What's New in RMF Data Gatherer z/OS V2.5

November 2021

IBM

RMF Data Gatherer Enhancements at a Glance

- New RMF Product Structure
  - Licensing Model
  - z/OS Advanced DataGatherer
  - z/OS Advanced Data Gatherer APIs
  - SMF Record Retrieval Service

- Enhanced RMF Master concept for CF data gathering
  - Optimized CF HW Data Collection
  - Helper System for CF HW Data Collection
  - Considerations for SMF 74-4 record

New RMF Product Structure

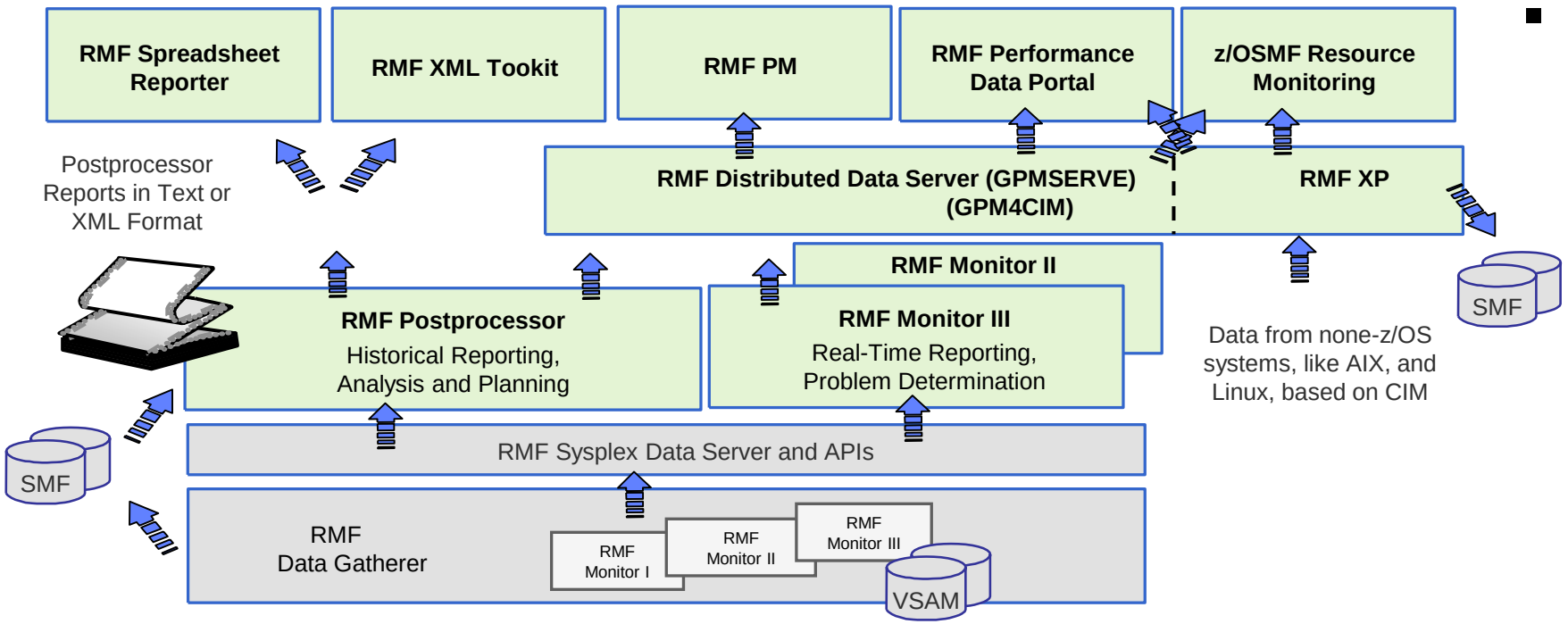
NEW FLEXIBLE LICENSING MODEL

MAKE Z/OS PERFORMANCE DATA AVAILABLE TO A BROADER SET OF EXPLOITERS

New Product Structure

z/OS V2.5

- RMF consists of two components that work together in providing the capabilities needed for performance management:
  - RMF Data Gatherer: collects performance measurements from the hardware and operating system and provides access to these measurements across the sysplex
  - RMF Reporter: uses the collected measurements to report performance statistics in tabular and graphical reports



- **New RMF product structure will be introduced in z/OS V2R5**
  - Make Data Gatherer and Reporter independent from each other
  - Move the Data Gatherer into the z/OS base
  - Offer more flexible licensing model for users who require raw performance data from z/OS
  - Keep migration/upgrade actions for RMF users at a minimum

New Product Structure - Overview

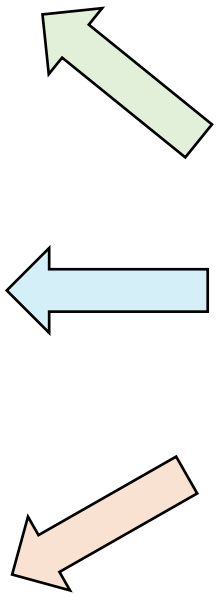
- With z/OS V2R3 and V2R4 APARs OA58281 and OA58759, the RMF product was restructured into a Data Gatherer and a Reporter component
- With z/OS V2R5, the new Data Gatherer component (566527401) is shipped as z/OS base element and packaged as *z/OS Data Gatherer* into new FMID HRG77D0
- The existing RMF Reporter component (566527404) stays with optional z/OS element *RMF* and is packaged into FMIDs HRM77D0 and JRM77DJ
- The move of the Data Gatherer into the z/OS base impacts the RMF installation procedure as well as the RMF licensing model
- Various Data Gatherer API enhancements

Benefits

- ✓ Make z/OS performance data available to a broader set of exploiters
- ✓ New flexible licensing model allows clients to run the Data Gatherer in basic or in advanced mode with or without RMF Reporter
- ✓ Priced feature RMF continues to provide the same functional capability as before V2R5

New Product Structure - Licensing Model

- A new RMF licensing model will be rolled out that offers Data Gatherer base functionality as part of their z/OS entitlement
- It allows clients to use advanced Data Gatherer functionality when they have bought the z/OS Advanced Data Gatherer feature
- If the RMF feature is enabled, full RMF gathering and reporting functionality (as known today) is provided

