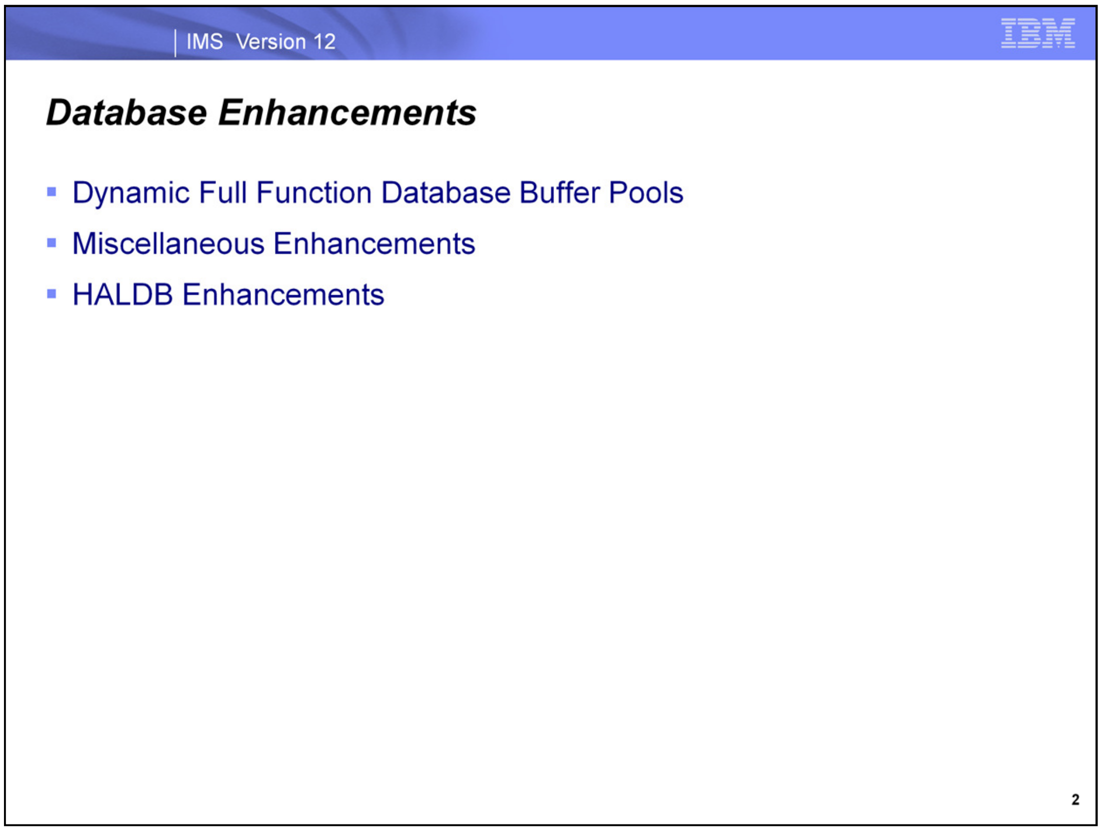
IMS Version 12

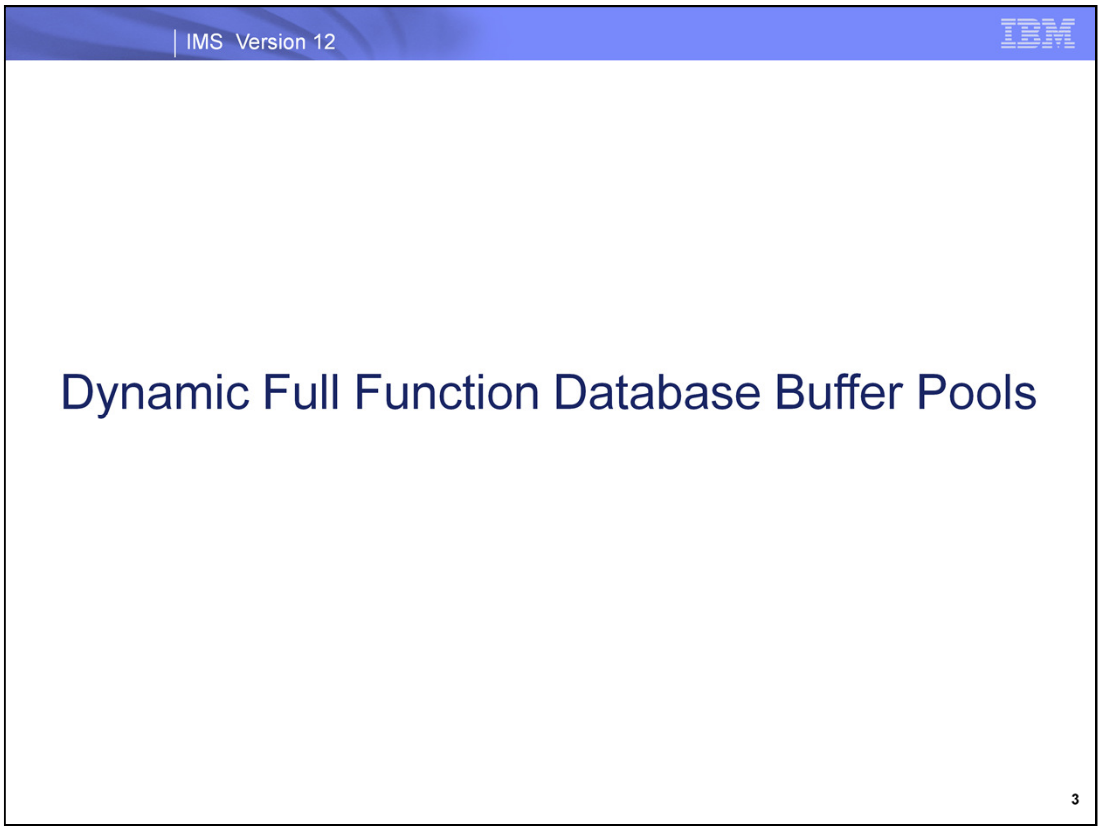
Database

Information Management software



Database Enhancements

- Dynamic Full Function Database Buffer Pools
- Miscellaneous Enhancements
- HALDB Enhancements



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Dynamic Full Function Database Buffer Pools

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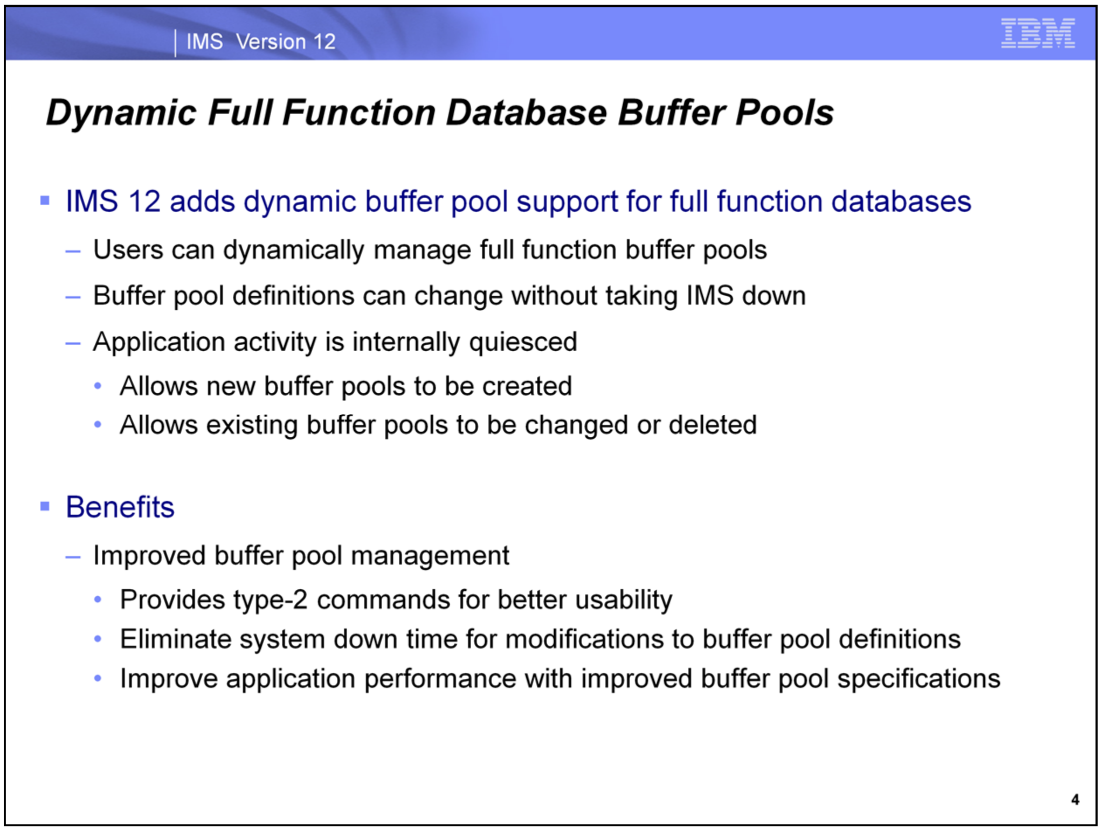
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Dynamic Full Function Database Buffer Pools

- IMS 12 adds dynamic buffer pool support for full function databases
  - Users can dynamically manage full function buffer pools
  - Buffer pool definitions can change without taking IMS down
  - Application activity is internally quiesced
    - Allows new buffer pools to be created
    - Allows existing buffer pools to be changed or deleted
- Benefits
  - Improved buffer pool management
    - Provides type-2 commands for better usability
    - Eliminate system down time for modifications to buffer pool definitions
    - Improve application performance with improved buffer pool specifications

