CICS and VSAM/RLS User Experience

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March 3, 2011
Session 8277
CICS and VSAM/RLS User Experience

Agenda

- Who we are
- Environment overview
- Issue encountered
- Available Options and Selection
- Implementation and Customization
- Issues encountered
- Tips and hints
CICS and VSAM/RLS User Experience

Who we are and Environment Overview
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**Who we are**

- Headquartered in Atlanta, Ga.
- 7\(^{th}\) Largest Bank in US
- Regional Presence in Southeast and Mid-Atlantic
- $174+ Billion in assets
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Environment Overview

- 34 LPARS
  - 6 NET390
  - 8 ICF
  - 6 DataMover
    - 1 NET390
    - 2 Control
    - 3 System Data Mover
  - 14 Application
    - 2 Tech ‘Sandbox’
    - 4 Development and Integrated Testing
    - 2 QA
    - 6 Production

- z/OS 1.11

- Program Products for CICS
  - Omegamon for CICS
  - IBM Suite of PD Tools
  - GT Ivory
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Environment Overview (cont)

- DB2 V9.0
  - 60 Subsystems
  - Multiple Data-Sharing Groups
  - New Function Mode

- WebSphere/MQ for z/OS V7.0
  - Shared Queues between High Availability LPARs (In process)
  - Clustering enabled
  - Extensive use of MQ-CICS Bridge
Environment Overview (cont)

- CICS TS 4.1
  - 266 Total Regions
    - 112 Development/Maintenance
    - 14 Training
    - 16 Integrated Testing – Release Planning Path 1
    - 16 Integrated Testing – Release Planning Path 2
    - 12 Integrated Testing – Break Fix Path
    - 32 QAPlex – Release Path 1
    - 32 QAPlex – Release Path 2
    - 32 Production
      - 26 High Availability
      - 2 WUI
      - 4 Legacy
  - VSAM/RLS
  - Temporary Storage Shared Queues
  - Extensive use of BAS
  - DVIPA, Shared IP Ports, & SYSPLEX Distributor
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Issues Encountered
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Issues Encountered

• High Availability Environment
  • Single FOR servicing multiple LPARs
  • Potential outage if FOR or LPAR is down
  • Critical applications updating file(s)
  • 26 AORs using 1 FOR
  • Cross LPAR performance
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Available Options

Short Term

- Move ‘read-only’ files to AORs
  - Reduce dependency on a single FOR
  - Reduce function shipping overhead
- Duplicate FORs
  - One on each LPAR
  - Reduce workload of a single FOR
  - Limit outage in the event the LPAR and/or FOR failed
- Automation to start FOR on remaining LPAR in the event of a failure
- Write File Control Exit to re-route request to ‘hot standby’ FOR
  - Concerns with file integrity
  - Emergency restarts
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Available Options

Long Term

- VSAM/RLS
  - No additional cost
  - No programming changes
  - New address spaces for SMSVSAM on each LPAR
  - SMSVSAM will serialize file updates
    - Local cache or cache structures used for READ/BROWSE requests
  - Coupling Facility required
    - At least 1 cache structure and lock structure must be defined
  - Dataset Catalog definition must be changed
    - Valid LOG parm definition
  - FCT change required
    - Identify file as RLS
  - New ‘terminology’
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Available Options

Long Term – Cont.

• VSAM Transparency
  • Purchased product
  • Migrate VSAM data to DB2 tables
  • No application changes required
  • Data available to both online and batch
  • Global exits used for CICS access
  • Separate address space required for Batch access
  • Conversion utilities available
  • Application vendor support concerns
  • Unknown performance overhead
  • JCL changes required for batch processing
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Available Options

Long Term – Cont.