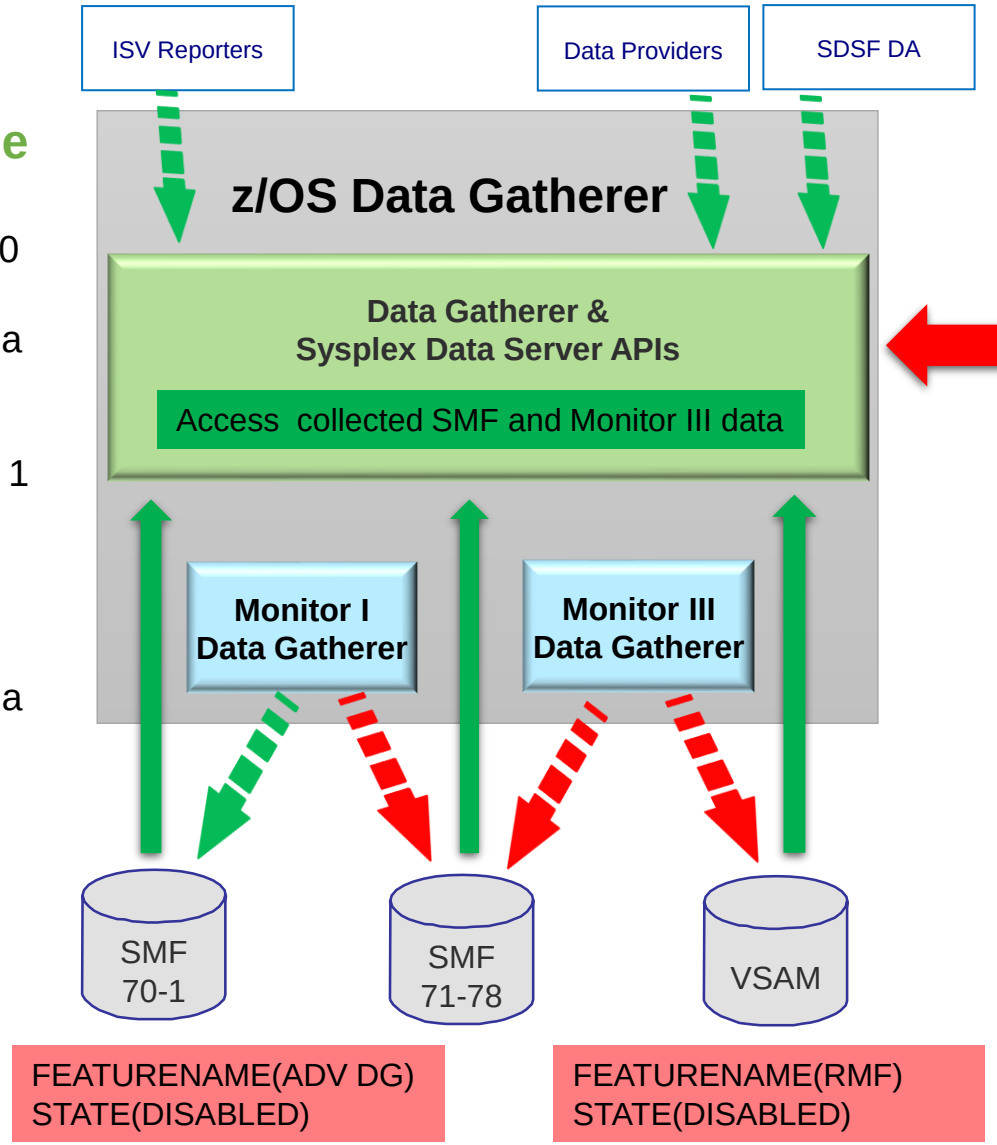


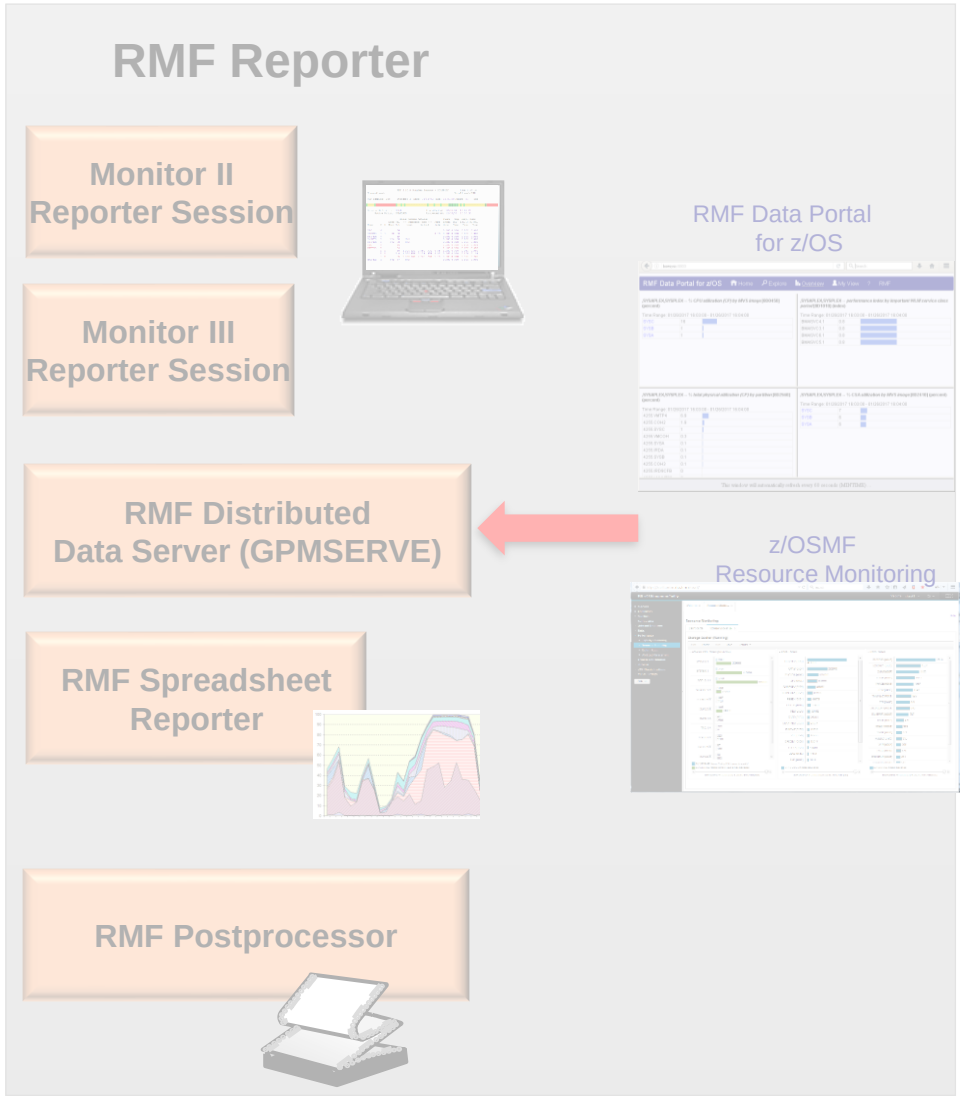
Element or Feature FMIDs	Level	Type	Dynamic Enablement via IFAPRDxx
z/OS Data Gatherer • HRG77D0	z/OS V2R5	Base Element	N
z/OS Advanced Data Gatherer • HRG77D0	z/OS V2R5	Priced Feature	Y
RMF • HRM77D0 • JRM77DJ (Japanese)	z/OS V2R5	Priced Feature	Y

z/OS Data Gatherer Base Functionality

Standalone z/OS Data Gatherer in basic mode

- Capability of writing SMF 70 subtype 1 record data
- Access to Monitor II data via Sysplex Data Server API ERB2XDGS
- Access to SMF 70 subtype 1 data in SMF buffer via Sysplex Data Server APIs ERBDSQRY/ERBDSREC
- Access to SMF 70-79 data located in SMF data sets via new Data Gatherer API GRBSMFR
- Access to Monitor III data located in Monitor III VSAM data sets via Sysplex Data Server API ERB3XDRS