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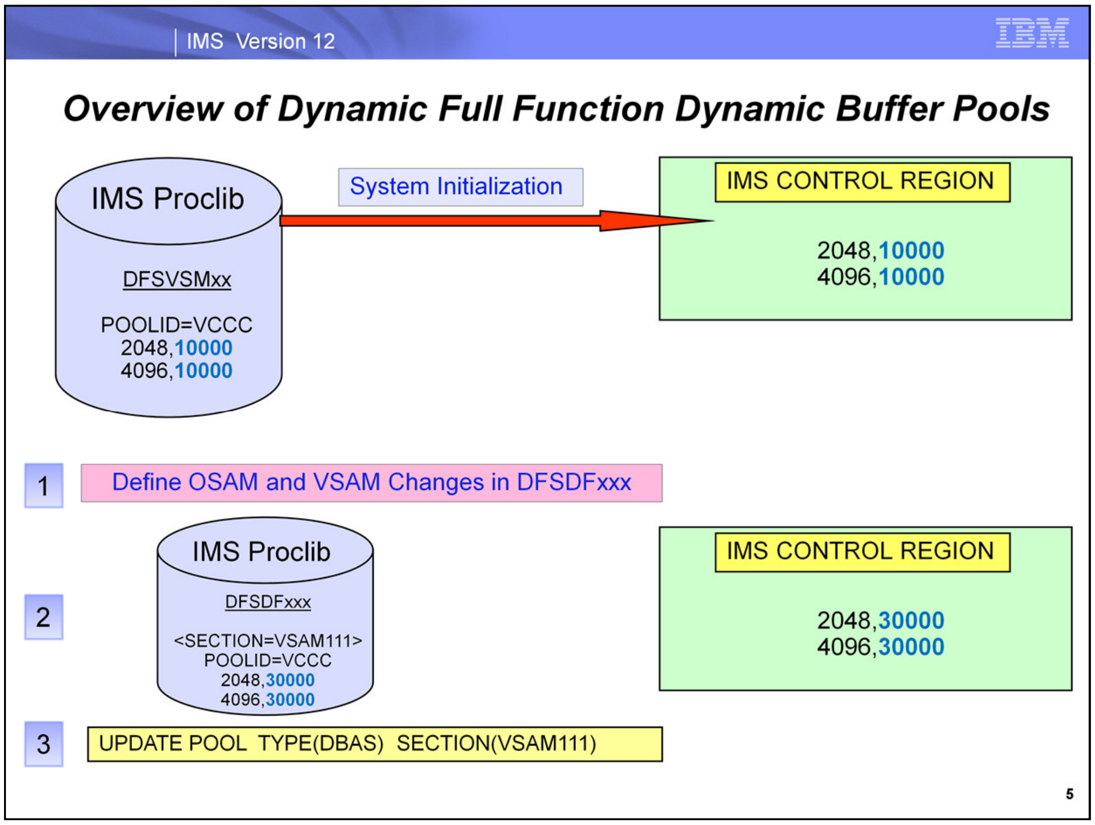
With IMS 12, users can add, change and delete full function buffer pools. This support is provided using new specifications in the DFSDFxxx proclib member in conjunction with the UPDATE POOL command. With this support, full function buffer pools can be managed without restarting IMS. IMS is able to internally quiesce application read and update activity to allow the UPDATE POOL command to complete with very little disruption to transaction workloads. Finally, with the ability to dynamically update full function buffer pool specifications, there can be better application performance when the buffer pools are sufficient to avoid unnecessary I/O.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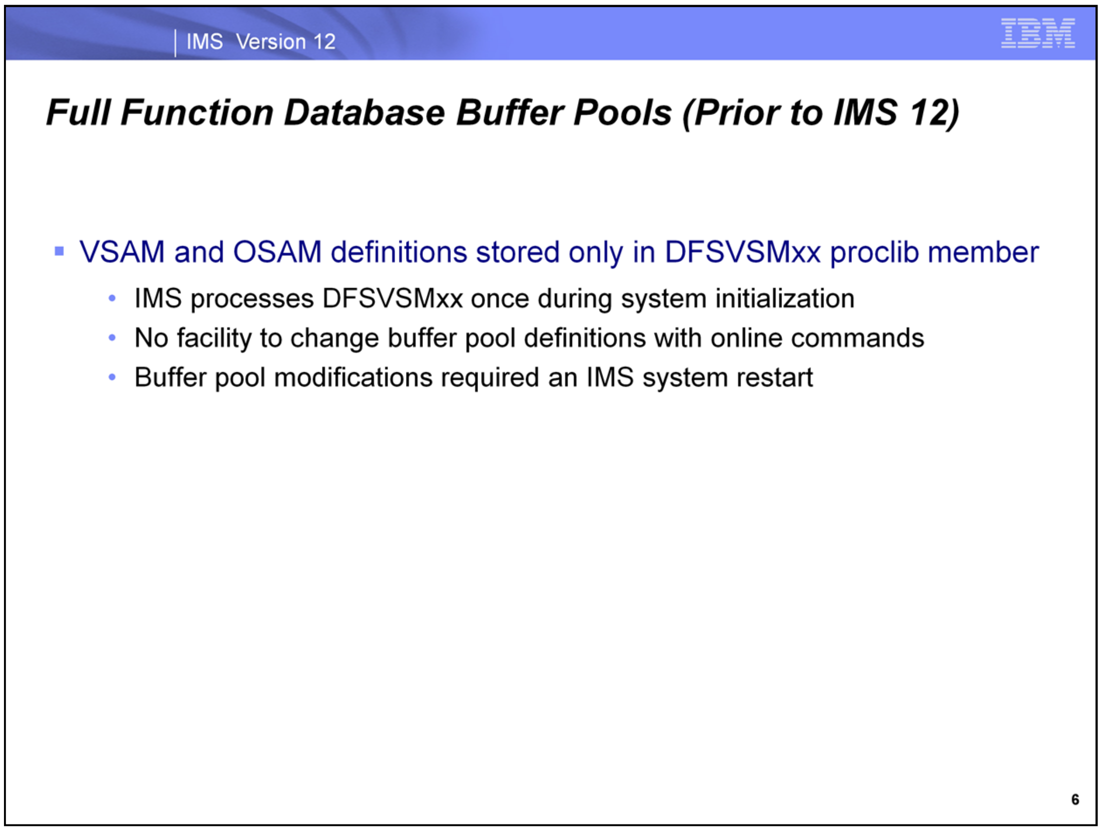
Overview of Dynamic Full Function Dynamic Buffer Pools

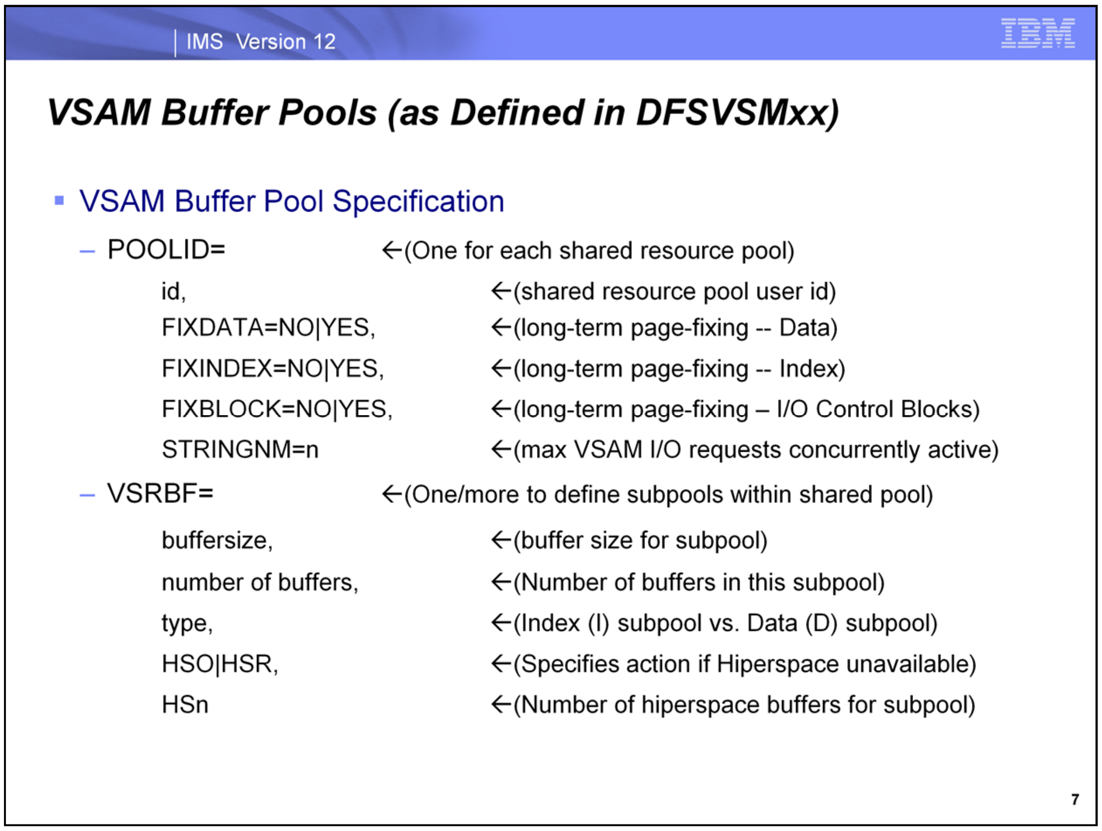
At system initialization, the full function buffer pool specifications are loaded from the DFSVSMxx member in the IMS PROCLIB data set. These buffer pool specifications can be changed dynamically by specifying new definition sections for OSAM and VSAM in the DFSDFxxx member of the IMS PROCLIB data set. An UPDATE POOL TYPE(DBAS) SECTION(OSAMxxx,VSAMxxx) must be issued to bring these full function buffer pool definitions into affect. These dynamic changes are retained across an Emergency Restart because they are stored in the Restart Data Set. However, the changes are lost with a subsequent Cold or Warm Start. To make the changes permanent, it is necessary to change the DFSVSMxx proclib member, too.



Full Function Database Buffer Pools (Prior to IMS 12)

- VSAM and OSAM definitions stored only in DFSVSMxx proclib member
  - IMS processes DFSVSMxx once during system initialization
  - No facility to change buffer pool definitions with online commands
  - Buffer pool modifications required an IMS system restart

In IMS 11 and earlier releases, the VSAM and OSAM buffer pool definitions were only stored in the DFSVSMxx proclib member. This member is only loaded once during IMS initialization. There is no facility to change the buffer pool definitions without changing the DFSVSMxx member in proclib and restarting IMS.



