CICS and VSAM/RLS User Experience

Glenn A. Schneck
SunTrust Banks, Inc.

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

SHARE
Technology · Connections · Results

Who we are and Environment Overview

CICS and VSAM/RLS User Experience

Who we are

- Headquartered in Atlanta, Ga.
- 7th Largest Bank in US
- Regional Presence in Southeast and Mid-Atlantic
- $174+ Billion in assets

CICS and VSAM/RLS User Experience

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

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

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

Issues Encountered

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

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’

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

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
  - NOTE: Review CICS and Transactional VSAM presentation by Ed Addison, IBM Level 2 (http://www-1.ibm.com/support/docview.wss?uid=swg27009511&aid=1)

CICS and VSAM/RLS User Experience

Implementation and Customization

CICS and VSAM/RLS User Experience

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).

CICS and VSAM/RLS User Experience

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 CIsize, but may require larger cache structure
  - We are using the default of ‘Z’
- Grant UPDATE access to SMSVSAM to the SHCDS datasets

CICS and VSAM/RLS User Experience

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.

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

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.
```

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

Issues Encountered

CICS and VSAM/RLS User Experience

Issues Enrountered

- 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 YYYYYYYY 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

CICS and VSAM/RLS User Experience

Issues Encountered - Cont

**IGW400I **
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

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

Performance

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

Performance – Cont

RMF Coupling Facility - Structure Details

Cache Structure		: CICSVSAMRLS_STRUC1		
Coupling Facility		: ICFPROD1		
System		: *ALL		
Structure Size		: 566M	Connection Name	:
Direct. Entries	Total	: 270K	Jobname	:
	Current	: 268K	Status	:
Data Elements	Total	: 245K	ASID	:
	Current	: 242K	CF Level	:
Request Rate		: 1491		
Read Rate		: 139.7		
Write Rate		: 317.4		
Castout Rate		: 0.0		
XI Rate		: 114.0		
Directory Reclaims		: 1571		

Press Enter to return to the Report panel.
If data is missing, see Help panel.

CICS and VSAM/RLS User Experience

Performance – Cont

RMF Coupling Facility - Structure Details

Cache Structure		: CICSVSAMRLS_STRUC2		
Coupling Facility		: ICFPROD2		
System		: *ALL		
Structure Size		: 566M	Connection Name	:
Direct. Entries	Total	: 248K	Jobname	:
	Current	: 245K	Status	:
Data Elements	Total	: 248K	ASID	:
	Current	: 246K	CF Level	:
Request Rate		: 298.5		
Read Rate		: 67.3		
Write Rate		: 82.8		
Castout Rate		: 0.0		
XI Rate		: 17.8		
Directory Reclaims		: 1010		

Press Enter to return to the Report panel.
If data is missing, see Help panel.

CICS and VSAM/RLS User Experience

Performance – Cont

RMF V1R11 CF Activity - PRODPLEX Line 1 of 125

Command ===> Scroll ===> CSR

RMF Coupling Facility - Structure Details

Lock Structure		: IGWLOCK00		
Coupling Facility		: ICFPROD1		
System		: *ALL		
Structure Size		: 634M	Connection Name	:
List entries	Total	: 1333K	Jobname	:
	Current	: 1374	Status	:
Lock Entries	Total	: 67.1M	ASID	:
	Current	: 11605	CF Level	:
Contention	(%)	: 5.3		
False Contention	(%)	: 0.2		

Press Enter to return to the Report panel.

If data is missing, see Help panel.

CICS and VSAM/RLS User Experience

Tips and Hints

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

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

CICS and VSAM/RLS User Experience

Questions????