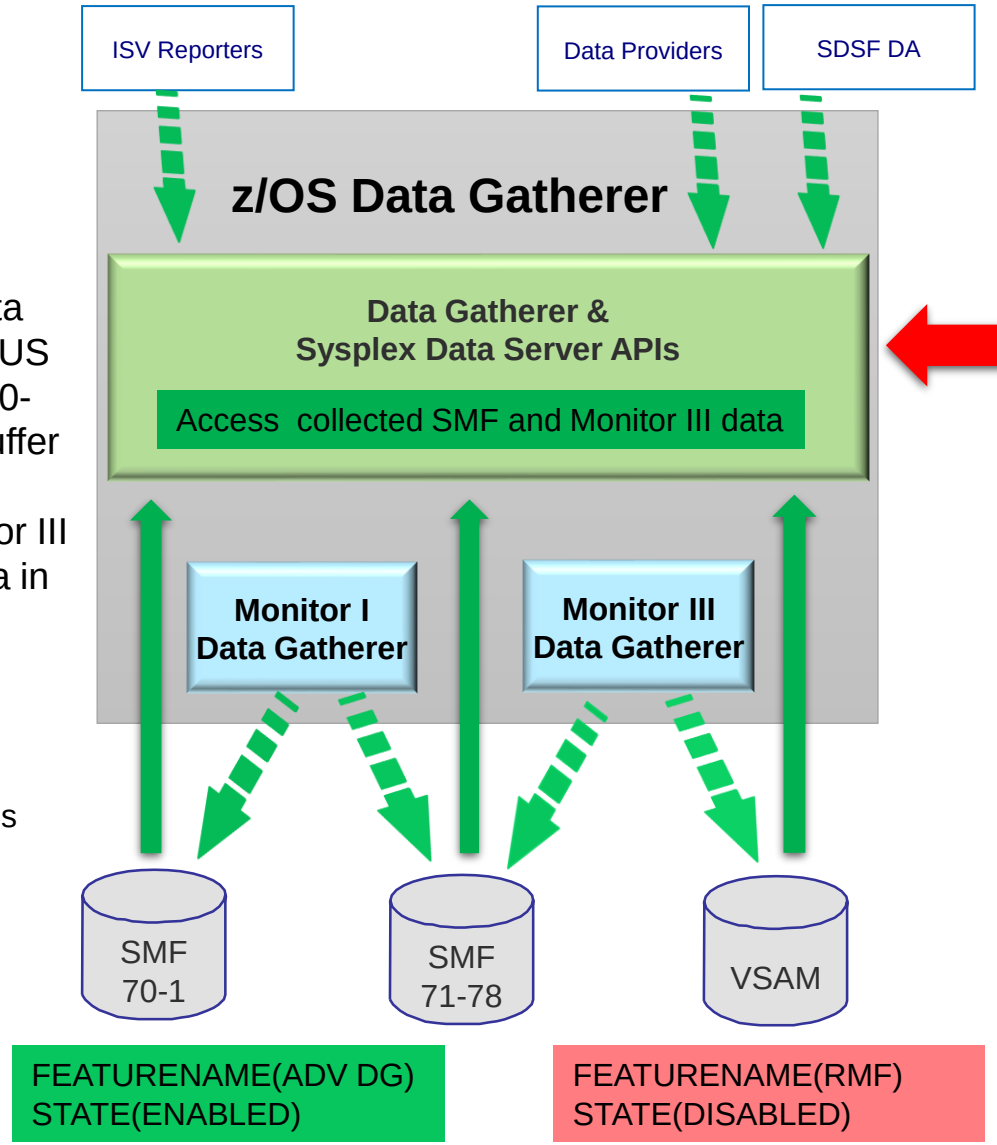


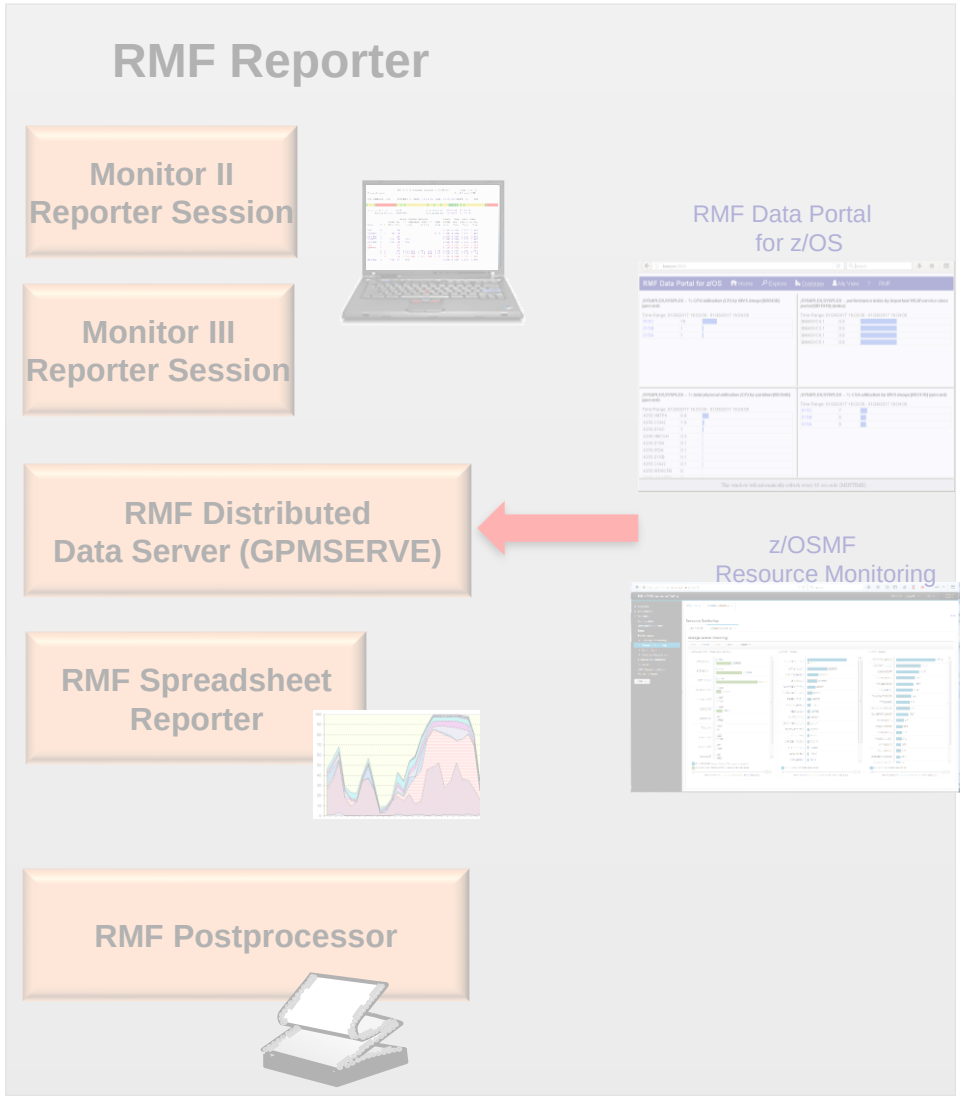


z/OS Advanced Data Gatherer Functionality

Standalone z/OS Data Gatherer in advanced mode

- Functional capability of Data Gatherer in basic mode PLUS
- Capability of writing SMF 70-78 record data into SMF buffer and SMF log stream
- Access to Monitor II, Monitor III and SMF 70-78 record data in SMF buffer
  - Sysplex Data Server API ERB2XDGS
  - Sysplex Data Server API ERB3XDRS
  - Sysplex Data Server APIs ERBDSQRY/ERBDSRE

