z/OS V2.5 IBM Education Assistant

Solution Name: New RMF Product Structure

Solution Element(s): RMF

Agenda

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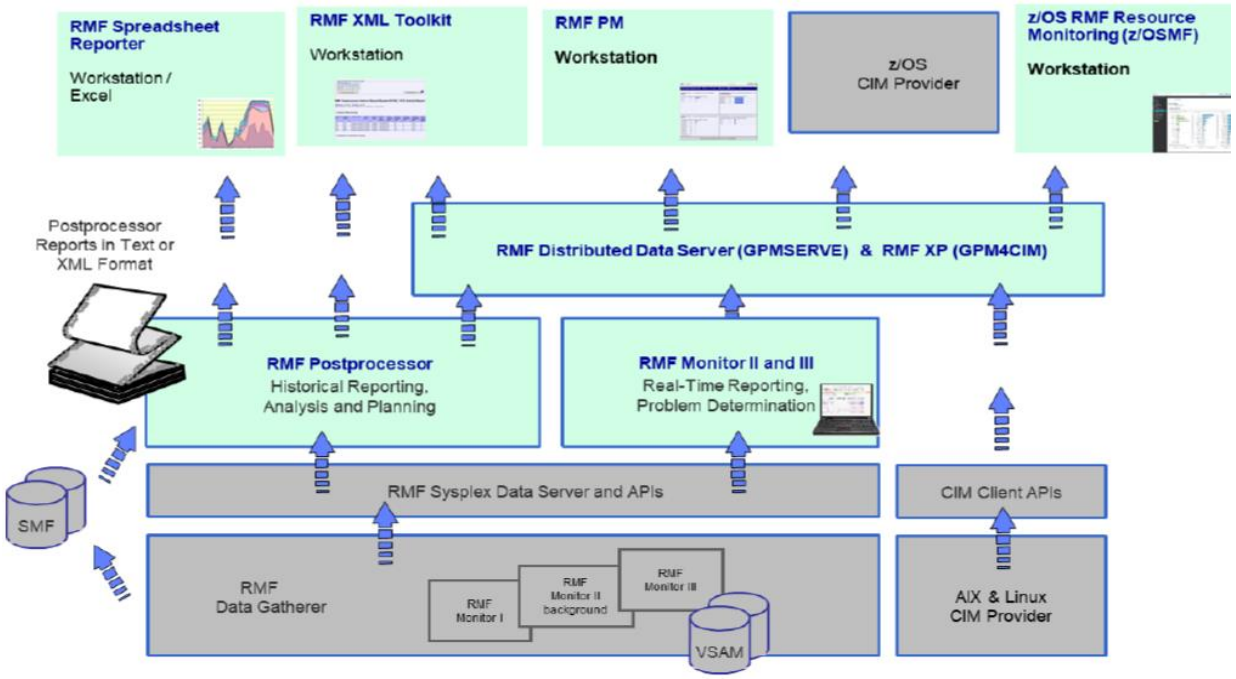
Trademarks

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

Objectives

- 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

Overview

- Who (Audience)
  - RMF users
- What (Solution)
  - 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
- Wow (Benefit / Value, Need Addressed)
  - 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, advanced mode with or without RMF Reporter
  - Priced feature RMF continues to provide the same functional capability as before V2R5

Licensing Model

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

- 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

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 and log-stream via Sysplex Data Server API 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

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 and logstream
  - Sysplex Data Server API ERB2XDGS
  - Sysplex Data Server API ERB3XDRS
  - Sysplex Data Server APIs ERBDSQRY/ERBDSREC

RMF
- 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 to be enabled

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

z/OS Data Gatherer 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.

z/OS Advanced Data Gatherer

- Data retrieval, assembly and data conversion to another release or service level
  - External APIs for Monitor III data and SMF buffer/logstream data already in place
  - SMF record retrieval from data sets internally available and used by RMF Postprocessor

