DFSMS Basics: VSAM

Transactional VSAM (TVS) Basics and Implementation

Enhancing your RLS applications through transactional processing of VSAM data sets

Speaker: Neal Bohling, bohling@us.ibm.com
Session: 9094
Agenda

• RLS & TVS Overview – what’s the problem?
• Transactional VSAM Overview – what’s the solution?
• Setup and Use – how do I use it?
• Performance Considerations
• Commands – tracking what’s going on
• References – for more information
Quick Background - RLS

Problem:
- One data set, many users.
- Serialization can get messy and data can get lost.

Previous solution:
- CICS FOR (Function Shipping)

RLS Solution:
- VSAM Record Level Sharing
  - All access goes through SMSVSAM
  - Plex-wide serialization through locks in the CF
RLS Access

App 1

App 2

App 3

App n

System 1

System n

SMSVSAM

DATA SET
Typical RLS Setup

LPAR 1

APP_n
APP2
APP1

SMSVSAM

RPL

Lock Str
Cache
Cluster

DASD

SMSVSAM

RPL

CF

RPL

lock

lock

lock

APP_n
APP2
APP1

Session 9094 - TVS
Quick Background – RLS & CICS

New Problem:
- Any recoverable data set open is READ ONLY to non-recoverable access (RLS and non-RLS)
- Ex. CICS through RLS and “batch” using RLS.

Common Solutions:
- Quiesce current activity
- Move CICS activity to a different file
- “Batch Window”

TVS Solution:
- Batch jobs using TVS become Recoverable Registered Regions
- Jobs using TVS can run simultaneously with CICS
- TVS Manages Recovery
RLS Access

- Recoverable App 1
- NON-CICS With TVS
- "Batch" TVS
- CICS n

System 1

SMSVSAM

DATA SET
TRANSACTIONAL VSAM

Design Objective:

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

Recovery Capabilities include:

- Transactional Recovery
- Data set recovery

**VSAM RLS becomes a "transactionalized" access method, hence "Transactional VSAM" (TVS).**
**TVS Overview**

*Transactional VSAM allows* any job that uses RLS (such as batch jobs) to be recoverable

**Implications:**

- Cross-system record-level serialization through RLS
- *Recoverable subsystems (such as CICS) need not come down to allow other RLS activity (such as batch) (24x7 avail)*
- Fully able to interact with other recoverable regions
Data Set Recovery

• What is recovery?

• BACKWARD:
  • Allows the last update or set of updates to be undone
  • ‘UNDO’
  • Uses atomic updates / transactions
  • Uses logs to store changes

• FORWARD
  • Allows utilities to rebuild a file from backup
  • Uses logs to store forward-changes
Transactions and Transactional Recovery

- **A Transaction or Unit of Recovery is a set of updates or changes that act as one unit of processing**

- **Atomic update**
  - All of nothing

- **Commit**
  - Finalizes a set of updates

- **Backout**
  - Removes a set of updates
  - Based on logged updates

- **Referred to in TVS as a UR**
Transaction Example

Buying a cup of coffee:

*Series of steps to complete:*

1. You order
2. They name the price
3. You pay
4. Change
5. Coffee!
6. Transaction complete!
   Coffee in Hand!
Recoverable data sets are data sets that support backout (and potentially forward recovery) when opened by a recoverable region (such as CICS or TVS)

RECOVERABLE
- Can do transaction recovery
- LOG(UNDO) – backward
- Changes are logged
- Changes can be backed out
- Read ONLY for non-RLS access
- LOG(ALL) – forward recovery

NON-RECOVERABLE
- Cannot recover
- LOG(NONE) or undefined
- Changes are not logged
- Changes cannot be undone
- R/W from all regions
Recoverable Regions

*Recoverable Subsystems are applications capable of:*
  - Transactional Recovery (backward recovery)
  - Data set Recovery (forward recovery)
  - Data set changes are logged
  - An example of an IBM recoverable region is CICS

*A Recoverable Subsystem Manager is capable of:*
  - Managing transactional recovery between one or more recoverable subsystems
  - An example of an IBM Recoverable Subsystem is the z/OS Recoverable Resource Manager (RRS)
  - Recoverable Subsystems Register with Manager
  - Uses ‘Units of Recovery’ (UR, transaction)
Recovery (Backward)

If there is a failure:

• Locks will be held to maintain integrity (RETAINED locks)
• Read the log file to retrieve unmodified data
• Restore data to unmodified state
• Release the serialization

If a BACKOUT fails:

• Log the backout failure in another log, the SHUNTLOG
• Maintain serialization on the modified data (RETAINED locks)
Transaction Example

Buying a cup of coffee:

Series of steps to complete:

1. You order
2. They name the price
3. You pay
4. Change
5. Coffee!
6. Transaction complete! Coffee in Hand!
A Technical Example – successful

1. Read UPD record 4
2. Modify record 4
3. PUT modified 4-a
4. Insert record 7 PUT
5. Commit
6. End of Transaction!

TVS
- Lock record 4
- Log unmodified rec 4
- Write modified rec 4
- Lock record 7
- Log unmodified data
- Write record 7
- Update logs
- Release locks

Data Set
- 2
- 4-a
- 6
- 7
- 8
- 10

Session 9094 - TVS
A Technical Example – Failure!

Application / UR
1. Read UPD record 4
2. Modify record 4
3. PUT modified 4-a
4. Insert record 7 PUT
5. Backout
6. End of Transaction!

TVS
Lock record 4
Log unmodified rec 4
Write modified rec 4
Lock record 7
Log unmodified data
Write record 7
Read unmodified data
Restore data
Update logs
Release locks

Data Set
2
4-a
6
8
10

Session 9094 - TVS
More on logging

- Data Set updates are written to the LOG
- TVS, RRS, CICS all take advantage of it in different ways
- TVS uses System LOGGER (IXLOGR)
- Uses LOGSTREAMS
  - Defined in the LOGR Policy in the coupling facility
- Logstreams can be shared between CICS / TVS, especially for forward recovery
TVS Logs

- **Undo Log** (required) – Primary System Log
  - One per image
  - Holds the changes made by URids on that system
  - Used for backout

- **SHUNT Log** (required) – Secondary System Log
  - One per image
  - Holds URs that TVS cannot complete (I/O error, etc)
  - Holds Long-running URs (moved from Undo log)

- Forward recovery logs (optional)
  - Plex-wide logs
  - Shared between CICS and TVS
  - Assigned to data sets during data set allocation (LOGSTREAMID)

- Log of Logs (optional)
  - Holds tie-up records and file-close records
  - Used by recovery applications such as CICSVR
TVS Component Interaction

Three basic functions necessary for transactional recovery:

- **Resource locking (VSAM RLS)**
  - Serialized access to changed resources
  - At the record level
  - Uses the coupling facility

- **Resource Recovery Logging (LOGGER)**
  - Keep track of backward changes (UNDO)
  - Keep track of forward changes (REDO / FR)

- **Two-phase commit and backout protocols (RRS)**
  - Ensures ATOMIC operation (transactions)
  - COMMIT
  - BACKOUT
The Overall Flow

- As TVS comes up:
  - Registers with SMSVSAM as a recoverable subsystem
  - Dynamically connect to the BACKOUT and SHUNT logs

- When a request is issued (GET/PUT/etc):
  - Register transaction with RRS and get a Unit of Recovery ID
  - Hold record-level serialization for the duration of URid
  - Log the unmodified data via IXLOGR to the backout log, and optionally the change in the forward recovery log

- When a COMMIT is issued:
  - Commit can be issued explicitly (via RRSCMIT)
  - Commits are implicitly issued during EOT
  - Release the locks
  - Log the successful COMMIT
SETUP

Hardware / Software changes to enable TVS
System Requirements

• Hardware:
  • Coupling Facility
  • At least one z/OS LPAR (monoplex or parallel sysplex)

• Software:
  • z/OS 1.4 or higher (current lowest release is z/OS 1.10)
  • z/OS VSAM RLS (SMSVSAM) Implemented
  • z/OS Transactional VSAM (separately priced feature)
  • z/OS RRMS Implemented (RRS)
  • z/OS System Logger Implemented
  • CICS VSAM Recovery (CICSVR) Utility (optional)
Required Parmlib Configuration

- **IGDSMSxx Parmlib Member** (Note, this does not include RLS/SMSVSAM parameters)
  - **SYSNAME**(sysname1,sysname2,…)*
    - Systems on which TVS is to run
    - Same order is TVSNAME
  - **TVSNAME**(nn1,nn2,..)*
    - TVS Instance names
    - Suffix to IGWTIV
  - **TV_START_TYPE**(COLD|WARM,COLD|WARM,…)
    - Type of startup
    - Same order as TVSNAME
    - COLD – deletes any information in UNDO & SHUNT logs and starts
    - WARM – reads the UNDO & SHUNT log and performs any actions needed