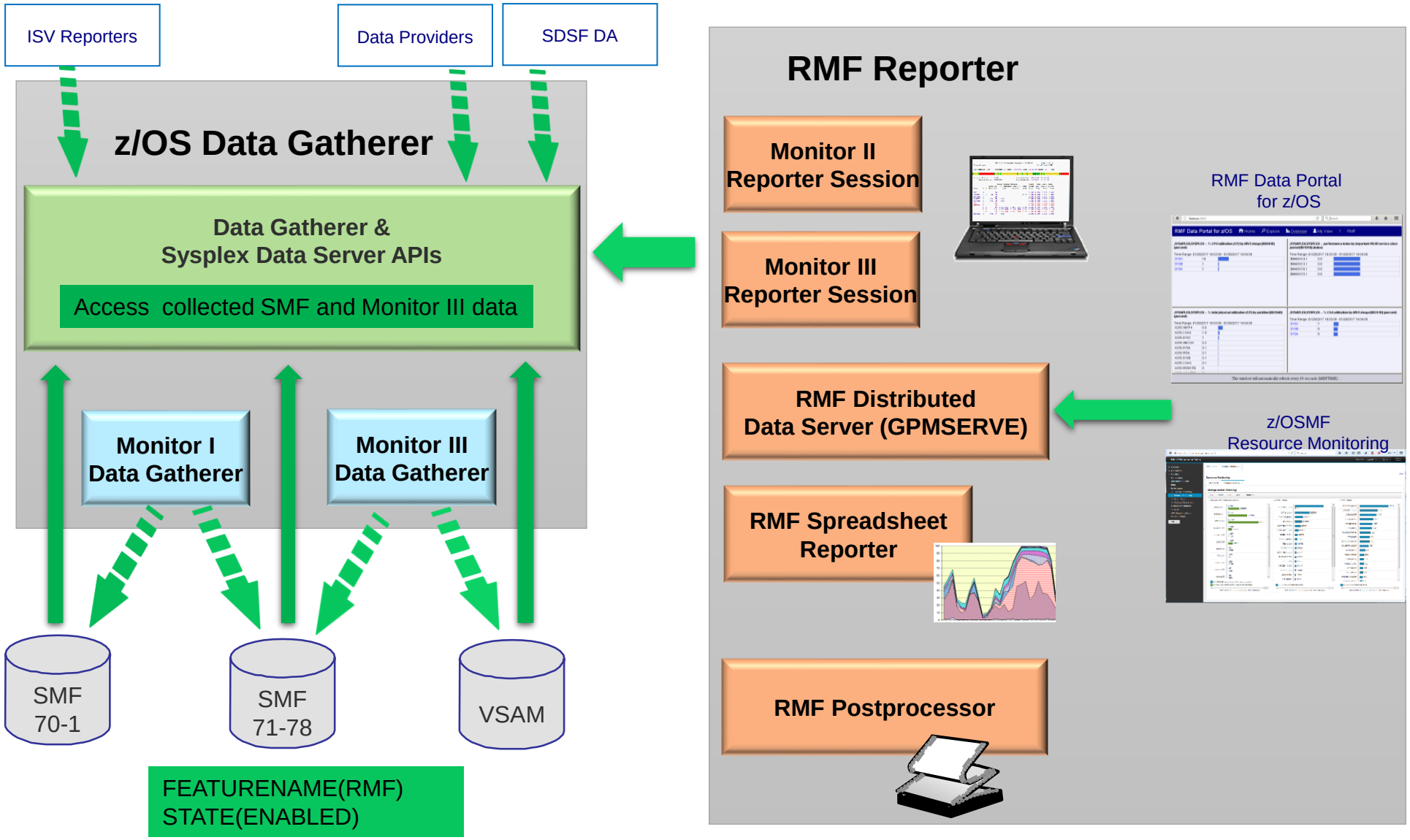




RMF Functionality

RMF functionality

- Full z/OS Data Gatherer and RMF Reporter functionality
  - RMF Postprocessor
  - Monitor II and III ISPF reports
  - Distributed Data Server
  - Monitor II background session
- The presence of the RMF feature implicitly causes the z/OS Advanced Data Gatherer feature to be enabled



New Product Structure - License Checks

Name	FEATURENAME value
z/OS Advanced Data Gatherer	ADV DG
RMF	RMF

```
PRODUCT  OWNER('IBM CORP')
         NAME('z/OS')
         ID(5650-ZOS)
         FEATURENAME(name)
         STATE(ENABLED|DISABLED)
```

z/OS Data Gatherer Function	No feature is enabled
SMF Record Writer	ERB117I Advanced Data Gatherer is not enabled to run on this system Fully functional if SMF 70 subtype 1 is being written
Monitor III Gatherer	ERB117I Advanced Data Gatherer is not enabled to run on this system.
API ERBSMFI API ERB2XDGS	fully functional ERBSMFI return codes 116 and 120 no longer used
API ERBDSQRY API ERBDSREC	can only be used for SMF 70 subtype 1 record data as no other SMF type/subtype is written
API ERB3XDRS	fully functional for pre-allocated VSAM data sets No online monitoring since Monitor III Gatherer was disabled
API GRBSMFR	fully functional

- RMF license checking unchanged from previous releases
- Presence of RMF feature implicitly causes ADV DG feature to be enabled
- All systems in the Parallel Sysplex **must** have the RMF feature enabled. Having the RMF feature only partially enabled is an unsupported configuration scenario

New Product Structure – Messages

ERB117I ADVANCED DATA GATHERER IS NOT ENABLED TO RUN ON THIS SYSTEM.

Explanation: Only base Data Gatherer functionality can be used on this system.

- No SMF record data other than SMF 70 subtype 1 are written by the z/OS Data Gatherer
- No Monitor III data is collected
- Monitor III data cannot be accessed via Sysplex Data Server API ERB3XDRS.

System action: The request for the Advanced Data Gatherer function is not processed.

User response: Have your system administrator check whether you have a license for the z/OS Advanced Data Gatherer or the RMF feature. If so, please enable one of the two features.

ERB119I RMF IS ENABLED TO RUN ON THIS SYSTEM BUT THE REPORTER IS NOT INSTALLED.

Explanation: The RMF feature is properly enabled but RMF module ERB3RCTL cannot be loaded.

System action: The z/OS Data Gatherer continues its processing.

User response: Have your system administrator check why load module ERB3RCTL cannot be loaded.

ERB148I DISTRIBUTED DATA SERVER CANNOT BE STARTED.

Explanation: The Data Gatherer control session is configured to provide automatic sysplex-wide management for the Distributed Data Server but the RMF feature is not enabled.

System action: The z/OS Data Gatherer continues its processing.

User response: Have your system administrator check whether you have a license for RMF, and if so, have him enable the feature. Ensure that the master system on which the Distributed Data Server is automatically started has the RMF feature enabled and is on the highest z/OS release in the sysplex. If the feature cannot be enabled on the master system, stop automatic sysplex-wide management for the Distributed Data Server by omitting the DDS option in the RMF start command and in the EXEC statement of the RMF procedure.

New Product Structure – z/OS Advanced Data Gatherer APIs

- Data retrieval, assembly and data conversion to another release or service level
  - External APIs for Monitor III data and SMF buffer data already in place
  - New z/OS 2.5 API GRBSMFR to retrieve SMF 70-79 from SMF data sets or SMF logstreams

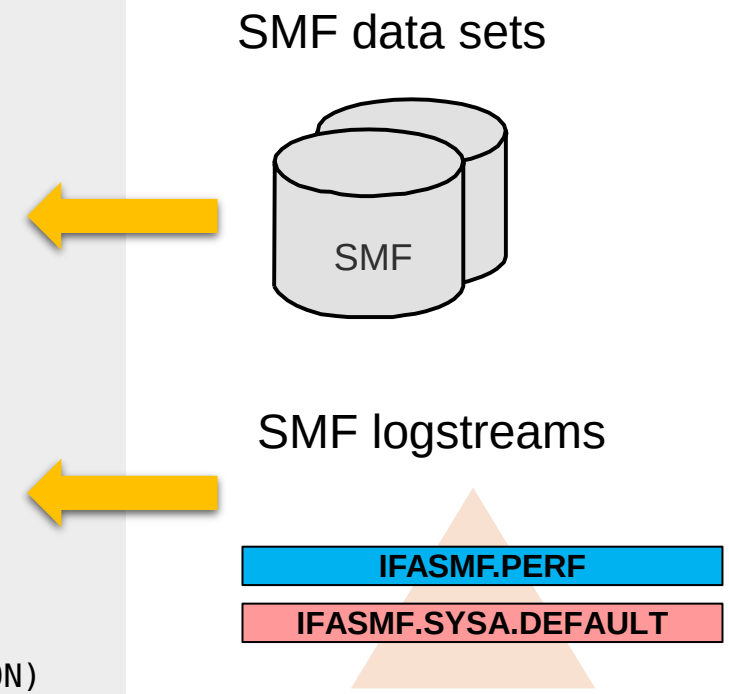
SMF buffer		SMF data set		Monitor III In-Storage Buffer	Monitor III VSAM data set
ERBDSREC ERBDSQRY	ERB2XDGS ERBSMFI	New z/OS Data Gatherer API GRBSMFR		ERB3XDRS	
Monitor I	Monitor II	Monitor I	Monitor II	Monitor III	

- All Monitor III measurement tables externalized
  - Delivered in SYS1.MACLIB and SYS1.AGRBMAC1
  - mappings published in z/OS Data Gatherer Programmer's Guide
  - Shipped as bilingual Assembler / PLX macro
- Other mapping macros externalized if they provide business value to application programmers

