VSAM Record Level Sharing (RLS Overview) Part 1 and 2

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Transactional VSAM (TVS)
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- Multiple Lock Structure (future enhancement)
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- Summary
RLS z/OS Release Enhancements
RLS z/OS Release Enhancements

- OS/390 2.1  - VSAM RLS general availability (1996)
- z/OS 1.4  - Transactional VSAM (priced feature)
- All z/OS Releases - RAS support shipped via APARs
- z/OS 1.7 - VSAM RLS 64 Buffering
- z/OS 1.8 - RMF support for 64 bit buffering. RAS support. RSM changes.
- z/OS 1.9 – RAS support, sysplex wide dumping.
- z/OS x.x - Multiple Lock Structure support
- z/OS x.x - CA Reclaim
IBM Products Exploiting VSAM RLS
IBM Products Exploiting RLS/TVS:

- CICS
- HSM
- INFOMAN
- SCLM
- IMS (RLS and TVS)
Record Level Sharing (RLS) – Design Direction
Record Level Sharing (RLS) - Design

- VSAM RLS is another method of access, to your existing VSAM files, which provides full read and write integrity at the record level, to any number of users in your parallel sysplex.
Review of Base VSAM
Review of Base VSAM

- Share options
- Buffering
- Locking
- RAS
- Performance Measurements
Review of Base VSAM

- **Share options.**
  - Share option of the data set.
  - `SHAREOPTIONS(crossregion,crosssystem)`
    - `SHAREOPTIONS(1,x)` - Defined as one user opened to the data set for read/write or any number of users for input only. VSAM provides full read/write integrity.
    - `SHAREOPTIONS(2,x)` - Defined as one user opened to the data set for read/write and any number of users for input. VSAM provides full read/write integrity for the read/write user, however, the readers do not receive read integrity.
    - `SHAREOPTIONS(3,x)` - Defined as any number of users opened to the data set for read/write. VSAM does not provide any read/write integrity.
    - `SHAREOPTIONS(4,x)` – VSAM will flush buffers after each request.
  - `ACB MACRF=(DDN/DSN)` is the only real mechanism for sharing VSAM files.
Example of ShareOptions (2,x)

AddressSpace1
//dd1 DD DSNAME=dataset1
OPEN ACB1 ddname=dd1,
macrf=(out)

//dd2 DD DSNAME=dataset1
OPEN ACB1 ddname=dd2,
macrf=(out,dsn)

(read/write integrity)

AddressSpace2
//dd1 DD DSNAME=dataset1
OPEN ACB1 ddname=dd1,
macrf=(in)

//dd1 DD DSNAME=dataset1
OPEN ACB1 ddname=dd1,
macrf=(in)

(no read integrity)
Base VSAM - Buffering

- Base VSAM provides 3 types of buffering: ACB
  macrf=(NSR/LSR/GSR).

  - NSR - Non-Shared Resources
  - LSR - Local Shared Resources
  - GSR - Global Shared Resources

- For LSR/GSR, user defined the buffer pool:

  POOL1  BLDVRP  BUFFERS=(1024(5)),
  STRNO=4,
  TYPE=LSR,
  MODE=31,
  RMODE31=ALL
Example of LSR Buffering

AddressSpace1

Buffer

RPL1
GET Record1
.
.
.

Buffer

RPL2
GET Record1
.
.
.

Buffer

RPL3
GET Record2
.
.
.

(read/write integrity)
Base VSAM - Locking

- Base VSAM serializes on a CI level.
- Multiple users attempting to access the same CI for read and write either defer on the CI or are returned an exclusive control conflict error by VSAM.
- CIs with many records per CI, or applications that repeatedly access the same CI can have a performance impact due to retrying of exclusive control conflict errors.
Example of Base VSAM LSR Serialization

Scope = Single LSR Buffer Pool
Granularity = Control Interval
Ownership = RPL

GET UPD  RPL_1
(Record B)

GET UPD  RPL_2
(Record E)
• fails - Exclusive Control Conflict
Base VSAM - RAS

- Base VSAM has little to no first time data capture, and internal recovery, for logic errors.
  - All resources are obtained in a single address space.
  - EOT acted as cleanup routine (plus estae stacked by open/close).
  - Performance highly valued over RAS.
  - RAS in general was not a major requirement when VSAM was developed.

End result:
  - Difficult problems to debug.
  - Broken data sets and data integrity problems.
Base VSAM – Performance Measurements

- Base VSAM provides SMF 62 and 64 records.
  - SMF 62 – Created by OPEN for each ACB.
  - SMF 64 - Created by EOV and CLOSE for each ACB, however, the stats represent the sum of all ACBs connected to the control block structure.
Review of RLS
Review of RLS

- Share options
  - Example of RLS Readers/Writers
  - Example of Shareoption (2,x) with RLS and base VSAM
- Buffering
- Locking
- RAS
- Performance Measurements
Review of RLS

Share options.

- largely ignored by RLS.
- Exception is SHAREOPTIONS(2,x) -
  - Now defined as one user opened to the data set for non-RLS read/write and any number of users for non-RLS read. VSAM provides full read/write integrity for the non-RLS read/write user, however, the readers do not receive read integrity.
  - Or, any number of users opened for RLS read/write and any number of users for non-RLS read. VSAM provides full read/write integrity for the RLS users and no read integrity for the non-RLS readers.
Example of RLS Readers/ Writers

System 1

AddressSpace 1

OPEN ACB macrf=(rls,out)
(read/write integrity)

SMSVSAM Dataspace

OPEN ACB1 macrf=(rls,in), rlsread=cr
(read/write integrity)

AddressSpace n

System mn

AddressSpace 1

OPEN ACB macrf=(rls,out)
(read/write integrity)

SMSVSAM Dataspace

OPEN ACB1 macrf=(rls,in), rlsread=nri
(no read integrity)

AddressSpace n
Example of Shareoption (2,x) with RLS and base VSAM

System1

AddressSpace1

OPEN ACB macr=(rls,out)
(read/write integrity)

SMSVSAM Dataspace

ACB AMBL AMB ...

ACB AMBL AMB ...

AddressSpace2

OPEN ACB1 macr=(rls,in), rlsread=cr
(read/write integrity)

Systemnn

AddressSpace1

OPEN ACB macr=(rls,out)
(read/write integrity)

SMSVSAM Dataspace

ACB AMBL AMB ...

ACB AMBL AMB ...

