IBM

Introduction to SMF Recording and RMF Monitoring
zSTSU – November 16, 2004

JoAnne Brown
WSC - ATS
joabrown@us.ibm.com

IBM

Disclaimer and Trademarks

Disclaimer

The information in this document has not been submitted to any formal IBM test and is distributed on an "as is" basis without any warranty expressed or implied. Use of this information or the implementation of any of these techniques is a user responsibility and depends on the user's ability to evaluate and integrate them into the user's operational environment. While each item may have been reviewed for accuracy in a specific situation there is no guarantee the same or similar results may be achieved elsewhere. Users attempting to adapt these techniques to their environments do so at their own risk.

Trademarks

The following names are trademarks of the IBM Corporation and may be used throughout this presentation:

zSeries, CICS, CICS/ESA, CICS/MVS, z/VM, z/OS, IBM Logo, e-business Logo, Enterprise Systems Architecture/390, ES/3090, ES/9000, ESA/370 Enterprise Systems Connection Architecture, ESA/390, IBM, IMS, IMS/ESA, MVS, MVS/XA, S/390, 3090, Large Systems Performance Reference, LSPR, OS/390
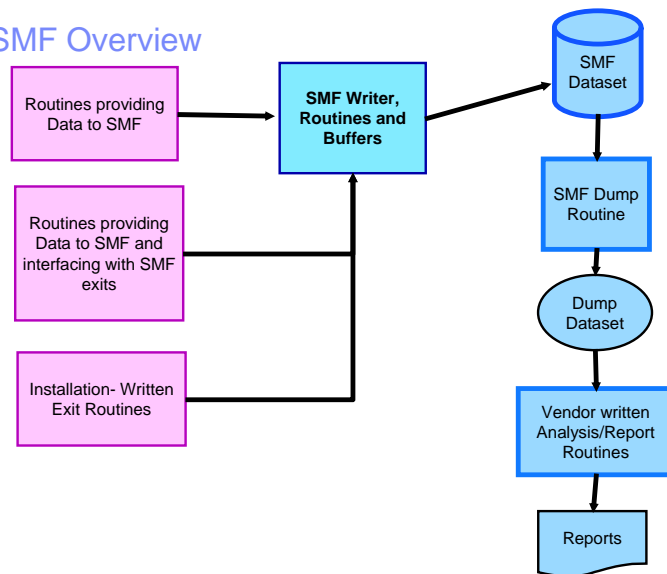
Agenda

- System Management Facility
  - ►Overview
  - ►Record Types
  - ►SMF Dump Program
  - ►Erbscan
- RMF Performance Monitors
  - ►Overview
  - ►Performance Data
  - ►Measurements
  - ►Monitor I, II, III
  - ►RMF Postprocessor
- SMF Data Buffer
- FTPing data

SMF Overview

SMF data

- Produced by elements, features, subsystems, and program products of z/OS system

- Each record is assigned a record type
  - ► Types 00-127 are reserved for IBM Products
  - ► Types 128-255 are available for user records

- Within a record there can be one or more subtypes

- Allocate SMF Data Sets for data collection
  - ► IBM recommends catalog datasets in Master catalog
  - ► Minimum of two data sets - IBM recommends 3 data sets, though more may be needed because of volume

---

Which SMF records do you need?

- What are the performance objectives for the system?
  - ► How are they measured?
- What reports are required?
- How will the measurement data be used
  - ► System usage reporting
  - ► Performance analysis and tuning recommendations
  - ► Report whether system met performance objectives
  - ► Historical analysis or trends
  - ► Forecasting future capacity
- What performance monitors are running
  - ► What performance data is produced by the monitors
  - ► Legal obligations
  - ► Auditor obligations

SMF Record types - RMF Reporting Monitors

SMF Record Type	Real-time Mon I	Snapshot Mon II	Interactive Mon III	Long-Term Postprocessor	RMF Activity Report
70.1	X	X	X	X	Processor
70.2	X			X	Cryptographic hardware
71	X	X		X	Paging
72.3	X		X	X	Workload service classes
73	X	X	X	X	Channel path
74.1	X	X	X	X	Device Activity
74.2			X	X	XCF
74.3/6		X	X	X	UNIX
74.4			X	X	Coupling facility
74.5			X	X	Cache
74.7				X	Ficon Directors
75	X	X		X	Page data set
76	X			X	System Counters
77	X	X	X	X	Enqueue
78.2	X		X	X	Virtual Storage
78.3	X	X	X	X	I/O Queuing
79		X			Various