VSAM Buffer Pools (as Defined in DFSVSMxx)

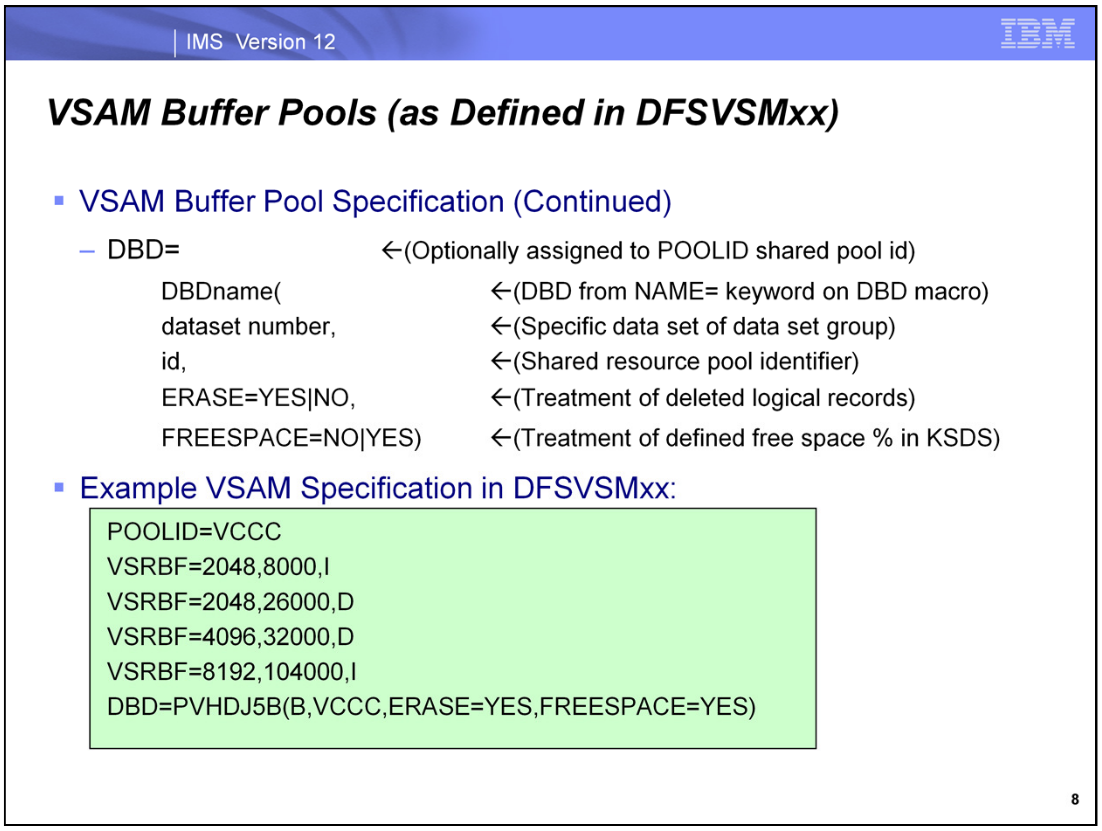
- VSAM Buffer Pool Specification
  - POOLID= ←(One for each shared resource pool)

id,	←(shared resource pool user id)
FIXDATA=NO|YES,	←(long-term page-fixing -- Data)
FIXINDEX=NO|YES,	←(long-term page-fixing -- Index)
FIXBLOCK=NO|YES,	←(long-term page-fixing – I/O Control Blocks)
STRINGNM=n	←(max VSAM I/O requests concurrently active)

  - VSRBF= ←(One/more to define subpools within shared pool)

buffersize,	←(buffer size for subpool)
number of buffers,	←(Number of buffers in this subpool)
type,	←(Index (I) subpool vs. Data (D) subpool)
HSO|HSR,	←(Specifies action if Hiperspace unavailable)
HSn	←(Number of hiperspace buffers for subpool)

In the DFSVSMxx proclib member, there are three parts to the VSAM buffer pool specification: 1) POOLID, 2) VSRBF, and 3) DBD. These are the keywords for the POOLID and VSRBF statements.



VSAM Buffer Pools (as Defined in DFSVSMxx)

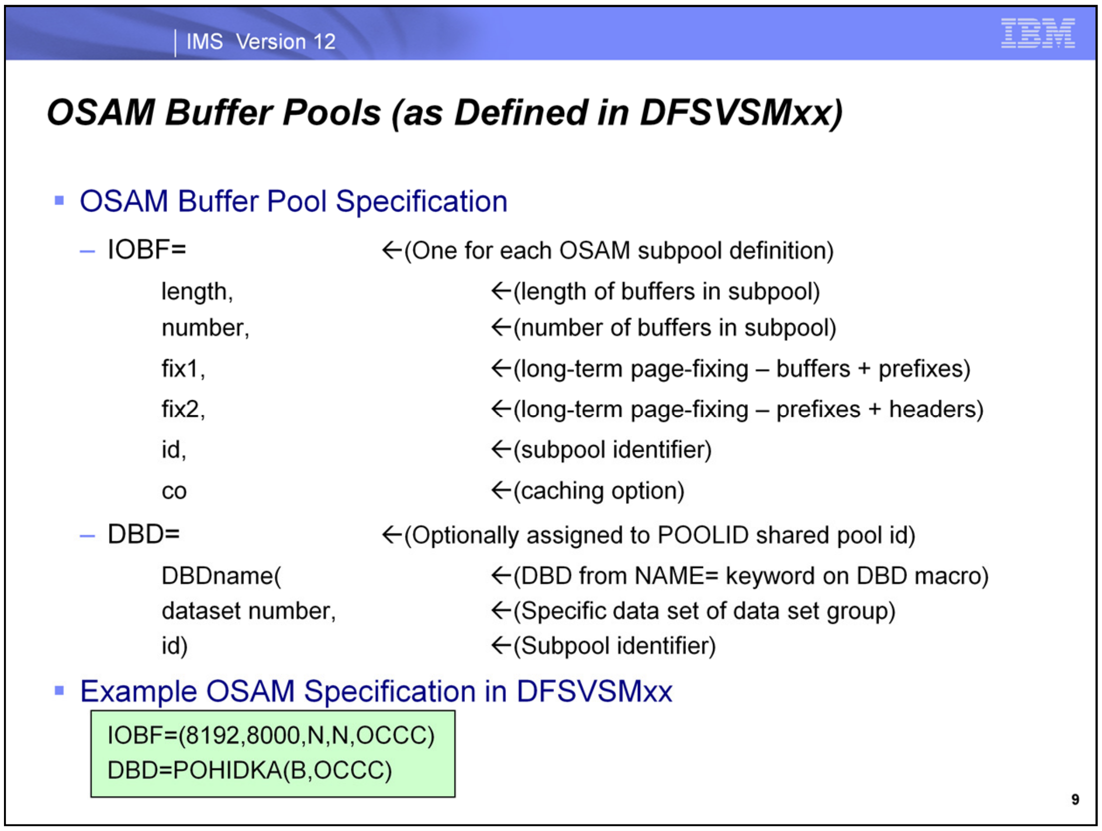
- VSAM Buffer Pool Specification (Continued)
  - DBD= ←(Optionally assigned to POOLID shared pool id)

DBDname(	←(DBD from NAME= keyword on DBD macro)
dataset number,	←(Specific data set of data set group)
id,	←(Shared resource pool identifier)
ERASE=YES|NO,	←(Treatment of deleted logical records)
FREESPACE=NO|YES)	←(Treatment of defined free space % in KSDS)

- Example VSAM Specification in DFSVSMxx:

```
POOLID=VCCC
VSRBF=2048,8000,I
VSRBF=2048,26000,D
VSRBF=4096,32000,D
VSRBF=8192,104000,I
DBD=PVHDJ5B(B,VCCC,ERASE=YES,FREESPACE=YES)
```

These are the keywords for the DBD statement which allows a DBD to be assigned to a specific POOLID.



OSAM Buffer Pools (as Defined in DFSVSMxx)

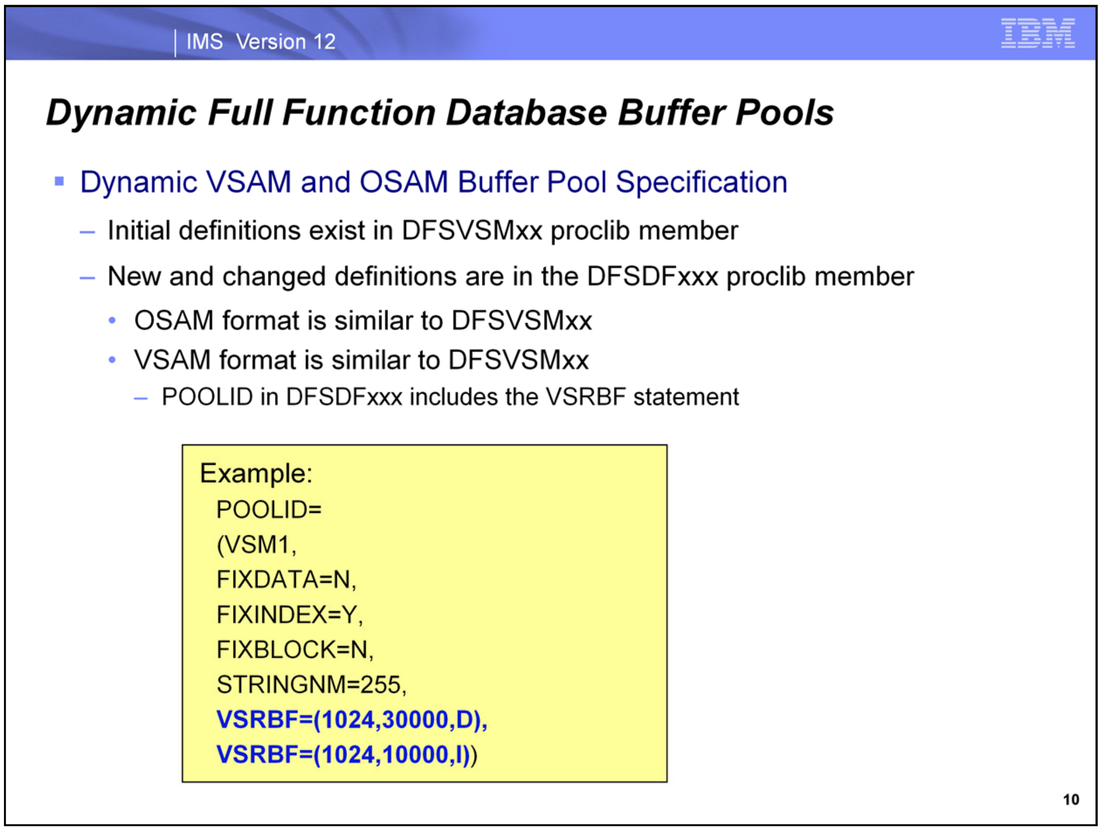
- OSAM Buffer Pool Specification

– IOBF=	←(One for each OSAM subpool definition)
length,	←(length of buffers in subpool)
number,	←(number of buffers in subpool)
fix1,	←(long-term page-fixing – buffers + prefixes)
fix2,	←(long-term page-fixing – prefixes + headers)
id,	←(subpool identifier)
co	←(caching option)
– DBD=	←(Optionally assigned to POOLID shared pool id)
DBDname(	←(DBD from NAME= keyword on DBD macro)
dataset number,	←(Specific data set of data set group)
id)	←(Subpool identifier)

- Example OSAM Specification in DFSVSMxx

```
IOBF=(8192,8000,N,N,OCCC)
DBD=POHIDKA(B,OCCC)
```

In the DFSVSMxx proclib member, the OSAM Buffer Pool specifications have two statements: 1) IOBF, and 2) DBD.



