



z/OS Operating System

DFSMSdfp OAM tape sublevel support

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This presentation will discuss DFSMSdfp OAM tape level support.

Agenda

- Overview of OAM tape sublevel
- OAM tape sublevel usage and invocation
- Migration and coexistence considerations

This module starts with an overview of adding the tape sublevel to the object access method (OAM) storage hierarchy, followed by discussions of what changes are needed in detail for the OAM tape sublevel support. In the end, some issues that need to be considered on migrating the pre-V1R9 systems to V1R9 are addressed.

OAM tape sublevel

- Problem statement / need addressed:
- Need automatic method to move data from one tape family to another.
 - ▶ Example: VTS ← → Native tape
 - ▶ Previously required manual MOVEVOL utility
 - ▶ Customer requirement MR0426056115
 - ▶ Customer Council requirements from surveys
 - ▶ IBM internal requirements with 3995 optical library withdrawn from marketing

Currently, the OAM storage hierarchy consists of three levels: disk, optical, and tape. This support offers further granularity of the tape level by creating two sublevels of tape. This effectively expands OAM's storage hierarchy into four levels; disk, optical, tape sublevel 1 (TSL1) and tape sublevel 2 (TSL2).

Today, it is easy to transition object data from disk to optical or tape but once the data has been placed in a storage family, to migrate data within the storage family is a manual effort with our MOVEVOL command.

With the 3995 optical library being withdrawn from marketing, tape and the virtual tape server (VTS) will play an increasing role in our support. IBM's offering to replace the 3995 optical library is a VTS configured with large cache and limited logical volumes to emulate one or more 3995 optical libraries. A key problem with the VTS option from customer perspective is 'what to do when the VTS is full?'

With this support, OSMC storage group processing can be used as the mechanism to automatically offload object data from a VTS to native tape in order to facilitate the solution to this problem.

In addition to enabling the ability to write and read object data directly to and from a given tape sublevel, this support provides the ability to transition object data within the tape family (for example: from VTS to native tape). An installation will be able to move data freely in and out of all four hierarchy levels via OSREQ and OSMC functions.

OAM tape sublevel

- **Solution:**
 - ▶ Expand OAM storage hierarchy
 - DASD
 - Optical
 - Tape
 - TSL1 (tape sublevel 1)
 - TSL2 (tape sublevel 2)
- **Benefit:**
 - ▶ Read/Write directly using OSREQ
 - ▶ Move data automatically using OSMC storage cycle

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OAM tape sublevel

- Using OAM tape sublevel, you can:
 - ▶ Store objects directly to TSL1 or TSL2
 - ▶ Use OSMC to automatically transition objects from one tape family to another
- Value:
 - ▶ More granularity and segregation when storing object data to tape
 - ▶ Moving data with the OSMC storage group cycle is much easier and efficient than using MOVEVOL utility

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OAM tape sublevel usage and invocation

- To exploit tape sublevel support, an installation will need to:
 - ▶ Modify existing storage class constructs or create new storage class constructs in ISMF (pre-existing tape storage classes will default to TSL1) using the new OAM Sublevel and will need to alter their ACS routines to exploit them
 - ▶ Modify new and existing SETOAM keywords in the CBROAMxx Parmlib member to define TSL2 related parameters to OAM

Each level of the storage hierarchy is associated with SMS storage class (SC) constructs. These constructs are currently defined by the Initial Access Response Seconds (IARS) and the Sustained Data Rate (SDR) keywords in the ISMF storage class definition panels. This support adds a new OAM Sublevel (OSL) parameter to the storage class to indicate what sublevel this storage class is associated with.

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- Modify existing storage class constructs or create new storage class constructs in ISMF (pre-existing tape storage classes will default to TSL1) using the new OAM Sublevel and will need to alter their ACS routines to exploit them.
- Modify new and existing SETOAM keywords in the CBROAMxx Parmlib member to define TSL2 related parameters to OAM.

