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RMF – The Latest and Greatest

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IBM Corporation

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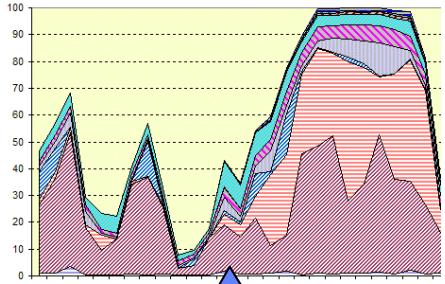
Session 15210

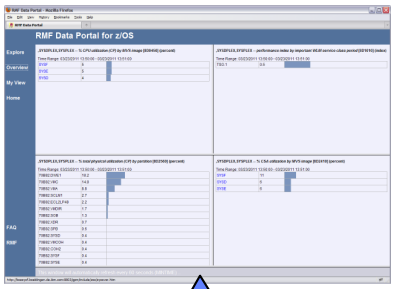
SHARE in Anaheim

RMF Product Overview

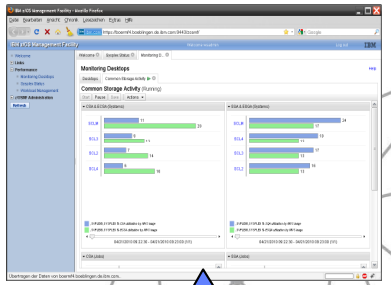
RMF Spreadsheet Reporter



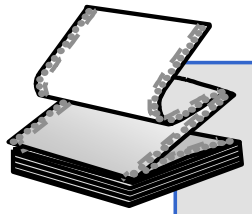
RMF Performance Data Portal



z/OSMF Resource Monitoring



RMF Distributed Data Server (GPMSERVE) & RMF XP (GPM4CIM)



RMF Postprocessor
Historical Reporting,
Analysis and Planning

RMF Monitor II and III
Real-Time Reporting,
Problem Determination

SMF

RMF Sysplex Data Server and APIs

CIM Client APIs

RMF
Data Gatherer

RMF
Monitor I

RMF
Monitor II
background

RMF
Monitor III

VSAM

AIX & Linux
CIM Provider

z/OS V2R1 RMF Content at a Glance

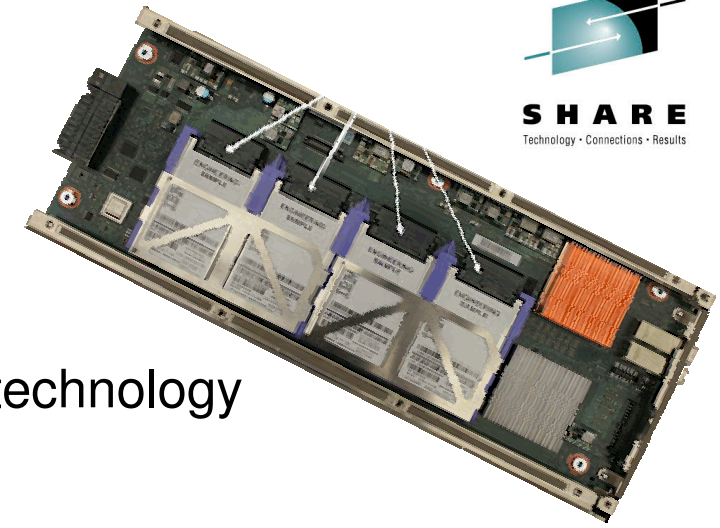
- IBM zEnterprise EC12 Support
  - Statistics for Flash Memory and Pageable Large Pages
  - z Enterprise Data Compression Express Reporting (zEDC)
  - Shared Memory Communication Reporting (SMC-R)
  - Support of I/O Interrupt Delay Time Facility
  - Extended Infiniband Link Reporting
  - Support of Crypto Express4 Card
  - Warning Track Interruption Facility Statistics

- Exploitation of System z Integrated Information Processors
  - zIIP Usage Option for Monitor III Gatherer

- Postprocessor XML formatted Reports
  - Transition to XML Format almost complete
  - Advanced Sorting and Filtering Capabilities

- z/OSMF Resource Monitoring
  - Context sensitive Application Linkage to WLM
  - Windows Support

zEC12 – Flash Express

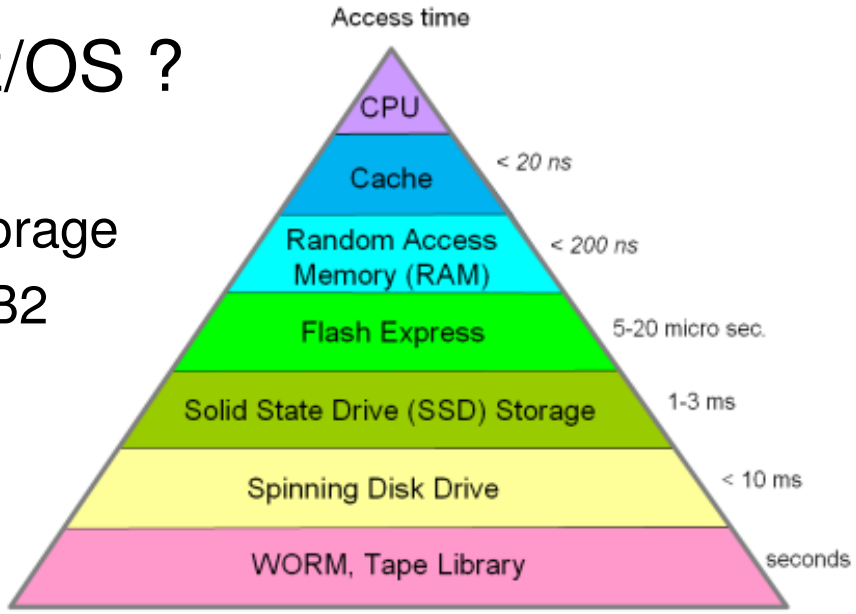


What is Flash Express?

- New memory hierarchie of the zSeries family
- Delivers tier within the fast Solid State Drive (SSD) technology
- Also denoted as Storage Class Memory (SCM)
- 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

How is Flash Express exploited by z/OS ?

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



zEC12 – Flash Memory & Pageable Large Pages RMF Support

- New Storage Class Memory (SCM) statistics in
  - ⇨ RMF Postprocessor Paging Activity report
  - ⇨ RMF Postprocessor Page Data Set Activity (PAGESP) report
  - ⇨ RMF Monitor II Page Data Set Activity (PGSP) report
- New statistics for Pageable Large Pages in
  - ⇨ RMF Postprocessor Paging Activity report
  - ⇨ RMF Postprocessor Virtual Storage Activity (VSTOR) report
  - ⇨ RMF Monitor III Storage Memory Objects (STORM) report

OA38660

zEC12 – Flash Memory & Pageable Large Pages

- New SCM statistics in the FRAMES AND SLOT COUNTS section of the RMF Postprocessor Paging Activity report

The number of shared pages backed on SCM

SHARED FRAMES	TOTAL SLOTS	CENTRAL STORAGE	FIXED TOT	FIXED BEL	AUX DASD	AUX SCM
MIN	7,937	44	30	0	13	0
MAX	7,937	44	30	0	13	0
AVG	7,937	44	30	0	13	0

LOCAL PAGE DATA SET SLOTS	TOTAL	AVAILABLE	BAD	NON-VIO	VIO
MIN	5,399,997	4,269,302	0	1,128,251	0
MAX	5,399,997	4,271,746	0	1,130,695	0
AVG	5,399,997	4,269,838	0	1,130,159	0

SCM PAGING BLOCKS	TOTAL	AVAILABLE	BAD	IN-USE
MIN	0	0	0	0
MAX	0	0	0	0
AVG	0	0	0	0

System wide statistics of 4K SCM paging blocks as: Total, Available, Unavailable and Used 4K blocks

zEC12 – Flash Memory & Pageable Large Pages...

- New SCM and Large Pages statistics in the MEMORY OBJECTS section of the RMF Postprocessor Paging Activity report

```
                                P A G I N G   A C T I V I T Y

OPT = IEAOPT00    LFAREA SIZE = 209715200      MEMORY OBJECTS AND HIGH VIRTUAL STORAGE FRAMES
-------------------------------------------------------------------------------------------------------------

MEMORY OBJECTS          COMMON      SHARED       1 MB
------------------  ---------  ---------  ---------
      MIN                   53          1          1
      MAX                   56          1          4
      AVG                   54          1          2

1 MB FRAMES          ------------ FIXED ------------  ----------- PAGEABLE ----------
------------------       TOTAL  AVAILABLE     IN-USE      TOTAL  AVAILABLE     IN-USE
      MIN                  200         80         30        560        496         57
      MAX                  200        170        120        560        503         64
      AVG                  200        136         64        560        501         59

HIGH SHARED FRAMES        TOTAL   CENTRAL STORAGE      AUX DASD    AUX SCM
------------------  ---------     ---------------  ---------  ---------
      MIN            136902.1M              206          0          0
      MAX            136902.1M              206          0          0
      AVG            136902.1M              206          0          0

HIGH COMMON FRAMES        TOTAL                      AUX DASD    AUX SCM
------------------   --------                     ---------  ---------
      MIN             17301504                          0          0
      MAX             17301504                          0          0
      AVG             17301504                          0          0
```

System wide usage of Large Frame Area (Fixed Frames) and Pageable Large Frames

Size of high virtual **shared** and **common** area in units of 4KB pages

Number of auxiliary storage slots used for high virtual common and shared memory pages that are backed on SCM storage

zEC12 – Flash Memory & Pageable Large Pages...

- New SCM statistics RMF Postprocessor Page Data Set Activity report

```
                                P A G E   D A T A   S E T   A C T I V I T Y

          z/OS V1R13                SYSTEM ID TRX2              DATE 03/10/2012              INTERVAL 15.00.012
                                                                TIME 13.00.00                CYCLE 1.000 SECONDS


NUMBER OF SAMPLES =      900                      PAGE DATA SET AND SCM USAGE
                                                  --------------------------
PAGE                                                                          %     PAGE                    V
SPACE     VOLUME   DEV   DEVICE     SLOTS   ---- SLOTS USED ---   BAD       IN    TRANS NUMBER   PAGES    I
TYPE      SERIAL   NUM   TYPE       ALLOC     MIN     MAX    AVG   SLOTS     USE   TIME  IO REQ   XFER'D O  DATA SET NAME
PLPA      TRX2PP   D406  33903       71999   16851   16851  16851       0    0.00  0.000       0        0    PAGE.VTRX2PP.PLPA
COMMON    TRX2PP   D406  33903       35999      34      34     34       0    0.00  0.000       0        0    PAGE.VTRX2PP.COMMON
LOCAL     TRX2P1   D506  33903      593999       0       0      0       0    0.00  0.000       0        0 Y  PAGE.VTRX2P1.LOCAL1
SCM       N/A      N/A   N/A        131072   43151   43151  43151       0    0.00  0.000       0        0    N/A
```

System wide statistics of
4K SCM paging block usage and
SCM paging activity

zEC12 – Flash Memory & Pageable Large Pages...

- Statistics for Fixed Large Memory Objects in RMF Postprocessor Virtual Storage Activity report

```
                              V I R T U A L   S T O R A G E   A C T I V I T Y
                                                                                PAGE    4
      z/OS V2R1                SYSTEM ID SYS3            DATE 11/25/2011        INTERVAL 14.59.996
                               RPT VERSION V2R1 RMF      TIME 05.30.00          CYCLE 1.000 SECONDS

                                              PRIVATE AREA DETAIL

JOB NAME -  JES2        MEMORY LIMIT - 20000M
...

MEMORY ALLOCATION IN HIGH VIRTUAL MEMORY (ABOVE 2GB)

BYTES                    MIN                MAX                AVG     PEAK
  PRIVATE          1.823T 05.31.52  22.41T 05.50.36  11.51T   131.8T
  SHARED           485.1M 05.31.52   1822M 05.58.15  552.2M   1.333T
  COMMON           885.1M 05.31.52   1.22M 05.56.15    1.2T   1.927T

MEMORY OBJECTS
  PRIVATE                80 05.31.52     160 05.35.52     110
  SHARED                 20 05.31.52      70 05.35.52      23
  COMMON                 30 05.31.52      60 05.35.52      44
  1 MB                   20 05.31.52      70 05.35.52      25

FRAMES (1 MB)
  FIXED                   4 05.31.52      26 05.35.52      21
  PAGEABLE                4 05.31.52      26 05.35.52      21
```

Decomposition into
Fixed and Pageable Large Pages

zEC12 – Flash Memory & Pageable Large Pages...

New Large Page statistics in RMF Monitor III STORM report

System wide usage of Large Frame Area (Fixed Frames) and Pageable Large Frames

```
                        RMF V1R13  Storage Memory Objects

Samples: 60      System: TRX1  Date: 04/18/12  Time: 10.56.00

------------------------------ System Summary -------------------------------
 ---MemObj---    ---Frames---    -1MB MemObj-    --1MB Fixed--   -1MB Pageable-
 Shared     1    Shared   206    Total      4    Total     200   Initial     560
 Common    51    Common 24554    Common     3    Common     76   Dynamic       0
                 %Used    8.3                    %Used    52.8   %Used      10.5
-----------------------------------------------------------------------------
           Service       ---- Memory Objects --- -1MB Frames- ----- Bytes -----
Jobname  C Class    ASID Total  Comm   Shr  1 MB Fixed Pgable Total  Comm   Shr

OMVS     S SYSTEM   0007    15     0     0     0     0     12 1351M     0     0
COMM641M B JESLOW   0035     3     1     0     1    30      0 32.0M 30.0M     0
STOR641M B JESLOW   0054     3     0     0     1    30      0 32.0M     0     0
```

Average number of 1 MB frames that are used by pageable and DREF memory objects owned by this address space

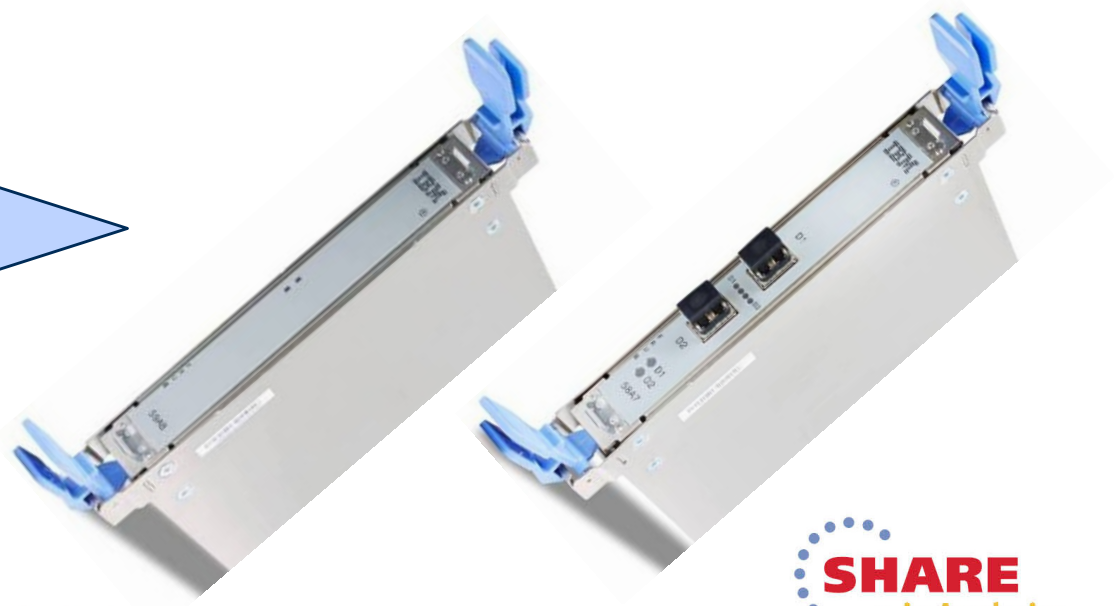
zEC12 - Data Compression Express

- 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 and zBC12.
- 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.

zEC12 - Shared Memory Communication

- 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
- 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)

✓ Common PCIe form factor
✓ Common API for retrieval of activity statistics



zEC12 - 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                   03B0
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