Dynamic Full Function Database Buffer Pools

- Dynamic VSAM and OSAM Buffer Pool Specification
  - Initial definitions exist in DFSVSMxx proclib member
  - New and changed definitions are in the DFSDFxxx proclib member
    - OSAM format is similar to DFSVSMxx
    - VSAM format is similar to DFSVSMxx
      - POOLID in DFSDFxxx includes the VSRBF statement

Example:

```
POOLID=
(VSM1,
FIXDATA=N,
FIXINDEX=Y,
FIXBLOCK=N,
STRINGNM=255,
VSRBF=(1024,30000,D),
VSRBF=(1024,10000,I))
```

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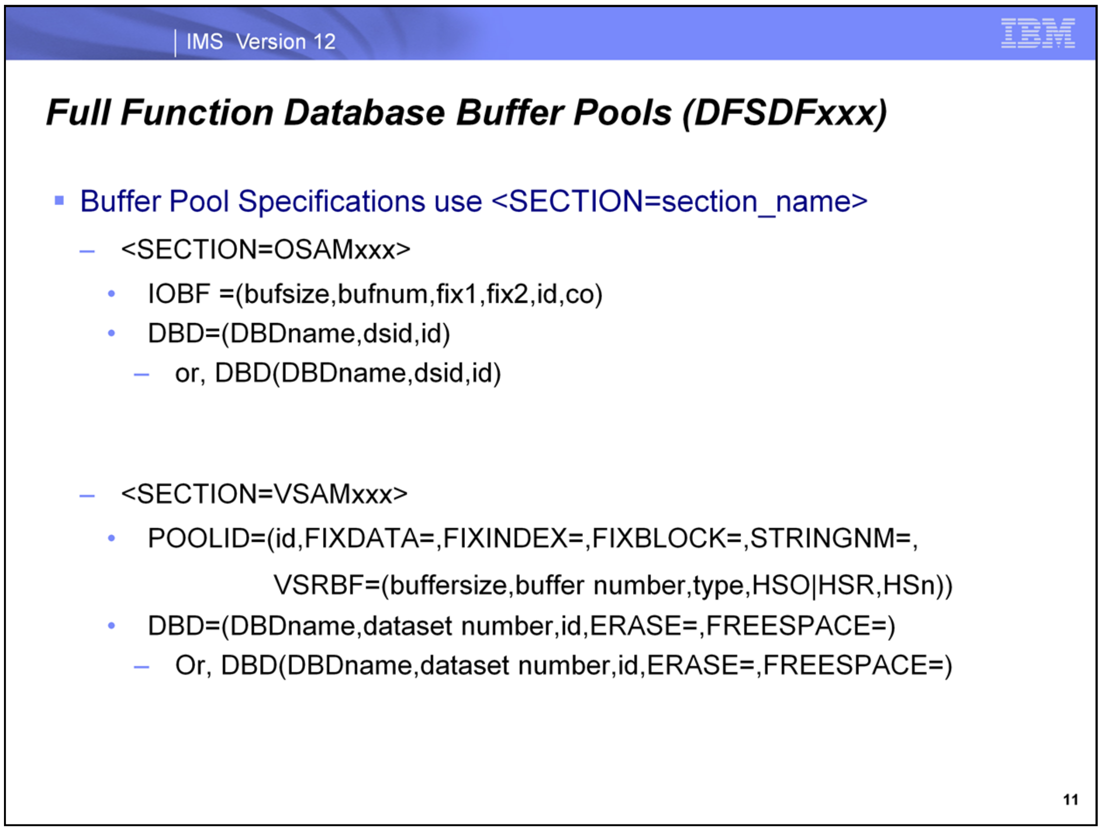
With IMS 12, there is a new feature for dynamically adding, updating and deleting VSAM and OSAM buffer pools. The initial VSAM and OSAM buffer pool specifications still exist in the DFSVSMxx proclib member and they are loaded during normal restart. However, new VSAM and OSAM buffer pools can be added and existing buffer pools can be changed using specifications in one or more DFSDFxxx proclib members in conjunction with the type-2 UPDATE POOL command.



Full Function Database Buffer Pools (DFSDFxxx)

- Buffer Pool Specifications use <SECTION=section_name>
  - <SECTION=OSAMxxx>
    - IOBF =(bufsize,bufnum,fix1,fix2,id,co)
    - DBD=(DBDname,dsid,id)
      - or, DBD(DBDname,dsid,id)
  - <SECTION=VSAMxxx>
    - POOLID=(id,FIXDATA=,FIXINDEX=,FIXBLOCK=,STRINGNM=,
      VSRBF=(buffersize,buffer number,type,HSO|HSR,HSn))
    - DBD=(DBDname,dataset number,id,ERASE=,FREESPACE=)
      - Or, DBD(DBDname,dataset number,id,ERASE=,FREESPACE=)

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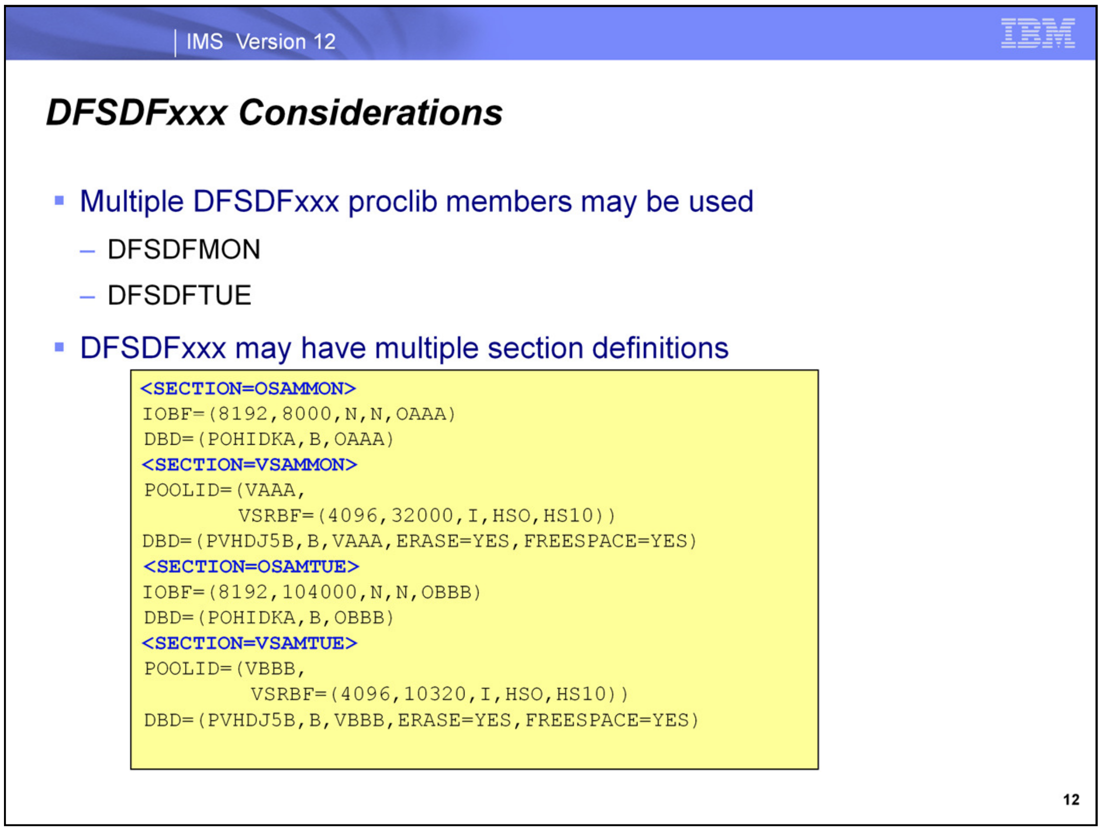
The OSAM buffer pool specifications in the DFSDFxxx proclib member are under Section headings. For example, the OSAM section is <SECTION=OSAMxxx> where xxx is any alphanumeric characters. Similarly, the VSAM buffer pool specifications are under the section heading <SECTION=VSAMxxx>.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DFSDFxxx Considerations

- Multiple DFSDFxxx proclib members may be used
  - DFSDFMON
  - DFSDFTUE
- DFSDFxxx may have multiple section definitions

```
<SECTION=OSAMMON>
IOBF=(8192,8000,N,N,OAAA)
DBD=(POHIDKA,B,OAAA)
<SECTION=VSAMMON>
POOLID=(VAAA,
       VSRBF=(4096,32000,I,HSO,HS10))
DBD=(PVHDJ5B,B,VAAA,ERASE=YES,FREESPACE=YES)
<SECTION=OSAMTUE>
IOBF=(8192,104000,N,N,OBBB)
DBD=(POHIDKA,B,OBBB)
<SECTION=VSAMTUE>
POOLID=(VBBB,
        VSRBF=(4096,10320,I,HSO,HS10))
DBD=(PVHDJ5B,B,VBBB,ERASE=YES,FREESPACE=YES)
```