AddressSpace2

OPEN ACB1 macr=(nsr,in)
(no read integrity)
RLS - Buffering

- VSAM now provides 4 types of buffering: ACB macrf=(NSR/LSR/GSR/RLS).
  
  - NSR - Non-Shared Resources
  - LSR - Local Shared Resources
  - GSR - Global Shared Resources
  - RLS - Record Level Sharing

- Each image in the sysplex has one 31 bit local buffer pool, (located in a dataspace) with a current maximum size of 1.7 gig and one 64 bit pool located in the SMSVSAM address space. Both buffer pools are managed by LRU.

- Pool sizes controlled by PARMLIB parameters: RLS_Max_Pool_Size (31 bit pool) and RLSAboveTheBarMaxPoolSize (64 bit pool).

- Buffer coherency is maintained through the use of CF cache structures and the XCF cross-invalidation function.
The LRU for the 31 bit pool operates in the following 4 modes:

- **Normal Mode** - Total pool size is less than 80% of RLS_Max.Pool_Size.
- **Maintenance Mode** - Total pool size is greater than 80% and less than 120% of RLS_Max.Pool_Size.
- **Accelerated Mode** - Total pool size is greater than 120% and less than 2*RLS_Max.Pool_Size.
- **Panic Mode** - Total pool size is greater than 2*RLS_Max.Pool_Size or greater than 1728M.
The LRU will release 31 bit buffers as follows:

- **Normal Mode** - IGWBLCRU will release invalid and paged out buffers.
  - Initial_Free_UIC = 240.
  - Buffer_UIC + 1.
  - Maximum age of buffers is 60 minutes.

- **Maintenance Mode** - Reduce Initial_Free_UIC by 1. If Buffer_UIC > Initial_Free_UIC_Count then buffer is released (22.5 minutes max).

- **Accelerated Mode** - Reduce Initial_Free_UIC by 4. If Buffer_UIC > Initial_Free_UIC then buffer is released. Requests for new buffers will first be stolen. If there are no buffers to steal a new get block will be done (7.5 minutes max).

- **Panic Mode** - Reduce Initial_Free_UIC by 8. If Buffer_UIC > Initial_Free_UIC then buffer is released. Requests for new buffers will first be stolen (3.75 minutes max). If no buffers to steal, the request will be put to sleep until the LRU runs.
Setting the Local Buffer Pool Size – Considerations (cont):

- The LRU for the 64 bit buffer pool operates in four modes:
  - **Normal Mode** - Total 64 bit pool size is less than 80% of \( \text{RLSAboveTheBarMaxPoolSize} \).
  - **Maintenance Mode** - Total 64 bit pool size is greater than 80% and less than 90% of \( \text{RLSAboveTheBarMaxPoolSize} \).
  - **Accelerated Mode** - Total 64 bit pool size is greater than 90% and less than 100% of \( \text{RLSAboveTheBarMaxPoolSize} \).
  - **Panic Mode** - Total 64 bit pool size is greater than 100% of \( \text{RLSAboveTheBarMaxPoolSize} \).
The LRU will release 64 bit buffers as follows:

- **Normal Mode** - Buffers 60 minutes or older will be released.
- **Maintenance Mode** - Buffers 60 minutes or older will be released.
- **Accelerated Mode** - Buffers 30 minutes are older will be released. Requests for new buffers will first be stolen. If there are no buffers to steal a new get block will be done.
- **Panic Mode** - Buffers 5 minutes are older will be released. Requests for new buffers will first be stolen. If there are no buffers to steal, the request will sleep until LRU runs.
RLS Above The Bar Max Pool Size (500)

System n

SMS VSAM Address Space

- Panic Mode
  - Buffer Time = 5
  - Buffer Time = 40

- Accel Mode
  - Buffer Time = 30
  - Buffer Time = 40

- Maint Mode
  - Buffer Time = 60
  - Buffer Time = 70

- Normal Mode
  - Buffer Time = 5
  - Buffer Time = 30
  - Buffer Time = 60
  - Buffer Time = xx

SMS VSAM Dataspace 2 Gig (31 bit pool)

- ACB
- AMBL
- AMB
- ...
Setting up Parameters/Structures sizes

- Local Buffer Pool Sizes:
  - \texttt{RLS\_MAX\_POOL\_SIZE}(nnnn) Where nnnn = (10 to 9999), anything over 1500 is treated as a maximum of 1728M.
  - \texttt{RLS\_Above\_The\_Bar\_Max\_Pool\_Size}(sysname1,nnnn) Where nnnn is either 0, or 500M to 2,000,000M
  - \texttt{RLS\_Max\_C\_Feature\_Level}(Z/A)

- Pool Size values are a goal for which the LRU tries to maintain. If more buffers are required at any given time, the pool may temporarily exceed the values set.

- Real Storage - Total amount of buffer pools should not exceed amount of real storage. A paged out buffer is immediately freed by the LRU.
Sizing the RLS Cache Structures

The “ideal” cache structure size:

- Total_Cache_Structure_sizes = ((RLS_Max_Pool_Size) * Number_of_SMSVSAMs_in_Sysplex) + (RLSAboveTheBarMaxPoolSize(system1) + … + RLSAboveTheBarMaxPoolSize(systemn))

Assumes the following:
- RLS_MaxCFFeaturelevel(A) - caching all data
- No sharing of data across the sysplex.
- If more than one cache structure to be allocated, Data sets are “evenly” distributed (size, number, amount of data accessed) between the individual cache structures.
Example CPU Time for GET Request

- Get request in which all CIs were found in the local buffer pool: .0001xx - .0002xx seconds
- Get Request in which at least the one CI is read from DASD: .001x - .02xxxx Seconds
Example CPU Time for GET Request

- Get request in which all CIs were found in the local buffer pool: \text{.0001xx - .0002xx seconds}

- Get Request in which at least the one CI is read from DASD: \text{.001x - .02xxxx Seconds}
RLS Buffer Invalidate Example

System 1
USER 1 (WRITER)
- GET UPD - Record A
  - Locate Record A
  - EXCL Lock on Record A
  - Test Buffer Validity
    - Buffer is valid
  - Return record to caller
- PUT UPD - Record A (Version 2)
- CF cache write CI / DASD write
  - CF invalidates User 2's buffer
- Release EXCL Lock on Record A

System 2
USER 2 (READER)
- GET NUP,CR - Record A
  - Locate Record A
  - SHR Lock on Record A
  - WAIT for Lock
- Test Buffer Validity
  - Buffer is invalid
  - Refresh buffer
  - CF Cache Read
- Locate Record A
- Return record to caller
- Release SHR Lock on Record A
RLS - Locking

- RLS serializes on a record level.