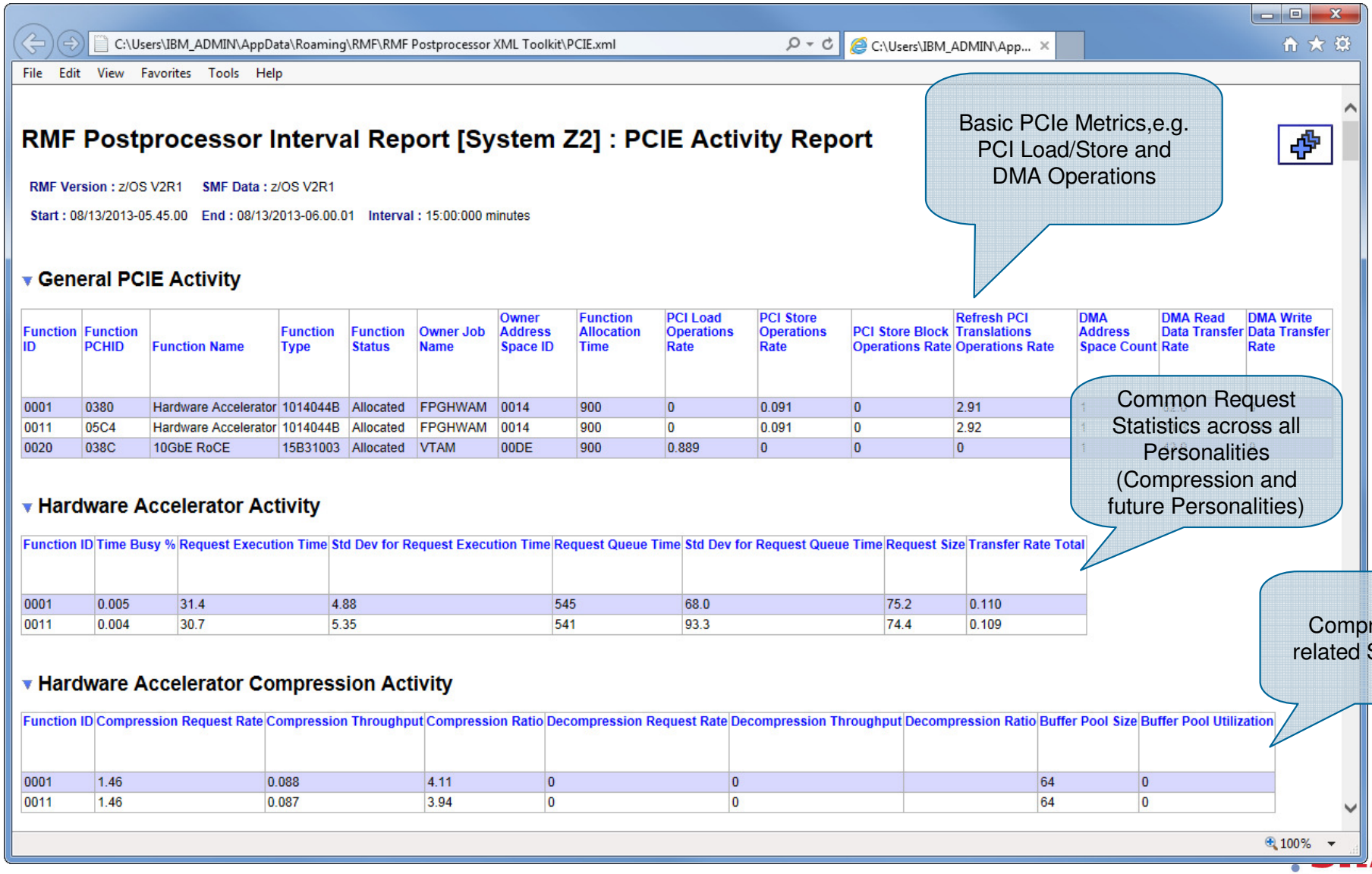
```
D PCIE,PFID=001
IQP024I 12.10.53 DISPLAY PCIE 521
PCIE     0013 ACTIVE
PFID  DEVICE TYPE NAME          STATUS  ASID  JOBNAME  PCHID VFN
0001  Hardware Accelerator      ALLC    0014  FPGHWAM  0380  0001
 CLIENT ASIDS: NONE
 Application Description: zEDC Express
 Device State: Ready
 Adapter Info -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

zEC12 - 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

- 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)

zEC12 - RMF Postprocessor PCIE Activity Report



C:\Users\IBM_ADMIN\AppData\Roaming\RMF\RMF Postprocessor XML Toolkit\PCIE.xml

File Edit View Favorites Tools Help

RMF Postprocessor Interval Report [System Z2] : PCIE Activity Report

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

Start : 08/13/2013-05.45.00 End : 08/13/2013-06.00.01 Interval : 15:00:000 minutes

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
0001	0380	Hardware Accelerator	1014044B	Allocated	FPGHWAM	0014	900	0	0.091	0	2.91			
0011	05C4	Hardware Accelerator	1014044B	Allocated	FPGHWAM	0014	900	0	0.091	0	2.92			
0020	038C	10GbE RoCE	15B31003	Allocated	VTAM	00DE	900	0.889	0	0	0			

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
0001	0.005	31.4	4.88	545	68.0	75.2	0.110
0011	0.004	30.7	5.35	541	93.3	74.4	0.109

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
0001	1.46	0.088	4.11	0	0		64	0
0011	1.46	0.087	3.94	0	0		64	0

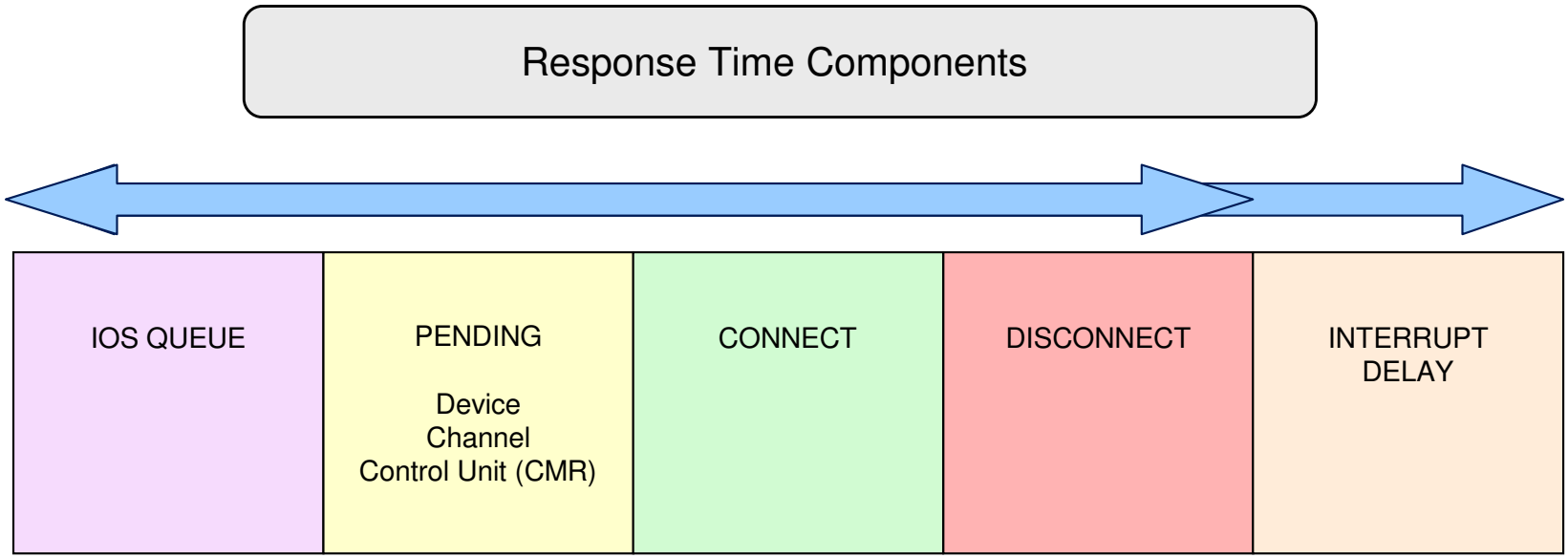
100%

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

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

Compression related Statistics

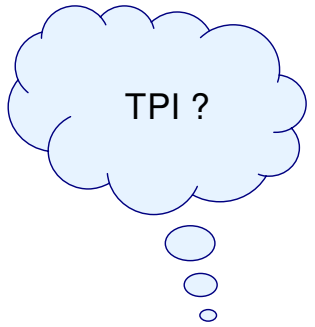
zEC12 – I/O Interrupt Delay Time

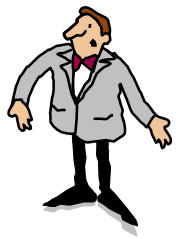


- Interrupt Delay time measures the time between when the I/O completes and z/OS issues the TSCH instruction to retrieve the results.
- How long does it take for z/OS to see and process the interrupt after I/O completes ?

zEC12 – I/O Interrupt Delay Time

- I/O interrupt delay time (aka I/O elongation) occurs when an I/O is delayed due to
  - a non-dispatched logical processor
  - the lack of an interrupt enabled CP
- I/O interrupt delay time is NOT included in the I/O response time
- I/O interrupt delay time could NOT be measured in the past



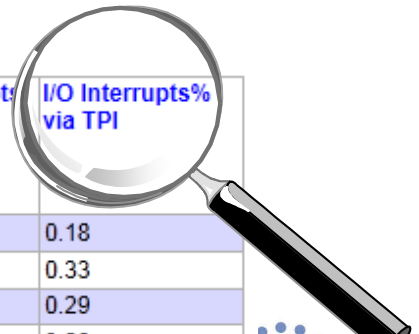


CPU Activity

CPU : 2817 Model : 729 H/W Model : M32 Sequence Code : 00000000000E3206 HiperDispatch : NO

CPC Capacity : 2780 Change Reason : NONE

CPU Number	CPU Type	Time% Online	Time% LPAR Busy	Time% MVS Busy	Time% Parked	LOG PROC Share%	HiperDispatch Priority	I/O Interrupts Rate	I/O Interrupts% via TPI
0	CP	100.00	1.60	1.57	------	31.9		1.87	0.18
1	CP	100.00	1.14	1.12	------	31.9		2.69	0.33
2	CP	100.00	0.85	0.83	------	31.9		2.72	0.29
TOTAL/AVERAGE	CP		**1.20**	**1.18**		**95.7**		**7.27**	**0.28**



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zEC12 – I/O Interrupt Delay Time

- New field AVG INT DLY in RMF Postprocessor Device Activity report.
- Caution: Interrupt Delay Time is not included in AVG RESP Time

D I R E C T A C C E S S D E V I C E A C T I V I T Y

z/OS V1R13 SYSTEM ID TRX2 DATE 11/23/2011 INTERVAL 14.59.998
RPT VERSION V1R13 RMF TIME 12.30.00 CYCLE 1.000 SECONDS

TOTAL SAMPLES = 900 IODF = 01 CR-DATE: 11/15/2011 CR-TIME: 07.33.54 ACT: POR

STORAGE GROUP	DEV NUM	DEVICE TYPE	NUMBER OF CYL	VOLUME SERIAL	PAV	LCU	DEVICE ACTIVITY RATE	AVG RESP TIME	AVG IOSQ TIME	AVG CMR DLY	AVG DB DLY	AVG INT DLY	AVG PEND TIME	AVG DISC TIME	AVG CONN TIME
XTEST	2208	33903	3339	TRXSX9	1	0032	0.001	.384	.000	.128	.000	.123	.256	.000	.128
XTEST	2209	33903	3339	TRXSXA	1	0032	0.001	.256	.000	.000	.000	.135	.256	.000	.000
	220A	33909	10017	TRXT01	1	0032	0.000	.000	.000	.000	.000	.000	.000	.000	.000
	220B	33909	10017	TRXT02	1	0032	0.000	.000	.000	.000	.000	.000	.000	.000	.000

zEC12 – Enhanced CF Link Reporting

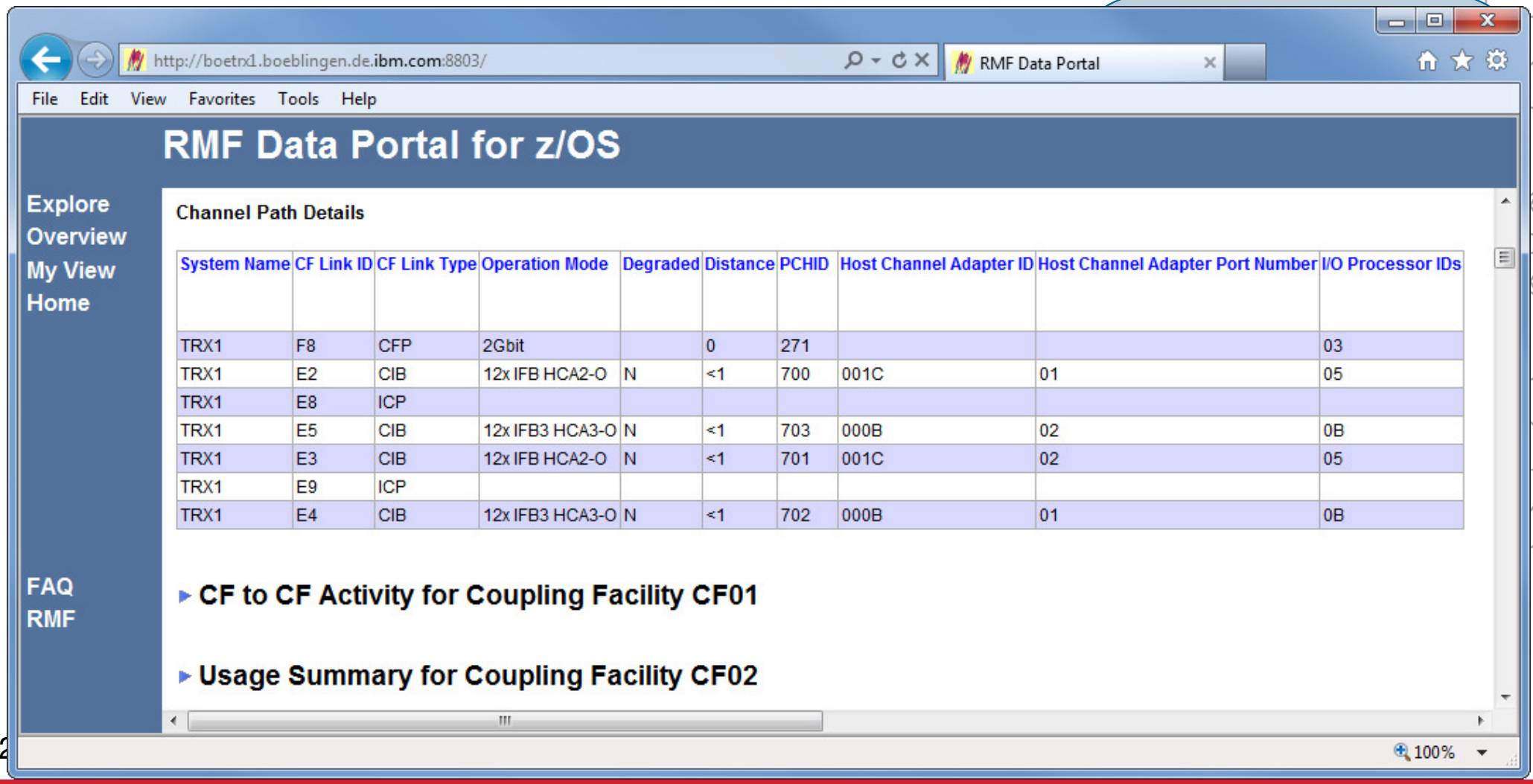
- In a System z environment different types of coupling links can be used to connect a Coupling Facility (CF) to the operating system.
- Each coupling link type has effect on link performance, response times and coupling overheads.
- For configurations covering large distances, the time spent on the link can be the largest part of the response time.

Type	Description	CHPID Type	Link Rate	Distance
ISC-3	InterSystem Channel-3	CFP (CF Peer)	2 Gbps	10 km unrepeated (6.2 miles) 100 km repeated
PSIFB	12x IB-DDR Parallel Sysplex InfiniBand 12x IB-SDR Parallel Sysplex InfiniBand	CIB (Coupling over Infiniband)	6 GBps 3 GBps (When connected to a System z9 EC or System z9 BC)	150 meters (492 feet)
PSIFB-LR	1x IB-SDR Parallel Sysplex InfiniBand – Long Reach Double data rate (1 x IB-DDR) is supported if connected to a System z qualified DWDM supporting DDR.	CIB (Coupling over Infiniband)	2.5 Gbps 5.0 Gbps	10 km unrepeated (6.2.miles) 100 km repeated
IC	Internal Coupling Channel	ICP (Internal CF Peer)	Internal speeds	n/a

zEC12 – Enhanced CF Link Reporting

RMF Postprocessor Coupling Facility Activity Report:

- New CHANNEL PATH DETAILS in Subchannel Activity Section



System Name	CF Link ID	CF Link Type	Operation Mode	Degraded	Distance	PCHID	Host Channel Adapter ID	Host Channel Adapter Port Number	I/O Processor IDs
TRX1	F8	CFP	2Gbit		0	271			03
TRX1	E2	CIB	12x IFB HCA2-O	N	<1	700	001C	01	05
TRX1	E8	ICP							
TRX1	E5	CIB	12x IFB3 HCA3-O	N	<1	703	000B	02	0B
TRX1	E3	CIB	12x IFB HCA2-O	N	<1	701	001C	02	05
TRX1	E9	ICP							
TRX1	E4	CIB	12x IFB3 HCA3-O	N	<1	702	000B	01	0B

zEC12 – Enhanced CF Link Reporting…

RMF Postprocessor Coupling Facility Activity Report:

- New CHANNEL PATH DETAILS in CF to CF Activity Section

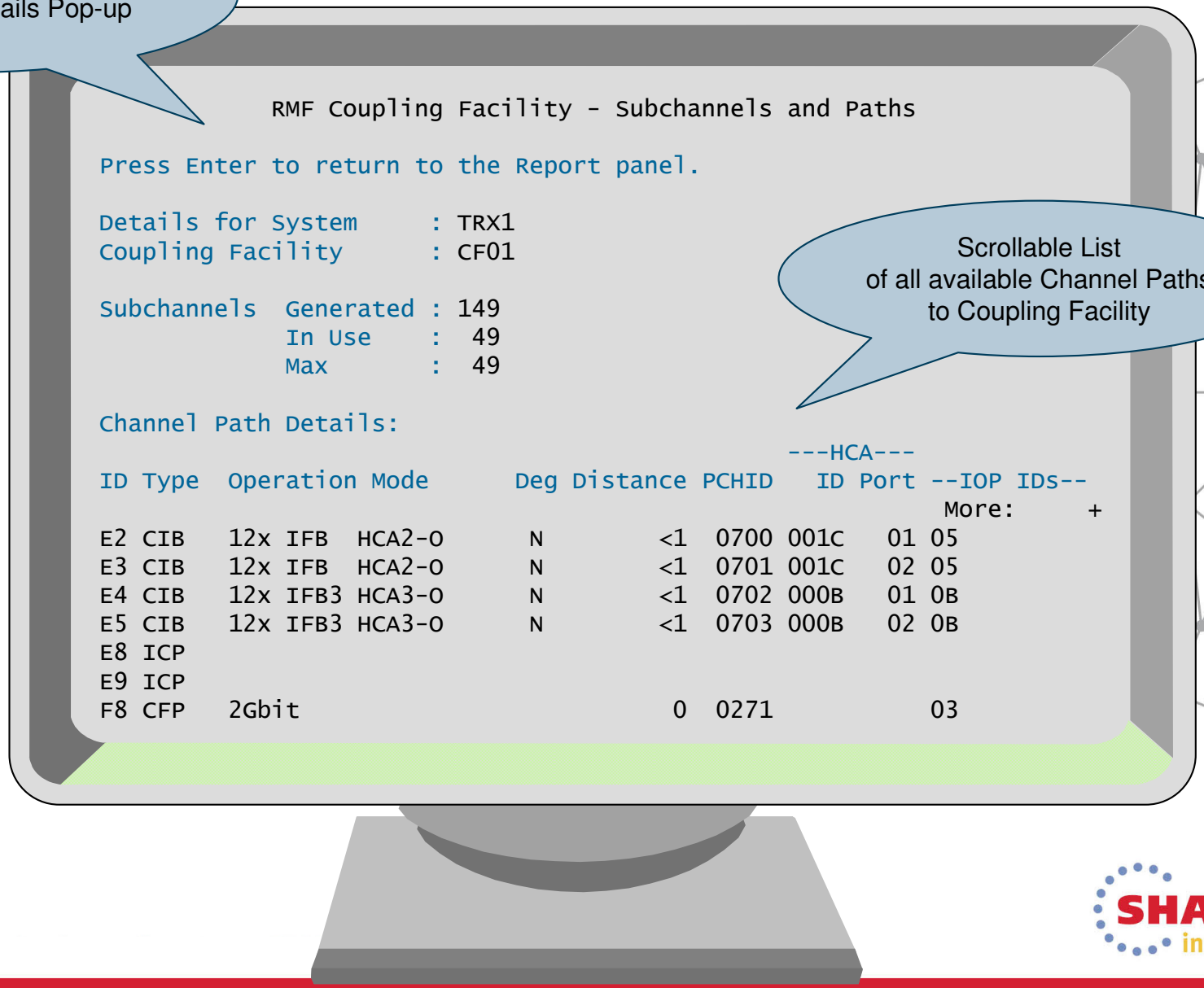
```
COUPLING FACILITY NAME = X5CFP87
-------------------------------------------------------------------------------------------------------------------
                                                CF TO CF ACTIVITY
-------------------------------------------------------------------------------------------------------------------
            # REQ                              ---------- REQUESTS ----------   ----------
 PEER       TOTAL        -- CF LINKS --                 #   -SERVICE TIME(MIC)          #
 CF         AVG/SEC      TYPE       USE                 REQ     AVG    STD_DEV          REQ
 X5CFH89  243089         CFP          2        SYNC  243089    18.6       4.9    SYNC     0     0.0                  0.0       0.0
            270.1
 X5CFR89   34647K        CIB          6        SYNC   34647K   12.4       4.0    SYNC    83                   8.4       9.0       0.0
            38497
-------------------------------------------------------------------------------------------------------------------
                                                CHANNEL PATH DETAILS
-------------------------------------------------------------------------------------------------------------------
 PEER CF    ID  TYPE    OPERATION MODE      DEGRADED   DISTANCE
 X5CFH89    02  CFP     2GBIT                          0
            03  CFP     2GBIT                          0
 X5CFR89    D0  CIB     12X IFB  HCA3-O        N        <1
            D1  CIB     12X IFB  HCA3-O        N        <1
            D2  CIB     12X IFB  HCA3-O        N        <1
            D3  CIB     12X IFB  HCA3-O        N        <1
            E0  CIB     12X IFB3 HCA3-O        Y        <1
            E1  CIB     12X IFB3 HCA3-O        Y        <1
```

Channel path details for CF to CF links of type CIB or CFP:

- Operation mode
- Degraded status
- Link distance

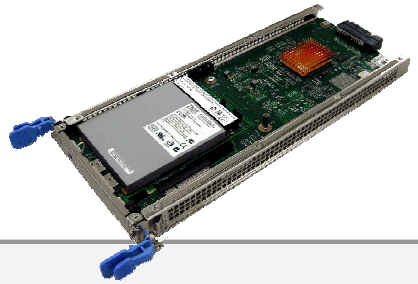
zEC12 – Enhanced CF Link Reporting…

RMF Monitor III CFSYS Report:
Channel Paths Details Pop-up



Scrollable List
of all available Channel Paths
to Coupling Facility

zEC12 - Support of Crypto Express4 Card



OA37016