New Product Structure – SMF Record Retrieval Service GRBSMFR

- SMF post-processing applications can use new GRBSMFR service to retrieve SMF records from SMF data sets or SMF log streams.
- Service provides three different functions:
  - OPEN
  - GET
  - CLOSE
- CONVERT option allows up conversion for SMF records created by a lower z/OS release or service level
- ASSEMBLE option can be used to reassemble SMF records that were physically broken by data gatherer (If length of logical SMF record was > 32K)
- FILTLIST parameter allows to specify SMF Record Type/Subtype, SMF System ID and a data and timerange filter

```
?GRBSMFR    D OPEN
            |   D ASSEMBLE
            |   O CONVERT
            |   O NONE
            |     REQTOKEN(reqtoken)
            |     DDNAME(ddname)
            |     FILTLIST(filtlist)
            |     ANSAREAP(ansareap)
            |     ANSAREAL(ansareal)
            O GET
            |     REQTOKEN(reqtoken)
            |     RSTOKEN(rstoken)
            |     ANSAREAP(ansareap)
            |     ANSAREAL(ansareal)
            O CLOSE
                  REQTOKEN(reqtoken)
              RETCODE(retcode)
              REASCODE(reascode)
             DPLISTVER(IMPLIED_VERSION)
             OPLISTVER(MAX)
             OPLISTVER(plistver)
             DMF(S)
             OMF(L,mfctrl[,mfattr!0D])
             OMF(E,mfctrl[,COMPLETE])
```



New Product Structure – Installation

Element	FMID(s)	COMP ID	RETAIN Release	Level
z/OS Data Gatherer	HRG77D0	566527401	7D0	z/OS V2R5
RMF	HRM77D0 JRM77DJ	566527404	7D0 7DJ	z/OS V2R5

Renaming of z/OS Data Gatherer load modules

- Internal LNKLST & LPA modules renamed from ERB* to GRB*
- Externally known LNKLST modules renamed from ERB* to GRB* (GRBAPPL, GRB3XDRS, …)
- ALIAS name ERB* added (ERBAPPL, ERB3XDRS, …)
- User exits keep their name prefix ERB*

z/OS Data Gatherer SMP/E libraries

- Target libraries
  - **SYS1.SGRBLINK**
  - **SYS1.SGRBLPA**
  - **SYS1.SGRBCLS**
  - SYS1.PROCLIB
  - SYS1.MACLIB
  - SYS1.SAMPLIB
  - SYS1.PARMLIB
- Distribution libraries
  - **SYS1.AGRBMOD1**
  - **SYS1.AGRBMAC1**
  - **SYS1.AGRBCLS**
  - SYS1.APROCLIB
  - SYS1.ASAMPLIB
  - SYS1.APARMLIB

RMF SMP/E libraries

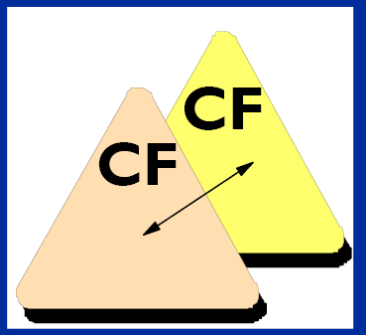
- Target libraries
  - **SYS1.SERBLNKE**
  - SYS1.SERBCLS
  - SYS1.SERBPENU
  - SYS1.SERBMENU
  - SYS1.SERBT
  - SYS1.SERBTENU
  - SYS1.SERBPWSV
  - SYS1.PROCLIB
  - SYS1.MACLIB
  - SYS1.SAMPLIB
  - SYS1.PARMLIB
- Distribution libraries
  - SYS1.AERBMOD1
  - SYS1.AERBMAC1
  - SYS1.AERBCLS
  - SYS1.AERBMENU
  - SYS1.AERBPMENU
  - SYS1.AERBT
  - SYS1.AERBTENU
  - SYS1.AERBPWSV
  - SYS1.APROCLIB
  - SYS1.ASAMPLIB
  - SYS1.APARMLIB
- Japanese libraries
  - SYS1.SERBMJPN
  - SYS1.SERBPJPN
  - SYS1.SERBTJPN
  - SYS1.AERBMJPN
  - SYS1.AERBPJPN
  - SYS1.AERBTJPN

SYS1.SERBLPA and **SYS1.SERBLINK** not used anymore

New Product Structure – Upgrade Considerations

- Upgrade from z/OS V2R3 or V2R4 to z/OS V2R5 **+ z/OS Data Gatherer in basic mode**
  - Check your IFAPRDxx PARMLIB member. Priced features *RMF* and *z/OS Advanced Data Gatherer* should be disabled
  - If RMF was used on V2R3/V2R4, remove SYS1.SERBLINK from the active link list set and from the APF list
  - If RMF was used on V2R3/V2R4, remove SYS1.SERBLPA from the LPA list
  - Add the SYS1.SGRBLINK library to the link list, add the SYS1.SGRBLINK library to the APF list and add the SYS1.SGRBLPA library to the LPA list. Then IPL the system
  - IBM supplied CLISTs ERBS2V, ERBV2S and REXX execs ERBSCAN, ERBSHOW, ERBVSDEF are installed into SYS1.SGRBCLS. Ensure that you use the version in SYS1.SGRBCLS and do not reference SYS1.SERBCLS which is the home of the RMF CLISTs and REXX execs
- Upgrade from z/OS V2R3 or V2R4 to z/OS V2R5 + **z/OS Data Gatherer in advanced mode** w/o RMF Reporter
  - Ensure that you have ordered priced feature *z/OS Advanced Data Gatherer*
  - Check your IFAPRDxx PARMLIB member. Priced feature *z/OS Advanced Data Gatherer* must be enabled. Priced feature *RMF* should be disabled
  - If RMF was used on V2R3/V2R4, remove SYS1.SERBLINK from the active link list set and from the APF list
  - If RMF was used on V2R3/V2R4, remove SYS1.SERBLPA from the LPA list
  - Add the SYS1.SGRBLINK library to the link list, add the SYS1.SGRBLINK library to the APF list and add the SYS1.SGRBLPA library to the LPA list. Then IPL the system
  - IBM supplied CLISTs ERBS2V, ERBV2S and REXX execs ERBSCAN, ERBSHOW, ERBVSDEF are installed into SYS1.SGRBCLS. Ensure that you use the version in SYS1.SGRBCLS and do not reference SYS1.SERBCLS which is the home of the RMF CLISTs and REXX execs
- Upgrade from z/OS V2R3 or V2R4 to z/OS V2R5 + **RMF** (includes z/OS Data Gatherer in advanced mode and RMF Reporter)
  - Ensure that you have ordered priced feature *RMF*
  - Check your IFAPRDxx PARMLIB member. Priced features *z/OS Advanced Data Gatherer* and *RMF* must be enabled
  - RMF load modules reside in library SYS1.SERBLNKE
    - If RMF was used on V2R3/V2R4, remove SYS1.SERBLINK from the active link list set and from the APF list
    - Add SYS1.SERBLNKE library to the link list and the APF list
  - Add the SYS1.SGRBLINK library to the link list, add the SYS1.SGRBLINK library to the APF list and add the SYS1.SGRBLPA library to the LPA list. Remove SYS1.SERBLPA from the LPA list then IPL the system
  - IBM supplied CLISTs ERBS2V, ERBV2S and REXX execs ERBSCAN, ERBSHOW, ERBVSDEF are installed into SYS1.SGRBCLS. Ensure that you use the version in SYS1.SGRBCLS and do not reference SYS1.SERBCLS which is the home of the RMF CLISTs and REXX execs

ENHANCED RMF MASTER CONCEPT FOR CF DATA GATHERING



REDUCED SYSTEM OVERHEAD AND CONTENTION
FOR RMF CF HW DATA COLLECTION IN SYSPLEX ENVIRONMENTS

RMF CF HW Data Collection

- In sysplex environments with many Coupling Facility (CF) structures and larger distances between sysplex systems and CFs, RMF data collection of CF hardware statistics causes a higher system overhead.
- Observed by clients and addressed by RFE 124161 with title "RMF CF statistics gathering only once per sysplex"
- Background Information: CF HW Data Collection
  - Coupling Facility HW statistics obtained from CF microcode by use of synchronous requests.
  - Consists of structure control information (like min/max/current allocated structure size) or resource consumption data (like CF processor time used for structure)
  - CF HW statistics are independent from sysplex system collecting the data

    ➡ Need to be collected on only one sysplex system

  - Today, RMF collects CF HW data on multiple sysplex systems:
    - For SMF 74-4, on each system collecting SMF 74-4 records
    - For Monitor III CF activity reporting, on each system running with Monitor III CFDETAIL data gathering option.