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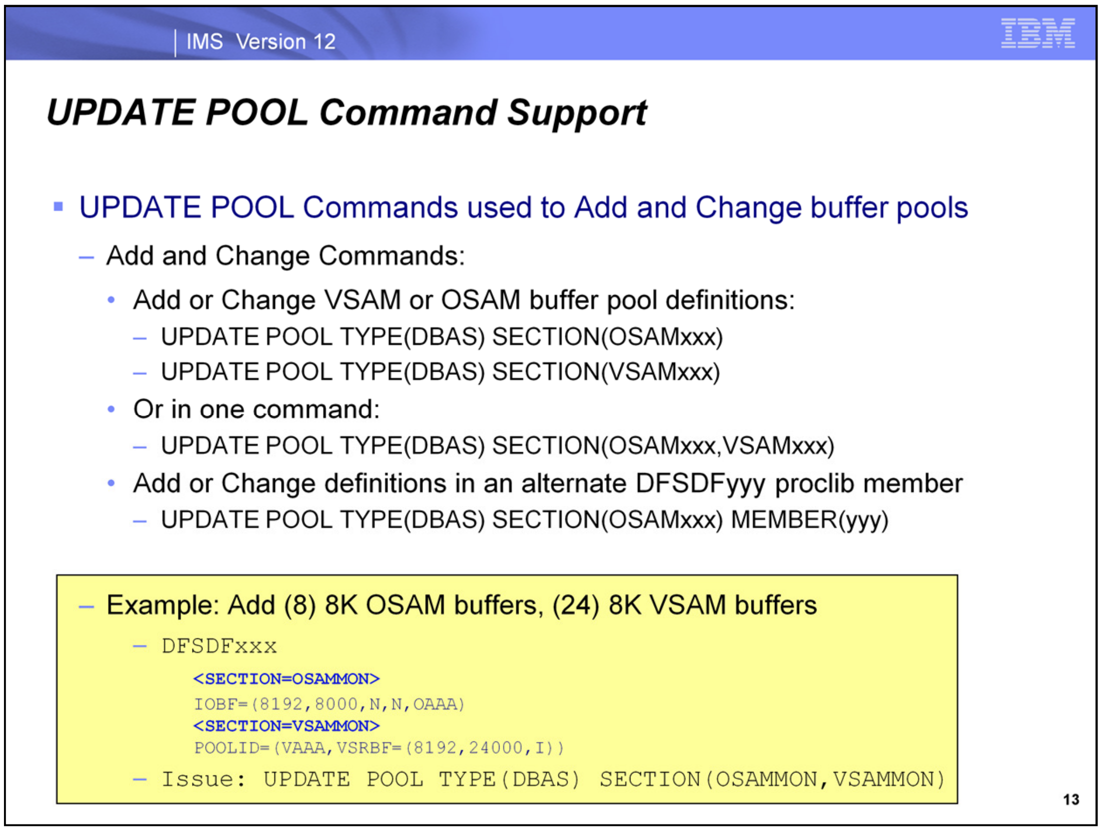
The VSAM and OSAM buffer pool specifications can be placed into different DFSDFxxx members in proclib since the UPDATE POOL command allows the user to specify the MEMBER keyword identifying the suffix of the DFSDFxxx proclib member in the proclib data set. Alternatively, the user can specify multiple VSAM and OSAM sections within one or more DFSDFxxx members.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UPDATE POOL Command Support

- UPDATE POOL Commands used to Add and Change buffer pools
  - Add and Change Commands:
    - Add or Change VSAM or OSAM buffer pool definitions:
      - UPDATE POOL TYPE(DBAS) SECTION(OSAMxxx)
      - UPDATE POOL TYPE(DBAS) SECTION(VSAMxxx)
    - Or in one command:
      - UPDATE POOL TYPE(DBAS) SECTION(OSAMxxx,VSAMxxx)
    - Add or Change definitions in an alternate DFSDFyyy proclib member
      - UPDATE POOL TYPE(DBAS) SECTION(OSAMxxx) MEMBER(yyy)

- Example: Add (8) 8K OSAM buffers, (24) 8K VSAM buffers
  - DFSDFxxx

```
<SECTION=OSAMMON>
IOBF=(8192,8000,N,N,OAAA)
<SECTION=VSAMMON>
POOLID=(VAAA,VSRBF=(8192,24000,I))
```

  - Issue: UPDATE POOL TYPE(DBAS) SECTION(OSAMMON,VSAMMON)

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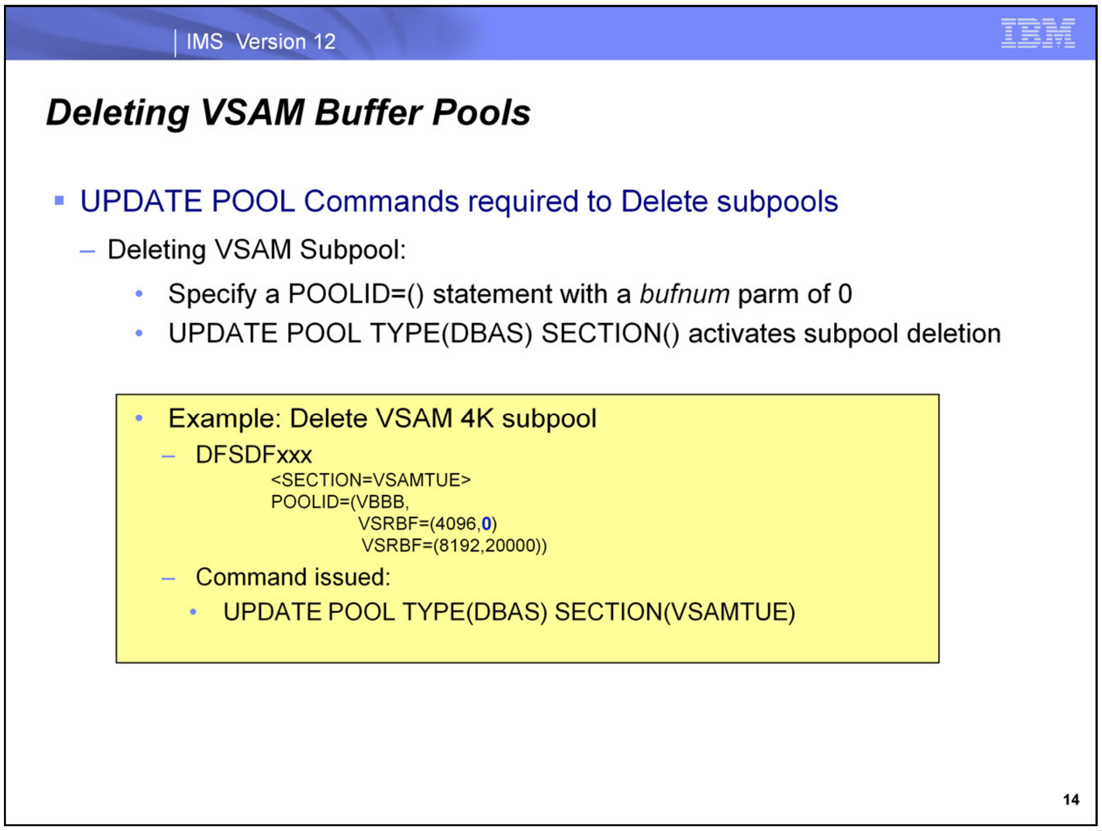
The ability to add or change VSAM and OSAM buffer pools requires both the DFSDFxxx proclib member specifications along with the type-2 UPDATE POOL command identifying the statement sections. The UPDATE POOL command can be issued individually for specific VSAM and OSAM sections, or the command can be issued for both VSAM and OSAM sections in the same command. The UPDATE POOL command can also reference a specific DFSDFxxx proclib member in the proclib data set using the MEMBER(yyy) keyword. In this case, yyy is the suffix used in DFSDFyyy. The default for yyy is 000.



Deleting VSAM Buffer Pools

- UPDATE POOL Commands required to Delete subpools
  - Deleting VSAM Subpool:
    - Specify a POOLID=() statement with a *bufnum* parm of 0
    - UPDATE POOL TYPE(DBAS) SECTION() activates subpool deletion

- Example: Delete VSAM 4K subpool
  - DFSDFxxx

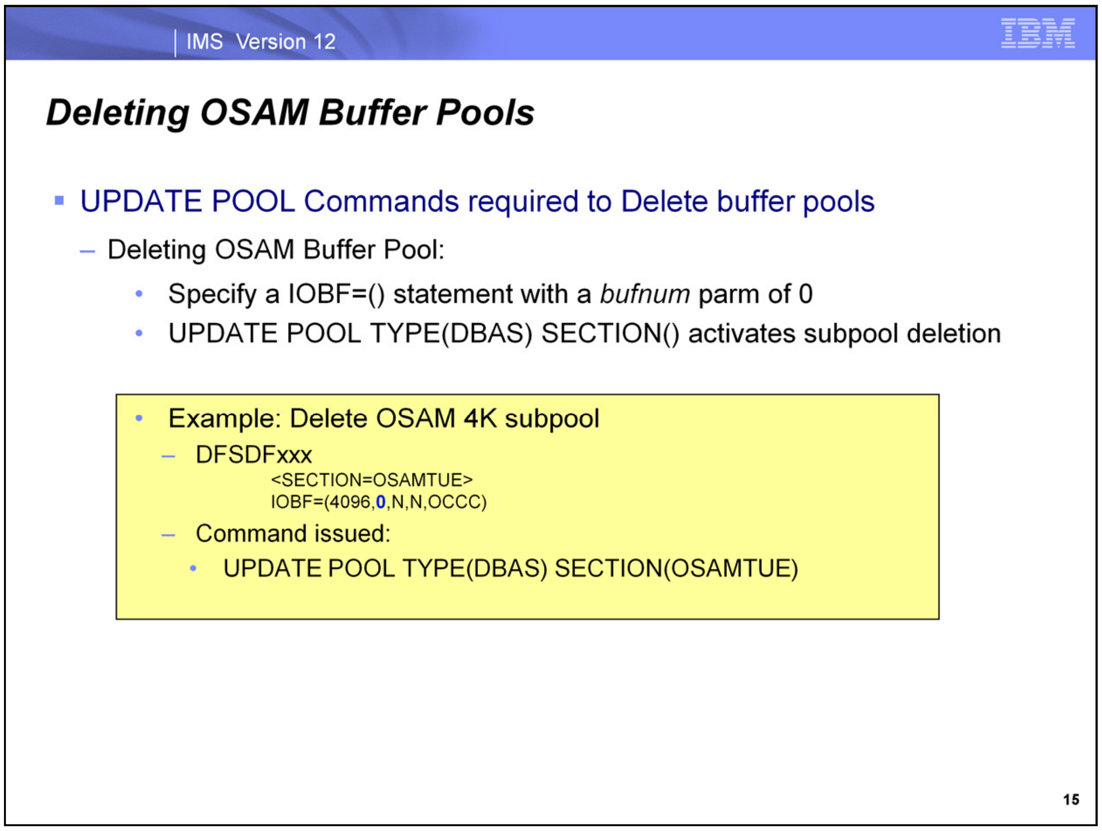
```
<SECTION=VSAMTUE>
POOLID=(VBBB,
        VSRBF=(4096,0)
        VSRBF=(8192,20000))
```

  - Command issued:
    - UPDATE POOL TYPE(DBAS) SECTION(VSAMTUE)

It is possible to delete a VSAM buffer pool by specifying a POOLID in a VSAM section with the VSRBF statement for the size of the buffer and a “0” for the number of buffers. The UPDATE POOL command is needed to complete the deletion of the VSAM buffer pool.