SYS1, SYS2, SYS3
001, 002, 003
WARM, WARM, WARM
Parmlib Configuration (Optional)

- **LOG_OF_LOGS**(logstreamid)
  - Specifies LOG of LOGS logstream
  - Used for forward recovery

- **MAXLOCKS**(nnn,iii)
  - Specifies when to issue warning messages about the number of held locks

- **AKP**(nnn,nnn,…) - Activity Keypoint trigger
  - Helps TVS maintain the UNDO and SHUNT logs
  - Removes entries that are no longer needed (URid no longer in use)
  - Defaults to 1000

- **QTIMEOUT**(nnn|300)
  - Number of seconds to wait before QUIESCE EXITS assume that the QUIESCE will not complete
TVS Startup Messages:

IGW865I TRANSACTIONAL VSAM INITIALIZATION HAS STARTED.
IGW414I SMSVSAM SERVER ADDRESS SPACE IS NOW ACTIVE. 327

IGW860I TRANSACTIONAL VSAM HAS SUCCESSFULLY REGISTERED WITH RLS

IGW848I 02182011 11.45.28 SYSTEM UNDO LOG IGWTVO01.IGWLOG.SYSLOG 553
INITIALIZATION HAS STARTED
IGW848I 02182011 11.45.29 SYSTEM UNDO LOG IGWTVO01.IGWLOG.SYSLOG 577
INITIALIZATION HAS ENDED
IGW848I 02182011 11.45.29 SYSTEM SHUNT LOG IGWTVO01.IGWSHUNT.SHUNTLOG
INITIALIZATION HAS STARTED
IGW848I 02182011 11.45.29 SYSTEM SHUNT LOG IGWTVO01.IGWSHUNT.SHUNTLOG
INITIALIZATION HAS ENDED

IGW865I TRANSACTIONAL VSAM INITIALIZATION IS COMPLETE.
IGW886I 0 RESTART TASKS WILL BE PROCESSED DURING TRANSACTIONAL VSAM
RESTART PROCESSING
IGW866I TRANSACTIONAL VSAM RESTART PROCESSING IS COMPLETE.
Logger Configuration

- Update the CFRM Policy to contain list structures for the LOGS

- Update the LOGR Policy to contain the SMSVSAM logs

```
//POLICY EXEC PGM=IXCMIAPU
//SYSIN DD *
DEFINE STRUCTURE
   NAME(LOG_IGWLOG_001)
   LOGSNUM(10)
   MAXBUFSIZE(64000)
   AVGBUFSIZE(2048)

//POLICY EXEC PGM=IXCMIAPU
//SYSIN DD *
DEFINE LOGSTREAM
   NAME(IGWTV001.IGWLOG.SYSLOG)
   STRUCTURENAME(LOG_IGWLOG_001)
   LS_SIZE(1180)
   STG_DUPLEX(YES)
   DUPLEXMODE(COND)
   HIGHOFFLOAD(85)
   LOWOFFLOAD(15)
   DIAG(YES)
```
Data Set Allocation

- Add the following to IDCAMS define:
  - LOG( )
    - **NONE** – non-recoverable data set. Any RLS application can read/write
    - **UNDO** – Recoverable data set requiring backout logging. Can be opened for read/write by any RLS Recoverable Subsystems (CICS or TVS)
    - **ALL** – Recoverable data set requiring backout and forward recovery logging. Can be opened for read/write by any RLS Recoverable Subsystem
  - **LOGSTREAMID(logs_id)**
    - Logstream ID for any data set defined with LOG(ALL)

```
DEFINE CLUSTER (  
   NAME(recoverabledataset) -  
   RECORDSIZE(100 100) -  
   STORCLAS(storclasname) -  
   FSPC(20 20) -  
   LOG (ALL) -  
   SHAREOPTIONS(2 3) -  
   LOGSTREAMID(logs_id) -  
   CISZ(512) -  
   KEYS(06 8) INDEXED -  
) -  
DATA (  
   NAME(recoverabledataset.DATA) -  
   VOLUME(volser) -  
   TRACKS (1,1)) -  
INDEX (  
   NAME(recoverables.INDEX) -  
   VOLUME(volser) -  
   TRACKS (1,1))
```
Application Changes