- Users updating or inserting a record will hold the lock exclusive for the duration of the write request or transaction.

- Users reading a record will hold the lock share when consistent read (CR) is specified. Lock is released at end of request

  - ACB RLSREAD=CR
  - //dd1 DD dsn=datasetname,RLS=CR
RLS - Locking (cont.)

- Users reading a record will not obtain any locks when no read integrity (NRI) is specified.
  - ACB RLSREAD=NRI
  - //dd1 DD dsn=datasetname,RLS=NRI

- Users reading a record will hold the lock share when consistent read extended (CRE) is specified. The lock is released at the end of the transaction:
  - ACB RLSREAD=CRE
  - //dd1 DD dsn=datasetname,RLS=CRE

- RLS locking is performed through the use of a CF lock structure and the XES locking services.
Example of VSAM RLS Serialization

Scope = Sysplex
Granularity = Record
Ownership = CICS Transaction or Batch Job

VSAM RLS Locks
- Waits for record lock

Record B
- Holder (EXCL)
- CICS1.Tran1
- Waiter (SHARE)
- CICS3.Tran3

Record E
- Holder (EXCL)
- CICS2.Tran2

Control Interval

CICS1.Tran1
GET UPD RPL_1
(Record B)

CICS2.Tran2
GET UPD RPL_2
(Record E)

CICS3.Tran3
GET CR RPL_3
(Record B)

Record A
Record B
Record C
Record D
Record E
Overview of Get Path

RLS Client AddressSpace

OPEN ACB MACRF=RLS,
RLSREAD=CR
GET Dir,Asy Key1

SMSVSAM Address Space

RLSAboveTheBarPool
2,000,000M

--- 32768M ---

Buffer  Buffer  Buffer

--- 1728M ---

Buffer  Buffer  Buffer  Buffer

SMSVSAM DataSpace
2,000M

...(VRM...)

**Index_search:**

(Call BMF to locate Index CIs, if no_buffer Call SCM to read from CF or DASD)

**Lock_Record:**

(Call SMLS to obtain record lock)

**Get_Data_CI:**

(Call BMF to locate Data CI, If no_buffer Call SCM to read from CF or DASD)

**UnLock_Record:**

(Call SMLS to release record lock)
RLS - RAS

- RLS provides extensive first time data capture for logic errors.
  - Many "health checks" in the code which produce ABEND0F4 dumps to capture the problem at the earliest possible point.
  - All mainline paths protected by recovery routines which force the data set to be closed in order to prevent damage to the data set.
    - Initial recovery design terminated SMSVSAM.
    - New recovery design marks data set as unusable.
  - Extensive logging and tracing facilities.
  - RAS is considered a high priority element of RLS design.

End result:

- Problems easier to debug.
- Much less likely for broken data sets or data integrity problems.
RLS Performance Measurements

- SMF 62 and 64
  - SMF 62 – Created by RLS OPEN for each ACB.
  - SMF 64 – Created by RLS EOV and CLOSE for each ACB. Stats are on an ACB level.

- SMF 42 Subtypes 15, 16, 17, 18, 19
  - **Subtype 15** - RLS statistics by Storage Class
  - **Subtype 16** - RLS statistics by Data set
    - Must use V SMS,MONDS(spherename),ON to collect subtype 16 statistics.
  - **Subtype 17** - RLS locking Statistics for IGWLOCK00
  - **Subtype 18** - RLS caching Statistics
  - **Subtype 19** - BMF statistics

  SMF formatter soon to be available as part of our IPCS VERBX SMSXDATA

- Note: Only one system in the sysplex collects the SMF 42 records. The system collecting the records is displayed in the D SMS,SMVSAM operator command.
RLS/TVS Configuration Change
Configuration Changes

- **Update CFRM policy to define lock, cache, list, log structures.**
  - See DFSMSdfp Storage Administration Reference for sizing info.
- **Update SYS1.PARMLIB(IGDSMSxx) with RLS/TVS parameters.**
  - See MVS Initialization and Tuning.
- **Define new SHCDSs (Share Control Data Sets).**
  - See DFSMSdfp Storage Administration Reference.
- **Update SMS configuration for Cache Sets.**
  - See DFSMSdfp Storage Administration Reference.
- **Update data sets with LOG(NONE/UNDO/ALL) and LOGSTREAMID.**
  - See Access Methods Services for ICF.
## System Requirements - PARMLIB Changes

SYS1.PARMLIB(IGDSMSxx)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
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<tbody>
<tr>
<td>SMS ACDS(acds)</td>
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<tr>
<td>INTERVAL(nnn</td>
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<td>REVERIFY(YES</td>
<td>NO)</td>
</tr>
<tr>
<td>SYSTEMS(8</td>
<td>32)</td>
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<tr>
<td>SIZE(nnnnnK</td>
<td>M)</td>
</tr>
<tr>
<td>JOBNAME(jobname</td>
<td>*)</td>
</tr>
<tr>
<td>SELECT(event,event....)</td>
<td></td>
</tr>
<tr>
<td>DSNTYPE(LIBRARY</td>
<td>PDS)</td>
</tr>
<tr>
<td>RLSMAXCFFEATURELEVEL(A</td>
<td>Z)</td>
</tr>
<tr>
<td>RLSINIT(NO</td>
<td>YES)</td>
</tr>
<tr>
<td>CF_TIME(nnn</td>
<td>3600)</td>
</tr>
<tr>
<td>CACHETIME(nnn</td>
<td>3600)</td>
</tr>
<tr>
<td>RLSTMOUT(nnn</td>
<td>0)</td>
</tr>
<tr>
<td>RLSFixedPoolSize(system.size)</td>
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</tr>
<tr>
<td>TVSNAMENnn1,nnn2....</td>
<td></td>
</tr>
<tr>
<td>TV_START_TYPE(WARM</td>
<td>COLD,WARM</td>
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<tr>
<td>LOG_OF_LOGS(logstream)</td>
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<tr>
<td>RLS_MAX_POOL_SIZE(nnn</td>
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<tr>
<td>SMF_TIME(NO</td>
<td>YES)</td>
</tr>
<tr>
<td>BMF_TIME(nnn</td>
<td>3600)</td>
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<tr>
<td>DEADLOCK_DETECTION(iii</td>
<td>15,kkk</td>
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<tr>
<td>RLSAboveTheBarMaxPoolSize(system,size)</td>
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<tr>
<td>SYSNAME(sys1,sys2,...)</td>
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<tr>
<td>MAXLOCKS(max</td>
<td>0,incr</td>
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<tr>
<td>AKP(nnn</td>
<td>1000,nnn</td>
</tr>
<tr>
<td>QTIMEOUT(nnn</td>
<td>300)</td>
</tr>
</tbody>
</table>
SYSPLEX with SMSVSAM (and TVS) - Example