- Transactional VSAM
  - Purchased product
  - Requires implementation of RLS
  - Recoverable data available to both online and batch concurrently
  - Vendor support concerns
  - Unknown performance overhead
  - Several application changes required
    - Modify program or JCL to request Transactional VSAM
    - Update batch programs to invoke Resource Recovery Services (RRS) for commit and backout
    - Be careful of Unit of Recovery (UR) lock contention
    - Code like CICS programs
    - New error codes
    - Exclude use of file backup/restore for job restarting
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Implementation and Customization
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Implementation and Customization

- Create SMSVSAM address space
  - Create SHCDS datasets
    - At least two Active and at least one Spare
    - Activated with V SMS,SHCDS(shcdsname),NEW and NEWSPARE commands.
  - Create cache structure(s) and lock structure.
  - Create at least one cache set
    - Cache set is an SMS object
    - Used to point an SMS Storage class to the appropriate cache structure(s)
    - Storage class must then be coded on files that are to become RLS files
      - We changed our already existing Storage classes that our VSAM files use to include the cache set, thus applications did not have to alter the Storage class of their files
      - Can create two cache structures and include both on the cache set definition – this will provide balancing and failover (this is what we did and is recommended).
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Implementation and Customization – Cont

Create SMSVSAM address space - Cont

• Update existing Storage Classes to include cache sets, or create new Storage Classes.

• Update the IGDSMSxx member of SYS1.PARMLIB to include RLS parms:
  • RLSINIT(YES)
    • Will automatically start SMSVSAM at IPL. (NOTE: Can be started manually with command: V SMS,SMSVSAM,ACTIVE).
  • RLS_MAX_POOL_SIZE
    • Size of the local SMSVSAM cache space, default is 100Meg
    • We increased ours to 200Meg.
  • RLS_MaxCfFeatureLevel – A value of ‘Z’ is the default
    • Changing to ‘A’ may improve performance of files with greater than 4K C1size, but may require larger cache structure
    • We are using the default of ‘Z’

• Grant UPDATE access to SMSVSAM to the SHCDS datasets
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*Implementation and Customization – Cont*

Create SMSVSAM address space - Cont

- Grant ALTER access to SMSVSAM to Facility Class Profile IXLSTR.IGWLOCK00 (the Lock structure).
- Bring up SMSVSAM servers either with manual command or with RLSINIT(YES) and IPL
  - No JCL stored in SYS1.PROCLIB for SMSVSAM – the system will build the server JCL itself.
- Add SIT parm RLS=YES to appropriate CICS regions and cycle them.
- Make changes to application files as needed
  - LOG Parm
  - BWO parm – Where required
  - Specifying these parms in your SMS Dataclasses will negate the need for this step
  - We had our apps change the LOG and BWO parms on their dataset definitions.
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Implementation and Customization – Cont

Create SMSVSAM address space – Cont

• Change FCT definition for files to be opened as RLS to include RLS=YES and remove remote parms
  • You can leave them in your FOR as RLS files, but then the overhead of function shipping plus RLS is incurred
  • Recommend to open the files in your AORs
  • Some shops use this as an intermediate step – we went straight to the AORs
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Implementation and Customization – Cont
Create SMSVSAM address space – Cont

- Grant access to MVS, Storage group and/or CICS personnel to RACF Facility class profile STGADMIN.IGWSHCDS.REPAIR
  - Required to run IDCAMS SHCDS
  - Useful in problem determination

  //SHCDS  EXEC PGM=IDCAMS
  //SYSPRINT DD  SYSOUT=*  
  //SYSIN   DD  *

  SHCDS LSS(ALL)  ** lists all jobs/regions that are connected
  RLS on this sysplex
  SHCDS LSSDSL(CICSPR20)  ** lists info for all RLS files open in this
  region
  SHCDS LISTDS(PROD2.GLVSAM.LOG)  ** lists RLS info for this file.
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Implementation and Customization – Cont

