active & Fixed Frames (WLM View)

Metric Group	Value
SYSTEM.1	2907
SYSSTC.1	4436
STCDEF.1	3530
GPMSERVE.1	261
OE.2	0
OMVSKERN.1	0

FTP51 [0041] 564
CBIND1 [005D] 499

SYSPF.*.STORAGE # frames fixed by WLM service class period
SYSPF.*.STORAGE # frames active by WLM service class period
05/02/2014 10:35:00 - 05/02/2014 10:36:00 (1/1)

Retrieve Historical Data

To retrieve historical data from the DDS, specify the metric groups, timeframe, and range. This action may generate significant amount of overhead on the DDS host, especially for long time ranges.

Metric groups:

Active & Fixed Frames (WLM View)
Active Frames
Fixed Frames

Timeframe:

Condition: Past Amount: 2 Unit: Hours

Data sample range:

☐ Use the default range

☒ Specify the range in seconds: 600

OK

Restore Defaults

Cancel

Help

Retrieve performance data from the past corresponding to the content of the RMFGAT in-storage buffer or the RMFGAT VSAM Data Sets

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z/OSMF Resource Monitoring – Spreadsheet Export

Export Dashboard

Step1: Select Scope and Intervals

Step2: Select Metrics and Resources

Select the scope and intervals

Scope of Data to Export

Metric group:

Active & Fixed Frames

Include all metrics

Include a selection

Entire dashboard with all metrics

Range of Intervals to Export

Start time of first interval

03/03/2014 14:25:00

End time of last interval

03/03/2014 14:45:00

Export Dashboard

Select the metrics and resources to include when exporting the metric group.

Metric group to export: Active & Fixed Frames (WLM View)

Metrics:

S1*STORAGE # frames fixed by WLM service class period

S1*STORAGE # frames active by WLM service class period

Resources:

OMVS.1

OMVS.3

SHRDB2.1

STCCL.1

STCCL.1

STCCL.1

SYSTO.1

SYSTO.1

SYSTEM.1

< Back

Next >

Finish

Cancel




< Back

Next >

Finish

Cancel



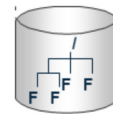
 Storage Soaker_Active & Fixed Frames (WLM View).csv
 Storage Soaker_Active Frames.csv
 Storage Soaker_Fixed Frames.csv

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RMF Enhancements at a Glance



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z/OSMF Resource Monitoring & Mobile Devices



Very convenient to know right now that the Sysplex of my boss has got enough CSA and SQA...

💡 Cross platform performance monitoring anytime and everywhere!



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z/OSMF supports by default the recent versions of Mozilla Firefox and Microsoft Internet Explorer
However, z/OSMF can be used together with the most browsers available for mobile devices as well
Cross platform performance monitoring anytime and everywhere: Try z/OSMF on your tablet PC or smartphone!

zEvent Mobile Application



- Receive push messages based critical system events
- Access to z/OS performance data from mobile devices
- Single point of control for the enterprise
- Developed with IBM Mobile First Studio
- Prototype status (Android OS)
- Current availability target is 1Q 2016
- Supported Monitoring Facilities:
 - RMF Performance Data Portal
 - z/OSMF Resource Monitoring