SYSTEM1

CICS AOR1
RLS

VSAMPGM1
RLS

RRS
IMS

DB2
MVS Logger

SMSVSAM Dataspace
31 bit Buffer Pool

CF1

IGWLOCK00
RLSCache
LogStream
LogStream

Forward Recovery log

System1 UndoLog ShuntLog

SYSTEMn

CICS AORn
RLS

VSAMPGMn
RLS

RRS
IMS

DB2
MVS Logger

SMSVSAM Dataspace
31 bit Buffer Pool

Systemn UndoLog ShuntLog

64 bit pool

64 bit pool
SMSVSAM Initialization

IGW619I ACTIVE SHARE CONTROL DATA SET 209
SYS1.DFPSHCDS.ACTIVE2.VSPLXPK ADDED.

IGW619I SPARE SHARE CONTROL DATA SET 283
SYS1.DFPSHCDS.SPARSE.VSPLXPK ADDED.

IGW321I Running Protocol 4
IXL014I IXLCN Request for Structure IGWLOCK00 313
WAS SUCCESSFUL. JOBNAMe: SMSVSAM ASID: 0009
CONNECTOR NAME: SYSTEM1 CFNAME: FACIL01

IGW321I System Ordinal is 1
IGW453I SMSVSAM ADDRESS SPACE HAS SUCCESSFULLY 316
CONNECTED TO DFSMS LOCK STRUCTURE IGWLOCK00

IGW321I No retained locks
IGW321I 0 RLS Sphere Record Table Entries read
IGW321I 0 RLS Sphere Record Table Entries deleted
IGW321I No Spheres in lost locks
IGW414I SMSVSAM SERVER ADDRESS SPACE IS NOW ACTIVE.

IGW467I DFSMS RLS_MAX_POOL_SIZE PARMLIB VALUE SET DURING 354
SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM: SYSTEM1
CURRENT VALUE: 100

IGW467I DFSMS DEADLOCK_DETECTION PARMLIB VALUE SET DURING 355
SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM: SYSTEM1
THIS SYSTEM IS OPERATING AS THE GLOBAL DEADLOCK PROCESSOR.
CURRENT VALUE: 15  4

IGW467I DFSMS RLS_MAXCFFEATURELEVEL PARMLIB VALUE SET DURING
SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM: SYSTEM1
CURRENT VALUE: Z
SMSMVSAM Initialization (with TVS) - (cont.)

SYSTEM1

SYSTEM1  05008 11:34:01.17  IGW467I DFSMS TVSNANE PARMLIB VALUE SET DURING 578
    SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM:
    SYSTEM1 TVSNANE: IGWTV001

SYSTEM1  05008 11:34:01.18  IGW467I DFSMS TRANSACTIONAL VSAM UNDO LOG PARMLIB VALUE SET
    DURING SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM:
    SYSTEM1 UNDO LOGSTREAM NAME:
    IGWTV001.IGWLOG.SYSLOG

SYSTEM1  05008 11:34:01.18  IGW467I DFSMS TRANSACTIONAL VSAM SHUNT LOG PARMLIB VALUE SET
    DURING SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM:
    SYSTEM1 SHUNT LOGSTREAM NAME:
    IGWTV001.IGWSHUNT.SHUNTLOG
    .
    .
System Requirements - SMSVSAM Initialization - Example

SYSTEM1

SYSTEM1  05008 11:34:01.18 IGW467I DFSMS TRANSACTIONAL VSAM TVS_START_TYPE PARMLIB
VALUE SET DURING SMSVSAM ADDRESS SPACE INITIALIZATION
ON SYSTEM: SYSTEM1 TVSNAME VALUE: IGWTV001
CURRENT VALUE: WARM 1

SYSTEM1  05008 11:34:06.29 IGW860I TRANSACTIONAL VSAM HAS SUCCESSFULLY REGISTERED
WITH RLS

SYSTEM1  05008 11:35:36.63 IGW865I TRANSACTIONAL VSAM INITIALIZATION IS COMPLETE.

SYSTEM1  05008 11:35:36.65 IGW886I 0 RESTART TASKS WILL BE PROCESSED DURING
TRANSACTIONAL RESTART PROCESSING

SYSTEM1  05008 11:35:36.65 IGW866I TRANSACTIONAL VSAM RESTART PROCESSING IS COMPLETE.
SMSVSAM Commands
SMSVSAM Display Commands

D SMS[, 
[,CFCACHE(structurename|*) ] 
[,CFLS ] 
[,CFVOL(volid) ] 
[,DSNAME(dsn){,WTOR} ] 
[,JOB(jobname){,WTOR} ] 
[,LOG({logstreamid|ALL}{,WTOR} ] 
[,MONDS(specmask|*) ] 
[,SHCDS ] 
[,SHUNTED,{SPHERE(sphere)|UR({urid|ALL}){,WTOR}] 
[,SMSVSAM[,ALL] ]}
SMSVSAM Display Commands (cont)

D SMS[,  
    [,TRANVSAM[,ALL][,ALLLOGS][,WTOR] ]  
    [,URID({urid|ALL})[,WTOR]} ]  
D SMS,SMSVSAM,DIA(G(CONTENTION))
D SMS,SMSVSAM (example)

D SMS,SMSVSAM
DISPLAY SMS,SMSVSAM - SERVER STATUS
  SYSNAME: SYSTEM1 AVAILABLE ASID: 0033 STEP: SmsVsamInitComplete

DISPLAY SMS,SMSVSAM - JOB STATUS
  SUBSYSTEMS CONNECTED: 1 BATCH: 1

DISPLAY SMS,SMSVSAM - LOCK TABLE STATUS (IGWLOCK00)
  CONNECT STATUS:
    SYSNAME: SYSTEM1 ACTIVE RSN: 02010407 RbldNotActive