A new column is added to OAM's TAPEVOL table in DB2® to indicate which tape sublevel (TSL1 or TSL2) each tape volume is associated with.

The ODLOCFL column in OAM's Object Directory Table indicates on what storage hierarchy the primary copy of a given object resides. The current valid values for this column are 'D', 'R', blank, and 'T' which indicate DASD, Recalled, Optical and Tape respectively. With this support, the 'T' will signify that the object resides on TSL1 media and a new indicator value 'U' will be introduced to signify that the object resides on TSL2 media.

As mentioned earlier there are *optional* migration/installation steps to EXPLOIT the new function.

To implement the tape sublevel function, the **storage administrator** will need to set up the storage class constructs and modify ACS routines to use the new storage class definitions to direct processing to the appropriate tape sublevel.

To implement this support, the **DB2 database administrator** will need to update the OAM configuration database. Migration job CBRSMR19, provided in SAMPLIB, will add the column TSL to the OAM Tapevol table.

To implement this support the **MVS system programmer** will need to make the following changes:

SETOAM L2DATACLASS(*dataclass*) statement of the CBROAMxx PARMLIB member can be used to define the dataclass to be used for TSL2 at the global level.

SETOAM STORAGEGROUP(*group-name* L2DATACLASS(*dataclass*)) statement of the CBROAMxx PARMLIB member can be used to define the dataclass to be used for TSL2 for a specific storage group.

SETOAM STORAGEGROUP(*group-name* L2TAPEUNITNAME(*unitname*)) statement of the CBROAMxx PARMLIB member can be used to define the tapeunitname to be used for TSL2 for a specific storage group.

OAM tape sublevel usage and invocation

- **New OAM SUBLEVEL (OSL) parameter in the SMS Storage Class construct associated with each OAM object**

- ▶ Initial access response seconds (IARS):

- 0 = DASD
- 1-9999 = Removable Media

- ▶ Sustained data rate (SDR):

- 0-2 = Optical
- **3-9999 = Tape**

- ▶ **OAM sublevel (OSL):**

- 1 = OAM Sublevel 1 (default)
- 2 = OAM Sublevel 2

Example: A storage class defined with IARS=1, SDR=3, and OSL=2 would equate to TSL2.

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To exploit tape sublevel support, a customer installation will need to:

- Modify existing storage class constructs or create new storage class constructs in ISMF (pre-existing tape storage classes will default to TSL1) using the new OAM Sublevel and will need to alter their ACS routines to exploit them.

- Modify new and existing SETOAM keywords in the CBROAMxx Parmlib member to define TSL2 related parameters to OAM.

A new column is added to OAM's TAPEVOL table in DB2 to indicate which tape sublevel (TSL1 or TSL2) each tape volume is associated with.

The ODLOCFL column in OAM's Object Directory Table indicates on what storage hierarchy the primary copy of a given object resides. The current valid values for this column are 'D', 'R', blank, and 'T' which indicate DASD, Recalled, Optical and Tape respectively. With this support, the 'T' will signify that the object resides on TSL1 media and a new indicator value 'U' will be introduced to signify that the object resides on TSL2 media.

OAM tape sublevel usage and invocation

- CBROAMxx Parmlib Member SETOAM statement
 - ▶ L2TAPEUNITNAME(*unitname*)
 - ▶ L2DATACLASS(*dataclass*)

Note: Backup copies of objects are not associated with a SMSstorage class and therefore the new TSL2 keywords will not apply to object backup storage groups.

The OAM component's PARMLIB member is CBROAMxx, where xx is the unique suffix specified by the use of OAM=xx parameter in the OAM started procedure, the START command for the OAM started procedure, or in the F OAM.RESTART command. This PARMLIB member is used by OAM during the OAM address space initialization process to determine parameters and configuration information to be used while the address space is active.

New keywords, L2TAPEUNITNAME and L2DATACLASS will be added to the SETOAM statement in the CBROAMxx member of PARMLIB in support of the new tape sublevel function added in this release. These new keywords will provide the installation with the ability to specify a tape sublevel that will be used at the global and storage group level.