Enhanced CF HW Data Collection – Overview

- With z/OS 2.5 a z/OS System Programmer can switch on an optimized gathering of Coupling Facility Hardware (CF HW) statistics. In optimization mode, CF HW data is only collected on one system in the sysplex.
- If optimized data collection of CF HW statistics is active, the z/OS System Programmer can select the optimal sysplex system for RMF CF HW data collection of a specific CF.

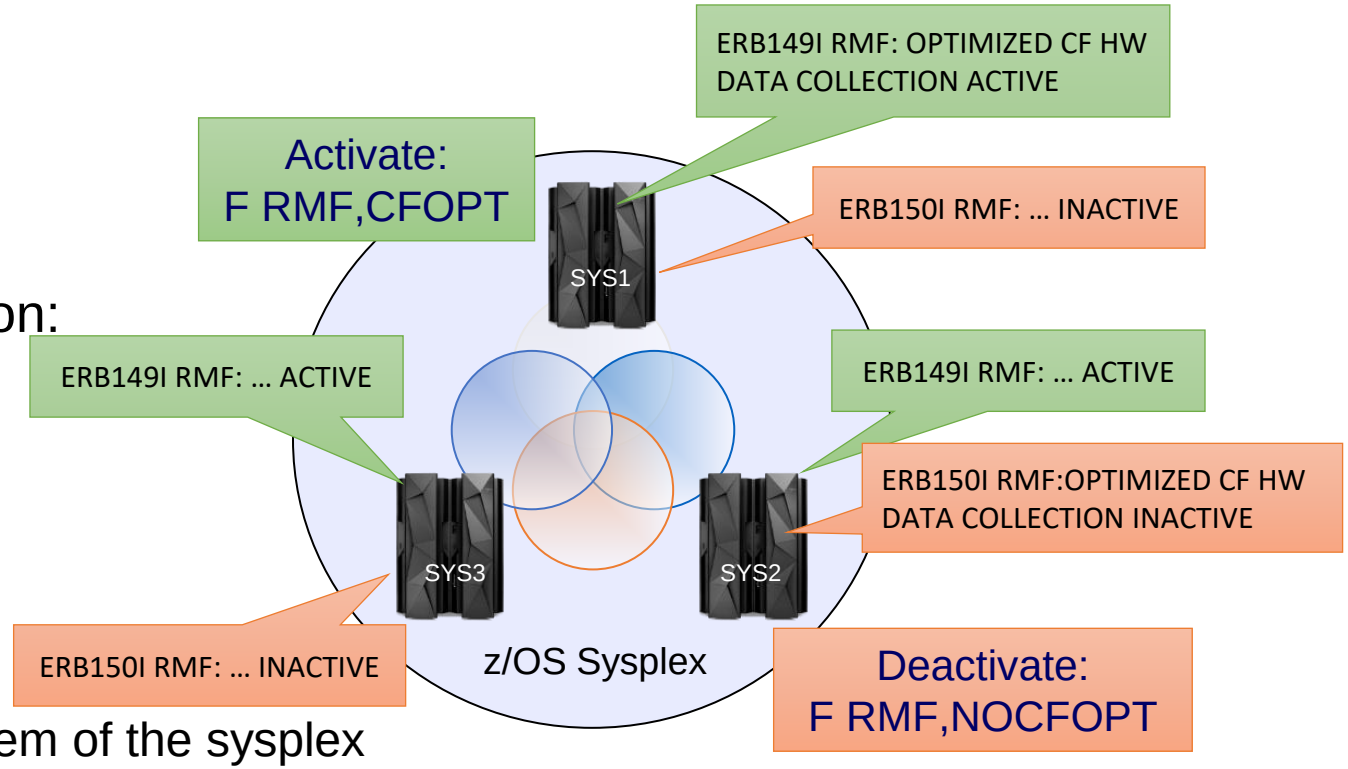
Benefit

✓ Reduce the system overhead and contention caused by the RMF CF HW data collection in sysplex environments with many CF structures and a larger distance between sysplex systems and their coupling facilities.

CF HW Data Collection - CFOPT Session Control Option

- New RMF control session option CFOPT can be used to switch on the optimized CF HW data collection. In optimization mode, CF HW statistics will be collected on the RMF master system only.
- Only one RMF master system within the sysplex, determined according to following rules:
  1. Monitor III Gatherer active
  2. Highest RMF Release
  3. SMF Buffer active
  4. Monitor III MASTER option specified
- Following possibilities to specify CFOPT option:
  1. Start command: START RMF,,,CFOPT
  2. Modify command: MODIFY RMF,CFOPT
  3. Procedure parm:

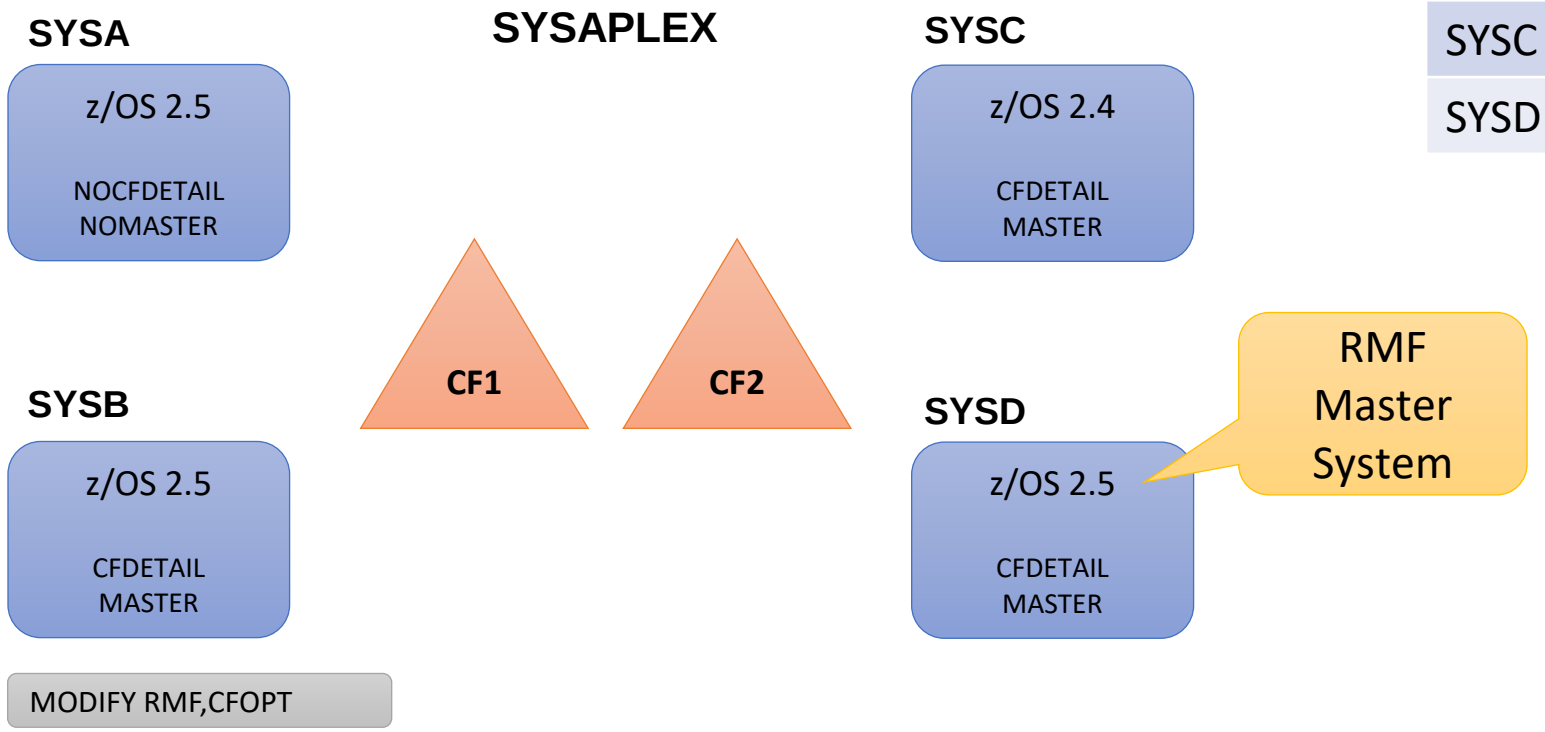
```
//RMF       PROC
//IEFPROC   EXEC PGM=ERBMFMFC,REGION=256M,TIME=1440,
//          PARM='CFOPT'
```