SMF Record Types

- Type 30 - accounting information for address spaces

- Type 42 subtype 6 - data set level performance

- Type 70-79 - RMF records
  - type 70 - CPU Activity Report
  - type 72 - Workload Activity Report
  - type 74 - Device Activity Report

- Type 92 - File System Activity
  - Mount & Unmount
  - Open & Close a file
- Type 99 - System Resource Manager Decisions
  - Only collect Subtype 6 unless requested by IBM service

SMF Dump program

- SMF Dump Exit - IEFU29
  - ► Parmlib member - SMFPRMxx
  - ► Example: `SUBSYS(STC,EXITS(IEFU29,IEFACTRT),INTERVAL(SMF,SYNC),`
    `TYPE(0,30,70:79,88,89,245))`
- JCL - IFASMFDP program
  - ► Copies the input SMF data to output datasets
  - ► Input are SMF records in VSAM data sets
  - ► Output dataset is a sequential dataset
  - ► Capability for multiple input and output data sets
  - ► Options to dump and clear SMF data sets
  - ► Specify record type and subtype
  - ► Specify start and end dates and times for records written
  - ► Specify system ids

Sample JCL - SMF Dump

```
//JBROWNJ JOB (????,????),'SMFDUMP',MSGLEVEL=1,NOTIFY=JBROWN,
//STEP1     EXEC PGM=IFASMFDP
//DUMPIN    DD DISP=SHR,DSN=SYSA.MAN1
//DUMPOUT   DD DSN=JBROWN.SMFDATA,DISP=SHR,
//          SPACE=(CYL,(25,25,0))
//SYSPRINT  DD SYSOUT=*
//SYSIN     DD *
  OUTDD(DUMPOUT,TYPE(70:78))
  INDD(DUMPIN,OPTIONS(DUMP))
  INDD(DUMPIN,OPTIONS(CLEAR))
  DATE(2003104,2003108)
  SID(SYSA)
  START(0800)
  END(1600)
//NULL DD *
```

SMF Dump - Summary Report

- Summary Activity Report
  - ► Generated when Dump option specified
  - ► At least one record was read or written

```
                    SUMMARY ACTIVITY REPORT
START DATE-TIME  10/21/2002-00:20:00              END DATE-TIME  10/22/2002-00:00:02
RECORD        RECORDS         PERCENT      AVG. RECORD    MIN. RECORD    MAX. RECORD       RECORDS
 TYPE           READ          OF TOTAL        LENGTH         LENGTH         LENGTH         WRITTEN
   2              1            .00 %          18.00            18             18              1
   3              1            .00 %          18.00            18             18              1
  70            432            .68 %        2,936.00         2,076          3,420           432
  71            432            .68 %        1,604.00         1,604          1,604           432
  72         36,720         57.43 %          848.65           512         26,968        36,720
  73            432            .68 %       19,704.00        19,704         19,704           432
  74         21,168         33.11 %       23,254.50           364         32,752        21,168
  75          3,456          5.40 %          264.00           264            264         3,456
  77            432            .68 %          160.00           160            160           432
  78            868          1.36 %        8,949.16           596         32,696           868
TOTAL        63,942          100 %        8,486.39            18         32,752        63,942
NUMBER OF RECORDS IN ERROR            0
```
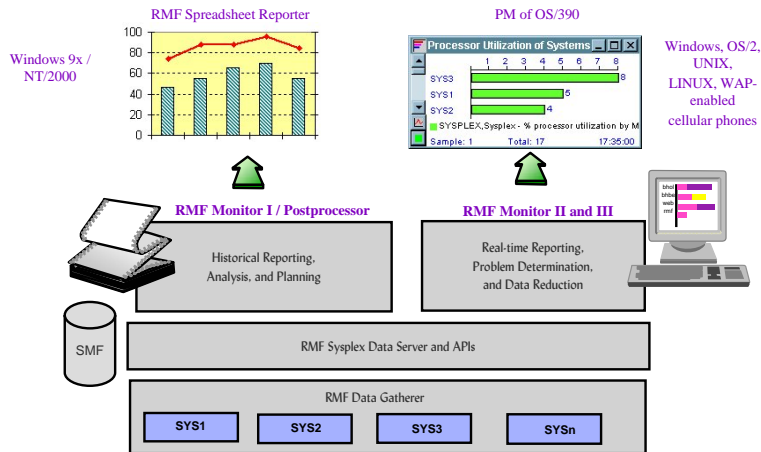