- Alter files to update LOG and BWO (optional) definitions
  - LOG(NONE) – No recovery
  - LOG(UNDO) – Dynamic Transaction Backout Only
  - LOG(ALL) – DTB plus forward recovery
  - BWO(TYPECICS) – When using LOG(ALL)
    - Online files do NOT hang up during backup utilities
  - BWO(NULL)
  - BWO(NO)
    - Online file hangs up during backup when backup utilities are utilized
- Update any JCL that creates files to include appropriate LOG and BWO specifications
- Alternatively you can update the SMS definitions with the appropriate LOG and BWO specifications
- Update FCT entry Record Level Sharing (RLS) File Access Mode to RLS
- New commands added to Quiesce and Unquiesce files prior to Open/Close
  - Quiesce will close files
  - Unquiesce will not automatically open files
- Updates to old CAFC process
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Implementation and Customization – Cont

- SMSVSAM activation status
  - Issue D SMS,SMSVSAM, ALL

```
DISPLAY SMS,SMSVSAM - SERVER STATUS
SYSNAME: LPRD       AVAILABLE ASID: 000A STEP: SmsVsamInitComplete
SYSNAME: LPRA       AVAILABLE ASID: 000A STEP: SmsVsamInitComplete
SYSNAME: LPRC       AVAILABLE ASID: 000A STEP: SmsVsamInitComplete
SYSNAME: LPRB       AVAILABLE ASID: 000A STEP: SmsVsamInitComplete
SYSNAME: LPRT       AVAILABLE ASID: 000A STEP: SmsVsamInitComplete
SYSNAME: LPRP       AVAILABLE ASID: 000A STEP: SmsVsamInitComplete
SYSNAME: ........ ........... ASID: .... STEP: ....................
SYSNAME: ........ ........... ASID: .... STEP: ....................
```

- SmsVsamInitComplete
  - Good startup
  - If anything other, check startup messages
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Issues Encountered
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*Issues Encountered*

- BWO(TYPECICS) to avoid potential AFCK abends caused by conflicts with HSM and other backup software
  - If done before FCT changes file will not open
- DFHFC0521 CITAT201 RLS OPEN of file YYYYYYYYYY failed. Undefined LOG parameter is invalid for an RLS file with update type SERVREQs.
  - File has LOG defined as NULL – Must be NONE, UNDO or ALL
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Issues Encountered - Cont

IGW400I ***************************************

IGW400I ABEND0F4 Rc1008 Rsn611BFBDA occurred to
IGW400I Job CICSRGN RPL 377B7D08 for data set
IGW400I PROD.XXXX.YYYY.ZZZZ

IGW400I

IGW400I ***************************************

RLS bug fixed in APAR OA15595 – PTF UA29694

** PTF closed on 10/03/2006
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Issues Encountered – Cont

Application design causing slow response

• **Application is using a multi-field key**
  • Datestamp & Timestamp as first two fields of key
  • Effect was to sequentially add records
  • File became high volume
  • All file activity updating same CI

• **RLS**
  • Locks on Record Level
  • Moves entire CI into cache
  • Writes entire CI to DASD on syncpoint
  • Each updating task gets it’s own copy of CI in cache
  • Does CI Validation – ensure all tasks have a valid CI
    • Task A writes CI while task B has CI cache, once task B attempts write it is invalid
      – does not include update from task A
    • Task B retrieves CI again
    • Potential performance issues if high activity file

• **Application updates**
  • Removed unnecessary update activity
  • Randomize keys using better algorithm
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*Issues Encountered – Cont*

Application design causing deadly embrace

- Application is using low-value keys
  - Multiple tasks accessing low-value records
  - Also DB2 access
  - Quiesce issued against the file during the embrace
- Application updates
  - Corrected low-value key access
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Performance
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**Performance**

The net effect of migrating to RLS will depend upon the original configuration:

- If the migration is from MRO - with a high proportion of requests being function shipped across XCF links - then there could be a reduction in overall CPU cost per transaction.

- If the migration is from MRO/XM or Local files, then there will be an increase in CPU cost per transaction.