- ✓ The CFOPT option can be specified on any system of the sysplex
- ✓ It is recognized on all z/OS 2.5 sysplex systems where RMF is active
- ✓ Modify command: 'MODIFY RMF,NOCFOPT' will switch off optimized CF data gathering.

Optimized CF HW Data Gathering

Example:
Sysplex setup with optimized CF HW data collection



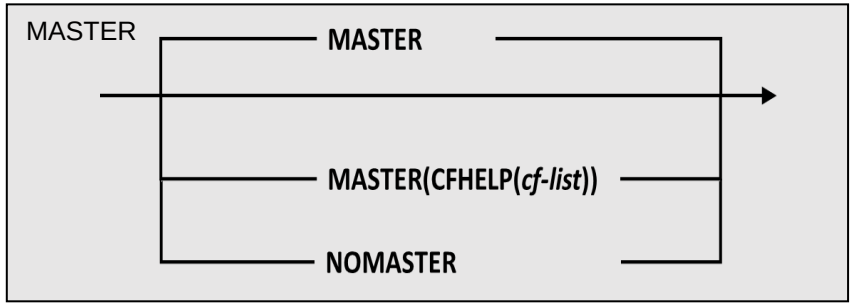
	CFIG3 Data Collection	SMF 74-4 Data Collection
SYSA	✖	✖
SYSB	✖	✖
SYSC	✔	✔
SYSD	✔	✔

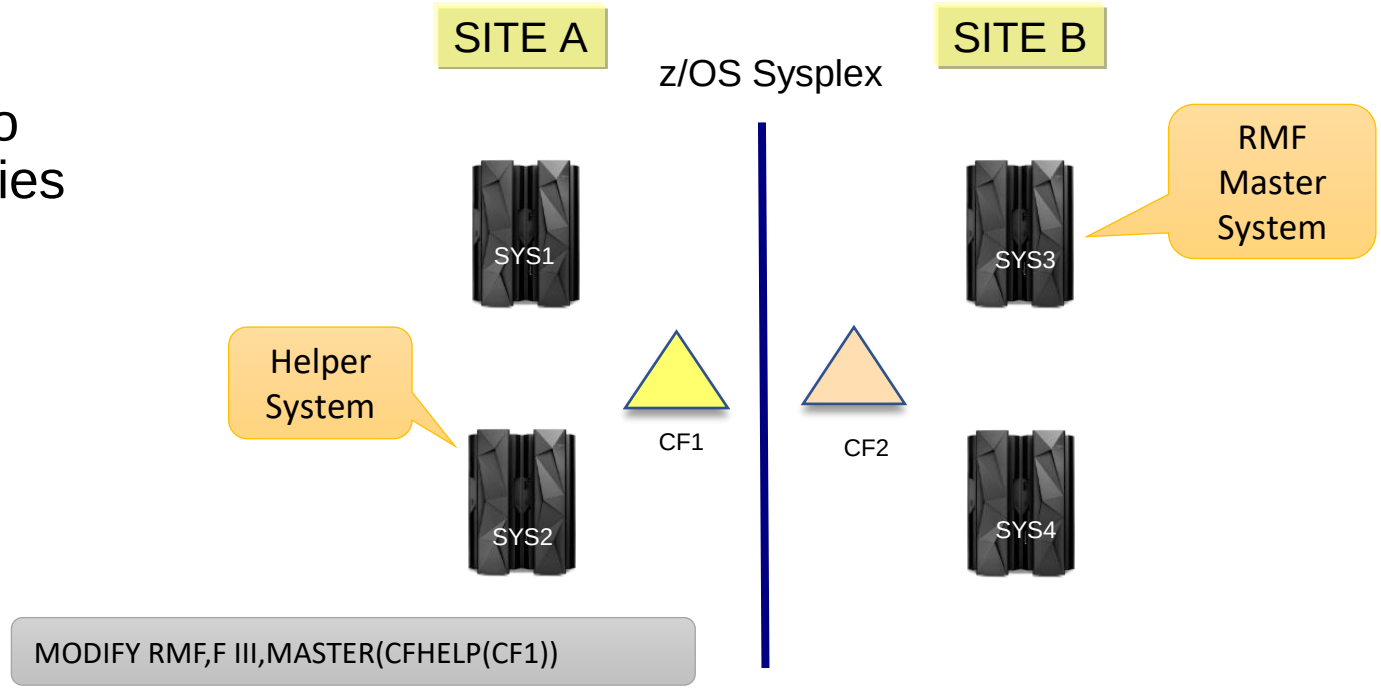
✖ NO CF HW DATA

✔ CF HW DATA

Monitor III CFHELP Suboption

- If optimized CF HW data gathering is active, new Monitor III data gatherer suboption can be used to select helper system for CF HW data collection of specific CF
- New MASTER CFHELP suboption allows to specify the names of up to 8 coupling facilities on a system that can act as helper system for CF HW data collection.