Viewing RMF Data

- ERBSCAN - Available OS/390 rel 6 scans the SMF dataset
- ERBSHOW - displays individual record
- TD100161 New Program for Viewing SMF Records
  - ► www.ibm.com/support/techdocs

```
  Rec-Num  Type    RecLn SMFDate  SMFTime   RMFDate  RMFTime
  -------  -------  ----- ---------------- ----------------
      469 072.003   964 2002.191 14:45:00 2002.191 14:30:00
      470 072.003   964 2002.191 14:45:00 2002.191 14:30:00
      471 072.003   964 2002.191 14:45:00 2002.191 14:30:00
      472 072.003   964 2002.191 14:45:00 2002.191 14:30:00
      473 072.003   964 2002.191 14:45:00 2002.191 14:30:00
      474 072.003   964 2002.191 14:45:00 2002.191 14:30:00
      475 072.003   964 2002.191 14:45:00 2002.191 14:30:00
      476 072.003   964 2002.191 14:45:00 2002.191 14:30:00
      477 072.003   964 2002.191 14:45:00 2002.191 14:30:00
      478 072.003  1444 2002.191 14:45:00 2002.191 14:30:00
      479 072.003  1444 2002.191 14:45:00 2002.191 14:30:00
      480 072.003   964 2002.191 14:45:00 2002.191 14:30:00
      481 072.003   964 2002.191 14:45:00 2002.191 14:30:00
```
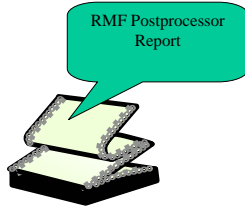
IBM

RMF Performance Monitors

© 2002 IBM Corporation

IBM

RMF Overview

- RMF is a tool which helps the operator, administrator and system programmer do their jobs effectively.

RMF Spreadsheet Reporter

PM of OS/390

Windows 9x / NT/2000

Processor Utilization of Systems

SYS3   8
SYS1   5
SYS2   4

SYSPLEX,Sysplex - % processor utilization by M
Sample: 1   Total: 17   17:35:00

Windows, OS/2, UNIX, LINUX, WAP-enabled cellular phones

RMF Monitor I / Postprocessor

Historical Reporting, Analysis, and Planning

RMF Monitor II and III

Real-time Reporting, Problem Determination, and Data Reduction

SMF

RMF Sysplex Data Server and APIs

RMF Data Gatherer

| SYS1 | SYS2 | SYS3 | SYSn |

© 2002 IBM Corporation

7

RMF Performance Data

RMF Postprocessor Report

MAN2

MAN1

MAN3

- Monitor I
  - ► SMF record types 70-78
- ► Postprocessor Reports
  - – Interval Reports
  - – Duration Reports
- Monitor II
  - ► SMF record type 79
  - ► Interactively displayed

RMF

- Monitor III
  - ► SMF record types 70-78
  - ► Interactively displayed

**RMFIII. DS1**

RMFIII. DS2
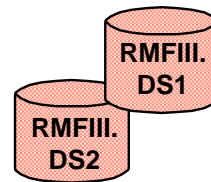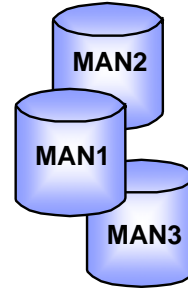
RMF Measurements