SMF buffer /logstream		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

SMF Record Retrieval Service GRBSMFR

```
?GRBSMFR   D OPEN
           |   D ASSEMBLE
           |   O CONVERT
           |   O NONE
           |     REQTOKEN(xreqtoken)
           |     DDNAME(xddname)
           |     FILTLIST(xfiltlist)
           |     ANSAREAP(xansareap)
           |     ANSAREAL(xansareal)
           O GET
           |     REQTOKEN(xreqtoken)
           |     RSTOKEN(xrstoken)
           |     ANSAREAP(xansareap)
           |     ANSAREAL(xansareal)
           O CLOSE
                 REQTOKEN(xreqtoken)
            RETCODE(xretcode)
            REASCODE(xreascode)
           DPLISTVER(IMPLIED_VERSION)
                 OPLISTVER(MAX)
                 OPLISTVER(plistver)
           DMF(S)¨
           OMF(L,xmfctrl[,xmfattr!BDY(DWORD)]
           OMF(E,xmfctrl[,COMPLETE])
```

OPEN

explores an SMF data set and returns information that can be used as input for calling the GET function

ASSEMBLE

SMF records written on another z/OS release or service level must be converted to the SMF record level that is supported by this service. In addition, all broken SMF records will be re-assembled into one large logical SMF record

CONVERT

SMF records written on another z/OS release or service level must be converted to the SMF record level that is supported by this service. No SMF re-assembly is done

NONE

SMF records must be neither converted to another SMF record level nor re-assembled to a large logical SMF record

GET

retrieves either broken, unbroken, or re-assembled SMF records from an SMF data set. Data conversion and/or re-assembly is done if requested by parameter ASSEMBLE or CONVERT

CLOSE

closes the SMF data set and cleans up internal work areas

SMF Record Retrieval Service GRBSMFR

```
?GRBSMFR   D OPEN
           |   D ASSEMBLE
           |   O CONVERT
           |   O NONE
           |     REQTOKEN(xreqtoken)
           |     DDNAME(xddname)
           |     FILTLIST(xfiltlist)
           |     ANSAREAP(xansareap)
           |     ANSAREAL(xansareal)
           O GET
           |     REQTOKEN(xreqtoken)
           |     RSTOKEN(xrstoken)
           |     ANSAREAP(xansareap)
           |     ANSAREAL(xansareal)
           O CLOSE
                 REQTOKEN(xreqtoken)
            RETCODE(xretcode)
            REASCODE(xreascode)
           DPLISTVER(IMPLIED_VERSION)
                 OPLISTVER(MAX)
                 OPLISTVER(plistver)
           DMF(S)¨
           OMF(L,xmfctrl[,xmfattr!BDY(DWORD)]
           OMF(E,xmfctrl[,COMPLETE])
```

REQTOKEN(xreqtoken)

the request token is returned by the OPEN function. The request token must be used for subsequent GET requests and the final CLOSE request

DDNAME(xddname)

DDNAME of the SMF data set that contains the SMF records to be retrieved records

FILTLIST(xfiltlist)

filter criteria that is applied to the input SMF records. The input SMF records are provided in the SMF data set that is specified in the ddname parameter.

Byte 0 -1	Byte 2-3	Byte 4-5	Byte 6-7	Byte 8-11	Byte 12-25	Byte 26-39
Version	Length	type	subtype	smfid	starttime	endtime

ANSAREAP(xansareap)

is the 64-bit address of the area to which the service returns the information requested by the caller. For OPEN requests, it contains the SMF Data Set Lookup table (DSLT) which provides the calling program with information about one specific SMF record in the SMF data set. Only SMF records that are matching the specified selection criteria are described in DSLT data sections

ANSAREAL(xansareal)

length of the allocated answer area. If you do not provide enough space, the service returns in this parameter the length needed for the complete data.
The length value returned on OPEN requests is the size of the SMF Data Set Lookup table.