Data sets will be accessed via TVS when:

- Any RLS access for recoverable data set
  - Via ACB:
    - `ACB MACRF=(RLS,OUT)` for recoverable data set
    - `ACB MACRF=(RLS,IN), RLSREAD=CRE`
  - Via DD:
    - `//ddname DD DSN=recoverable.dsn,DISP=SHR, RLS=(CR|NRI) and ACB MACRF=(OUT)`
    - `//ddname DD DSN=recoverable.dsn,DISP=SHR, RLS=(CRE) and ACB MACRF=(IN)"`
Application Changes (cont)

- **Recommendations:**
  - Can be EXPLICIT – add command to your job
  - Can be IMPLICIT – will run during End-of-Job

- RLS Applications using TVS should be modified to include:
  - SSRCMIT – commit
  - SSRBACK – backout

- SSRCMIT and SSRBACK will either COMMIT or BACKOUT the UR provided by SMSVSAM on behalf of the application

- Periodic explicit COMMIT/BACKOUT will release the locks in a timely fashion. Failure to do so may hold up other jobs.

- **High-Level Language Support:**
  - PLI, C & C++, COBOL, Assembler
Performance Considerations

- TVS does add overhead
  - Increased code path length
  - Cross-Address Space access to server
  - Loss of NSR chained sequential I/O
  - Loss of LSR deferred write
  - New overhead of record locking
  - New overhead of CF cache access
  - Logging (for already RLS work)

- Commit Frequency
  - Too many can add unnecessary overhead
  - Too few can cause delays due to lock contention

- “Parallelizing” the workload
  - Spreading out the work reduces individual overhead and increases overall efficiency
  - Several TVS streams can work simultaneously
Application Example (Commit)

Explicit Commit:

```
//ddname DD DSN=Recoverabledatasetname,DISP=SHR,RLS=CRE
//step1 EXEC PGM=vsamrlspgm
Begin JOB Step ------------------------ No locks held
OPEN ACB MACRF=(NSR,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
```

Implicit Commit:

```
//ddname DD DSN=Recoverabledatasetname,DISP=SHR,RLS=CRE
//step1 EXEC PGM=vsamrlspgm
Begin JOB Step ------------------------ No locks held
OPEN ACB MACRF=(NSR,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 Example (Backout)

Explicit Backout
//ddname DD DSN=Recoverabledatasetname,DISP=SHR,RLS=CRE
//step1 EXEC PGM=vsamrlspgm
Begin JOB Step ------------------------------------ --- No locks held
OPEN ACB MACRF=(NSR,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

Implicit Backout
//ddname DD DSN=Recoverabledatasetname,DISP=SHR,RLS=CRE
//step1 EXEC PGM=vsamrlspgm
Begin JOB Step ------------------------------------ --- No locks held
OPEN ACB MACRF=(NSR,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
Restart Considerations

- Restarting applications that use TVS must be done from the last COMMIT point.
- Restarting from the beginning could result in data integrity problems.
- A checkpoint / restart type system should be implemented to determine restart point of the application.
**Commands**

- **D SMS,TRANVSAM**

  ```
  D SMS,TRANVSAM
  RESPONSE=SYSTEM1
  IEE932I 006
  IGW800I 22.48.15 DISPLAY SMS,TRANSACTIONAL VSAM
  ```

  **DISPLAY SMS,TRANSACTIONAL VSAM - SERVER STATUS**

<table>
<thead>
<tr>
<th>System</th>
<th>TVSNMAE</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>IGWTV001</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</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGWTV001.IGWLOG.SYSLOG</td>
<td>Enabled</td>
<td>UnDoLog</td>
<td>Connected</td>
<td></td>
</tr>
<tr>
<td>IGWTV001.IGWSHUNT.SHUNTLOG</td>
<td>Enabled</td>
<td>ShuntLog</td>
<td>Connected</td>
<td></td>
</tr>
</tbody>
</table>
Commands

- D SMS,LOG(logid|ALL)
  - *Shows information about the logs currently in use by TVS*
- D SMS,SHUNTED,SPHERE|URID()
  - *Shows shunted work across the plex*
- D SMS,URID(urid)
  - *Displays information about the unit of recovery*
- D SMS,JOB(jobname)
  - *Displays information about the job, and for TVS, gives UR information*
Commands

• SHCDS commands provide a myriad of capabilities:
  • List information kept by SMSVSAM/TVS about subsystems and data sets:
    • LISTDS, LISTSUBSYS, LISTSUBSYSDS, LISTRECOVERY, LISTALL, LISTSHUNTED
  • Control Forward Recovery
    • FRSETRR, FRUNBIND, FRBIND, FRRESETRR, FRDELETEUNBOUNDLOCKS
  • Allow NON-RLS update – use sparingly
    • PERMITNONRLSUPDATE, DENYNONRLSUPDATE
  • Reset various information about subsystems or RLS
  • Handling SHUNTED work:
    • RETRY, PURGE
SHCDS Commands Example

Enter TSO or Workstation commands below:

```bash
===>   SHCDS LISTDS('recoverabledataset*')
----- LISTING FROM SHCDS ----- IDCSH02 ------------------------------------

DATA SET NAME----recoverabledataset
  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
  SUBSYSTEM NAME    SUBSYSTEM STATUS    RETAINED LOCKS    LOST LOCKS    NON-RLS UPDATE PERMITTED
  --------- ------- -------------------------- ----------- ---------- -----------------------------
  IGWTV001 ONLINE--FAILED                YES            NO           NO

***
Summary

- Transactional VSAM allows:
  - Concurrent access with recoverable regions (such as CICS)
  - Full data set recovery through logging and atomic updates
- Eliminates the Batch Window
- Requires minimal changes to existing jobs
- Provides plex-wide consistency
- Overall, provides a more effective way to integrate recoverable and non-recoverable workloads (ex. CICS and NON-CICS such as batch)
References:

- DFSMStvs Planning and Operating Guide, SC26-7348
- DFSMStvs Overview and Planning Guide, SG24-6971
- VSAM Demystified, SG24-6105
- MVS Initialization and Tuning Reference, SA22-7592
- MVS System Commands, SA22-7627
Copyright / Legal

NOTICES AND DISCLAIMERS

Copyright © 2010 by International Business Machines Corporation.
No part of this document may be reproduced or transmitted in any form without written permission from IBM Corporation.
Product data has been reviewed for accuracy as of the date of initial publication. Product data is subject to change without notice. This information could include technical inaccuracies or typographical errors. IBM may make improvements and/or changes in the product(s) and/or programs(s) at any time without notice.
Any statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.
References in this document to IBM products, programs, or services does not imply that IBM intends to make such products, programs or services available in all countries in which IBM operates or does business. Any reference to an IBM Program Product in this document is not intended to state or imply that only that program product may be used. Any functionally equivalent program, that does not infringe IBM’s intellectually property rights, may be used instead. It is the user’s responsibility to evaluate and verify the operation of any non-IBM product, program or service.

The information provided in this document is distributed "AS IS" without any warranty, either express or implied. IBM EXPRESSLY DISCLAIMS any warranties of merchantability, fitness for a particular purpose OR NONINFRINGEMENT. IBM shall have no responsibility to update this information. IBM products are warranted according to the terms and conditions of the agreements (e.g., IBM Customer Agreement, Statement of Limited Warranty, International Program License Agreement, etc.) under which they are provided. IBM is not responsible for the performance or interoperability of any non-IBM products discussed herein.

The provision of the information contained herein is not intended to, and does not, grant any right or license under any IBM patents or copyrights. Inquiries regarding patent or copyright licenses should be made, in writing, to:

IBM Director of Licensing
IBM Corporation
North Castle Drive
Armonk, NY  10504-1785
U.S.A.
Trademarks

DFSMSdfp, DFSMSdss, DFSMSshsm, DFSMSrmm, IBM, IMS, MVS, MVS/DFP, MVS/ESA, MVS/SP, MVS/XA, OS/390, SANergy, and SP are trademarks of International Business Machines Corporation in the United States, other countries, or both.

AIX, CICS, DB2, DFSMS/MVS, Parallel Sysplex, OS/390, S/390, Seascape, and z/OS are registered trademarks of International Business Machines Corporation in the United States, other countries, or both.

Domino, Lotus, Lotus Notes, Notes, and SmartSuite are trademarks or registered trademarks of Lotus Development Corporation. Tivoli, TME, Tivoli Enterprise are trademarks of Tivoli Systems Inc. in the United States and/or other countries.