- Measurement Values
  - ► Cycle Time
    - – How often RMF samples
  - ► Measurement Interval
    - – How often RMF produces a SMF record
- Data Scope
  - ► Single system
  - ► Sysplex
  - ► Storage controller cache- collect on one system
- Data Fields
  - ► Sampled data
  - ► Counts
  - ► Times
  - ► Rates (number/sec)
  - ► Percentages

Monitor III - Sending data sets to other Systems

- Sending Monitor III data sets to other systems

- Sending Mon III to a different system
  - Need to unload the VSAM dataset to a sequential dataset
  - CLIST ERBV2S
    - ERBV2S vsam_dsn seq_dsn [TRACKS(num_tracks)]

RMFIII. DS1

RMFIII. DS2
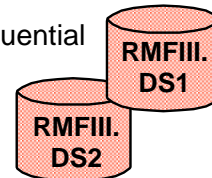
```
Use TRANSMIT to send the sequential dataset
```

Monitor I Measurements

- Various system activity
  - CPU Activity
  - DASD
  - Workload

- Reports are real-time or postprocessor
  - Single system or sysplex reports
  - Real-time reports are using data in buffer

Monitor I Options - Sample ERBRMFxx Member for Monitor I

```
/*******************************************************************/
/*   MEASUREMENTS                                                  */
/*******************************************************************/
  CACHE                     /* CACHE STATISTICS                */
  CHAN                      /* CHANNEL STATISTICS              */
  CPU                       /* CPU STATISTICS                  */
  DEVICE(DASD)              /* DIRECT ACCESS DEVICES MEASURED  */
  DEVICE(NOTAPE)            /* NO TAPE DEVICES MEASURED        */
  ENQ(SUMMARY)              /* SUMMARY OF ENQUEUES             */
  IOQ(DASD)                 /* DASD I/O QUEUEING MEASURED      */
  PAGESP                    /* PAGE/SWAP DATASET STATISTICS    */
  PAGING                    /* PAGING DATA                     */
  NOTRACE                   /* NO TRACE REPORT                 */
  VSTOR(S)                  /* VIRTUAL STORAGE SUMMARY DATA    */
  WKLD(PERIOD)              /* WORKLOAD MANAGER DATA           */
/*******************************************************************/
/*    TIMING and REPORTING OF DATA                                 */
/*******************************************************************/
  CYCLE(1000)               /* SAMPLE EVERY SECOND (1000 MSEC) */
  NOSTOP                    /* ACTIVE UNTIL OPERATOR ISSUES STOP */
  SYNC(SMF)                 /* USE INTVAL/SYNCVAL FROM SMFPRMXX */
  NOOPTIONS                 /* OPTIONS NOT DISPLAYED, NO REPLY */
  RECORD                    /* WRITE SMF RECORDS EVERY INTERVAL */
  NOREPORT                  /* NO WRITTEN REPORTS TO SYSOUT    */
  SYSOUT(A)                 /* REPORTS TO CLASS A, IF REPORT   */
/*******************************************************************/
```

Monitor II measurements

- On-demand monitoring - snapshot
  - Generates a requested report from a data sample
  - Address space information
  - Job resource information

Monitor II Options - Sample ERBRMFxx Member for Monitor II

```
ASD                   /* COLLECT ADDRESS SPACE STATE
                         DATA                        */
NOUSER                /* DO NOT COLLECT USER DATA    */
NODELTA               /* PRESENT DATA AS SESSION
                         TOTALS                      */
SINTV (30S)           /* SESSION INTERVAL = 30 SECONDS */
STOP (30M)            /* STOP AFTER 30 MINUTES       */
RECORD                /* SMF RECORDING               */
REPORT (DEFER)        /* ALL REPORTS TO BE PRODUCED
                         AFTER RMF ENDS              */
OPTIONS               /* OPERATOR MAY EXAMINE AND/OR
                         CHANGE THE RMF OPTIONS       */
SYSOUT(A)             /* INTERVAL REPORTS TO CLASS A
```