L2DATACLASS(*name*) << global and storage group level >>

An optional parameter that specifies the SMS data class to be used when storing objects to Tape Sublevel 2 for Object storage groups that do not have their own L2DATACLASS specification on the STORAGEGROUP subparameter of the SETOAM statement. Tape Sublevel is associated with the OAM Sublevel parameter specified in the SMS Storage Class construct. If you specify L2DATACLASS at the OAM global level, this specification of L2DATACLASS applies to each of the object storage groups which do not explicitly specify an L2DATACLASS. Using the L2DATACLASS keyword on the SETOAM statement at the global level allows the installation to affect Tape Device Selection Information, and volume expiration date for those Object storage groups which do not have an explicit L2DATACLASS keyword in their STORAGEGROUP subparameter list. There is NO global level OAM default L2DATACLASS.

L2TAPEUNITNAME(*unitname*) << storage group level only >>

A required subparameter of the STORAGEGROUP parameter, if using the Tape Sublevel 2 function. Tape Sublevel is associated with the OAM Sublevel parameter specified in the SMS Storage Class construct. This subparameter specifies the type of tape drive that OAM uses when writing data to or reading data from an Object storage group using Tape Sublevel 2. This L2TAPEUNITNAME is the MVS unit name that OAM uses to initially allocate a scratch tape when an object is stored to this Object storage group and stored on a tape volume. For *unitname*, specify the name of a valid MVS esoteric (group of devices defined to a group name) or a generic unit name. Valid generic unit names are:

- 3480--a base 3480 device
- 3480x--a 3480 device with the IDRC feature, or a base 3490 device
- 3490--a 3490E device
- 3590-1--a 3590 device (or a device that emulates a 3590-1)

The unit name specified is associated with each tape volume used for output during the process of writing objects to tape that belong to a specified Object storage group. This unit name is saved in the corresponding rows in the TAPEVOL table for each of these tape volumes, and is used during later allocations of these tape volumes for either reading or writing processing. Note: the L2TAPEUNITNAME keyword can not be associated with an Object Backup storage group.

L2TAPEUNITNAME is a required keyword when using Tape Sublevel 2, and is specified for all Tape Sublevel 2 allocations. In the automated tape library dataservers and manual tape libraries, this information might be used by the ACS filter routines, but is not required for device allocation. In the stand-alone environment, this information is **critical** in the allocation decision making process.

It is expected that many of the (SETOAM) parameters that OAM uses for TSL2 can be inherited from the TSL1 parameters. At a minimum, new keywords need to be introduced to define TAPEUNITNAME and DATACLASS for TSL2 at the storage group level.

These new CBROAMxx Parmlib member keywords are used by OAM's volume selection algorithm when allocating a scratch volume to satisfy a write request associated with a TSL2 storage class for a given object storage group. Similarly, with this support, OAM will now ensure that the hierarchy level associated with a candidate tape volume is consistent with the OAM sublevel specified by an object's storage class when considering a pre-existing group volume to satisfy a write request for a given object storage group.

Note: Backup copies of objects are not associated with an SMS storage class and therefore the new TSL2 keywords will not apply to object backup storage groups.

OAM tape sublevel usage and invocation

- **A new SUBLEVEL column is added to OAM's TAPEVOL table in DB2 to indicate which tape sublevel (TSL1 or TSL2) each tape volume is associated with.**
 - ▶ Valid values are:
 - 1 - This volume is associated with sublevel 1.
 - 2 - This volume is associated with sublevel 2.
 - *Blank* - This volume is not associated with a sublevel.
Only applies to OAM scratch or backup volumes.

Now the DB2 tape volume table must have a new column SUBLEVEL for each tape volume: 1, 2, or blank, to indicate which tape sublevel it is associated with.

If the tape volume has a blank SUBLEVEL, it must be either a scratch volume or a backup volume.