Java and all Java-based trademarks are trademarks of Sun Microsystems, Inc. in the United States, other countries, or both. UNIX is a registered trademark in the United States and other countries licensed exclusively through The Open Group.

Other company, product, and service names may be trademarks or service marks of others.
Backup Slides / Additional Reference
Example of TVS startup:

IGW865I TRANSACTIONAL VSAM INITIALIZATION HAS STARTED.
IGW414I SMSVSAM SERVER ADDRESS SPACE IS NOW ACTIVE. 327

IGW467I DFSMS TVSNAME PARMLIB VALUE SET DURING 510
SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM: SYSTEM1
TVSNAME: IGWTV001
CURRENT VALUE: ENA-ED 1

IGW467I DFSMS TRANSACTIONAL VSAM UNDO LOG PARMLIB VALUE SET DURING 513
SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM: SYSTEM1
UNDO LOGSTREAM NAME: IGWTV001.IGWLOG.SYSLOG
CURRENT VALUE: ENA-ED 1

IGW467I DFSMS TRANSACTIONAL VSAM SHUNT LOG PARMLIB VALUE SET DURING 514
SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM: SYSTEM1
SHUNT LOGSTREAM NAME: IGWTV001.IGWSHUNT.SHUNTLOG
CURRENT VALUE: ENA-ED 1

IGW467I DFSMS TRANSACTIONAL VSAM ACTIVITY KEY POINT PARMLIB VALUE 516
SET DURING SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM: SYSTEM1
CURRENT VALUE: 200

IGW467I DFSMS TRANSACTIONAL VSAM TVS_START_TYPE 517
PARMLIB VALUE SET DURING
SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM: SYSTEM1
TVSNAME VALUE: IGWTV001
CURRENT VALUE: WARM 1

IGW467I DFSMS TRANSACTIONAL VSAM LOG_OF_LOGS PARMLIB VALUE SET DURING 524
SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM: SYSTEM1
LOG_OF_LOGS LOGSTREAM NAME: IGWTVS1.LOG.OF.LOGS
CURRENT VALUE: ENA-ED 1
Example of TVS startup:

**IGW860I** TRANSACTIONAL VSAM HAS SUCCESSFULLY REGISTERED WITH RLS
**IGW876I** TRANSACTIONAL VSAM INITIALIZATION WAITING FOR RRS
**ATR201I** RRS COLD START IS IN PROGRESS.
**ASA2011I** RRS INITIALIZATION COMPLETE. COMPONENT ID=SCRRS
**IGW877I** TRANSACTIONAL VSAM INITIALIZATION RESUMING AFTER WAIT FOR RRS
**IGW848I** 02182011 11.45.28 SYSTEM UNDO LOG IGWTV001.IGWLOG.SYSLOG 553
**INITIALIZATION HAS STARTED**

**IXC582I** STRUCTURE TVS_LOG001 ALLOCATED BY SIZE/RATIOS. 566
  PHYSICAL STRUCTURE VERSION: C75A333B 5A6E2E32
  STRUCTURE TYPE: LIST
  CFNAME: FACIL02
  ALLOCATION SIZE: 12 M
  POLICY SIZE: 12000 K
  POLICY INITSIZE: 0 K
  POLICY MINSIZE: 0 K
  IXLCONN STRSIZE: 0 K
  ENTRY COUNT: 873
  ELEMENT COUNT: 7567
  ENTRY:ELEMENT RATIO: 1 : 9
**ALLOCATION SIZE IS WITHIN CFRM POLICY DEFINITIONS**

**IXL014I** IXLCONN REQUEST FOR STRUCTURE TVS_LOG001 567
**WAS SUCCESSFUL.** JOBNAME: IXGLOGR ASID: 0017
**CONNECTOR NAME:** IXGLOGR_SYSTEM1 CFNAME: FACIL02
Example of TVS startup:

IXL015I STRUCTURE ALLOCATION INFORMATION FOR 568
STRUCTURE TVS_LOG001, CONNECTOR NAME IXGLOGR_SYSTEM1
CFNAME ALLOCATION STATUS/FAILURE REASON
------- ----------------------------------------
FACIL02 STRUCTURE ALLOCATED CC001800
FACIL01 PREFERRED CF ALREADY SELECTED CC001800

IXG283I STAGING DATASET IXGLOGR.IGWTV001.IGWLOG.SYSLOG.SYSTEM1
ALLOCATED NEW FOR LOGSTREAM IGWTV001.IGWLOG.SYSLOG
CISIZE=4K, SIZE=442368