```
                                C R Y P T O   H A R D W A R E   A C T I V I T Y

            z/OS V1R13                  SYSTEM ID SYSF            DATE 11/29/2011
                                        RPT VERSION V1R13 RMF     TIME 16.00.00
-------- CRYPTOGRAPHIC COPROCESSOR --------
           -------- TOTAL --------  KEY-GEN
TYPE    ID    RATE   EXEC TIME  UTIL%   RATE
CEX2C    0    0.00     0.000      0.0    0.00
         1    2.16     295.9     63.9    2.14
CEX3C    2    0.00     0.000      0.0    0.00
CEX4C    4    2.15     227.8     48.9    2.15

-------- 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%
CEX2A    3   766.9     0.434     33.3   1024    362.4      0.521       18.9    369.5      0.183       6.8
                                        2048     0.00      0.000        0.0    34.99      2.175       7.6
CEX4A    5   998.9     0.365     36.5   1024    246.4      0.534       13.2    554.3      0.205      11.3
                                        2048     0.00      0.000        0.0    83.16      0.689       5.7
                                        4096     0.00      0.000        0.0    115.1      0.547       6.3

 -------- ICSF SERVICES ------------------------------------------------------------------------------------------
         ---- ENCRYPTION -----     ---- DECRYPTION -----     ----- MAC ------     -------- HASH ---------     ------ PIN -------
           SDES     TDES     AES     SDES     TDES     AES    GENERATE  VERIFY    SHA-256  SHA-512    TRANSLATE   VERIFY
 RATE      0.00     0.00     0.00     0.00     0.00     0.00       0.00    0.00       0.00     0.00       0.00        0.00      0.00
 SIZE      0.00     0.00     0.00     0.00     0.00     0.00       0.00    0.00       0.00     0.00
```

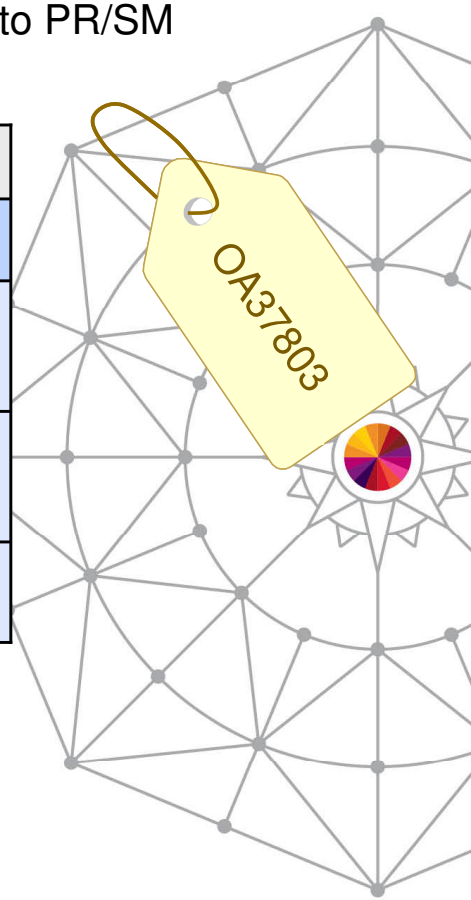
All measurements available for Crypto Express4 Card

zEC12 - Warning Track Interruption Facility Statistics

- In a PR/SM™ environment the LPAR hypervisor assigns physical engines to logical engines accordingly to the weighting factors of the partitions.
- Once the time slice for a logical engine is expired the currently executing work is suspended until a physical engine is assigned to the logical engine again.
- The Warning Track Interruption Facility notifies the operating system that PR/SM™ will undispatch a certain logical processor within the next 50 microseconds (grace period).
- z/OS is now able to save status for the running unit of work and re-dispatch the work unit on a different logical processor within the grace period.
- z/OS now signals to PR/SM that the logical processor can be un-dispatched.
- Warning Track processing is only supported in HyperDispatch=YES environments.
- A high benefit can be achieved for Vertical Medium and Low (VM/VL) processors that have a smaller capacity share guaranteed by PR/SM

zEC12 - Warning Track Interruption Facility Statistics...

- RMF keeps track of the number of times PR/SM issued a warning-track interruption to a logical processor and z/OS was able/unable to return the logical processor within the grace period.
- RMF measures the amount of time in microseconds that a processor was yielded to PR/SM due to Warning-track processing.



SMF record type 70 subtype 1 (CPU Activity) – CPU data section				
Offset	Name	Length	Format	Description
80 x50	SMF70WTS	4	Binary	The number of times PR/SM issued a warning-track interruption to a logical processor and z/OS was able to return the logical processor within the grace period.
84 x54	SMF70WTU	4	Binary	The number of times PR/SM issued a warning-track interruption to a logical processor and z/OS was unable to return the logical processor within the grace period.
88 x58	SMF70WTI	4	Binary	Amount of time in microseconds that a logical processor was yielded to PR/SM due to Warning Track processing.

RMF Postprocessor Overview Conditions		
Name	Qualifier	Description
WTRKCP (WTRKAAP) (WTRKIIP)	cpu-id	The percentage of times PR/SM issued a warning-track interruption to a processor and z/OS was able to return it to PR/SM within the grace period.
WTRKTCP (WTRKTAAP) (WTRKTIIP)	cpu-id	Time in microseconds that a purpose processor was yielded to PR/SM due to Warning Track processing.

RMF Monitor III zIIP Exploitation

- With z/OS V2R1 RMF, the Monitor III Data Gatherer (RMFGAT) can partially offload work to zIIP processors
- By default the RMF Monitor III Data Gatherer (RMFGAT) is enabled for zIIP exploitation
- When at least one zIIP processor is online for an LPAR, RMFGAT is partially offloading work to this processor without any further user interaction
- The RMFGAT zIIP exploitation can be controlled initially by means of the new Monitor III parmlib option ZIIPUSE

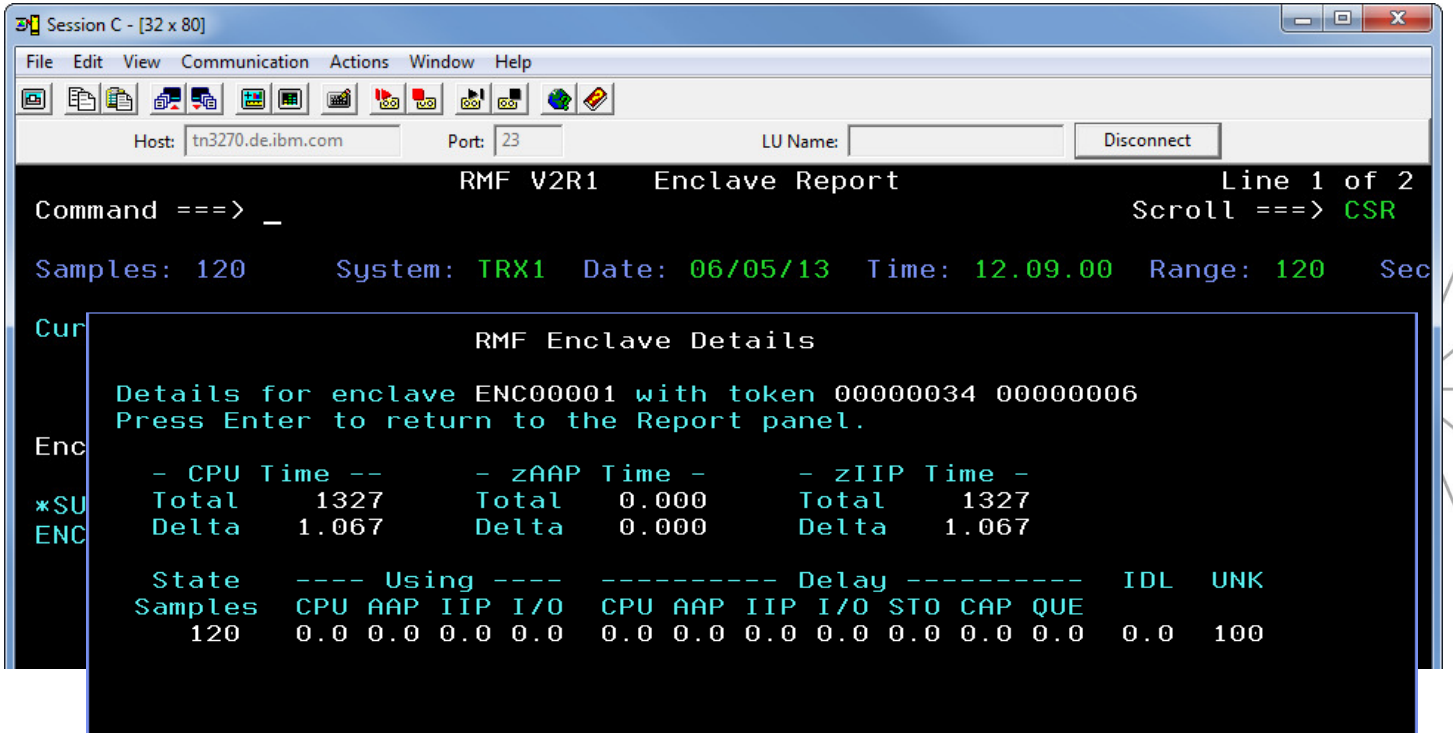
```
SYNC(00)                /* MINTIME SYNCHRONIZATION                */
SYSOUT(A)               /* MESSAGES TO SYSOUT CLASS A             */
WSTOR(32)               /* SIZE OF INSTORAGE BUFFER (IN MB)       */
ZIIPUSE                 /* PARTIAL USE OF zIIP ENGINES            */
IOSUB                   /* I/O SUBSYSTEM GATHERING ACTIVE         */
CFDETAIL                /* COUPLING FACILITY DETAILS              */
CACHE                   /* ACTIVATE CACHE GATHERING               */
VSAMRLS                 /* ACTIVATE VSAM RLS GATHERING            */
OPD                     /* ACTIVATE OMVS PROCESS DATA GATHERING   */
```

New Option ZIIPUSE