OAM tape sublevel usage and invocation

- The **ODLOCFL** column on OAM's object directory table in DB2 indicates on what storage hierarchy the primary copy of a given object resides.
 - ▶ 'D' = DASD
 - ▶ 'R' = Recalled
 - ▶ Blank = Optical
 - ▶ 'T' = Tape (TSL1)
 - ▶ **'U' = Tape (TSL2)**

The ODLOCFL column in OAM's Object Directory Table indicates on what storage hierarchy the primary copy of a given object resides. The current valid values for this column are 'D', 'R', blank, and 'T' which indicate DASD, Recalled, Optical and Tape respectively.

With this support, the 'T' will signify that the object resides on TSL1 media and a new indicator value 'U' will be introduced to signify that the object resides on TSL2 media.

OAM tape sublevel usage and invocation

Operator command	New	Changed syntax	Changed results
F OAM,UPDATE,SETOAM	No	Yes	Yes
F OAM,DISPLAY,SETOAM	No	No	Yes
F OAM,DISPLAY,VOL	No	No	Yes
F OAM,START,RECYCLE	No	Yes	Yes
D SMS,STORGRP(<i>grp-name</i>),DETAIL	No	No	Yes
D SMS,OSMC,TASK(<i>OSMC-task</i>)	No	No	Yes
F OAM,START,MOVEVOL	No	No	No***
F OAM,START,RECOVERY	No	No	No***

F OAM,UPDATE,SETOAM - New L2TAPEUNITNAME and L2DATACLASS keywords for SETOAM statement

F OAM,DISPLAY,SETOAM - New L2TAPEUNITNAME and L2DATACLASS keywords for SETOAM statement

F OAM,DISPLAY,VOL - Display volume's SUBLEVEL (1|2|blank)

F OAM,START,RECYCLE - Optionally specify which sublevel you want to recycle.

D SMS,STORGRP(*group-name*),DETAIL - Display L2TAPEUNITNAME and L2DATACLASS associated with this Storage Group

D SMS,OSMC,TASK(*active-OSMC-task*) - Display stats for writes to TSL2

No change to MOVEVOL or RECOVERY behavior, but worth mentioning that MOVEVOL and RECOVERY continue to move or recover primary objects from media to media in the same family. That is, before this support:

Optical → Optical (MOVEVOL/RECOVERY of optical volume, moved/recovered objects to a new optical volume)

Tape → Tape (MOVEVOL/RECOVERY of tape volume, moved/recovered objects to a new tape volume)

With V1R9 tape sublevel support:

Optical → Optical (MOVEVOL/RECOVERY of optical volume, moves/recovers objects to a new optical volume)

TSL1 → TSL1 (MOVEVOL/RECOVERY of tape sublevel 1 volume, moves/recovers objects to a new tape sublevel 1 volume)

TSL2 → TSL2 (MOVEVOL/RECOVERY of tape sublevel 2 volume, moves/recovers objects to a new tape sublevel 2 volume)

OAM tape sublevel usage and invocation

- SMF (type 85) records will be enhanced to reflect information regarding tape sublevel support:
 - ▶ Subtype 2: OSREQ STORE
 - ▶ Subtype 3: OSREQ RETRIEVE
 - ▶ Subtype 6: OSREQ DELETE
 - ▶ Subtype 32: OSMC Storage Group Processing
 - ▶ Subtype 40: Tape RECYCLE Command
 - ▶ Subtype 78: LCS Write Tape Request
 - ▶ Subtype 79: LCS Read Tape Request
 - ▶ Subtype 87: Demount Tape Volume

Several OAM SMF subtypes are modified to report Tape Sublevel info.