SMF Record Retrieval Service GRBSMFR

```
?GRBSMFR   D OPEN
           |   D ASSEMBLE
           |   O CONVERT
           |   O NONE
           |     REQTOKEN(xreqtoken)
           |     DDNAME(xddname)
           |     FILTLIST(xfiltlist)
           |     ANSAREAP(xansareap)
           |     ANSAREAL(xansareal)
           O GET
           |     REQTOKEN(xreqtoken)
           |     RSTOKEN(xrstoken)
           |     ANSAREAP(xansareap)
           |     ANSAREAL(xansareal)
           O CLOSE
                 REQTOKEN(xreqtoken)
            RETCODE(xretcode)
            REASCODE(xreascode)
           DPLISTVER(IMPLIED_VERSION)
                 OPLISTVER(MAX)
                 OPLISTVER(plistver)
           DMF(S)¨
           OMF(L,xmfctrl[,xmfattr!BDY(DWORD)]
           OMF(E,xmfctrl[,COMPLETE])
```

REQTOKEN(xreqtoken)

contains the request token that was returned by the OPEN function

RSTOKEN(xrstoken)

specifies the record set token which identifies the SMF record set that is to be processed by the GET function. Valid record set tokens are returned in the answer area of the OPEN request in bytes 8-11 of each data section

Byte 0 -3	Byte 4-5	Byte 6-7	Byte 8-11	Byte 12-15
Acronym	version	header length	Total length	number of data sections
Byte 16-17	Byte 18-19	Byte 20-23	Byte 24-31	
data section length	‘0000’X	Number of SMF record sets	QSAM input token	

Byte 0 -3		Byte 4 - 7	Byte 8 - 11	Byte 12-13	Byte 14-15
DSLT record ID		SMF record ID	record set token	broken record number	total broken records
Byte 16-17	Byte 18-19	Byte 20-23	Byte 24 - 27	Byte 28-31	
SMF type	SMF subtype	SMF ID	interval start date	interval end time	
Byte 32 – 35		Byte 36 – 47			
interval duration		not used			

ANSAREAP(xansareap)

specifies the 64-bit address of the area to which the service returns contains exactly one SMF record which is either a re-assembled or an unbroken SMF record.

ANSAREAL(xansareal)

Specifies the length of the allocated answer area. If you do not provide enough space, the service returns the estimated length needed for the complete data

SMF Record Retrieval Service GRBSMFR

```
?GRBSMFR   D OPEN
           |   D ASSEMBLE
           |   O CONVERT
           |   O NONE
           |     REQTOKEN(xreqtoken)
           |     DDNAME(xddname)
           |     FILTLIST(xfiltlist)
           |     ANSAREAP(xansareap)
           |     ANSAREAL(xansareal)
           O GET
           |     REQTOKEN(xreqtoken)
           |     RSTOKEN(xrstoken)
           |     ANSAREAP(xansareap)
           |     ANSAREAL(xansareal)
           O CLOSE
               REQTOKEN(xreqtoken)
            RETCODE(xretcode)
            REASCODE(xreascode)
           DPLISTVER(IMPLIED_VERSION)
                 OPLISTVER(MAX)
                 OPLISTVER(plistver)
           DMF(S)¨
           OMF(L,xmfctrl[,xmfattr!BDY(DWORD)]
           OMF(E,xmfctrl[,COMPLETE])
```

REQTOKEN(xreqtoken)

contains the request token that was returned by the OPEN function

RETCODE(xretcode)

output variable into which the return code is copied

REASCODE(xreascode)

output variable that will contain the reason code

PLISTVER(xplistver|IMPLIED_VERSION|MAX)

specifies the macro version. PLISTVER is the only key allowed on the list form of MF and determines which parameter list is generated