- The RMFGAT zIIP exploitation can be activated/deactivated dynamically by means of the following command: F RMF,F III,ZIIPUSE/NOZIIPUSE

RMF Monitor III zIIP Exploitation...

- When at least one zIIP processor is recognized by the Monitor III gatherer, RMFGAT will schedule an Enclave SRB and offloads the Coupling Facility gathering to the zIIP

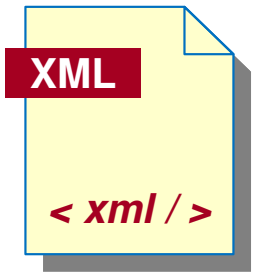


- In case the zIIP processor is activated dynamically by the CONFIG CPU(xx),ONLINE command, RMFGAT can exploit this processor starting with the next MINTIME
- Installations without Coupling Facilities (e.g. Monoplex) won't see significant RMFGAT zIIP activity

Postprocessor XML Formatted Reports

Rationale:

- RMF Postprocessor reports are limited to a page width of 132 characters
- No state-of-the-art display capability of Postprocessor reports
- No easy access to RMF Postprocessor data for application programs
  - ⇨ cumbersome to parse the text output
  - ⇨ each report has its own layout



RMF Postprocessor reports can now be generated in XML Format

Postprocessor XML Formatted Reports...

z/OS V1R11 RMF	z/OS V1R12 RMF	z/OS V1R13 RMF	z/OS V2R1 RMF
CPU Activity CRYPTO Activity FICON Director Activity ESS Disk Systems Activity OMVS Kernel Activity report OVERVIEW Report	DEVICE Activity WORKLOAD Activity	PAGING Activity SDELAY (XML only)	CACHE Subsystem Activity CF Activity CHANNEL Path Activity ENQUEUE Avtivity HFS Statistics IOQ Activity PCIE Activity (XML-only) PAGESP Activity SDEVICE Activity report VSTOR Activity XCF Activity

- Summary and Exception reports as well as interval reports based on data collected by a Monitor II background session are not available in XML format
- The XML format is the preferred RMF Postprocessor Report format for the future
- The XML Format supersedes the Text format. New Reports might not be implemented in Text format

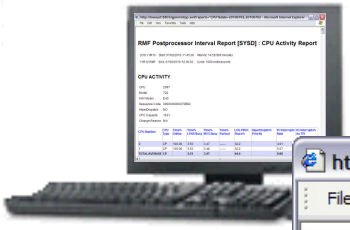
Postprocessor XML Formatted Reports...

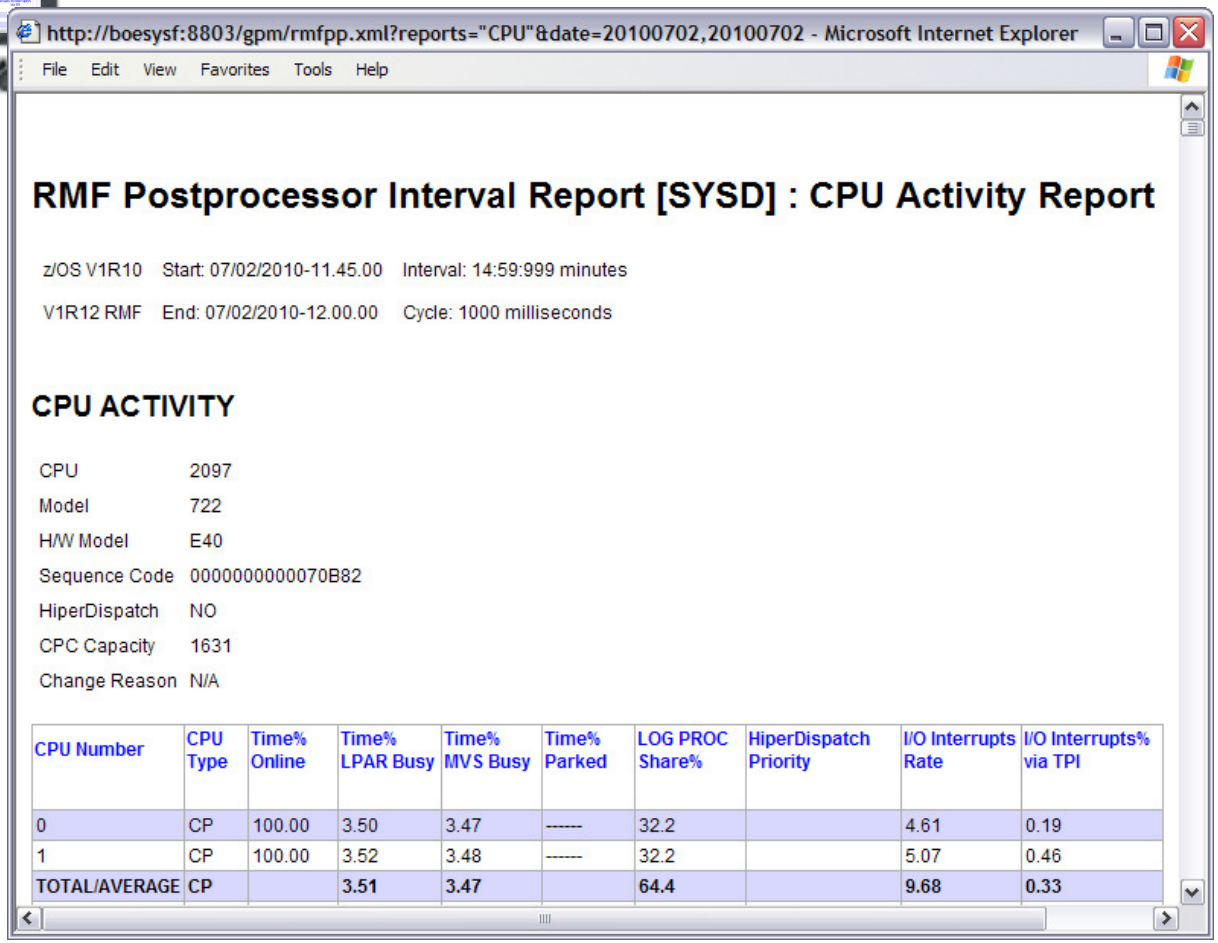
- The generation of Postprocessor reports in XML format is controlled by the new ddnames XPRPTS, XPXSRPTS and XPOVWRPT
- If the XML output is routed to permanent data sets rather than to SYSOUT, define the data set with RECFM=VB and LRECL between 256 and 8192. Specify an appropriate BLKSIZE.

ddname	Contents	Allocations	Notes
XPRPTS	Combined **single-system** report in XML format	One ddname for one data set to contain all single system reports for each interval during the session.	There is no dynamic allocation of this ddname, you have to define it explicitly if you want to get all reports in XML format into one data set or output class. If you define this ddname, no MFRnnnnn files are created. If you define this ddname and PPRPTS, no XML output in file XPRPTS is created.
XPOVWRPT	Combined **Overview** report in XML format	One ddname for one data set to contain all overview reports for each system included in the input data.	There is no dynamic allocation of this ddname, you have to define it explicitly if you want to get all overview reports in XML format into one data set or output class. If you define this ddname, no PPORPnnn files are created.
XPXSRPTS	Combined **sysplex-wide** report in XML format	One ddname for one data set to contain all sysplex reports for each interval included in the input data.	There is no dynamic allocation of this ddname, you have to define it explicitly if you want to get all reports in XML format into one data set or output class. If you define this ddname, no MFRnnnnn files are created. If you define this ddname and PPXSRPTS, no XML output in file XPXSRPTS is created.

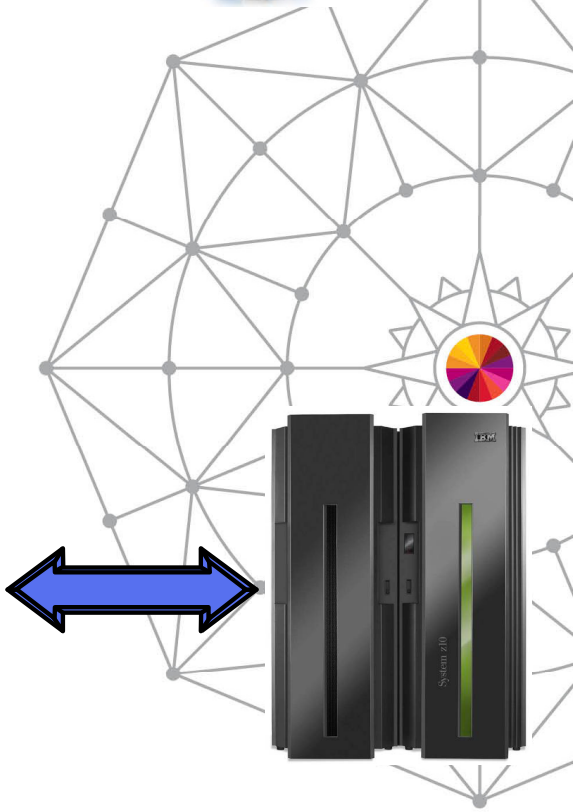
HTTP API to access Postprocessor XML Reports

- Web browser can be used as Postprocessor Data Portal
- All RMF Postprocessor XML formatted reports supported
- Application programs can use Distributed Data Server (DDS) HTTP API to retrieve RMF Postprocessor XML reports

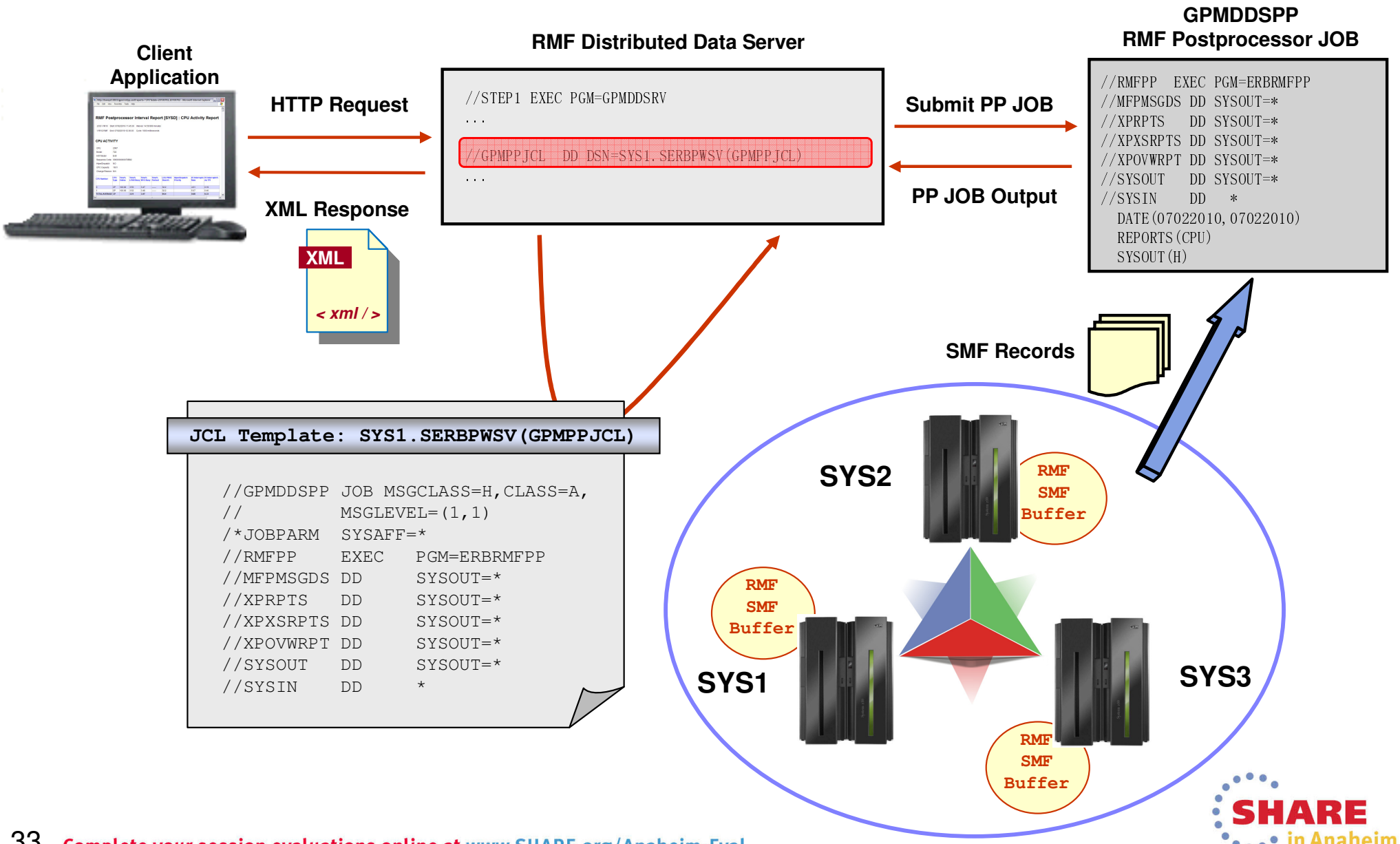




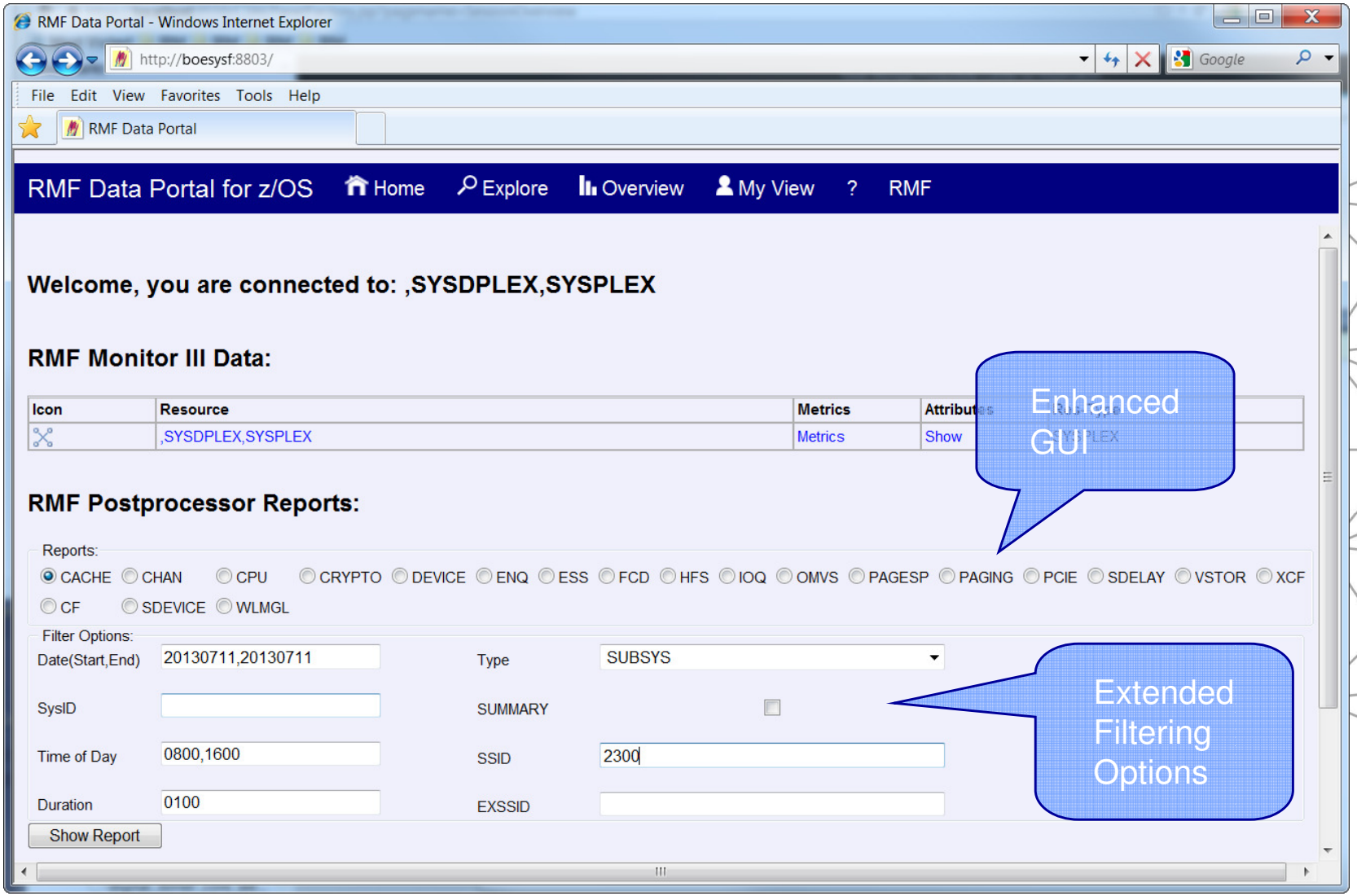
CPU Number	CPU Type	Time% Online	Time% LPAR Busy	Time% MVS Busy	Time% Parked	LOG PROC Share%	HiperDispatch Priority	I/O Interrupts Rate	I/O Interrupts% via TPI
0	CP	100.00	3.50	3.47	------	32.2		4.61	0.19
1	CP	100.00	3.52	3.48	------	32.2		5.07	0.46
TOTAL/AVERAGE	CP		3.51	3.47		64.4		9.68	0.33



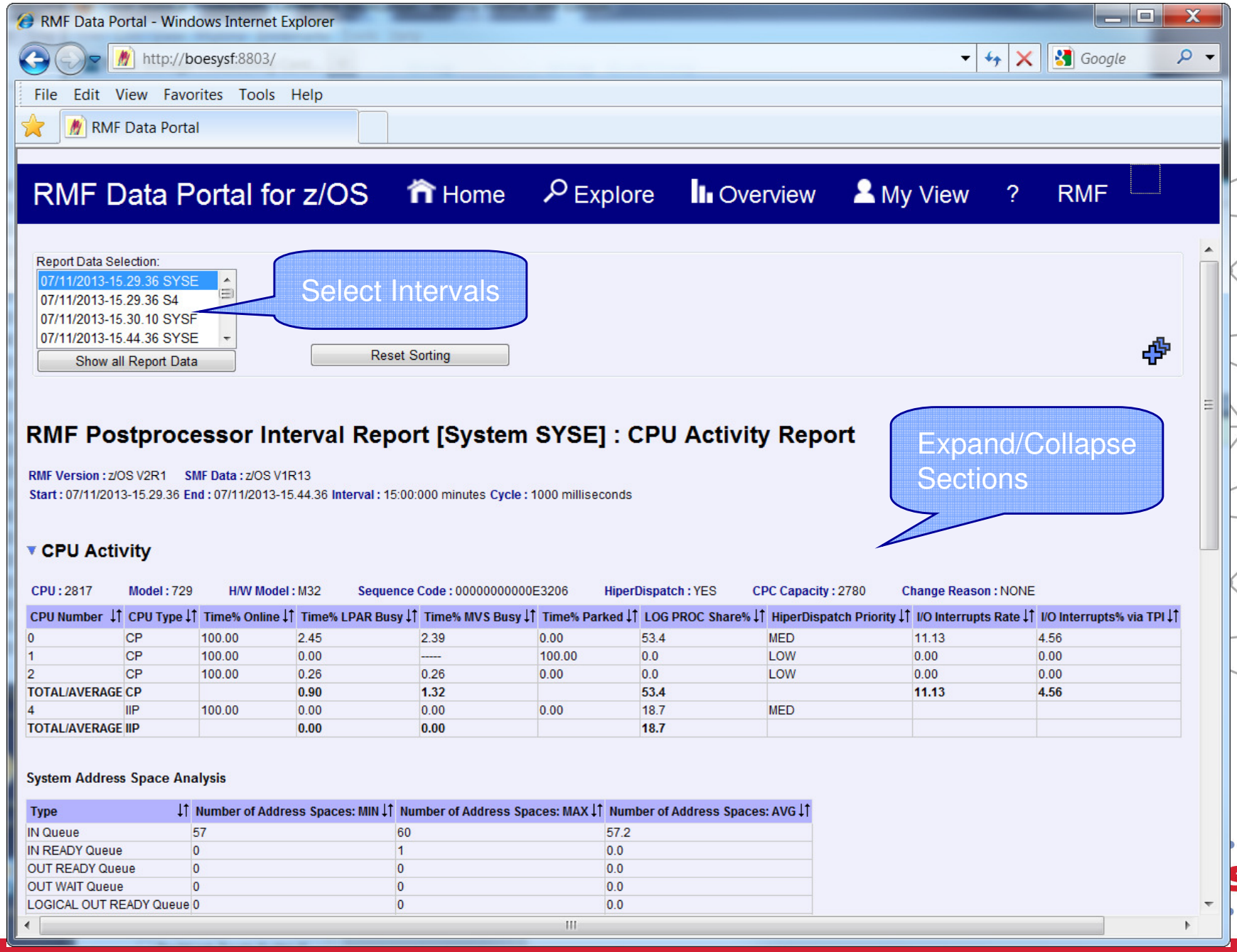
HTTP API to access Historical Data...



Postprocessor XML Formatted Reports...



Postprocessor XML Formatted Reports...



CPU Number	CPU Type	Time% Online	Time% LPAR Busy	Time% MVS Busy	Time% Parked	LOG PROC Share%	HiperDispatch Priority	I/O Interrupts Rate	I/O Interrupts% via TPI
0	CP	100.00	2.45	2.39	0.00	53.4	MED	11.13	4.56
1	CP	100.00	0.00	-----	100.00	0.0	LOW	0.00	0.00
2	CP	100.00	0.26	0.26	0.00	0.0	LOW	0.00	0.00
TOTAL/AVERAGE	**CP**		**0.90**	**1.32**		**53.4**		**11.13**	**4.56**
4	IIP	100.00	0.00	0.00	0.00	18.7	MED		
TOTAL/AVERAGE	**IIP**		**0.00**	**0.00**		**18.7**			

Type	Number of Address Spaces: MIN	Number of Address Spaces: MAX	Number of Address Spaces: AVG
IN Queue	57	60	57.2
IN READY Queue	0	1	0.0
OUT READY Queue	0	0	0.0
OUT WAIT Queue	0	0	0.0
LOGICAL OUT READY Queue	0	0	0.0

Postprocessor XML Formatted Reports...

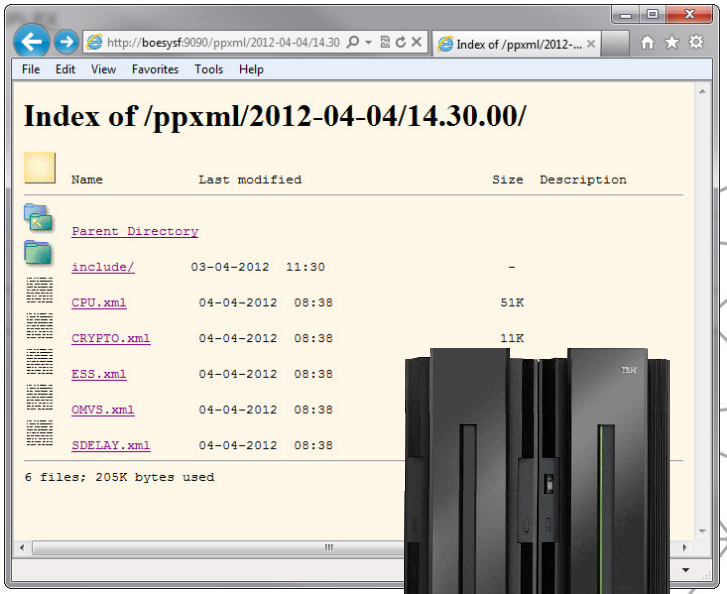
The RMF Data Portal is currently limited to the SMF Buffer of the RMF Sysplex Data Server.
No SMF Dump Data Sets can be specified