  COMPOSITE STATUS:
    ORIGINAL STRUCTURE: NOT VOLATILE FAILURE ISOLATED
    NEW STRUCTURE: NOT VOLATILE FAILURE ISOLATED

  STRUCTURE STATUS:
    SYSNAME: SYSTEM1 Duplex
System Requirements - SMSVSAM Displays

**SYSTEM1**

- 13.19.03 SYSTEM1  d sms,tranvsam

13.19.04 SYSTEM1  IEE932I 023

IGW800I 13.19.04 DISPLAY SMS,TRANSACTIONAL VSAM

DISPLAY SMS,TRANSACTIONAL VSAM - SERVER STATUS

<table>
<thead>
<tr>
<th>System</th>
<th>TVSNAME</th>
<th>State</th>
<th>Rrs</th>
<th>#Urs</th>
<th>Start</th>
<th>AKP</th>
<th>QtimeOut</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYSTEM1</td>
<td>IGWT001</td>
<td>ACTIVE</td>
<td>REG</td>
<td>0</td>
<td>WARM/WARM</td>
<td>200</td>
<td>400</td>
</tr>
</tbody>
</table>

DISPLAY SMS,TRANSACTIONAL VSAM - LOGSTREAM STATUS

<table>
<thead>
<tr>
<th>LogStreamName</th>
<th>State</th>
<th>Type</th>
<th>Connect Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGWT001.IGWLOG.SYSLOG</td>
<td>Enabled</td>
<td>UnDoLog</td>
<td>Connected</td>
</tr>
<tr>
<td>IGWT001.IGWSHUNT.SHUNTLOG</td>
<td>Enabled</td>
<td>ShuntLog</td>
<td>Connected</td>
</tr>
</tbody>
</table>
SMSVSAM Vary Commands

V SMS,{CFCACHE(cachename),{ENABLE|E } }  
{ {QUIESCE|Q} }  
{CFVOL(volid),{ENABLE|E } }  
{ {QUIESCE|Q} }  
{MONDS(dsname[,dsname...]),{ON|OFF} }  
{SHCDS(shcdsname),{NEW } }  
{ {NEWSPARE} }  
{ {DELETE } }  
{SMSVSAM,{ACTIVE } }  
{ {FALLBACK } }  
{ {TERMINATESERVER } }  
{ {FORCEDELETELOCKSTRUCTURE } }
SMSVSAM Vary Commands

V SMS, {TRANVSAM({tvsname|ALL}){,{QUIESCE|Q}}}

{ { {ENABLE|E} } }
{ {DISABLE|D} }
{ } {LOG(logstreamid){,{QUIESCE|Q}}}
{ { {ENABLE|E} } }
{ {DISABLE|D} }
{ } {SMSVSAM,SPHERE(sphere){,{QUIESCE|Q}}}
{ { {ENABLE|E} } }
{ }{TRANVSAM(tvsname),PEERRECOVERY{,{ACTIVE|A}}}
{ {ACTIVEFORCE } }
{ {INACTIVE|I}}
RLS/CICS Environment
RLS/CICS Environment

- CICS and base VSAM FOR configuration.
  - Advantages and disadvantages of the FOR/AOR configuration.
- CICS and RLS configuration.
  - Advantages and disadvantages of the CICS/RLS configuration.
- RLS/CICS data recovery.
  - Recoverable data sets.
  - Recoverable subsystems.
  - Retained locks.
  - Lost locks.
  - IDCAMS SHCDS commands
  - QUICOPY/QUIBWO interface.
RLS/CICS Environment

- RLS/CICS automation enhancements.
  - QUIOPEN/QUICLOSE interface.
CICS FOR/AOR Configuration

System1

CICS FOR
OPEN ACB macrf=(LSR,out)
( read/write integrity )

CICS AOR

System2

CICS AOR

CICS AOR

...
RLS/CICS Configuration

System1

CICS AOR1

OPEN ACB macrf=(rls,out)  
(read/write integrity)

SMSVSAM Dataspace

CICS AOR n

OPEN ACB macrf=(rls,out)  
(read/write integrity)

Systemnn

CICS AOR n

OPEN ACB macrf=(rls,out)  
(read/write integrity)

SMSVSAM Dataspace

CICS AOR n

OPEN ACB macrf=(rls,out)  
(read/write integrity)
RLS/CICS Data Recovery

- **Recoverable data sets**
  - defined as LOG(UND0/ALL) in the catalog.
    - UNDO - backout logging performed by CICS (or TVS).
    - ALL - both backout and forward recovery logging (or TVS).
  - LOG(ALL) data sets must have a LOGSTREAMID(forwardecoverylog) also defined in the catalog.

- **Non-Recoverable data sets**
  - defined as LOG(NONE) in the catalog.
    - No logging performed by CICS (or TVS).

- **Recoverable Subsystems.**
  - CICS (and TVS) must register with the SMSVSAM address space with a "subsystemname" so that locks obtained by that subsystem can be tracked.
RLS/CICS Data Recovery

- **Retained locks**
  - Record locks are converted to "retained" in the event of a failure. The "owning" subsystem is the only subsystem that may access the record locks during recovery. All other subsystems or VSAM RLS applications will received a retained lock error in the RPL.
  - SMSVSAM automatically notifies CICS when SMSVSAM restarts. CICS will automatically perform backouts when the file is reopened.

- **Lost Locks**
  - A data set which had actively held locks and a system failure occurs resulting in the loss of the RLS lock structure and at least one of the RLS address spaces at the exact same time.
  - Only the owning subsystem of the active locks may open the file and recovery the record locks. All other RLS opens will be failed until the data set has been fully recovered.
Retained Lock Example

SYSTEM1

CICS AOR1
ACB OPEN macrf=(rls,out)
Trans1
PUT record1
PUT record2

SMSVSA M

ACB
AMBL
AMB

SYSTEMn

CICS AORn
ACB OPEN macrf=(rls,out)
Trans1
GET record1
RC=8 RSN=24

CF1

IGWLOCK00

Lock Table
Record lock 1
Record lock 2

Record Table
RTE lock 1 - (retained)
RTE lock 1 - (retained)

SMSVSA M

IGWRETLK
IGWRETLK

ACB
AMBL
AMB

IGWRETLK

ACB
AMBL
AMB

DataSet1 LOG(ALL)
CICS logs

SMSVSAM Dataspace

SMSVSAM Dataspace
Lost Lock Example

**SYSTEM1**

- CICS AOR1
  - ACB OPEN macr=(rls,out)
  - Trans1
  - PUT record1
  - PUT record2

- SMSVSA
  - IGWRETLK

- IGWRETLK

- AMBL
  - AMB

- SMSVSAM Dataspace

**SYSTEMn**

- CICS AORn
  - ACB OPEN macr=(rls,out)
  - Rc=8 ACBERFLG=AF
  - IEC161I 241-0580

- SMSVSA
  - IGWRETLK

- IGWRETLK

- AMBL
  - AMB

- SMSVSAM Dataspace
RLS/CICS Data Recovery

- **IDCAMS SHCDS commands**
  
  - Used to list information about data set, clients, subsystems, etc. using RLS.