The database data set association with a subpool is established when the database data set is opened. If there is a database data set using a subpool that is to be deleted, the UPDATE POOL command must wait until the access to the subpool is completed before it can delete the subpool.

When the subpool is deleted, there is no association between the subpool and the database data set and the database data set can be associated with a new subpool by simply creating a new DBD= statement.



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Deleting OSAM Buffer Pools

- UPDATE POOL Commands required to Delete buffer pools
  - Deleting OSAM Buffer Pool:
    - Specify a IOBF=() statement with a *bufnum* parm of 0
    - UPDATE POOL TYPE(DBAS) SECTION() activates subpool deletion

- Example: Delete OSAM 4K subpool
  - DFSDFxxx
    ```
    <SECTION=OSAMTUE>
    IOBF=(4096,0,N,N,OCCC)
    ```
  - Command issued:
    - UPDATE POOL TYPE(DBAS) SECTION(OSAMTUE)

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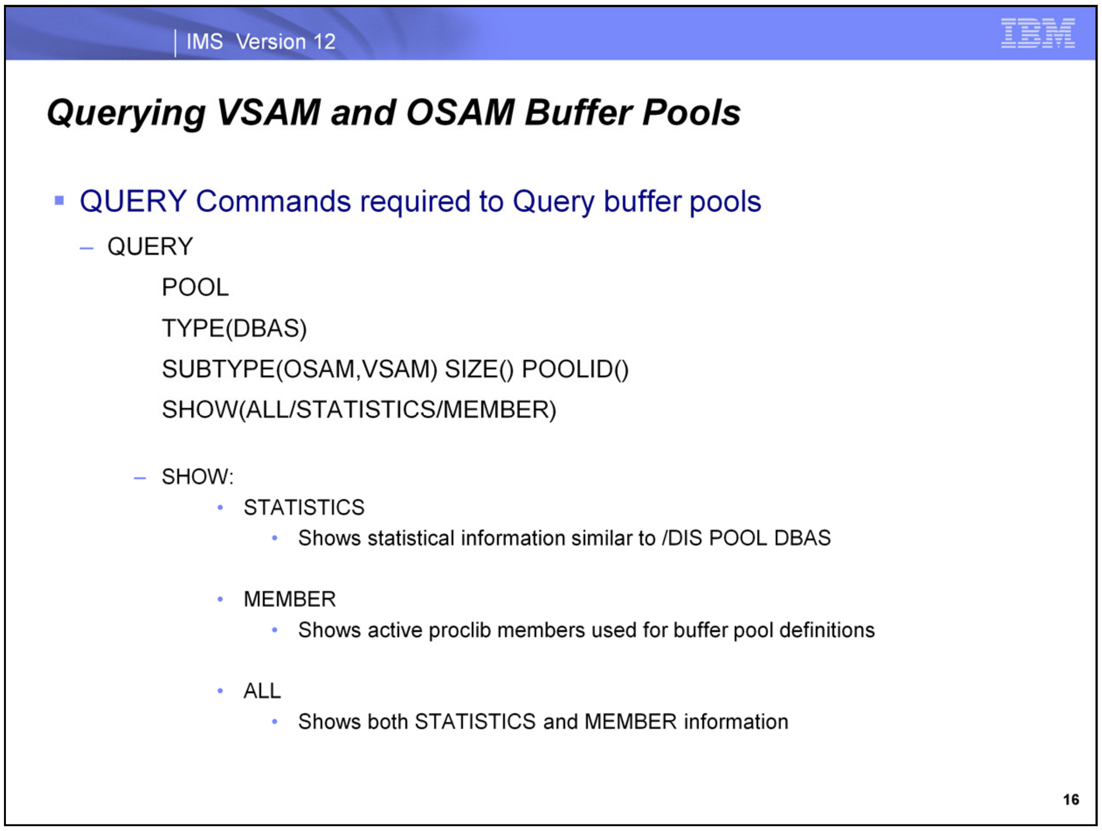
It is possible to delete an OSAM buffer pool by specifying the IOBF statement in the OSAM section using “0” for the number of buffers. The UPDATE POOL command is needed to complete the deletion of the OSAM buffer pool.

As with VSAM, the database data set association with a subpool is established when the database data set is opened. If there is a database data set using a subpool that is to be deleted, the UPDATE POOL command must wait until the access to the subpool is completed before it can delete the subpool.

When the subpool is deleted, there is no association between the subpool and the database data set and the database data set can be associated with a new subpool by simply creating a new DBD= statement.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Querying VSAM and OSAM Buffer Pools

- QUERY Commands required to Query buffer pools
  - QUERY

        POOL
        TYPE(DBAS)
        SUBTYPE(OSAM,VSAM) SIZE() POOLID()
        SHOW(ALL/STATISTICS/MEMBER)

  - SHOW:
    - STATISTICS
      - Shows statistical information similar to /DIS POOL DBAS
    - MEMBER
      - Shows active proclib members used for buffer pool definitions
    - ALL
      - Shows both STATISTICS and MEMBER information

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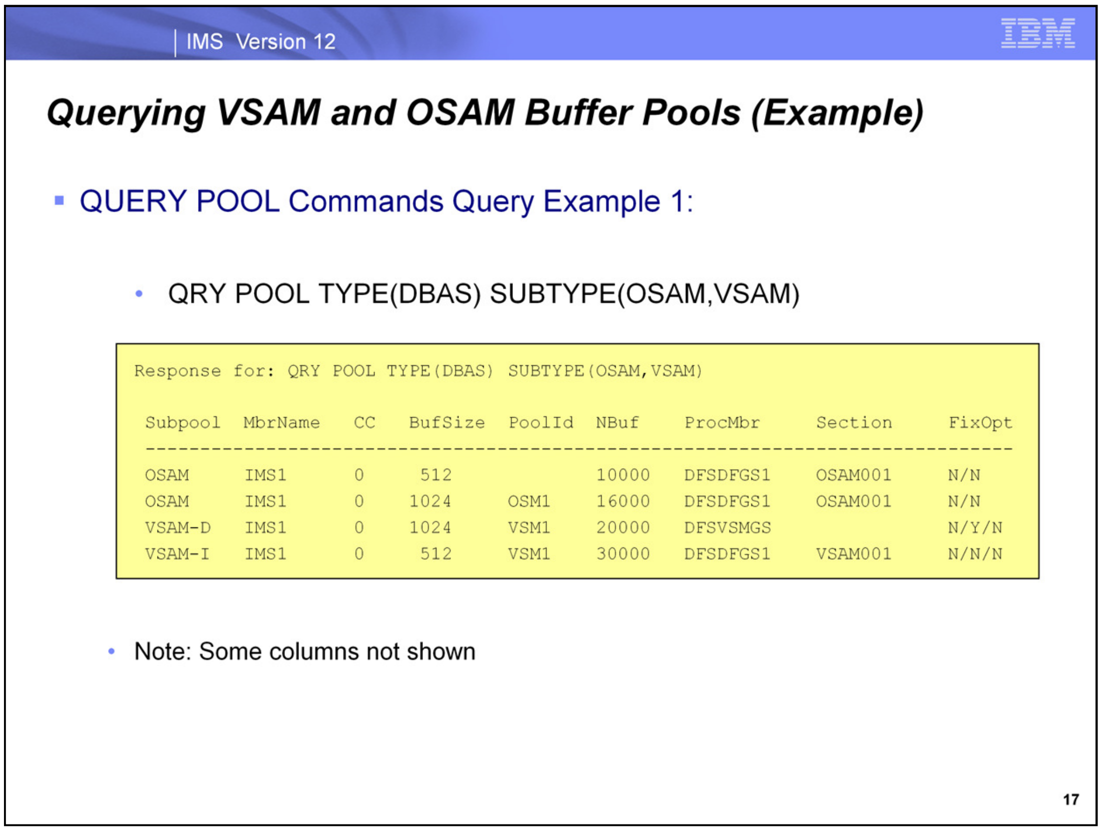
The QUERY POOL command is used to query information about the new and changed VSAM and OSAM buffer pools. The user can specifically limit the output to: 1) OSAM or VSAM buffer pools, 2) buffers of a particular size, or 3) specific pool ids. The options for the SHOW allows the user to show only statistical information that is similar to the current /DIS POOL DBAS command. Alternatively, the user can show the proclib member information used to add or update a buffer pool specification. It is also possible to show both statistical and member information using the ALL parameter.