```
//SHARAnnX JOB (DE03141,,),'SHARAnn',CLASS=A,USER=SHARAnn,
//         MSGCLASS=H,MSGLEVEL=(1,1),NOTIFY=SHARAnn
//*
//XMLPP    PROC REPORT=
//RMFPP    EXEC PGM=ERBRMFPP,COND=(4,LT,GETSMF)
//MFPINPUT DD   DISP=(OLD,PASS),DSN=*.RMFSORT.SORTOUT
//MFPMSGDS DD   SYSOUT=*
//XPRPTS   DD   PATH='/sharelab/sharann/xmlpp/&REPORT..xml',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=(SIRUSR,SIWUSR,SIRGRP),FILEDATA=TEXT
//XPXSRPTS DD   PATH='/sharelab/sharann/xmlpp/&REPORT..xml',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=(SIRUSR,SIWUSR,SIRGRP),FILEDATA=TEXT
//         PEND
//PPCPU    EXEC PROC=XMLPP,REPORT=CPU
//RMFPP.SYSIN DD   *
  REPORTS(CPU)
//PPWLMGL  EXEC PROC=XMLPP,REPORT=WLMGL
//RMFPP.SYSIN DD   *
  SYSRPTS(WLMGL(SCPER,POLICY))
//
```

Execute the Postprocessor JCL and redirect the output to any HFS directory

Postprocessor XML Report Access via IBM HTTP Server

- RMF Postprocessor Reports: Everywhere and Anytime

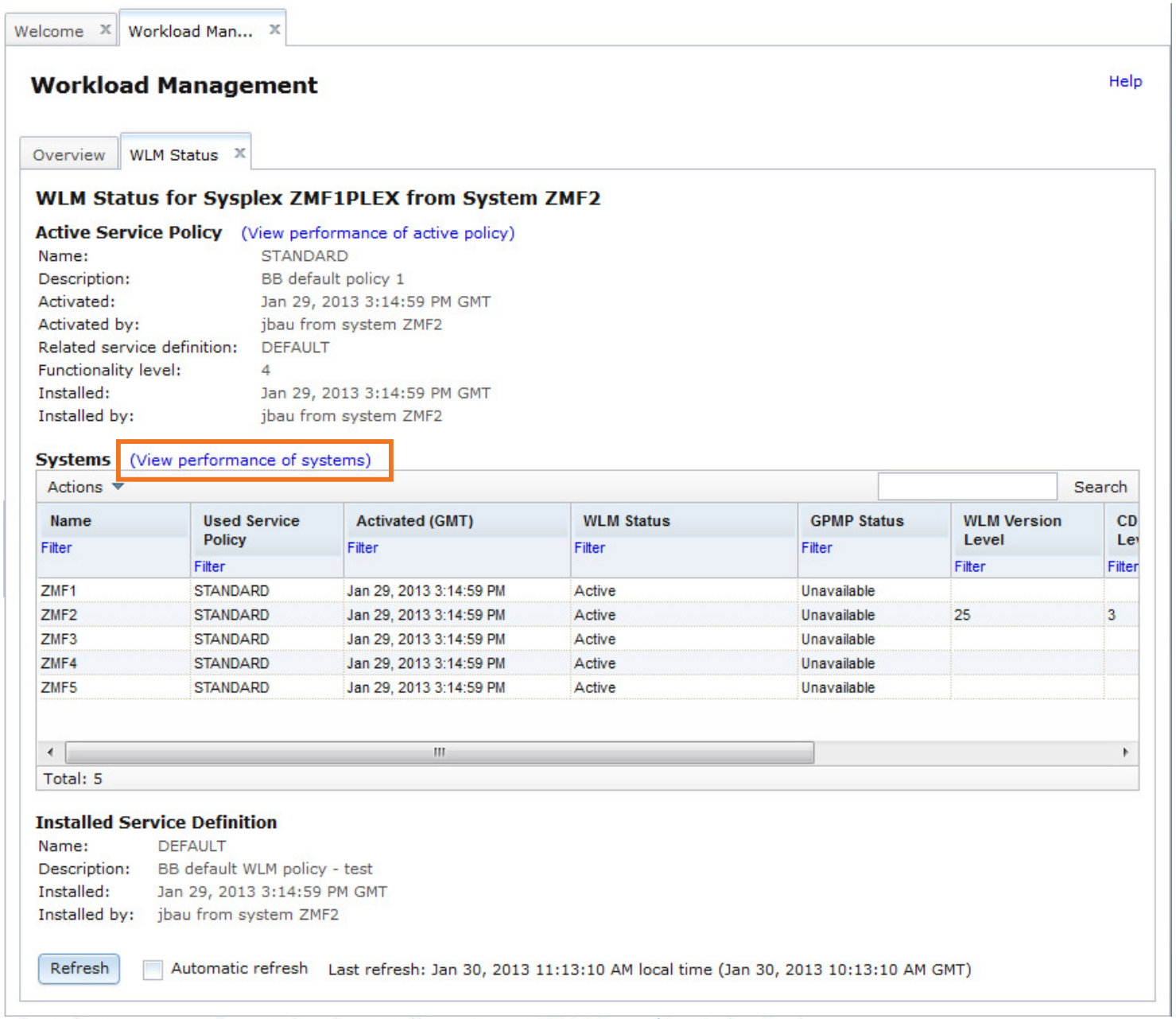


- ✓ Instant Access to all Reports
- ✓ No Maintenance of raw Data Archives

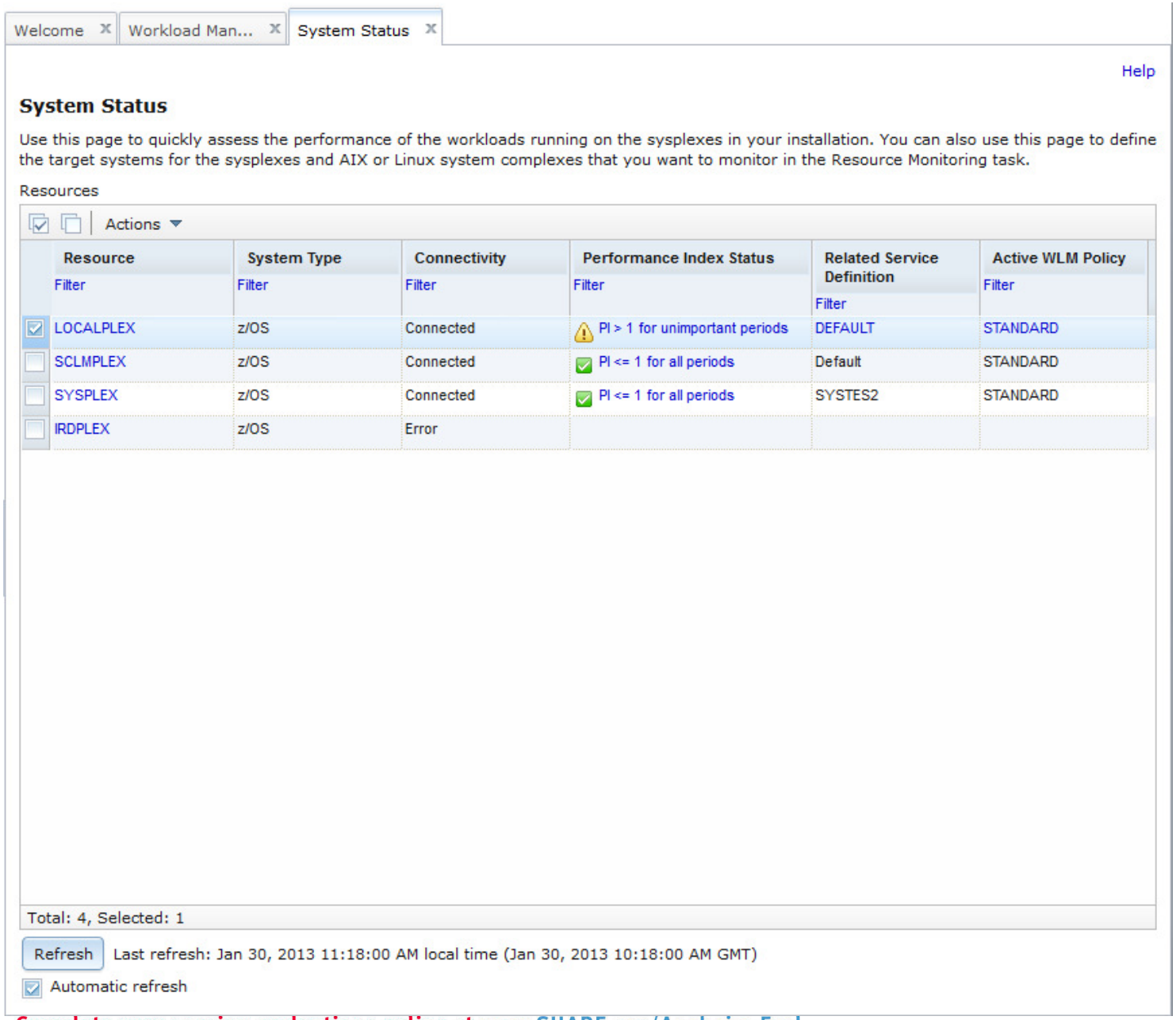
z/OSMF Application Linking (Resource Monitoring & WLM)

- The definitions of Workload Management determine the performance behavior of the systems.
- Resource Monitoring visualizes the performance behavior.
- Link z/OSMF WLM and RM to each other:
  - ⇨ When you work with WLM service definitions:
    Jump to Resource Monitoring to visualize the resulting performance.
  - ⇨ When you detect abnormal metric values in Resource Monitoring:
    Jump to Workload Management to look at the service definition.
- Performance metrics can be viewed more easily in context with the active service definition/policy and vice versa.

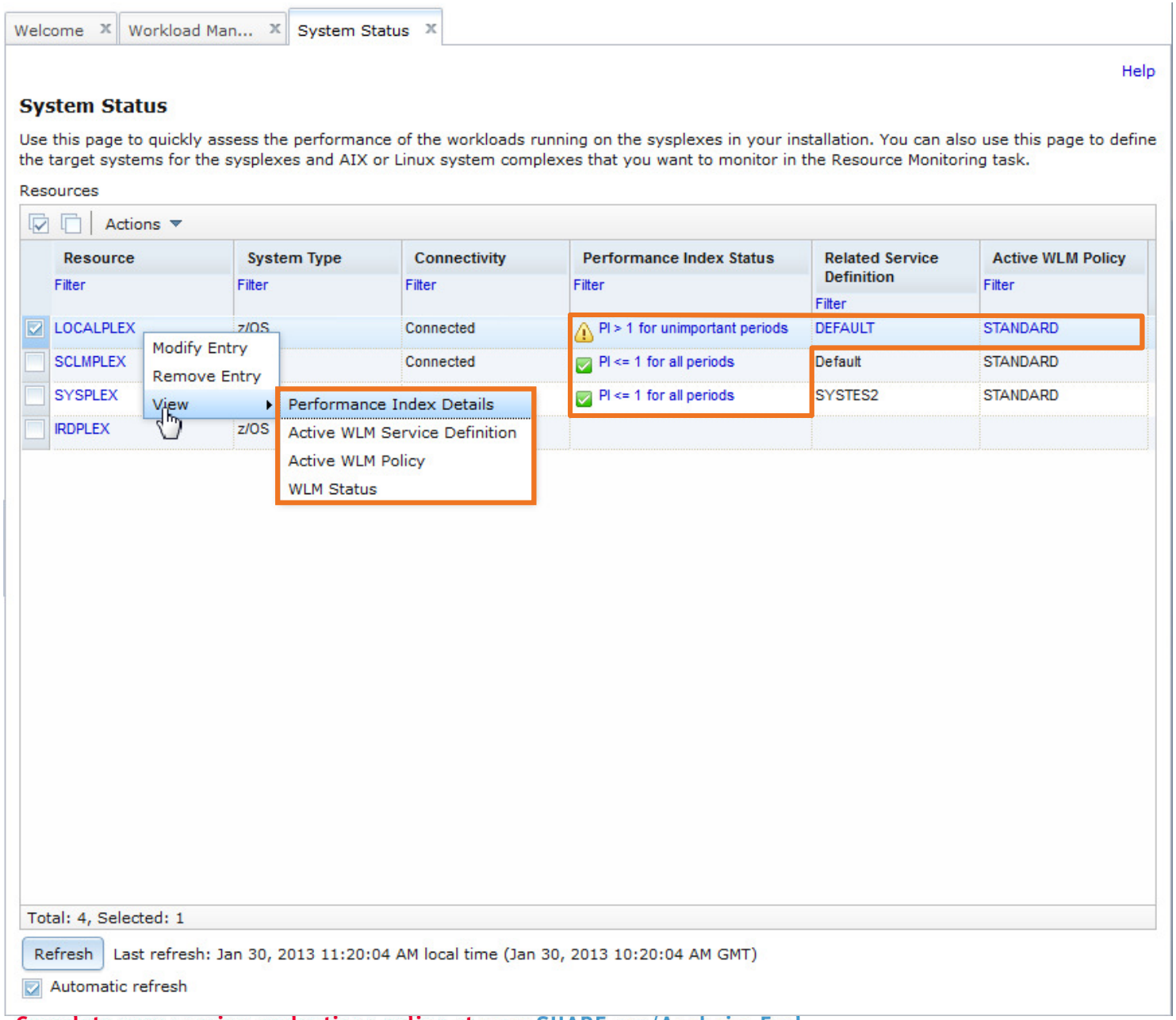
From WLM Status to RM System Status



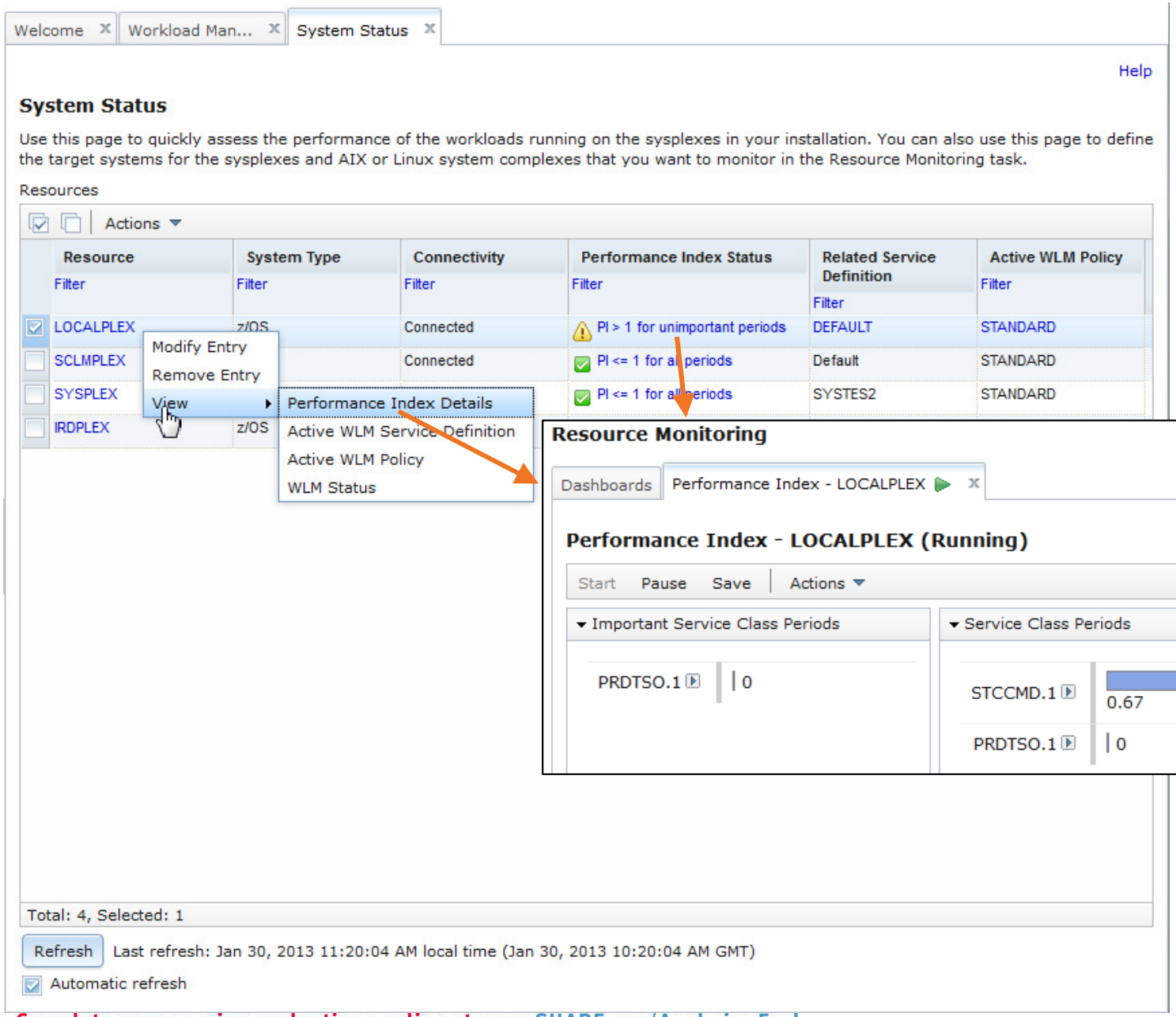
RM System Status



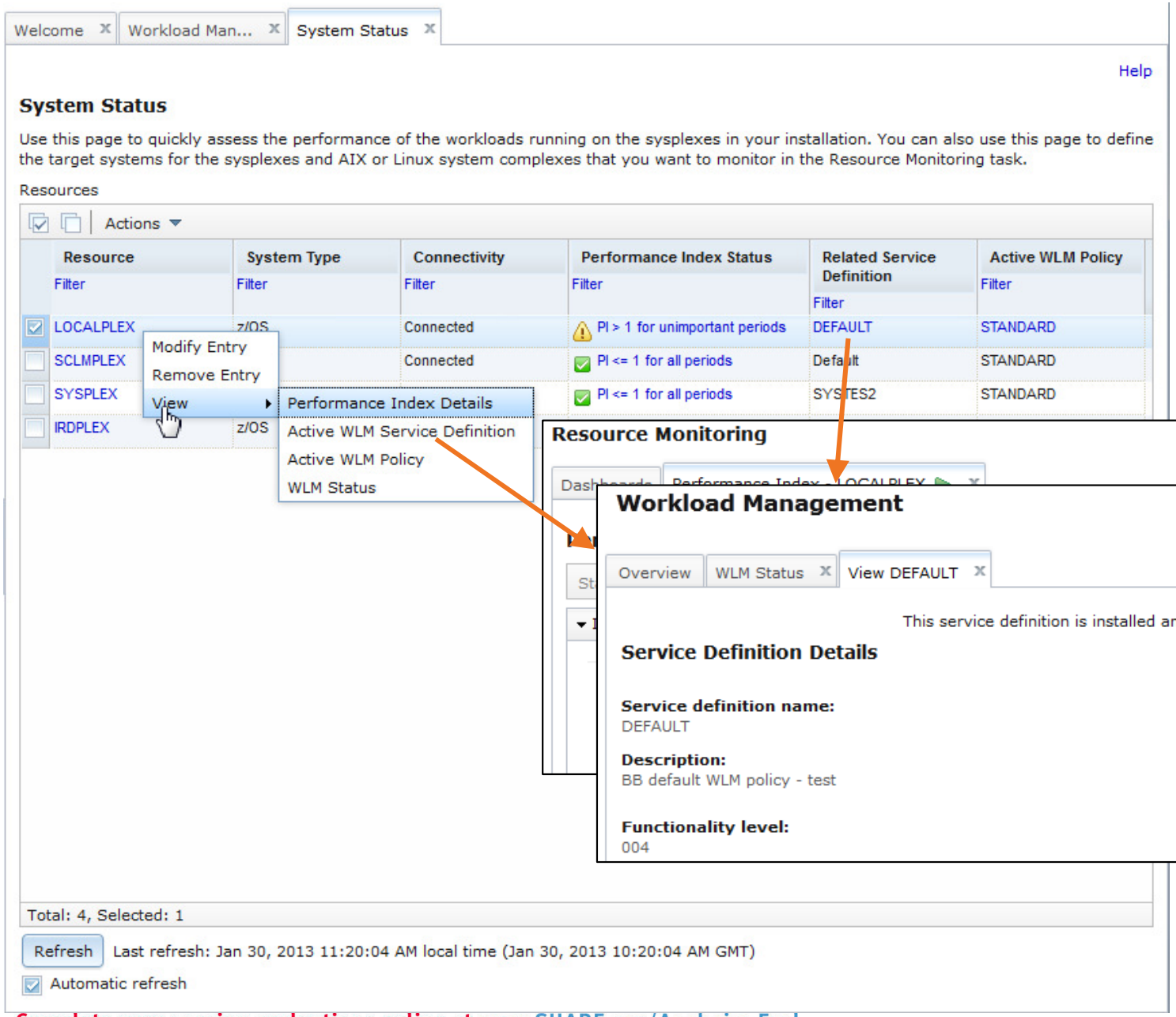
From RM System Status



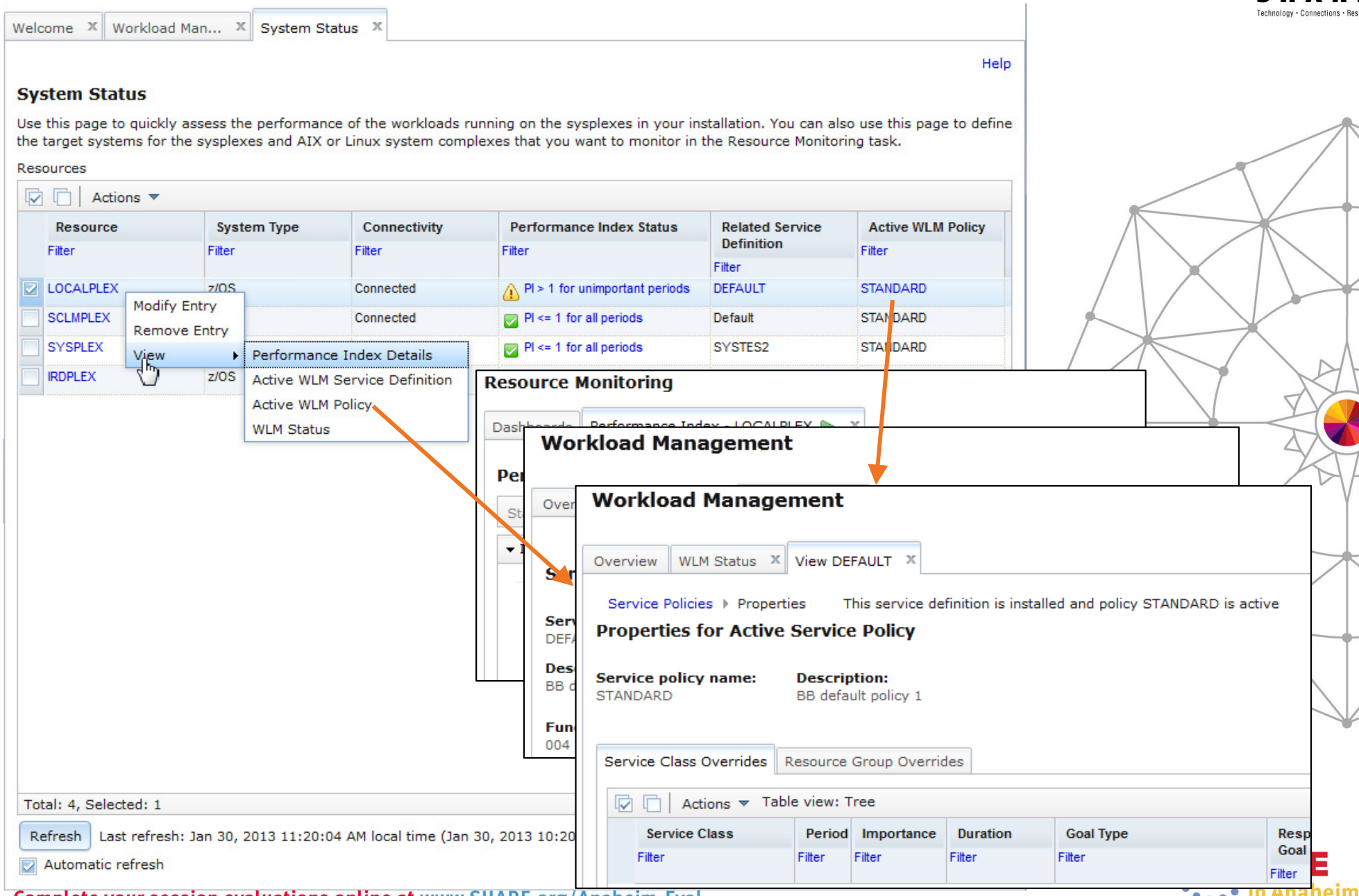
From RM System Status



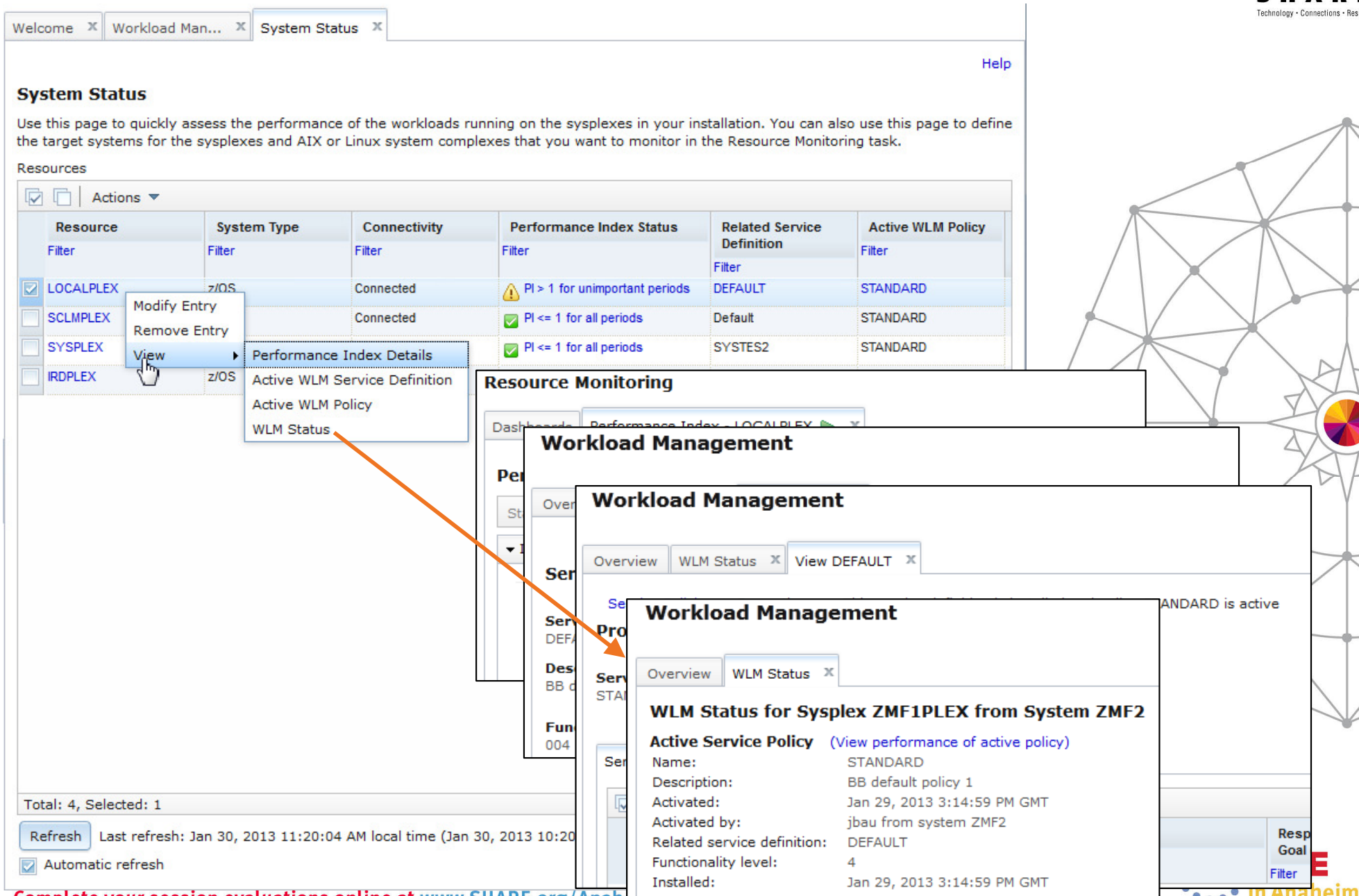
From RM System Status



From RM System Status



From RM System Status



From WLM to RM Dashboard (Service Classes)

Welcome | Workload Man...

Workload Management

Help

Overview | WLM Status

WLM Status for Sysplex ZMF1PLEX from System ZMF2

Active Service Policy (View performance of active policy)

Name:	STANDARD
Description:	BB default policy 1
Activated:	Jan 29, 2013 3:14:59 PM GMT
Activated by:	jbau from system ZMF2
Related service definition:	DEFAULT
Functionality level:	4
Installed:	Jan 29, 2013 3:14:59 PM GMT
Installed by:	jbau from system ZMF2

Systems (View performance of systems)

Actions ▼ Search

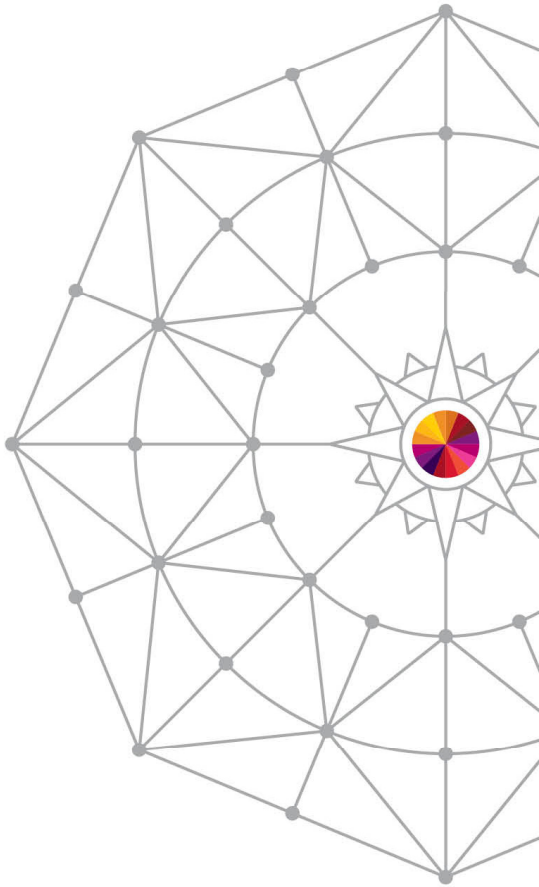
Name	Used Service Policy	Activated (GMT)	WLM Status	GPMP Status	WLM Version Level	CD Le
Filter	Filter	Filter	Filter	Filter	Filter	Filter
ZMF1	STANDARD	Jan 29, 2013 3:14:59 PM	Active	Unavailable		
ZMF2	STANDARD	Jan 29, 2013 3:14:59 PM	Active	Unavailable	25	3
ZMF3	STANDARD	Jan 29, 2013 3:14:59 PM	Active	Unavailable		
ZMF4	STANDARD	Jan 29, 2013 3:14:59 PM	Active	Unavailable		