- **QUICOPY/QUIBWO interface.**
  
  - Called by DSS to communicate with CICS (via the SMVSAM) address space to inform CICS when a DSS copy/backup begins and ends.
  - Allows DSS to either take a "sharp" copy (via the QUICOPY interface) or a "fuzzy" copy (via the QUIBWO interface).
  - CICS will halt new transactions when a QUICOPY is under way. New opens will not be allowed during a QUICOPY.
  - CICS will log the start and end of the copy/backup operation. The data set can then be fully recovered from the last backup.
SHCDS Commands

SHCDS  {{LISTDS(base_cluster_name) {JOBS}}} |  
{LISTSUBSYS(subsystem_name|ALL)} |  
{LISTSUBSYS{DS(subsystem_name)}} |  
{LISTRECOVERY(base_cluster_name|ALL)} |  
{LISTALL} |  
{FRSETRR(base_cluster_name)} |  
{FRUNBIND(base_cluster_name)} |  
{FRBIND(base_cluster_name)} |  
{FRRESETRR(base_cluster_name)} |  
{FRDELETEUNBOUNDLOCKS(base_cluster_name)} |  
{PERMITNONRLSUPDATE(base_cluster_name)} |  
{DENYNONRLSUPDATE(base_cluster_name)} |  
{REMOVESUBSYS(subsystem_name)} |  
{CFREPAIR{{INFILE(ddname) |  
INDATASET(datasetname)}}
SHCDS Commands (continued)

{LIST|NOLIST})
{CFRESET({INFILE(ddname) |
    INDATASET(datasetname})
{LIST|NOLIST})
{CFREPAIRDS({base_cluster_name |
    {partially_qualified_base_cluster_name)
{CFRESETDS({base_cluster_name |
    {partially_qualified_base_cluster_name)
{LISTSHUNTED {SPHERE(base_cluster_name) |
    URID(urid) |
    DATA(urid)})
{RETRY {SPHERE(base_cluster_name) |
    URID(urid)})
{PURGE {SPHERE(base_cluster_name) |
    URID(urid)})
# SHCDS Example

---

**ISPF Command Shell**

Enter TSO or Workstation commands below:

```powershell
===>
SHCDS LISTSUBSYS(aor1)
```

----- LISTING FROM SHCDS ----- IDCSH03

<table>
<thead>
<tr>
<th>SUBSYSTEM NAME</th>
<th>STATUS</th>
<th>RECOVERY</th>
<th>LOCKS</th>
<th>LOCKS</th>
<th>LOCKS</th>
<th>LOCKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AOR1</td>
<td>ONLINE--FAILED</td>
<td>YES</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

DATA SETS IN LOST LOCKS-------- 0
DATA SETS IN NON-RLS UPDATE STATE-- 0
TRANSACTION COUNT-------------- 1

***
SHCDS Example

ISPF Command Shell

Enter TSO or Workstation commands below:

===>
SHCDS LISTDS('dataset1**')

----- LISTING FROM SHCDS ----- IDCSH02 ------------------------------------------
DATA SET NAME----dataset1
CACHE STRUCTURE----CACHE01
RETAINED LOCKS-------YES  NON-RLS UPDATE PERMITTED-------NO
LOST LOCKS-----------NO  PERMIT FIRST TIME----------NO
LOCKS NOT BOUND-------NO  FORWARD RECOVERY REQUIRED------NO
RECOVERABLE----------YES
### SHARING SUBSYSTEM STATUS

<table>
<thead>
<tr>
<th>SUBSYSTEM</th>
<th>SUBSYSTEM</th>
<th>RETAINED</th>
<th>LOST</th>
<th>NON-RLS UPDATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AOR1</td>
<td>ONLINE--FAILED</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

***
RLS/CICS Automation Enhancements

**QUIOPEN/QUICLOSE Interface**

- **QUICLOSE** interface is used by CICS to fully close a data set around the sysplex.
  - SMSVSAM drives CICS quiesce exit which issues closes for all regions open to the data set.
  - SMSVSAM updates the catalog and marks the data set as quiesced.
  - RLS opens against a quiesced data set will be failed.
- **QUIOPEN** interface is used by CICS to enable a data set to be reopened for RLS use.
  - SMSVSAM drives CICS quiesce exit to ALL CICS regions registered with RLS.
  - SMSVSAM updates the catalog and marks the data set as unquiesced.
- Invoked with the following commands:
  - V SMS,SMSVSAM,SPHERE(spherename),Q
  - V SMS,SMSVSAM,SPHERE(spherename),E
  - F cicsname,CEMT SET DSN(RLSADSW.VFA1D.*),QUI
  - F cicsname,CEMT SET DSN(RLSADSW.VFA1D.*),UNQ
Transactional VSAM (TVS)
Transactional VSAM (TVS)

- Enhance VSAM Record Level Sharing (RLS) to provide data recovery capabilities for any application exploiting VSAM RLS.