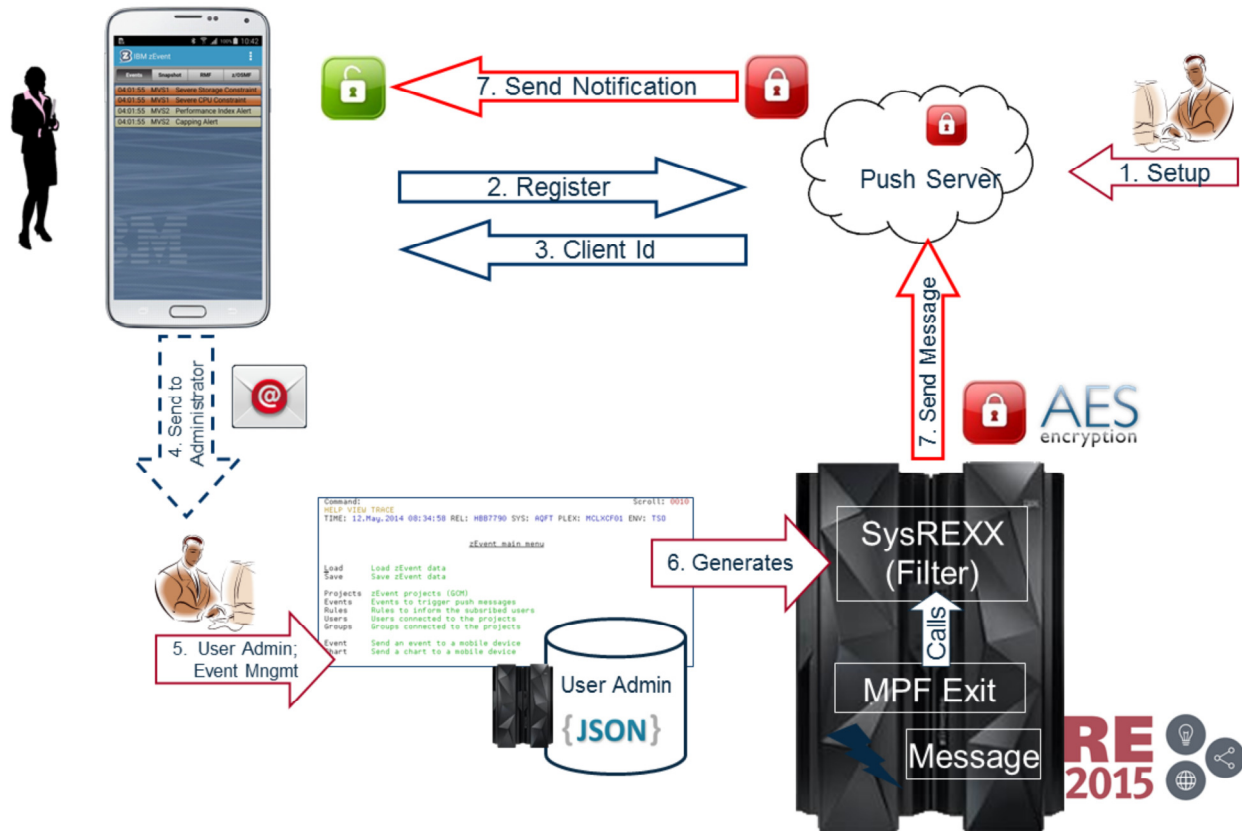
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Last but not least, the zEvent Mobile Application:

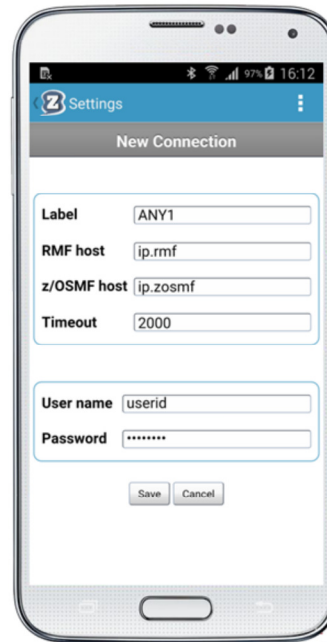
- This mobile App is currently under development and all details and capabilities – including the application name – are subject to change
- In a nutshell, the app provides the following two main features to system administrators and performance analysts:
 - Receive push messages based on critical system events instantly
 - Access to the RMF Data Portal and z/OSMF Resource Monitoring anywhere and every time

zEvent Mobile Application



zEvent Mobile Application

- Connect to all z/OS systems in the enterprise
- Direct connection from the App to the z/OS system or via Mobile First Server



zEvent Mobile Application

- Monitor z/OS system performance with the RMF Data Portal
- Exploit the extended capabilities of z/OSMF Resource Monitoring



Information and Tools

- RMF website: www.ibm.com/systems/z/os/zos/features/rmf/
 - Product information, newsletters, presentations, ...
 - Downloads
 - Spreadsheet Reporter
 - Postprocessor XML Toolkit
- RMF email address: rmf@de.ibm.com



- Documentation and news:
 - RMF Performance Management Guide, SC33-7992
 - RMF Report Analysis, SC33-7991
 - RMF User's Guide, SC33-7990
 - Latest version of PDF files can be downloaded from:
www.ibm.com/systems/z/os/zos/bkserv/v2r1/pdf/#rmf



Function Reference



Function	Availability
zEnterprise Data Compression Express Reporting Shared Memory Communication Reporting	z/OS 2.1 RMF z/OS 2.1 RMF
Support for Simultaneous Multithreading (SMT) Extended Measurements for PCIe attached Devices Additional ICFS Statistics for Crypto Express5S Support for LPARs with up to 4 TB real storage Support for z13 IBM Integrated Coupling Adapter (ICA SR) RMF z13 Toleration for z/OS V1R10 and V1R11 RMF z13 Toleration for z/OS V1R12 and V1R13	APAR OA44101 APAR OA44524 APAR OA43493 APAR OA44503 APAR OA44502 APAR OA45890 APAR OA45833
SCM I/O Adapter Performance Reporting	z/OS 2.2 RMF
RMF Monitor III PCIE Online Reporting	z/OS 2.2 RMF
RMF Monitor III Job Resource Consumption Reporting	z/OS 2.2 RMF
zFS Reporting Enhancements	z/OS 2.2 RMF
z/OSMF Resource Monitoring – Historical Reporting z/OSMF Resource Monitoring – Spreadsheet Export	APAR PI08825 APAR PI08825
zEvent Mobile Application	1Q 2016 (Subject to Change)

zEC12
Enhancements

z13
Enhancements