ZMF5	STANDARD	Jan 29, 2013 3:14:59 PM	Active	Unavailable		

Total: 5

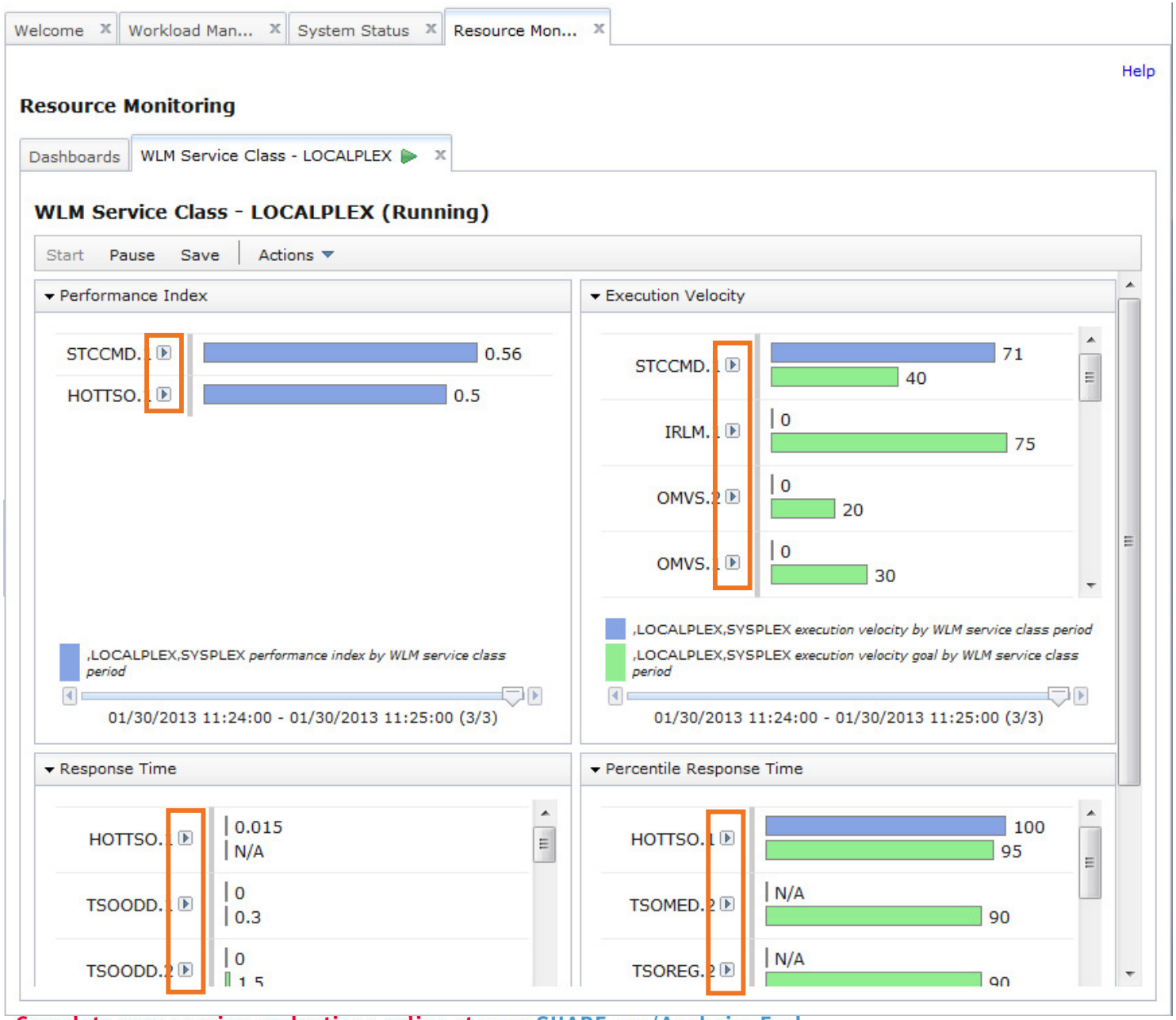
Installed Service Definition

Name:	DEFAULT
Description:	BB default WLM policy - test
Installed:	Jan 29, 2013 3:14:59 PM GMT
Installed by:	jbau from system ZMF2

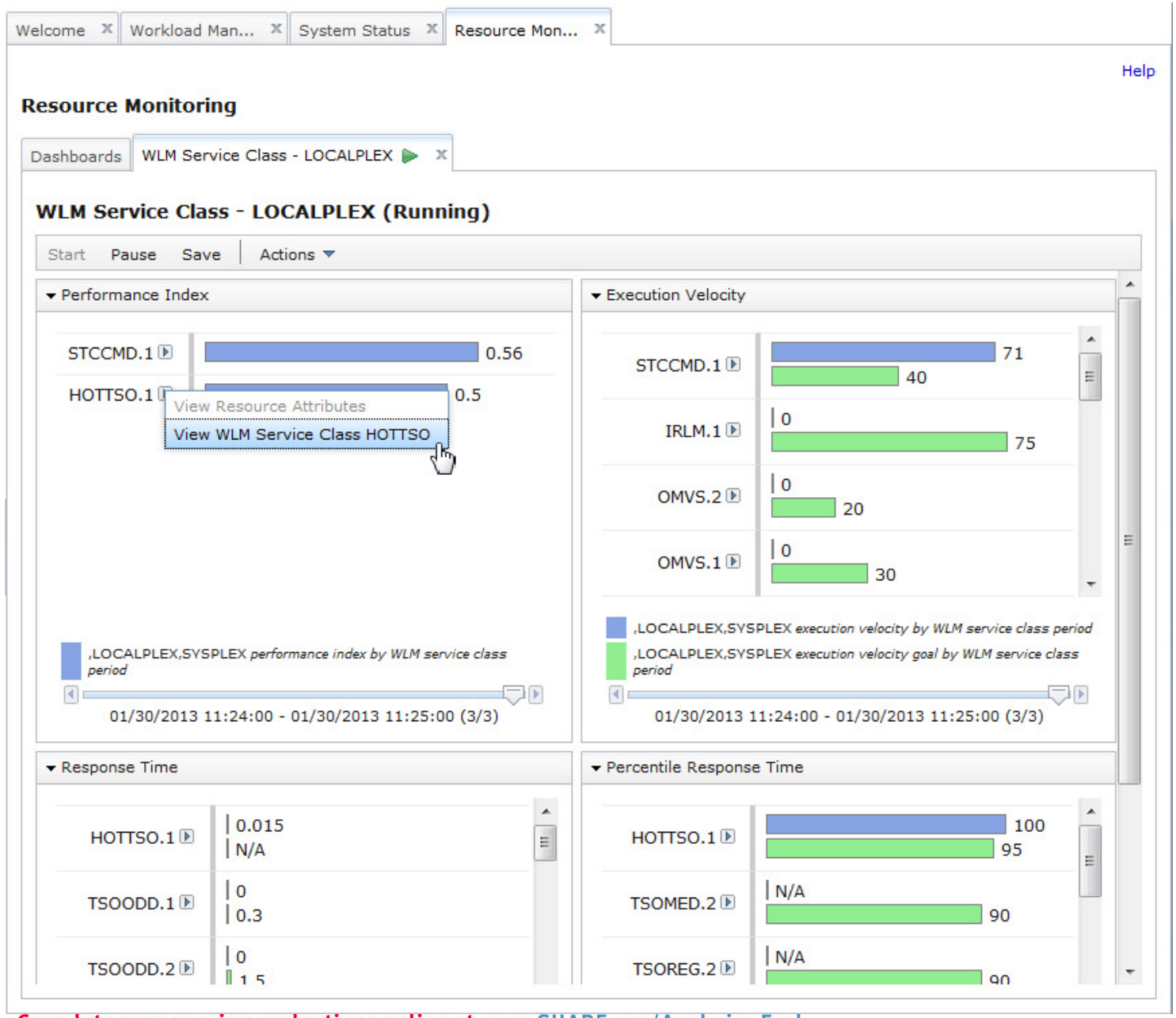
Refresh ☐ Automatic refresh Last refresh: Jan 30, 2013 11:13:10 AM local time (Jan 30, 2013 10:13:10 AM GMT)



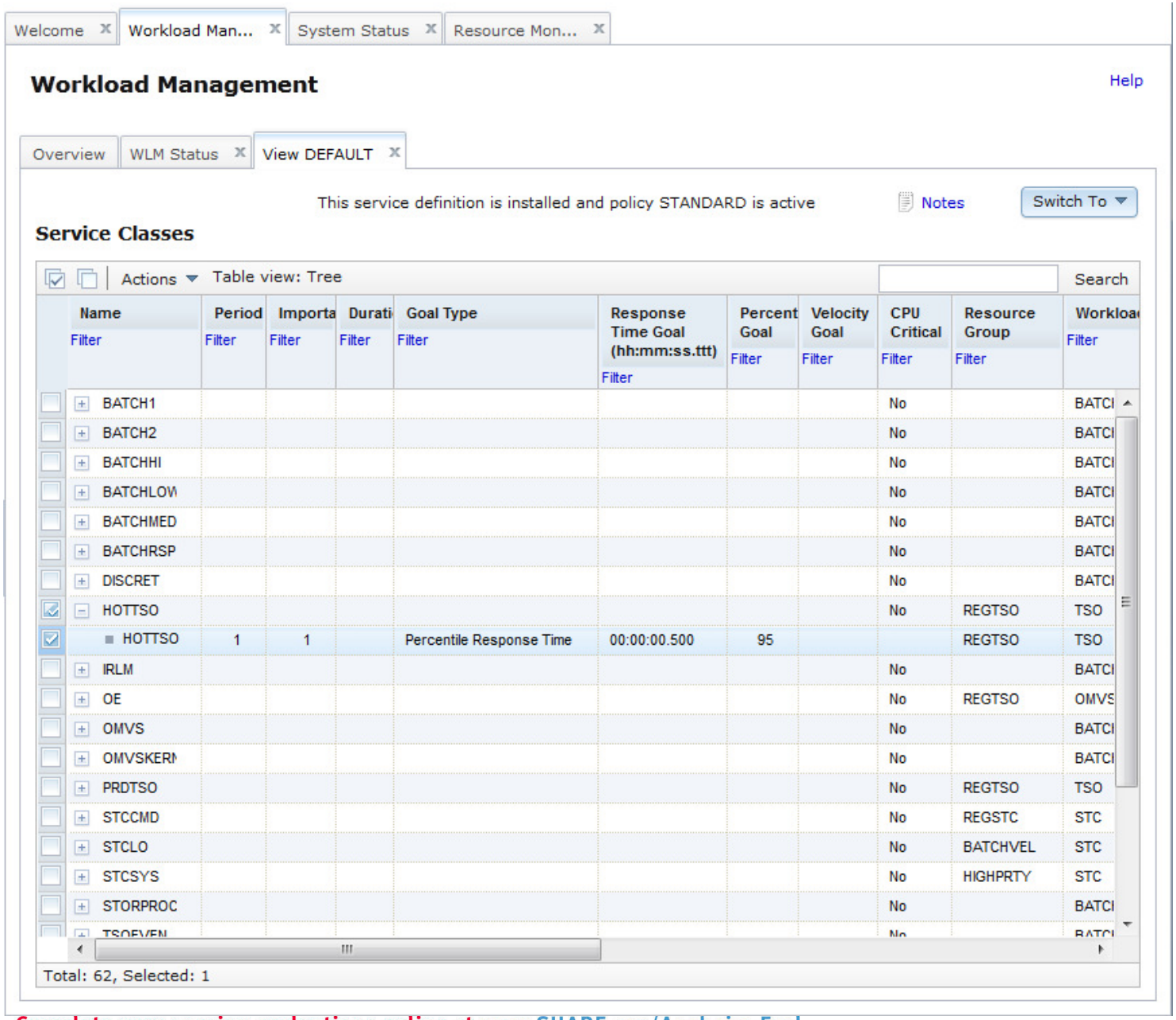
RM Dashboard – WLM Service Class Performance



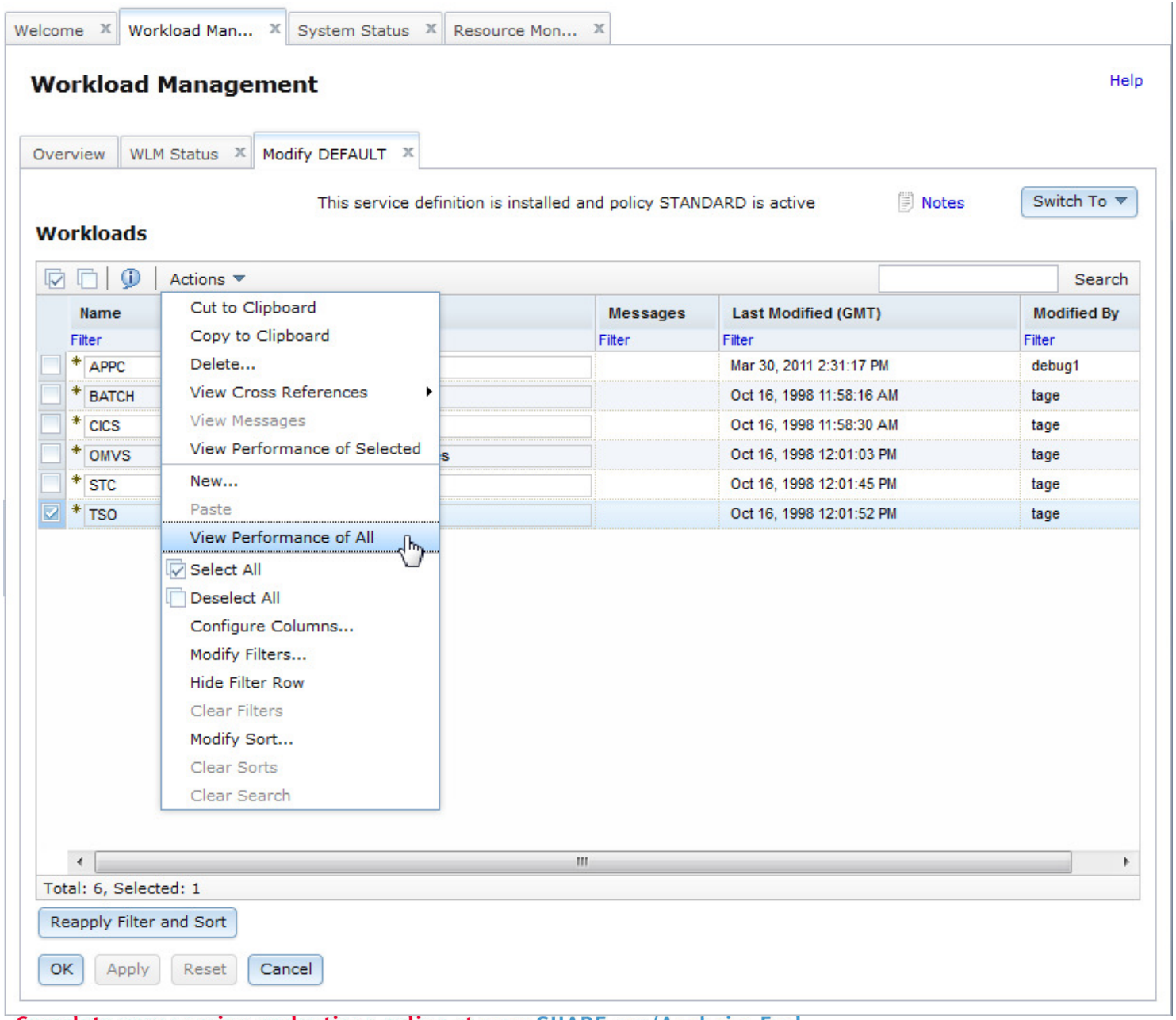
From RM Dashboard to WLM Service Classes



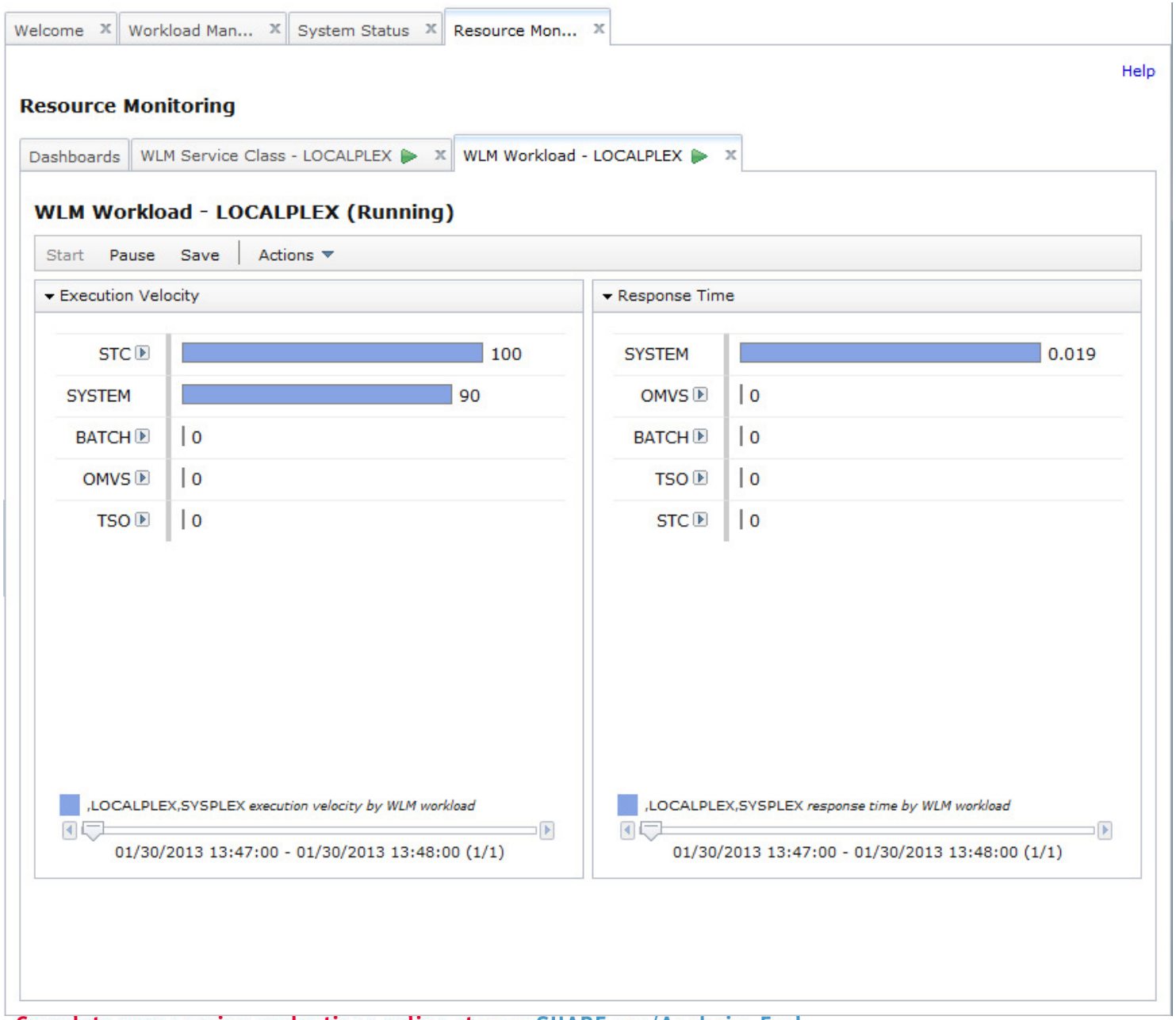
WLM Service Classes



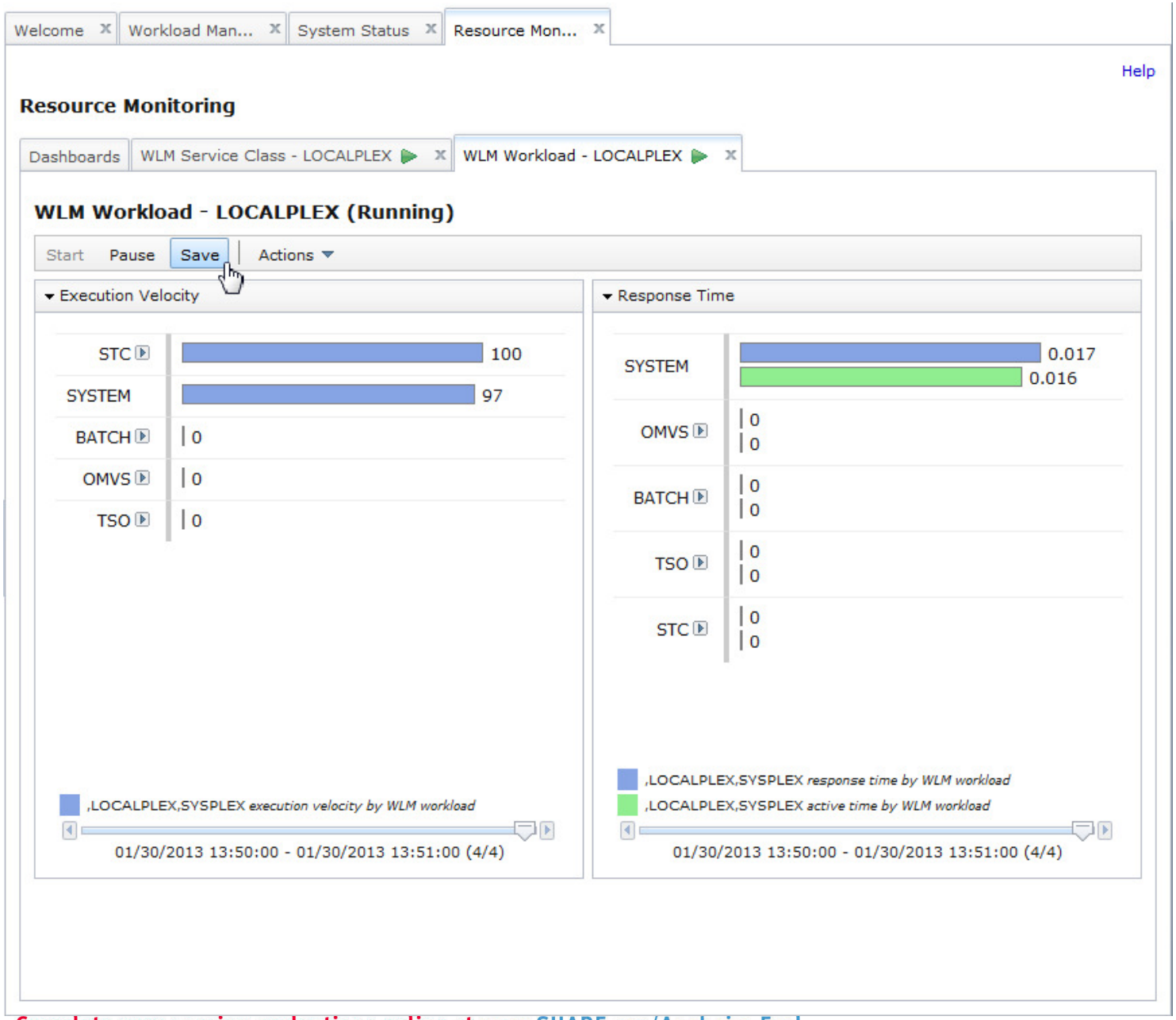
From WLM to RM Dashboard (Workloads)



RM Dashboard – WLM Workload Performance



Customization and Persistence

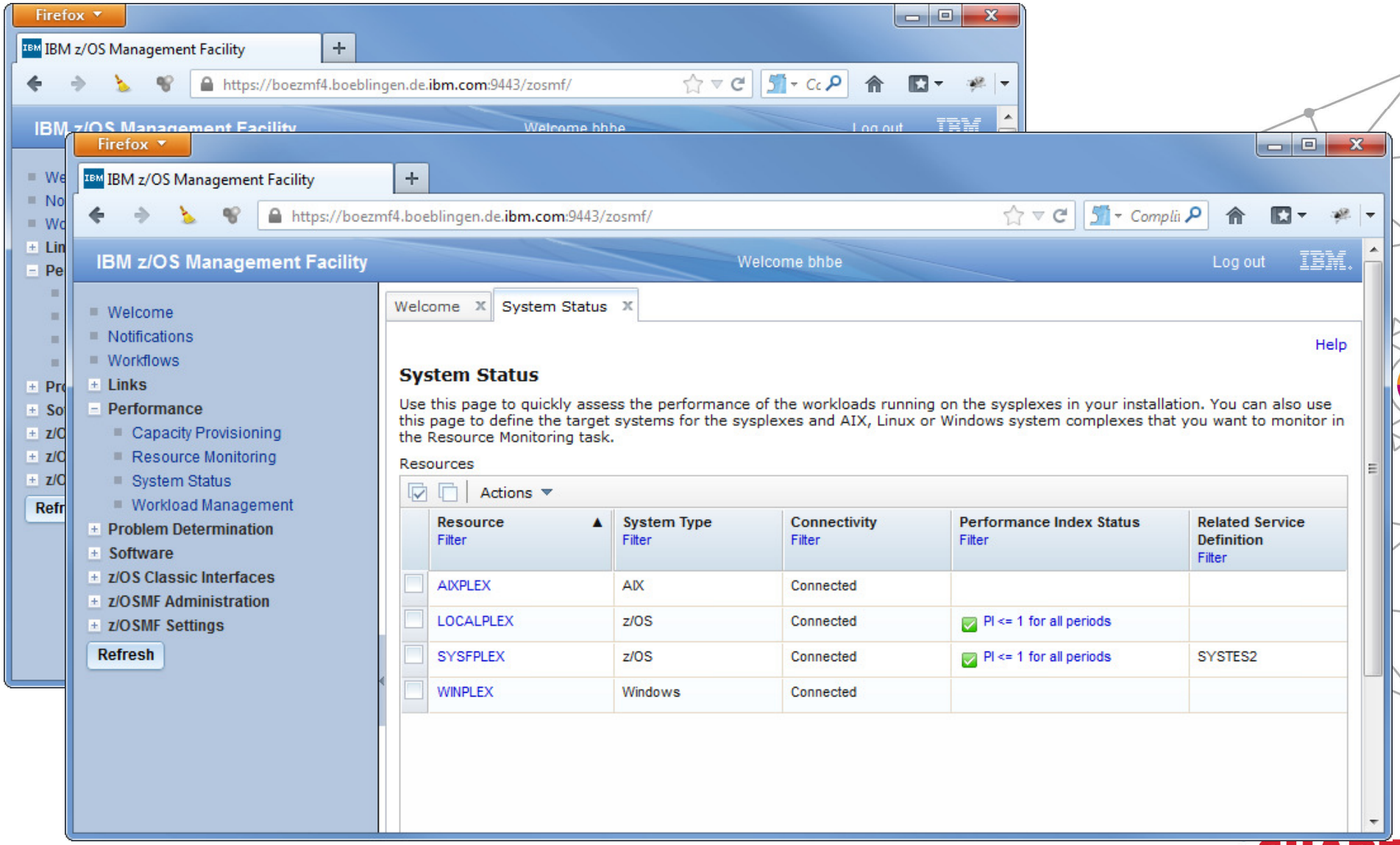


- The user can customize dashboards opened by Application Linking and save them to the Dashboards list.
- Then the Dashboard can be opened directly in Resource Monitoring using the Dashboards list.
- Subsequent application linking events will use the saved dashboard.

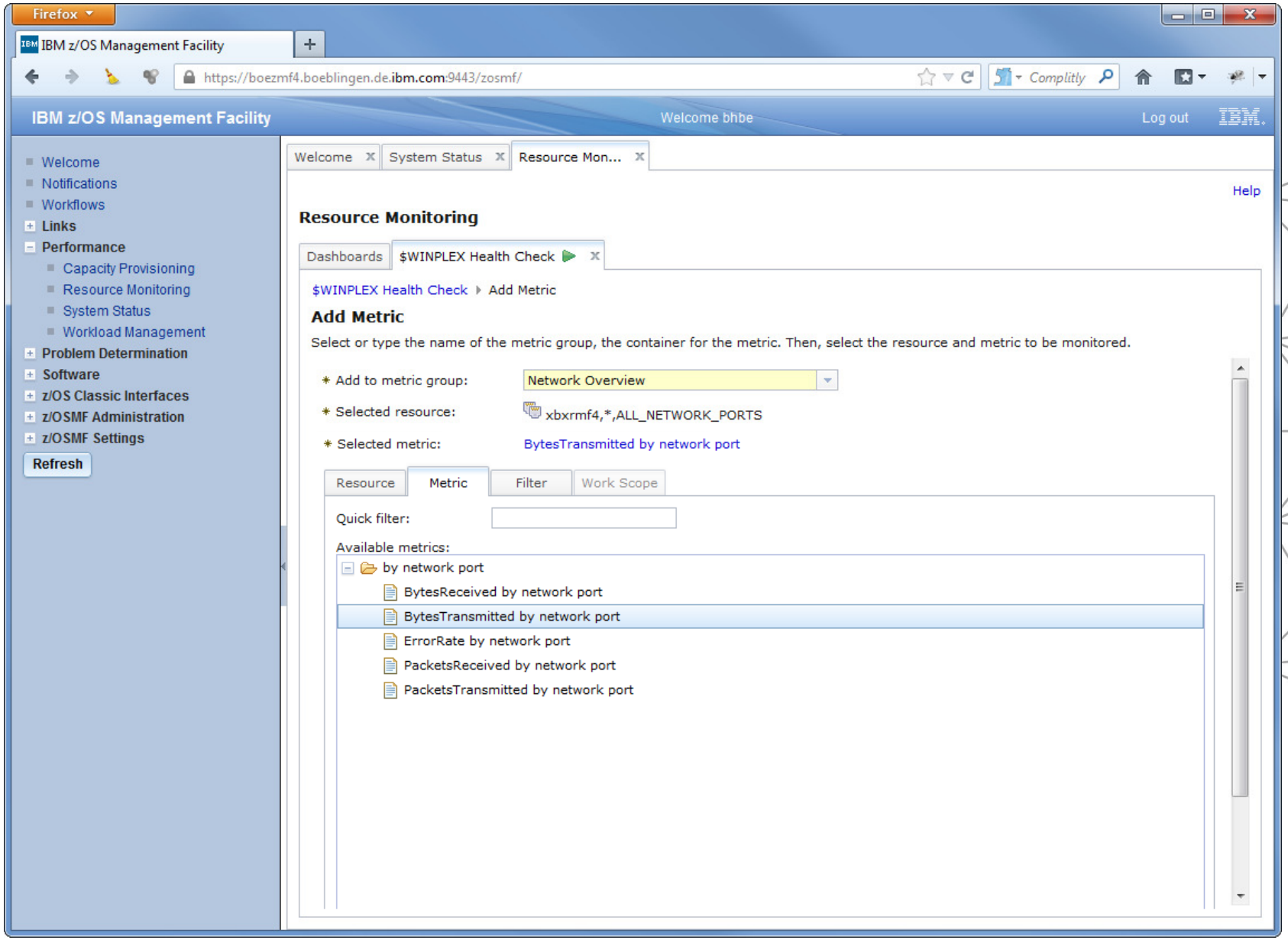
Conditions for Application Linking between WLM & RM

- In the Workload Management task, the *View Performance…* actions and links are only available if the service definition in the *View/Modify* tab is currently activated in the Sysplex.
- In the System Status task, the WLM related *View* actions (and corresponding links) are only available if the selected resource is the z/OS sysplex where z/OSMF is running in (local sysplex).