- VSAM RLS data recovery capabilities include:
  - transactional recovery
  - data set recovery

- VSAM RLS becomes a "transactionalized" access method, or is now referred to as "Transactional VSAM" (TVS).
System Requirements - Hardware/Software Requirements

- Parallel sysplex running z/OS 1.4 or higher with VSAM RLS implemented.
- z/OS Transactional VSAM (separately priced feature).
- z/OS RRMS implemented.
- z/OS System Logger implemented.
- CICS VSAM Recovery (CICVR) Utility (optional)
Application Requirements - Data Set Changes

Data sets accessed by RLS must have a LOG parm specified in the catalog. Valid values are:

- **LOG(NONE)** - Non-recoverable data set. Can be opened for input/output by any RLS application.
- **LOG(UNDO)** - Recoverable data set requiring backout (UNDO) logging. Can be opened for input/output by RLS recoverable subsystems (i.e. CICS) and/or RLS applications running on a z/OS system with the TVS feature installed.
- **LOG(ALL)** - Recoverable data set requiring both backout (undo) and forward recovery logging. Can be opened for input/output by RLS recoverable subsystems (i.e. CICS) and/or RLS applications running on a z/OS system with the TVS feature installed.
Application Requirements - Data Set Changes (cont)

- Data sets defined as LOG(ALL) must also have a LOGSTREAMEID(fowardrecoverylogname) specified in the catalog.
DEFINE CLUSTER (NAME(recoverabledataset) -
    RECORDSIZE(100 100) -
    STORCLAS(storclasname) -
    FSPC(20 20) -
    LOG (ALL) -
    SHAREOPTIONS(2 3) -
    LOGSTREAMID(forwardrecoverylog) -
    CISZ(512) -
    KEYS(06 8) INDEXED -
) -

DATA(NAME(recoverabledataset.DATA) -
    VOLUME(volser) -
    TRACKS (1,1)) -

INDEX(NAME(recoverabledataset.INDEX) -
    VOLUME(volser) -
    TRACKS (1,1))
Application Requirements – RLS/TVS Access Options

- Transactional VSAM support occurs when:
  - ACB MACRF=(RLS,OUT) for recoverable data set (LOG(UNDO|ALL))
  - ACB MACRF=(RLS,IN), RLSREAD=CRE.
  - //ddname DD DSN=recoverabledatasetname,DISP=shr,RLS=(CR|NRI) and ACB MACRF=(OUT)
  - //ddname DD DSN=datasetname,DISP=shr,RLS=CRE and ACB MACRF=(IN)
Application Requirements - Transactional Recovery

- RLS applications opening recoverable data sets on z/OS with the TVS feature installed, should be modified to add SRRCMIT and SRRBACK interfaces.

- SRRCMIT and SRRBACK will either commit or backout the unit of recovery (UR) provided by SMSVSAM on behalf of the VSAM RLS application.

- Explicitly committing or backing out the UR will release record level locks in a timely fashion. Failure to do so may impact other sharers of the data set.

- SMSVSAM will implicitly issue a commit or backout at EOT, if the VSAM application fails to do so.
Application Requirements - Supported Languages

- High level language support for RLS and RRS interfaces:
  - PLI
  - C & C++
  - COBOL
  - Assembler
Application Requirements - Explicit Commit Example

//ddname DD DSN=Recovereddatasetname,DISP=SHR

//step1 EXEC PGM=vsamrlspgm

Begin JOB Step  ------------------------------------- No locks held

OPEN ACB MACRF=(RLS,OUT)
(UR1)

GET UPD record 1------------------------------- Obtain an exclusive lock on record 1

PUT UPD record 1 ----------------------------- Lock on record 1 remains held

GET repeatable read record n--------------- Obtain a shared lock on record n

PUT ADD record n+1-------------------------- Obtain an exclusive lock on record n+1

GET UPD record 2 ----------------------------- Obtain an exclusive lock on record 2

PUT UPD record 2 ----------------------------- Lock on record 2 remains held

Call SRRCMIT -------------------------------------- Commit changes, all locks released.

CLOSE

End of JOB Step
Application Requirements - Implicit Commit Example

//ddname DD DSN=Recoverabledatasetname,DISP=SHR

//step1 EXEC PGM=vsamrlspgm

Begin JOB Step --------------------------------------- No locks held

OPEN ACB MACRF=(RLS,OUT)

(UR1)

GET UPD record 1------------------------- Obtain an exclusive lock on record 1

PUT UPD record 1 ------------------------- Lock on record 1 remains held

GET repeatable read record n------------- Obtain a shared lock on record n

PUT ADD record n+1----------------------- Obtain an exclusive lock on record n+1

GET UPD record 2 ------------------------ Obtain an exclusive lock on record 2

PUT UPD record 2 ------------------------ Lock on record 2 remains held

CLOSE ------------------------------------- All Locks are retained

End of JOB Step (normal)---------------------- Commit changes release all locks
Application Requirements - Explicit Backout Example

//ddname DD DSN=Recovereddatasetname,DISP=SHR

//step1 EXEC PGM=vsamrlspgm

Begin JOB Step --------------------------------------- No locks held

OPEN ACB MACRF=(RLS,OUT) (UR1)

GET UPD record 1----------------------------- Obtain an exclusive lock on record 1

PUT UPD record 1 ----------------------------- Lock on record 1 remains held

GET repeatable read record n------------------ Obtain a shared lock on record n

PUT ADD record n+1-------------------------- Obtain an exclusive lock on record n+1

GET UPD record 2 ----------------------------- Obtain an exclusive lock on record 2

PUT UPD record 2 ----------------------------- Lock on record 2 remains held

Call SRRBACK ----------------------------- Undo changes, all locks released.

CLOSE

End of JOB Step
Application Requirements - Implicit Backout Example

//ddname DD DSN=Recovereddatasetname,DISP=SHR

//step1 EXEC PGM=vsamrlspgm

Begin JOB Step --------------------------------------- No locks held
OPEN ACB MACRF=(RLS,OUT) (UR1)
GET UPD record 1------------------------ Obtain an exclusive lock on record 1
PUT UPD record 1 ------------------------ Lock on record 1 remains held
GET repeatable read record n-------------- Obtain a shared lock on record n
PUT ADD record n+1------------------------ Obtain an exclusive lock on record n+1
GET UPD record 2 ------------------------ Obtain an exclusive lock on record 2
PUT UPD record 2 ------------------------ Lock on record 2 remains held

------------------------ Cancel ------------------------

End of JOB Step (abnormal) -------------------------- Undo changes release all locks
Information about TVS

Information about DFSMS and TVS


Additional Information

- www.redbooks.ibm.com
  - Transactional VSAM Presentation Guide  SG24-6973
  - Transactional VSAM Overview and Planning Guide  SG24-6971
  - Transactional VSAM Application Migration Guide  SG24-6972
  - VSAM Demystified  SG24-6105
Multiple Lock Structure (MLS)
Multiple Lock Structure

- Multiple Lock Structures (MLS), goal of this function is to remove the single point of failure of one lock structure in the current VSAM RLS design
  - Current Locking Design
  - Current Locking Design - Issues
  - Multiple lock Structure Design
Current Locking Design

- The current design of locking uses one coupling facility (CF) lock structure, IGWLOCK00, which contains:
  - Record locks and record data (retained locks)
  - System "Special" locks:
    - Sphere, component, subsystem locks and data set related record data
Current Locking Design - Issues