Monitor III Measurements

- Frequency of samples
  - ► CYCLE - Time between samples
  - ► MINTIME - Measurement interval, samples are summarized
  - ► SYNC - Synchronization with clock of MINTIME
- Collecting monitor data
  - ► SMF records
    - – Written if record types are enabled in SMFPRMxx
    - – If Monitor I active, same synchronization as Monitor I
    - – If Monitor I not active, uses SMF INTVAL and SYNCVAL
  - ► VSAM data sets
    - – Specify up to 100 VSAM data sets for use by data gatherer
    - – DATASET - Control data recording to VSAM data sets
    - – MINTIME - Measurement interval of records
  - ► RMF local storage buffer
    - – WSTOR - specify the size of the storage buffer

11

Monitor III Options - Sample ERBRMFxx Member for Monitor III

```
/************************************************************************
* ERBRMF04 DEFAULT MEMBER MONITOR III DATA GATHERER                     *
*************************************************************************/
     NOOPTIONS                    /* NO OPERATOR INTERVENTION      */
     RESOURCE(*JES2,JES2)         /* RESOURCE SELECTION           */
     MINTIME(100)                 /* REPORTING INTVL,DEFAULT 100 SEC */
     WSTOR(10)                    /* STORAGE BUFFER 10-999 MB     */
        DS(START,
        WHOLD(10),                /* PAGE RELEASE 2-999 MB        */
        ADD(SYS1.RMFGAT.CLUSTER1,
            SYS1.RMFGAT.CLUSTER2))
*************************** Bottom of Data ***************************
```

Gathering RMF Data

Starting and Stopping RMF Monitors:

- Start RMF monitor I with S RMF command
- Start RMF monitor II background session with
  MODIFY RMF,session id command
  - ► session id is two alphanumeric characters
  - ► cannot be ZZ
- Start RMF monitor III with
  MODIFY RMF,START III command
  - ► procedure name is RMFGAT
- Stop monitors with modify command
  - ► monitor I   - F RMF,STOP ZZ
  - ► monitor II - F RMF,STOP session id
  - ► monitor III - F RMF,STOP III

RMF Postprocessor

- Reports system utilization and performance by "post processing " RMF and SMF data
  - ►SMF records written by RMF (Types 70-78)
  - ►SMF type 103 records from HTTP Server
  - ►SMF type 108 records from Domino
- Offers different types of reports
  - ►Interval reports
  - ►Duration reports
  - ►Summary reports
  - ►Exception reports
  - ►Overview reports
- ►SMF Data has to be sorted for the RMF Postprocessor

Sorting SMF data - JCL

```
//RMFSORT  EXEC PGM=SORT
//SORTIN   DD DSN=JBROWN.SMFDATA.DATE,
//         DISP=(SHR)
//SORTOUT  DD DSN=JBROWN.SMFDATA.SORTED,
//            UNIT=SYSDA,SPACE=(CYL,(10,1)),
//            DATACLAS=COMT,DISP=(NEW,CATLG)
//SORTWK01 DD DISP=(,DELETE),UNIT=SYSDA,SPACE=(CYL,(800))
//SORTWK02 DD DISP=(,DELETE),UNIT=SYSDA,SPACE=(CYL,(800))
//SORTWK04 DD DISP=(,DELETE),UNIT=SYSDA,SPACE=(CYL,(800))
//SORTWK05 DD DISP=(,DELETE),UNIT=SYSDA,SPACE=(CYL,(800))
//SORTWK06 DD DISP=(,DELETE),UNIT=SYSDA,SPACE=(CYL,(800))
//SYSPRINT DD SYSOUT=*
//SYSOUT   DD SYSOUT=*
//SYSIN    DD *
 SORT FIELDS=(11,4,CH,A,7,4,CH,A),EQUALS
 MODS E15=(ERBPPSRT,500),E35=(ERBPPSRT,500)
```

IBM.