- In a monitoring dashboard, the context menu icon is only visible if the performance data is retrieved from the local sysplex and the chart is related to WLM definitions, i.e.,
  - ⇨ The resources in the chart are WLM service classes, service class periods, report classes, or workloads.
  - ⇨ The metric is filtered by a workscope of a WLM service class, service class period, report class, or workload.
    (Example: *% using by MVS image [BATCH,S]* , where *[BATCH,S]* means: filtered by workscope of service class *BATCH*)

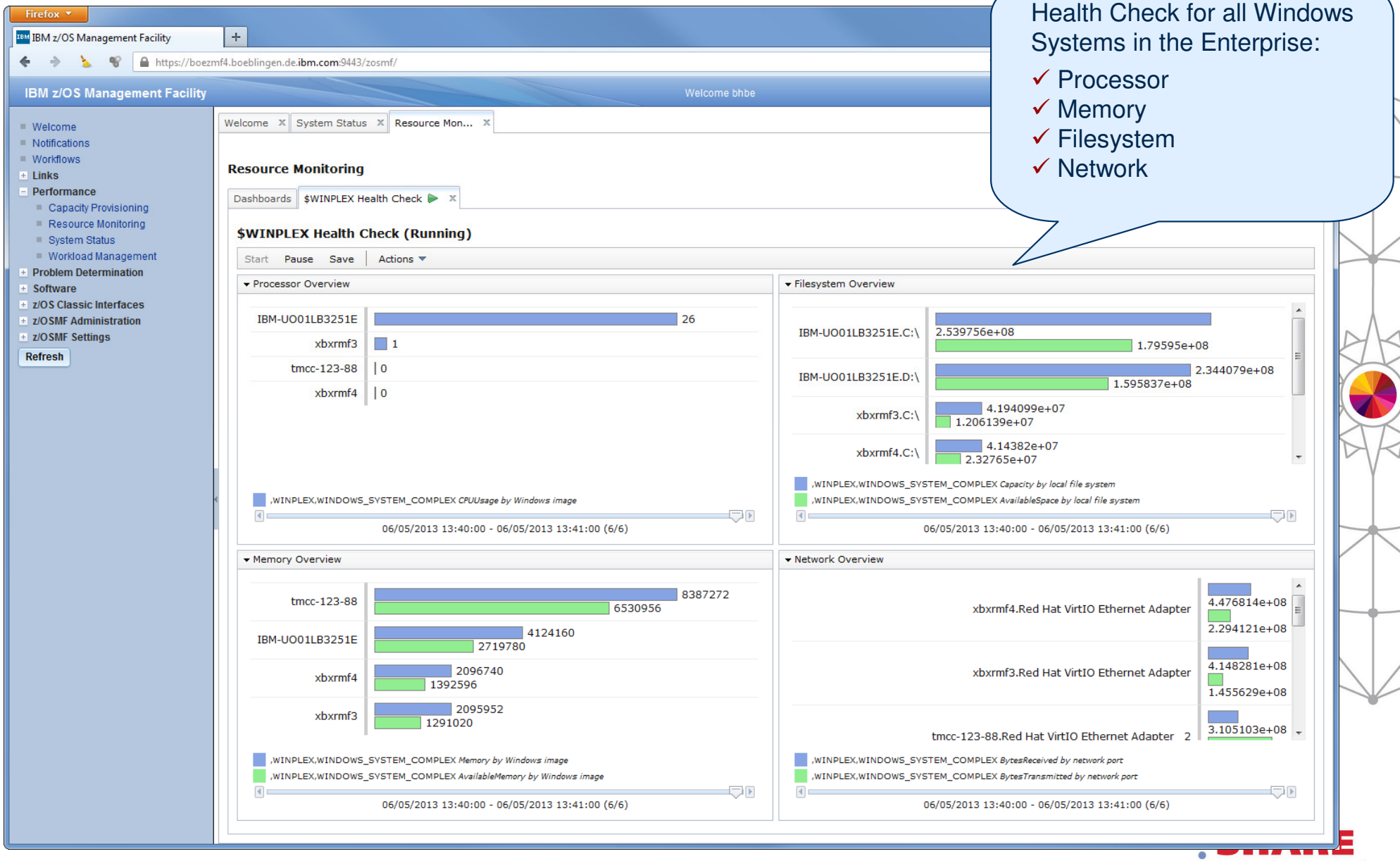
Resource Monitoring – Windows Support



Resource Monitoring – Windows Support



Resource Monitoring – Windows Support...



Information and Tools

RMF homepage: www.ibm.com/systems/z/os/zos/features/rmf/

- Product information, newsletters, presentations, ...
- Downloads
  - Spreadsheet Reporter
  - RMF PM Java Edition
  - Postprocessor XML Toolkit

RMF email address: rmf@de.ibm.com

Users Guide:
New RMF
XP Chapter

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/r13pdf/#rmf

Function Reference

Function	Availability
Storage Class Memory & Pageable Large Pages	APAR OA38660
I/O Interrupt Delay Time	APAR OA39993
IFB Link Reporting	APAR OA37826
Crypto CEX4 Statistics	APAR OA37016
Warning Track Support	APAR OA37803
Exploitation of System z Integrated Information Processors	z/OS 2.1 RMF
Postprocessor XML Formatted Reports	z/OS 1.11 RMF – z/OS 2.1 RMF
z/OSMF Resource Monitoring – Application Linking	z/OS 2.1 RMF

zEC12 Enhancements