- The current locking design has two issues:
  - IGWLOCK00 represents a single point of failure in the sysplex:
    - A "run away" application could fill IGWLOCK00 with record locks, causing all RLS application's lock requests in the sysplex to fail.
  - IGWLOCK00 could cause performance issues:
    - All RLS locking activity against a single lock structure in a single CF
Proposed Design - Multiple Lock Structure

- Continue to support IGWLOCK00 as the "primary" lock structure, which will contain:
  - Record locks and record data for data sets not using the new MLS support
  - System "special" locks:
    - Sphere, component, subsystem locks and data set record data.
  - "Lock structure" lock (associates data sets to lock structures)

- Add new "secondary" lock structures, which will contain:
  - Record locks and record data for data sets using the new MLS support

- Assign data sets to "secondary" lock structures via a new "lock set" parameter on the SMS STORCLAS construct
  - A "secondary" lock structure will be assigned from the list of lock structures specified in the lock set parameter
  - If the lock set parameter is blank, IGWLOCK00 will be assigned as the default
Mulitple Lock Structure Example

SYSTEM1

- SMSVSAM
- IGWLNRCLB
- IGWRETILK

DataSet1
STORCLAS
(SC_PROD)

SYSTEMn

- SMSVSAM
- IGWLNRCLB
- IGWRETILK

DataSet2
STORCLAS
(SC_TEST)

CF1

IGWLOCK00

- Lock Table
- Record lock
- Special lock
- LS lock
- Record Table
- RTE record lock
- Record data

RLSLOCK_PROD00

- Lock Table
- Record lock

CF2

RLSLOCK_TEST00

- Lock Table
- Record lock
- RTE record lock
Recommended APARs
Recommended APARs

- OA21101
  - D SMS,SMSVSAM,QUIESCE
- OA19421
  - Move index buffer above the bar for release 1.7 and above
- OA19975
  - Change the wait time for the castout lock in the RLS read path from 0.03second/0.000026 seconds to 0.0015 seconds.
- OA16676, OA16870, OA17643
  - Remove Assignedspheres ENQ hang
Recommended APARs

- OA17644, OA18070, OA18541, OA18285, OA18688, OA18902
  - SCM RAS APARs
- OA20367
  - RLS/Catalog hang in Open/Delete
- OA21705
  - Fix the storage leaks in MMFSTUFF dataspace
- OA18933
  - SSF compress/expand pool failure
Recommended APARs

- OA17556
  - D SMS,SMSVSAM,DIAG(CONTENTION)
  - Display TCBs in latches contention
- OA12045, OA12851, OA16982
  - VERBX IGWFP MAN ‘F(IPCS)’ From IPCS Panel
    - Q - Analyze current Failure
    - AS - Analyze current Address Space Threads
    - POOLS - Analyze SSF Pools
## Recommended APARs

D SMS, SMSVSAM, DIAG(CONTENTION) - example #1

```
SYSTEM1    d sms, smsvsam, diag(contention)
SYSTEM1    IGW343I VSAM RLS DIAG STATUS (V.01)

|---RESOURCE----|                     |------ WAITER  ------|  |--HOLDER---|     ELAPSED |
|TYPE        | ID      | JOB NAME       | ASID   | TASK           | ASID   | TASK        | TIME     |
|-------- -------- -------- ---- -------- ---- -------- --- -----|
LATCH    7F158C70 SMSVSAM        003A  008DA250      003A  008D7218  00:00:06
  DESCRIPTION: IGWLYSPH - SHM OBJECT POOL
LATCH    7F151E78 SMSVSAM        003A   008D7218      003A  008DC1C8 00:00:21
  DESCRIPTION: IGWLYDTS - SHM OBJECT POOL
LATCH    7BAD43B8 SMSVSAM       003A   008DC1C8     002D  007F3000  00:19:09
LATCH    7BAD43B8 SMSVSAM       003A   008D5A48      002D  007F3000  00:22:09
LATCH    7BAD43B8 SMSVSAM       003A   008D6938      002D  007F3000  00:33:23
LATCH    07F1B1D0 SMSVSAM      003A   008D64F8     003A  008D6CF0  01:47:20
LATCH    07F1D3B8 SMSVSAM      003A   008D6CF0     0000  00000000 11:23:30
```
Recommended APARs

D SMS,SMSVSAM,DIAG(CONTENTION) - example #2

|---RESOURCE----|                     |------ WAITER  ------|  |--HOLDER---|     ELAPSED |
|TYPE        | ID      | JOB NAME       | ASID   | TASK           | ASID   | TASK        | TIME     |
|-------- -------- -------- ---- -------- ---- -------- --- ----- |
|LATCH    7BAD43B8 SMSVSAM       003A 008D5A48 003A 007F3000 00:22:09 |
|LATCH    07F1B1D0  SMSVSAM      003A 007F3000 003A 008D5A48 00:22:09 |
|LATCH    07F1B1D0 SMSVSAM       003A 008D64F8 003A 008D5A48 00:22:24 |
|LATCH    07F1B1D0 SMSVSAM       003A 008D6CF0 003A 008D5A48 00:23:30 |

SYSTEM1       d sms,smsvsam,diag(contention)
SYSTEM1       IGW343I VSAM RLS DIAG STATUS (V.01)
Recommended APARs

IP VERBX IGWFPMAN ‘F(IPCS)’ - example

Function(F) Component AddressSpace Analysis IPCS Print Help
-----------------------------------------SMS PDSE IPCS MAIN----------------------------------

COMMAND==> 

Function( ) Component( ) CB@( 00000000 )

JOB( SMSVSAM ) or ASID( 000A )

VERB==> IGWFPMAN

Primary( 000A : SMSVSAM ) Secondary( 000A : SMSVSAM )

Dump: Dump Name
Title: Dump Title
Summary

- RLS provides full read/write integrity to your existing VSAM files.
- RLS can improve both performance and availability in your CICS and non-CICS VSAM environments.
- RLS provides data protection after a system failure.
- RLS provides automation for data recovery.
- Improved RAS
- Minimal application/configuration changes required.
Summary

- RLS has been enhanced to perform data recovery in the form of:
  - transactional recovery
  - data set recovery.
- VSAM RLS Applications can take advantage of RLS's new data recovery by using the RRS commit and backout protocols.
- VSAM RLS Applications should reconsider restart procedures in a shared environment.
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