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Querying VSAM and OSAM Buffer Pools (Example)

- QUERY POOL Commands Query Example 1:
  - QRY POOL TYPE(DBAS) SUBTYPE(OSAM,VSAM)

```
Response for: QRY POOL TYPE(DBAS) SUBTYPE(OSAM,VSAM)

 Subpool  MbrName   CC   BufSize  PoolId  NBuf    ProcMbr     Section     FixOpt
 --------------------------------------------------------------------------------
 OSAM     IMS1      0      512            10000   DFSDFGS1    OSAM001     N/N
 OSAM     IMS1      0     1024     OSM1   16000   DFSDFGS1    OSAM001     N/N
 VSAM-D   IMS1      0     1024     VSM1   20000   DFSVSMGS                N/Y/N
 VSAM-I   IMS1      0      512     VSM1   30000   DFSDFGS1    VSAM001     N/N/N
```

- Note: Some columns not shown

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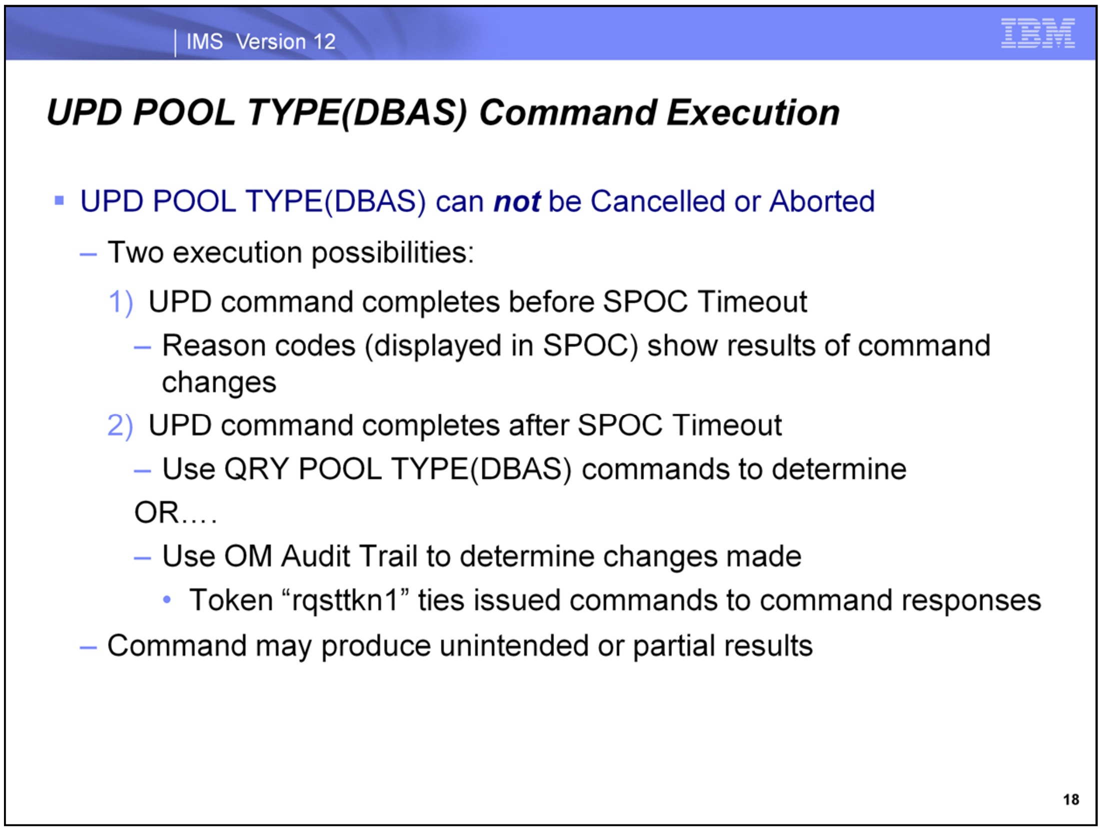
This example shows both VSAM and OSAM buffer pool specifications. It shows the proclib members used to create the various buffer pools and the VSAM and OSAM sections within each proclib member. There were other columns in the output of this command that are not shown here. There are: 1) LctReq/Rrba, 2) NewBlk/Rkey, 3) AltReq/BfAlt, 4) PurgRq/Nrec, 5) FndIpl/SyncPt,) BfSrch/VRds, 6) RdReq/Found, 7) BfStlW/VWts, 8) PurgWr/HSR-S, 9) WBsyId/HSW-S, 10) WBsyWr/HSNBuf, 11) WBsyRd/HS-R-F, 12) WRlseO/HS-W-F, and 13) NumErrors.

It should be noted that the /DIS POOL DBAS command will also show the dynamically added buffer pools.



UPD POOL TYPE(DBAS) Command Execution

- UPD POOL TYPE(DBAS) can ***not*** be Cancelled or Aborted
  - Two execution possibilities:
    1) UPD command completes before SPOC Timeout
       - Reason codes (displayed in SPOC) show results of command changes
    2) UPD command completes after SPOC Timeout
       - Use QRY POOL TYPE(DBAS) commands to determine

       OR….
       - Use OM Audit Trail to determine changes made
         - Token “rqsttkn1” ties issued commands to command responses
  - Command may produce unintended or partial results

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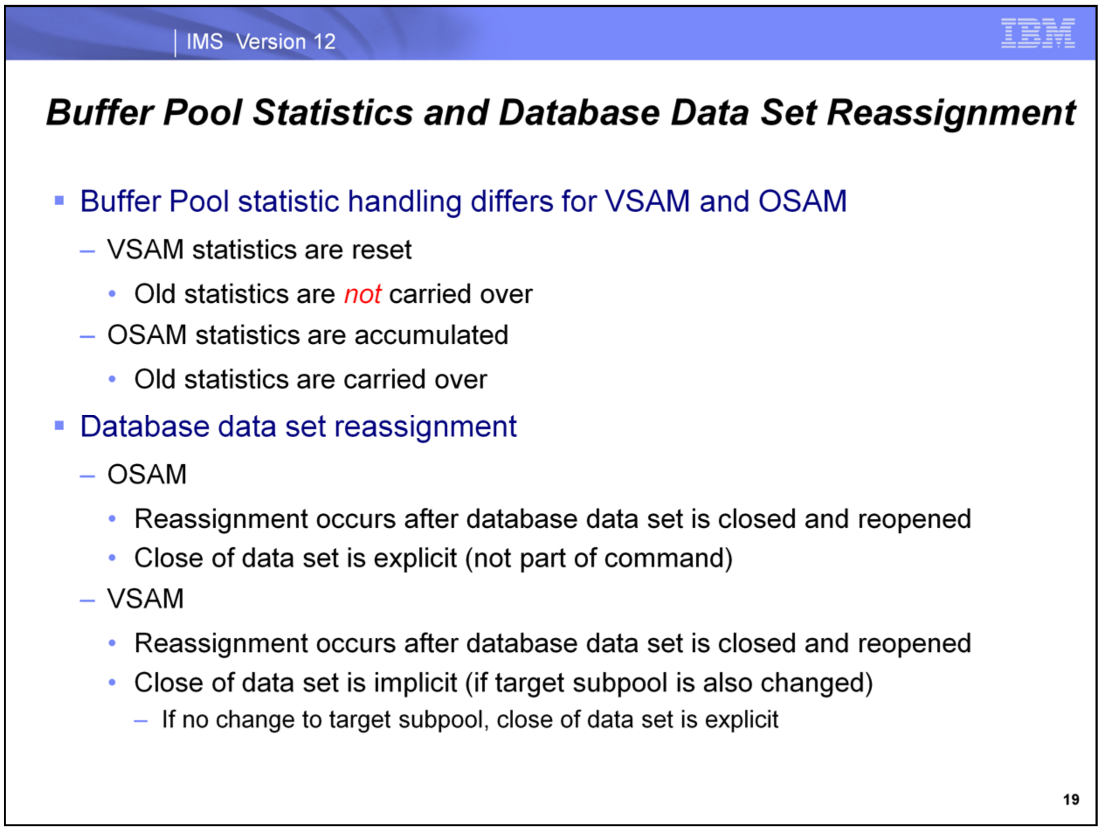
The UPD POOL TYPE(DBAS) command can not be cancelled or aborted once it is issued. There are two execution possibilities for this command. It can complete before the TSO SPOC timeout occurs or it can complete after the TSO SPOC timeout occurs. When the TSO SPOC timeout has occurred, the UPD POOL TYPE(DBAS) command continues to run in the background. If the UPD POOL TYPE(DBAS) command completes prior to the TSO SPOC timeout, then the results are shown on the TSO SPOC with reason codes next to each requested change. If the command completes after the TSO SPOC timeout, a series of targetted QRY POOL TYPE(DBAS) commands can be issued to determine the success or failure of the requested changes. It is also possible to use the OM Audit Trail to determine which changes succeeded, which changes failed, and which changes succeeded partially. The token “rqsttkn1” can be used to tie the commands in the OM Audit Trail to the command responses. The next several charts explain some issues with this command and how the command result might have unintended or partial results.