RMF Postprocessor

- Sample JCL for RMF Post Processor program

```
//RMFPP EXEC PGM=ERBRMFPP,REGION=0M
//MFPINPUT DD DISP=SHR,DSN=RMFDATA.SYSPLEX.SORTED
//* RMF/SMF input data, if omitted uses SMF buffer
//MFPMSGDS DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSIN  DD *
 SYSID(SYSA)
 REPORTS(CPU)           /* CPU Report          */
 REPORTS(DEVICE(DASD))  /* I/O Device Activity */
 SYSRPTS(WLMGL(SCPER))  /* WLM Activity Report */
 SYSRPTS(CF)            /* CF Report           */
 RTOD(0900,1600)        /* HHMM to HHMM        */
 SYSOUT(O)              /* SYSOUT Class        */
```


IBM.

SMF Data Buffer
Allows report creation using recent data without dumping, merging, or sorting SMF data

- RMF writes SMF records to an in-storage, wrap-around buffer
- Use RMF SMFBUF options - Default is record types 70-78
- **BUFSIZMAX** – Specifies the SMF Buffer size
  - Minimum = 128M
  - Maximum = 1G
  - Default = 128M
- **BUFUSEWARN** – Specifies the Buffer warning level
  - Message IEE986E is issued when the SMF buffer percentage **in use** drops below the specified value
  - Range 10% - 90%
  - Default = 25%
- SMFBUF may be specified on Start command
- START RMF,,,(SMFBUF(RECTYPE(70:78)))
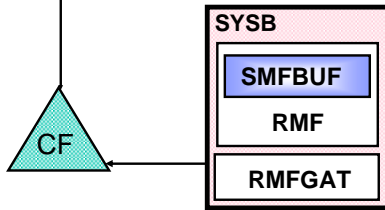- SMFBUF may be specified in parm= in RMF proclib

```
//IEFPROC   EXEC  PGM=ERBMFMFC,REGION=128M,
//PARM=' SMFBUF'
```

SMFBUF -Sysplex Reporting

SYSA

| SMFBUF |
| RMF |
| RMFGAT |

SYSB

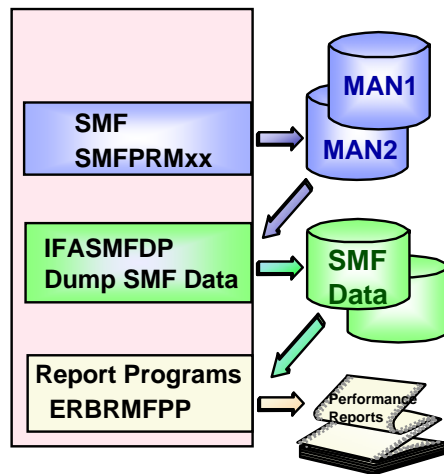| SMFBUF |
| RMF |
| RMFGAT |

CF
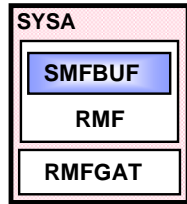
SMFBUF sysplex wide data

```
//RMFPP   EXEC PGM=ERBRMFPP,REGION=0M
//* MFPINPUT use SMF buffer
//MFPMSGDS  DD SYSOUT=*
//SYSPRINT  DD SYSOUT=*
//SYSIN DD DSN=RMF.REPORTS,DISP=SHR
```

Sysplex Reports

System Reports

Summary

Operating System Program Products

| SMF SMFPRMxx |
| IFASMFDP Dump SMF Data |
| Report Programs ERBRMFPP |

MAN1

MAN2

SMF Data

Performance Reports

- Performance data reports the usage of system resources
- Amount and granularity of SMF and RMF data is controlled parameters, such as interval value
- SMF and RMF parameters specified in PARMLIB
- SMF data copied with IFASMFDP program

FTPing SMF Data to IBM

Compress/Terse Instructions

- Compress/Terse the converted dataset using TRSMAIN which can be downloaded from:

    http://techsupport.services.ibm.com/390/trsmain.html

- ISPF command shell
    - terse 'WSC.CUSTNAME.SMF.RECORDS' **pack ispf**

- **SMF DATA MUST BE TERSED**

ISPF Command Shell - Terse

```
 Select Option ===> P

     P  PACK       - TERSE (PACK

     S  SPACK      - TERSE (SPACK

     U  UNPACK     - TERSE (UNPACK

     Input Dataset MUST NOT be the same as the Output Dataset


     Input  Dataset name   ===> 'WSC.CUSTNAME.SMF.RECORDS'


     Output Dataset name   ===> 'WSC.TERSE.CUSTNAME.SMF.RECORDS'


     Output Explicit Alloc ===> YES        ( Yes | No for default allocation)


 Enter END KEY to terminate ISPF/PDF
```