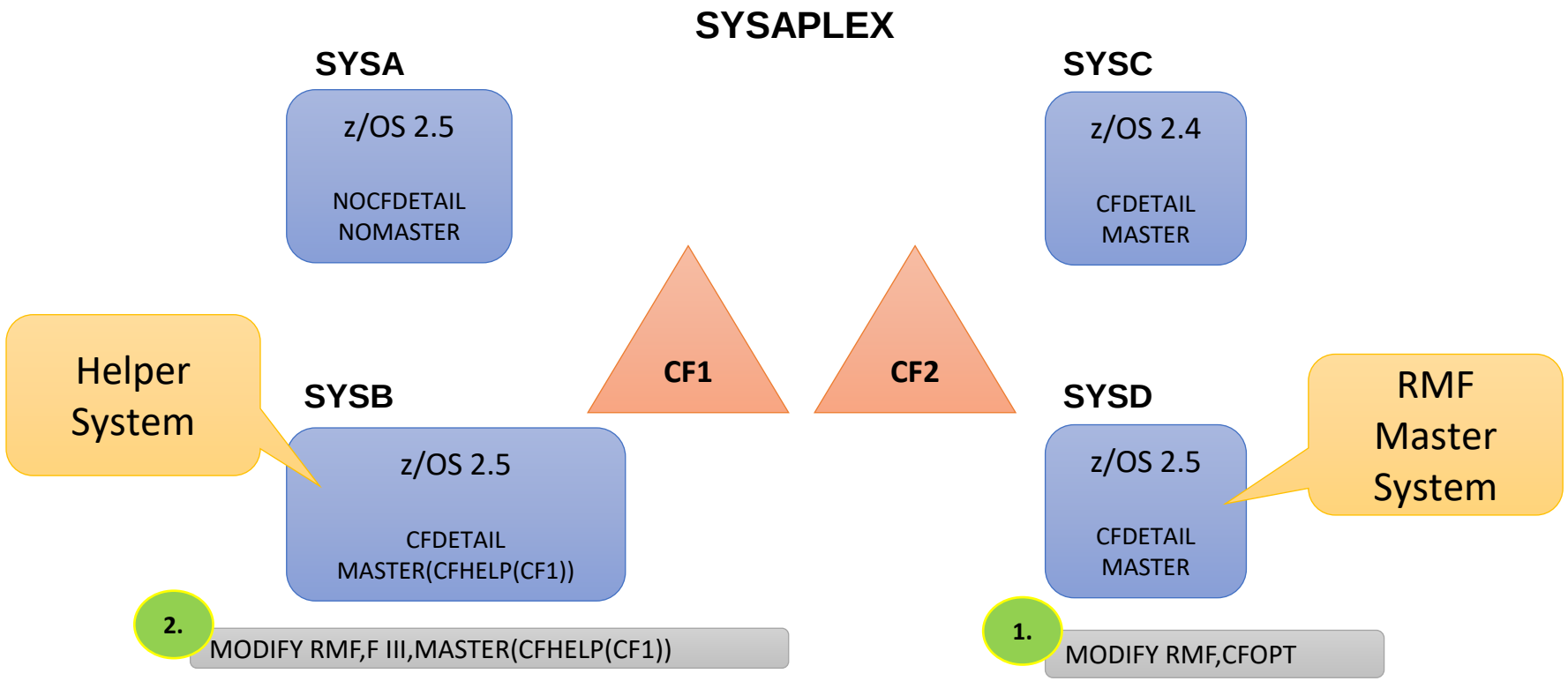




- Helper system collects CF HW statistics for the specified CF only if system is running the highest z/OS release in the sysplex
- As soon as there is a helper system collecting the CF HW statistics for a specific CF, CF HW statistics for that CF will no longer be collected by RMF master system.

Optimized CF HW Data Gathering with Helper System

Example:
Sysplex setup with optimized CF HW data collection and helper system



CFIG3 Data Collection

	CF1	CF2
SYSA	✗	✗
SYSB	✓	✗
SYSC	✓	✓
SYSD	✗	✓

SMF 74-4 Data Collection

	CF1	CF2
SYSA	✗	✗
SYSB	✓	✗
SYSC	✓	✓
SYSD	✗	✓

SMF record type 74.4

- SMF 74 subtype 4 **Local Coupling Facility Data Section:**

  New flag in field R744FFLG indicates, if CF HW statistic data are **NOT** available in the SMF 74 subtype 4 record.

Offsets	Name	Length	Format	Description
…				
16 10	R744FFLG	1	binary	Status Flags Bit Meaning when set … 5 No CF HW statistics available since optimized CF HW data gathering was active. 6-7 Reserved.

- The following SMF 74 subtype 4 data sections are only available, if the SMF 74 subtype 4 record was created by a sysplex system which collected CF HW statistic data, meaning bit 5 of status flag R744FFLG is **NOT** set:
  - Connectivity Data Section
  - Structure Data Section
  - Cache Data Section
  - Storage Class Memory Data Section
  - Asynchronous CF Duplexing Data Section
- SMF triplet fields SMF744XN, SMF744QN, SMF744CN, SMF744MN, and SMF744AN are all set to zero if the SMF record was created by a system that did not collect CF HW statistics (bit 5 of R744FFLG is turned on).

SMF record type 74.4 …

Request Data Section

Offsets	Name	Length	Format	Description
25 19	R744SFLG	1	binary	Status Flags Bit Meaning when set 0 Structure was connected to the system at the end of the interval. 1 Structure became active during the interval. 2 Structure is capable to participate in asynchronous duplexing. (Valid if bit 5 of R744FFLG is NOT set.) 3 Structure is in the duplexing active state. (Valid if bit 5 of R744FFLG is NOT set.) 4 Structure is primary instance of an asynchronously duplexed structure. (Valid if bit 5 of R744FFLG is NOT set.) 5 Structure is secondary instance of an asynchronously duplexed structure. (Valid if bit 5 of R744FFLG is NOT set.) 6 Structure is encrypted. (Valid if bit 5 of R744FFLG is NOT set.) 7 Reserved.
26 1A	*	1		Reserved.
27 1B	R744SLEC	1	binary	Lock structure only: lock table entry characteristic. (Valid if bit 5 of R744FFLG is NOT set.)

SMF record type 74.4 …

Request Data Section

Offsets		Name	Length	Format	Description
28	1C	R744SLEL	4	binary	List structure: limit on number of list entries. The estimated maximum number of list entries that may reside in storage class memory is not included. Lock structure: limit on number of data elements. (Valid if bit 5 of R744FFLG is NOT set.)
32	20	R744SLEM	4	binary	List structure: current number of list entries in use. The number of list entries that currently reside in storage class memory is not included. Lock structure: current number of data elements in use (Valid if bit 5 of R744FFLG is NOT set.)
36	24	R744SLTL	4	binary	Lock structure only: limit on number of lock table entries. (Valid if bit 5 of R744FFLG is NOT set.)
40	28	R744SLTM	4	binary	Lock structure only: Current number of lock table entries in use. (Valid if bit 5 of R744FFLG is NOT set.)
236	EC	R744SSIZ	4	binary	Allocated size of structure (units = 4K byte blocks). (Valid if bit 5 of R744FFLG is NOT set.)
240	F0	R744SMAS	4	binary	Maximum structure size. (Valid if bit 5 of R744FFLG is NOT set.)
244	F4	R744SMIS	4	binary	Minimum structure size. (Valid if bit 5 of R744FFLG is NOT set.)
248	F8	R744SDEC	4	binary	Cache structure only: Total directory entry count. (Valid if bit 5 of R744FFLG is NOT set.)

SMF record type 74.4 …

Request Data Section

Offsets		Name	Length	Format	Description
252	FC	R744SDEL	4	binary	Cache structure only: Total data element count. (Valid if bit 5 of R744FFLG is NOT set.)
256	100	R744SNLH	4	binary	List structure only: Number of list headers. (Valid if bit 5 of R744FFLG is NOT set.)
260	104	R744SMAE	4	binary	List structure only: maximum number of elements. The estimated maximum number of list elements that may reside in storage class memory is not included. (Valid if bit 5 of R744FFLG is NOT set.)
264	108	R744SCUE	4	binary	List structure only: current number of elements in use. The number of list elements that currently reside in storage class memory is not included. (Valid if bit 5 of R744FFLG is NOT set.)
…					
368	170	R744SETM	8	l_float	Structure execution time (microseconds). Valid if R744FLVL > 14. (Valid if bit 5 of R744FFLG is NOT set.)
…					
424	1A8	R744SQCH	1	binary	Asynchronous duplex operation queue characteristic. The number of queue entries is the product of: 4096 * 2 ** R744SQCH (Valid if bit 5 of R744FFLG is NOT set.)

Information and Tools

- Website
  - https://github.com/IBM/IBM-Z-zOS/tree/master/zOS-RMF
    with product information, newsletters, presentations, ...

- Documentation

  - z/OS Data Gatherer User's Guide, SC27-4934
  - z/OS Data Gatherer Programmer's Guide, GC27-4935
  - z/OS RMF Messages and Codes, SC34-2666
  - MVS System Management Facilities (SMF), SA38-0667
  - Latest version of PDF files can be downloaded from:
    http://www.ibm.com/systems/z/os/zos/bkserv/