IGW474I DFSMS VSAM RLS IS CONNECTING TO 576
TRANSACTIONAL VSAM LOGSTREAM IGWTV001.IGWLOG.SYSLOG
SYSTEM NAME: SYSTEM1
TRANSACTIONAL VSAM INSTANCE NAME: IGWTV001

IGW848I 02182011 11.45.29 SYSTEM UNDO LOG IGWTV001.IGWLOG.SYSLOG 577
INITIALIZATION HAS ENDED

IGW848I 02182011 11.45.29 SYSTEM SHUNT LOG IGWTV001.IGWSHUNT.SHUNTLOG
INITIALIZATION HAS STARTED

IXG283I STAGING DATASET IXGLOGR.IGWTV001.IGWSHUNT.SHUNTLOG.SYSTEM1 585
ALLOCATED NEW FOR LOGSTREAM IGWTV001.IGWSHUNT.SHUNTLOG
CISIZE=4K, SIZE=442368

IGW474I DFSMS VSAM RLS IS CONNECTING TO 587
TRANSACTIONAL VSAM LOGSTREAM IGWTV001.IGWSHUNT.SHUNTLOG
SYSTEM NAME: SYSTEM1
TRANSACTIONAL VSAM INSTANCE NAME: IGWTV001

IGW848I 02182011 11.45.29 SYSTEM SHUNT LOG IGWTV001.IGWSHUNT.SHUNTLOG
INITIALIZATION HAS ENDED
Example of TVS startup:

IGW848I 02182011 11.45.29 LOG OF LOGS IGWTVS1.LOG.OF.LOGS 589
INITIALIZATION HAS STARTED
IXG283I STAGING DATASET IXGLOGR.IGWTVS1.LOG.OF.LOGS.SYSTEM1 595
ALLOCATED NEW FOR LOGSTREAM IGWTVS1.LOG.OF.LOGS
CISIZE=4K, SIZE=442368
IGW474I DFSMS VSAM RLS IS CONNECTING TO 597
TRANSACTIONAL VSAM LOGSTREAM IGWTVS1.LOG.OF.LOGS
SYSTEM NAME: SYSTEM1
TRANSACTIONAL VSAM INSTANCE NAME: IGWTV001
IGW848I 02182011 11.45.30 LOG OF LOGS IGWTVS1.LOG.OF.LOGS 598
INITIALIZATION HAS ENDED

IGW865I TRANSACTIONAL VSAM INITIALIZATION IS COMPLETE.
IGW886I 0 RESTART TASKS WILL BE PROCESSED DURING TRANSACTIONAL VSAM
RESTART PROCESSING
IGW866I TRANSACTIONAL VSAM RESTART PROCESSING IS COMPLETE.
IGW467I DFSMS TRANSACTIONAL VSAM QTIMEOUT PARMLIB VALUE SET DURING 602
SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM: SYSTEM1
CURRENT VALUE: 400 1
IGW467I DFSMS TRANSACTIONAL VSAM MAXLOCKS PARMLIB VALUE SET DURING 603
SMSVSAM ADDRESS SPACE INITIALIZATION ON SYSTEM: SYSTEM1
CURRENT VALUE: 100 50 1
Recovery (Forward)

- To Recover a data set with retained locks:
  - Stop any current transactions
  - DELETE recoverabledataset
  - Restore backup copy
  - Apply committed changes since last backup
  - Restart access (Retry SHUNTED work)

- CICSVR automates this process
  (does not retry shunted work)
Recovery (Forward)

- To Recover a data set with retained locks, take following steps
  - `SHCDS FRSETRR(recoverabledataset)` – sets the FR indicator
  - `SHCDS FRUNBIND(recoverabledataset)` – unbinds the retained locks, allowing delete
  - `DELETE recoverabledataset`
  - `<Restore backup copy>`
  - `<apply committed changes since last backup (must set ACBRECOV)>`
  - `SHCDS FRBIND(recoverabledataset)` – reattach retained locks
  - `SHCDS FRRSETRR` – re-enable access to dataset
  - `SHCDS LISTSHUNTED SPHERE(recoverabledataset)` – display information about shunted work
  - `SHCDS RETRY SPHERE(recoverabledataset)` – retry the syncpoint

- CICSVR automates this process (does not retry shunted work)