- Our workload showed an approximate 5% increase in CPU cost per transaction when migrating from MRO/XM function shipping to RLS. Other workloads will vary depending on the path length of the application and the number of file requests per transaction.

- RLS has better scaling capabilities than CICS Function Shipping because it isn't limited to a single file owning region that is constrained to the speed of a CP due to its single TCB architecture.

Reference: CICS/RLS Study performed by IBM........CICS SupportPAc CP13
http://www-01.ibm.com/support/docview.wss?uid=swg24026507
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Performance – Cont

• 726 total files defined to RLS
• 24 Hour Period
  • 306,590,658 GET requests
  • 6,557,522 GET UPDATE requests
  • 313,148,180 ADD requests
  • 2,475,908 UPDATE requests
  • 1,263,926 DELETE requests
  • 97,760,829 BROWSE requests
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Performance – Cont

- 85 (of the 726) files defined to RLS as Read-Only (for the reporting period)
- 24 Hour Period
  - 65,602,703 GET requests
  - 28,316,884 BROWSE requests
## Performance – Cont

RMF Coupling Facility - Structure Details

<table>
<thead>
<tr>
<th>Cache Structure</th>
<th>CICSVSAMRLS_STRUC1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling Facility</td>
<td>ICFPROD1</td>
</tr>
<tr>
<td>System</td>
<td>*ALL</td>
</tr>
<tr>
<td>Structure Size</td>
<td>566M</td>
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<table>
<thead>
<tr>
<th>Direct. Entries</th>
<th>Total 270K Current 268K</th>
<th>Jobname :</th>
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<tbody>
<tr>
<td>Data Elements</td>
<td>Total 245K Current 242K</td>
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<tr>
<td>Request Rate</td>
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<td></td>
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<tr>
<td>Read Rate</td>
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</tr>
<tr>
<td>Write Rate</td>
<td>317.4</td>
<td></td>
</tr>
<tr>
<td>Castout Rate</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>XI Rate</td>
<td>114.0</td>
<td></td>
</tr>
<tr>
<td>Directory Reclaims</td>
<td>1571</td>
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</tr>
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If data is missing, see Help panel.
### RMF Coupling Facility - Structure Details

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<tr>
<th>Cache Structure</th>
<th>CICSVSAMRLS_STRUC2</th>
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<td>Coupling Facility</td>
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<tr>
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<tr>
<td>Direct. Entries Total</td>
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<tr>
<td>Direct. Entries Current</td>
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<tr>
<td>Data Elements Total</td>
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<td>Read Rate</td>
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<tr>
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<td>Castout Rate</td>
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<tr>
<td>XI Rate</td>
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<td>Directory Reclaims</td>
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</table>

Press Enter to return to the Report panel.
If data is missing, see Help panel.
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#### Performance – Cont

**RMF V1R11 CF Activity** - PRODPLEX  
**Line 1 of 125**

Command ===>  
Scroll ===> CSR

RMF Coupling Facility - Structure Details

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock Structure</td>
<td>IGWLOCK00</td>
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<tr>
<td>Coupling Facility</td>
<td>ICFPROD1</td>
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<tr>
<td>System</td>
<td>*ALL</td>
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<td>Contention (%)</td>
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<tr>
<td>False Contention (%)</td>
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Press Enter to return to the Report panel.  
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Tips and Hints
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*Tips and Hints*

- SMF Type 42, subtypes 15-19 have performance data for RLS
- Don’t be afraid of using RLS
  - Serious problems in 2000 and 2001
  - Our experience is that these issues have been resolved
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Tips and Hints - Cont

• Plan migration
• No ‘big bang theory’
• Work with MVS for setup of SMSVSAM
• Work with Automation for identification and resolution of error messages
• Make file definitions changes prior to FCT changes
• Monitor performance of SMSVSAM and CICS regions
• Move READ/BROWSE only files to all AORs
• Beware of KSDS files with sequential key and heavy ADD activity
Questions???