Subtype 2: OSREQ STORE - Set bits to indicate object stored on TSL1 or TSL2 media

Subtype 3: OSREQ RETRIEVE - Set bits to indicate object retrieved from TSL1 or TSL2 media

Subtype 6: OSREQ DELETE - Set bits to indicate object deleted from TSL1 or TSL2 media

Subtype 32: OSMC Storage Group Processing - New fields to report stats for read, writes and deletes involving TSL2 media

Subtype 40: Tape RECYCLE command - New field to indicate what sublevel specified on RECYCLE command

Subtype 78: LCS Tape Write Request - Set bits to indicate object written to TSL1 or TSL2 media

Subtype 79: LCS Tape Read Request - Set bits to indicate object read from TSL1 or TSL2 media

Subtype 87: LCS Tape Demount - Set bits to indicate demounted tape is TSL1 or TSL2 media

Migration and coexistence considerations

- Modify and run CBRSMR19 Migration job to add new SUBLEVEL column to DB2 TAPEVOL table.
- Modify and run CBRPBIND and any application binds.
- V1R9 Coexistence APAR OA17812 must be installed on any pre-V1R9 level systems before starting OAM the first time on V1R9.
 - ▶ PTF UA32909 for V1R7
 - ▶ PTF UA32910 for V1R8

Regardless of whether or not you intend to exploit the new function, you must modify and run the CBRSMR19 migration job to add the new TSL column to the DB2 TAPEVOL table, and prime it with '1' for grouped volumes and blank for scratch and backup volumes.

If you are running in an OAMplex, and is sharing data across systems, your system administrator must ensure all systems are capable of tape sublevel support before enabling the new support. To ensure all systems are capable of tape sublevel support, all systems in the OAMplex must have the OAM, ISMF and SMS modifications for tape sublevel support installed. (OA17812, PTFs UA32908, UA32909, UA32910 for V1R6, V1R7 and V1R8 respectively)

Migration and coexistence considerations

- OAM V1R9 Coexistence APAR OA17812 required on pre-V1R9 level systems in OAMplex with V1R9 level system.
- **Pre-V1R9 levels will**
 - ▶ Have no knowledge of the new OAM Sublevel (OSL) parameter in the SMS construct.
 - ▶ Always store to TSL1 volumes regardless of OSL parm in storage class.
 - ▶ Mark volumes SUBLEVEL='1' when scratch volumes assigned to object storage group.
 - ▶ Mark volumes SUBLEVEL=blank when recycled to OAMSCRATCH.
 - ▶ **Not recognize TSL2 volumes**, and therefore any attempts to access those volumes will be failed.

To support OAMplex customers, coexistence support is provided at the pre-V1R9 release levels for this enhancement.

Pre-V1R9 levels will

Have no knowledge of the new OAM Sublevel (OSL) parameter in the SMS construct.

Always store to TSL1 volumes regardless of OSL parm in storage class.

- Not write to TSL2 volumes.

Mark volumes SUBLEVEL='1' when scratch volumes assigned to object storage group.

Mark volumes SUBLEVEL=blank when recycled to OAMSCRATCH.

Not recognize TSL2 volumes, and therefore any attempts to access those volumes will be failed.

- OSREQ RETRIEVE (unknown value in ODLOCFL)
- OSREQ DELETE (unknown value in ODLOCFL)
- OSMC READ due to
 - Volume Recovery
 - Object Recovery
 - Movevol
 - Recycle
 - Object Recall

OSMC storage group processing will ignore objects w/ ODLOCFL='U'.

- A CBR9225I message issued for each collection.
- Backup, Transition, Object Expiration, Volume Expiration will not be performed for these objects.

OSMC fail if volser in ODLLOC not found.

- OSMC Restore of recalled object back to TSL2 tape will fail.
- OSMC transition from DB2 to TSL2 tape will fail.

If the SETOAM statements are added to the CBROAMxx member of PARMLIB and the system is backed down to a previous level of DFSMS, the new SETOAM statements relating to TSL2 need to be removed from PARMLIB.

References

- *z/OS® DFSMS V1R9 Object Access Method (OAM) Planning, Installation, and Storage Administration Guide for Object Support*

This information is provided for reference.

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