MF(S|L|E)

specifies the macro form

SMF Record Retrieval Service GRBSMFR

Return Code	Reason Code	Meaning /Action
0	0	**Meaning:** The operation was successful. The answer area contains the requested data.
		Action: Continue normal program execution.
4	0	**Meaning:** No SMF record data was found that matches the filter criteria specified in the filter list.
		Action: Specify other filter criteria in the filter_list parameter or continue normal program execution.
4	4	**Meaning:** At least one broken SMF record was detected in a SMF record set that belongs to a different time interval or was collected on another system than the other records in the SMF record set. The inconsistent SMF record is ignored.
		Action: Ensure that only consistent SMF record sets are passed to the service.
4	8	**Meaning:** At least one SMF record was not converted to the service level supported by the z/OS Data Gatherer.
		Action: The service provides the calling program with the unconverted broken SMF record in the answer area. Contact your system administrator and request the latest z/OS Data Gatherer service to be installed.
4	12	**Meaning:** At least one broken SMF record was found that cannot be reassembled by the service.
		Action: The service provides the calling program with the broken SMF record in the answer area.
4	16	**Meaning:** At least one incomplete SMF record set was found that cannot be reassembled by the service.
		Action: The service provides a DSLT entry in the answer area. The DSLT is supposed to belong to the incomplete SMF record set. Use the DSLT to determine which SMF records are affected and remove those records from the SMF data set or exclude them by using another filter in the filter_list parameter.
4	20	**Meaning:** At least one SMF record was converted to the version or SMF record level that is supported by GRBSMFR.
		Action: The service provides the calling program with the converted broken SMF record in the answer area.

SMF Record Retrieval Service GRBSMFR

Return Code	Reason Code	Meaning /Action
8	4	**Meaning:** The answer area provided by the calling program was too small for the service to return all the requested information.
		Action: Use the required answer area length returned by the OPEN or GET request. An answer area large enough to contain the re-assembled SMF record must be provided.
8	8	**Meaning:** The start or end time in the filter_list parameter was specified in an invalid format.
		Action: Specify start and end time in the format YYYYMMDDHHMMSS and rerun the program.
8	12	**Meaning:** The specified request token is invalid.
		Action: Specify the request token that was passed back on completion of the OPEN request.
8	16	**Meaning:** The specified record set token is invalid.
		Action: Use the DSLT to determine a valid SMF record set ID and specify the ID as SMF record set token
8	20	**Meaning:** The specified request type is invalid.
		Action: Specify request type OPEN, GET or CLOSE.
16	4	**Meaning:** The service was unable to access the SMF data set.
16	8	**Meaning:** Internal error. The service was unable to establish a recovery environment.
16	12	**Meaning:** Unexpected error. The error recovery routine of the service had control.
16	16	**Meaning:** Unexpected internal error.
16	20	**Meaning:** Unexpected error. Number of triplets in SMF record is higher than supported by the service.

Interactions & Dependencies

- Software Dependencies
  - None
- Hardware Dependencies
  - None
- Exploiters
  - z/OS Data Gatherer in basic mode
    - IBM Software Pricing tools require SMF 70 record data
    - SDSF DA (without the “JY” action) displays performance data provided by the z/OS Data Gatherer
  - z/OS Data Gatherer in advanced mode
    - raw performance data in general are used by
      - reporters like RMF and various ISV products
      - data providers like IBM Common Data Provider
      - machine learning & AI software products

Installation & Configuration

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 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*

- The z/OS Data Gatherer installs into

  SMP/E target libraries
  - SYS1.SGRBLINK
  - SYS1.SGRBLPA
  - SYS1.SGRBCLS
  - SYS1.PROCLIB
  - SYS1.MACLIB
  - SYS1.SAMPLIB
  - SYS1.PARMLIB

  SMP/E distribution libraries
  - SYS1.AGRBMOD1
  - SYS1.AGRBMAC1
  - SYS1.AGRBCLS
  - SYS1.APROCLIB
  - SYS1.ASAMPLIB
  - SYS1.APARMLIB

- SMP/E target and distribution libraries used by RMF

- 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 is not used anymore

Upgrade & Coexistence 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 SGRBLINK library to the link list, add the SGRBLINK library to the APF list and add the 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 SGRBLINK library to the link list, add the SGRBLINK library to the APF list and add the 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
  - Add the SGRBLINK library to the link list, add the SGRBLINK library to the APF list and add the 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

Appendix

- Documentation
  - z/OS Data Gatherer User's Guide
  - z/OS Data Gatherer Programmer's Guide
  - 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/

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