ISPF Command Shell - Terse

```
                    ALLOCATE NEW DATA SET
 COMMAND ===>

 DATA SET NAME: 'WSC.TERSED.CUSTNAME.SMF.RECORDS'

     VOLUME SERIAL     ===> 67YC13     (Blank for authorized default volume) *
     GENERIC UNIT      ===>            (Generic group name or unit address) *
     SPACE UNITS       ===> BLOCK      (BLKS, TRKS, or CYLS)
     PRIMARY QUANTITY  ===> 20         (In above units)
     SECONDARY QUANTITY ===> 10        (In above units)
     DIRECTORY BLOCKS  ===> 0          (Zero for sequential data set)
     RECORD FORMAT     ===> FB         ( Blank for TERSE default value)
     RECORD LENGTH     ===> 1024       ( Blank for TERSE default value)
     BLOCK SIZE        ===> 6144       ( Blank for TERSE default value)


     Releasing Space   ===> YES        (RLSE - YES or NO)


     EXPIRATION DATE   ===>            (YY/MM/DD
                                         in Julian form
                                         for retention period in days
                                        or blank)
     ( * Only one of these fields may be specified)
```

Testcase Data Exchange Access

- IBMers need to use their Intranet UserID and password to access Testcase Data Exchange
  - Organized into directories with individual owners
  - Need to contact a IBM Blue Group owner or administrator to obtain access to a directory
  - For additional information on creating a new IBM Blue Group please click on the following link

  http://w3-2.ibm.com/software/sdf/w3sdf.nsf/webpages/testcase+data+exchange#Using

---

Sample JCL To FTP - SMF data

```
//JBROWNJB JOB  (????,????),'TESTCASE FTP',MSGCLASS=O,
// NOTIFY=JBROWN
//FTPSTEP  EXEC PGM=FTP,REGION=4096K
//NETRC DD DSN=JBROWN.NETRC,DISP=SHR
//SYSMDUMP DD  SYSOUT=*
//SYSPRINT DD  SYSOUT=*
//OUTPUT   DD  SYSOUT=*
//INPUT    DD  *
testcase.boulder.ibm.com
cd /mvs/toibm
dir
bin
locsite cylinders
locsite pri=200
locsite sec=100
locsite recfm=fb
locsite lrecl=1024
locsite blksize=6144
put 'wsc.terse.custname.smf.records' 'custname.smf.records.terse'
```

Protecting Your Intranet Password

- If you choose to use a batch job to access Testcase Data Exchange, you need to protect your Intranet password by:
  - Creating a file - `YOUR_HIGHLEVEL_QUALIFIER.NETRC`
  - You need to protect the dataset from other MVS users

    - RACF – Dataset Profile Services

```
Sample YOUR_HIGHLEVEL_QUALIFIER.NETRC
*************************************************************
MACHINE testcase.boulder.ibm.com   LOGIN yourname@us.ibm.com
PASSWORD  yourpassword
*************************************************************
```

Connect to Testcase Data Exchange from Ready Prompt

From ready prompt
  FTP testcase.boulder.ibm.com
  USER: yourname@us.ibm.com
  PASSWORD: Intranet password
  CD MVS/toibm: move to working directory
  BIN: store file in Binary format
  PUT: '`WSC.TERSE.CUSTNAME.SMF.RECORDS`'
 '`custname.smf.records`'
  DIR: verify dataset is on the server

Additional Resources

SMF
- ► MVS Systems Management Facilities SA22-7630-09

RMF
- ► RMF Report Analysis SC33-7991-07
- ► RMF Users Guide SC33-7990-07

FTP Transmit Instructions For SMF data
http://w3-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/TD101748

Testcase Data Exchange Website
http://w3-2.ibm.com/software/sdf/w3sdf.nsf/webpages/testcase+data+exchange

---

Thank You