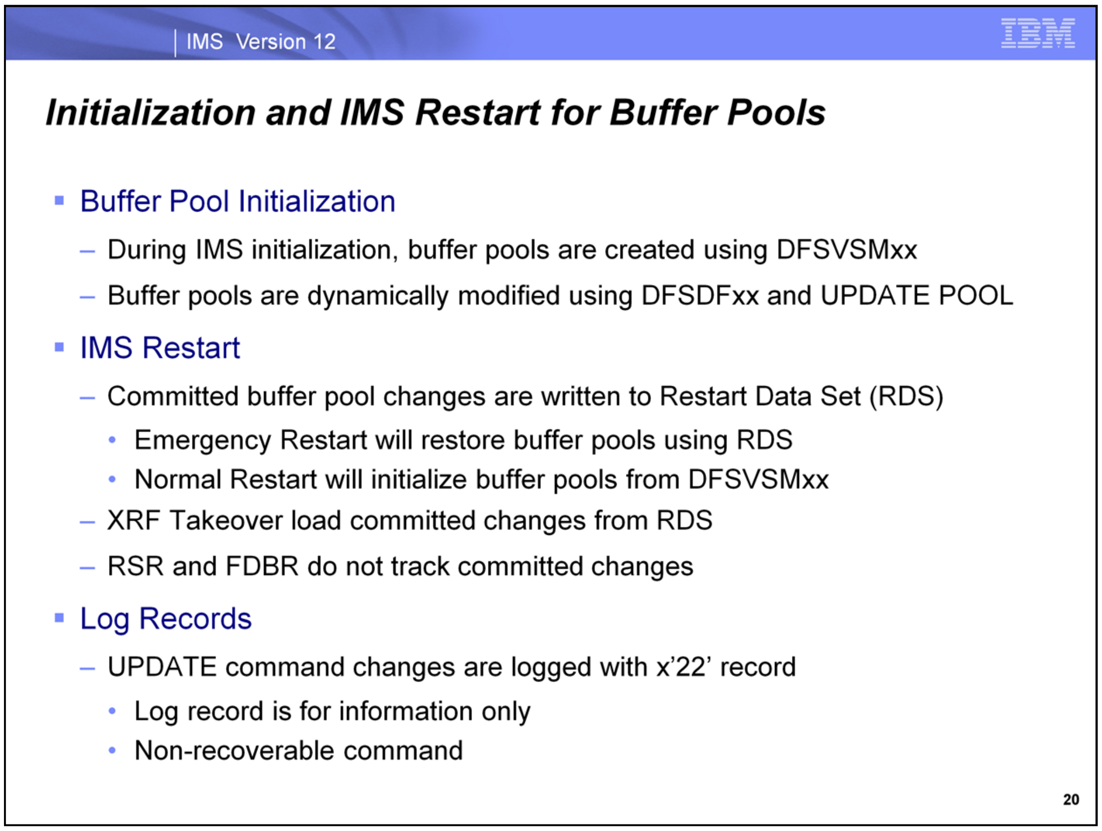


Buffer Pool Statistics and Database Data Set Reassignment

- Buffer Pool statistic handling differs for VSAM and OSAM
  - VSAM statistics are reset
    - Old statistics are *not* carried over
  - OSAM statistics are accumulated
    - Old statistics are carried over
- Database data set reassignment
  - OSAM
    - Reassignment occurs after database data set is closed and reopened
    - Close of data set is explicit (not part of command)
  - VSAM
    - Reassignment occurs after database data set is closed and reopened
    - Close of data set is implicit (if target subpool is also changed)
      - If no change to target subpool, close of data set is explicit

The buffer pool statistics are handled differently for VSAM and OSAM following an UPDATE POOL command. For VSAM, the buffer pool statistics are reset and the old statistics are not carried over. It is advisable to do a QUERY POOL for the VSAM buffer pool statistics prior to issuing the UPDATE POOL command. The OSAM statistics are carried over and are not reset with the UPDATE POOL command.

When a database data set is reassigned from one buffer pool to a different buffer pool, the database data set must be closed and reopened. For OSAM, the closing and reopening of the database data set must be done explicitly. In other words, it is not performed as part of the UPDATE POOL command. For VSAM, the database data set must also be closed and reopened. However, if there is a corresponding change to the target buffer pool along with the reassignment of the database data set (ex. Increase in buffers), then the closing and opening of the database data set is done implicitly by the UPDATE POOL command.



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Initialization and IMS Restart for Buffer Pools

- Buffer Pool Initialization
  - During IMS initialization, buffer pools are created using DFSVSMxx
  - Buffer pools are dynamically modified using DFSDFxx and UPDATE POOL
- IMS Restart
  - Committed buffer pool changes are written to Restart Data Set (RDS)
    - Emergency Restart will restore buffer pools using RDS
    - Normal Restart will initialize buffer pools from DFSVSMxx
  - XRF Takeover load committed changes from RDS
  - RSR and FDBR do not track committed changes
- Log Records
  - UPDATE command changes are logged with x'22' record
    - Log record is for information only
    - Non-recoverable command

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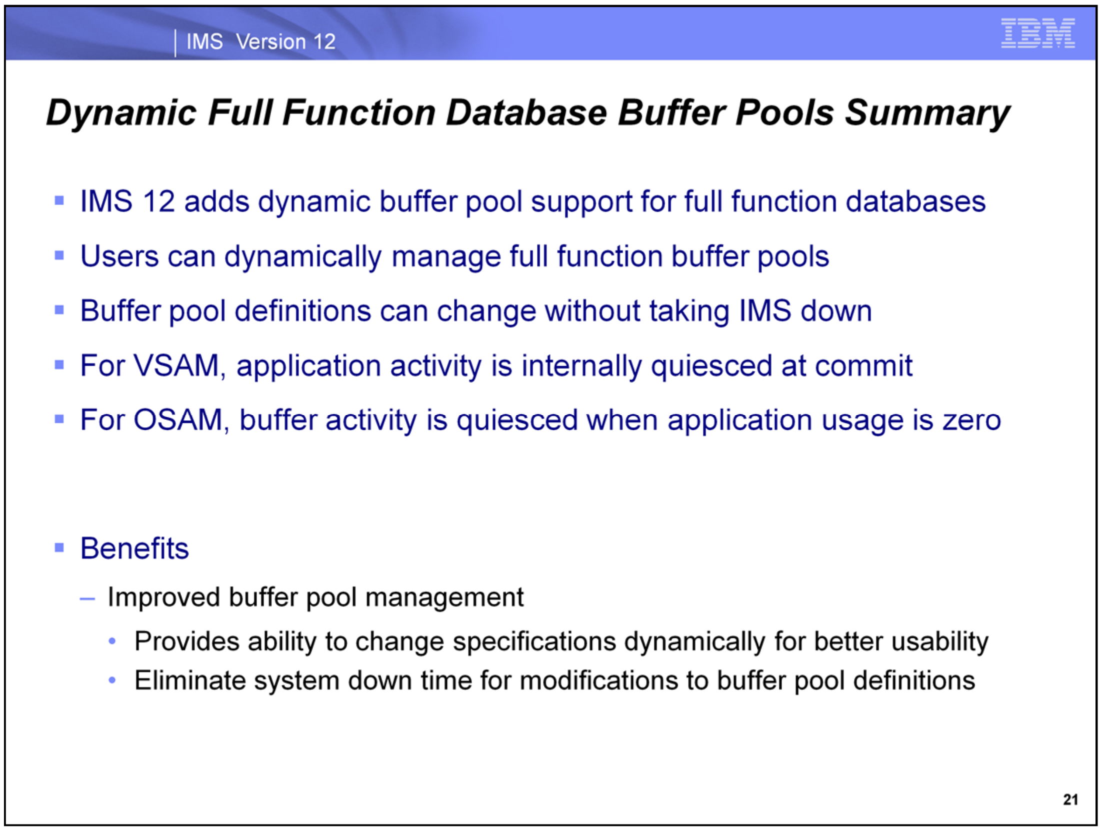
As in IMS 11 and earlier versions, the buffer pools are initially created during IMS initialization using the buffer pool definitions in the DFSVSMxx proclib member. These specifications are also read during a normal restart of IMS. In IMS 12, full function buffer pools can be added or changed using VSAM and OSAM definitions specified in the DFSDFxxx proclib members in conjunction with the UPDATE POOL command identifying the sections containing the new and changed buffer pool specifications.

IMS stores the new and changed buffer pool specifications in the Restart Data Set (RDS) and during an emergency restart, IMS restores these definitions from the RDS. The RDS is also used to restore definitions during an XRF takeover. However, RSR and FDBR do not read the RDS and therefore can not restore the new and changed buffer pool specifications. FDBR has its own buffer pools and they are not affected by this new feature. If an UPDATE POOL command is issued for RSR or FDBR, it is ignored.

The UPDATE POOL command logs information in the x'22' log record for information purposes only. The UPDATE POOL command itself is non-recoverable.

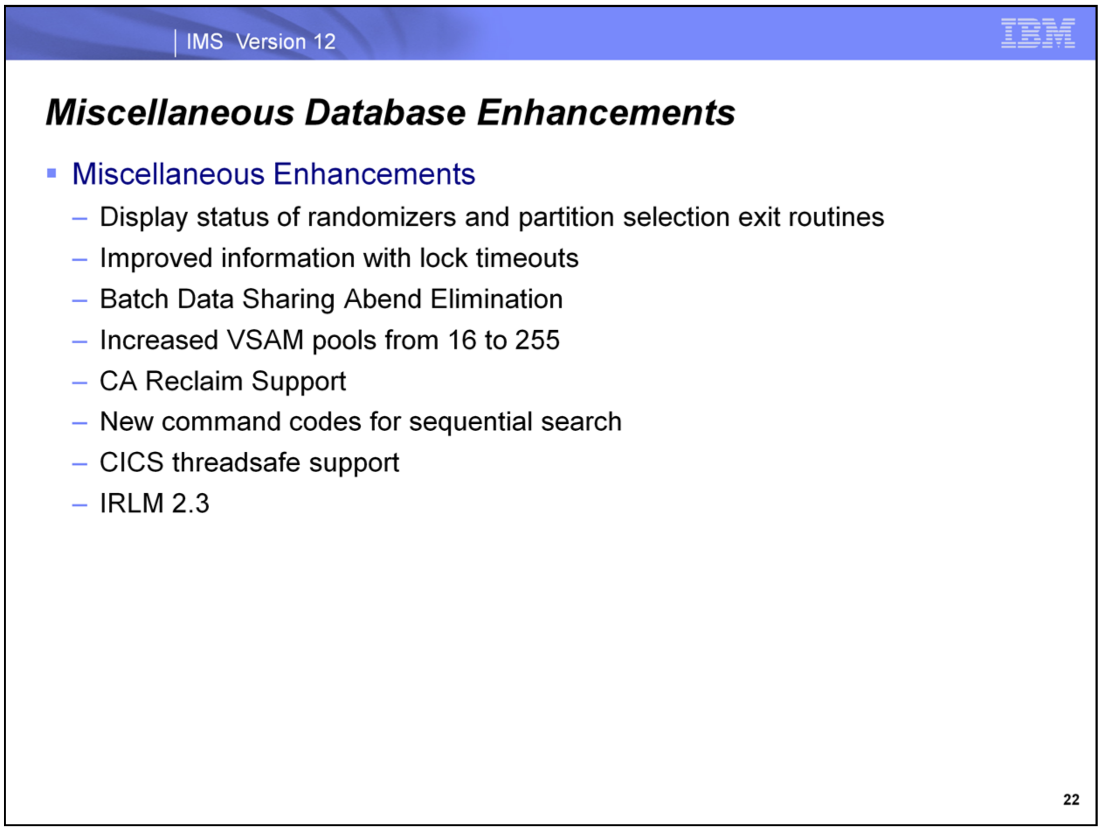


Dynamic Full Function Database Buffer Pools Summary

- IMS 12 adds dynamic buffer pool support for full function databases
- Users can dynamically manage full function buffer pools
- Buffer pool definitions can change without taking IMS down
- For VSAM, application activity is internally quiesced at commit
- For OSAM, buffer activity is quiesced when application usage is zero

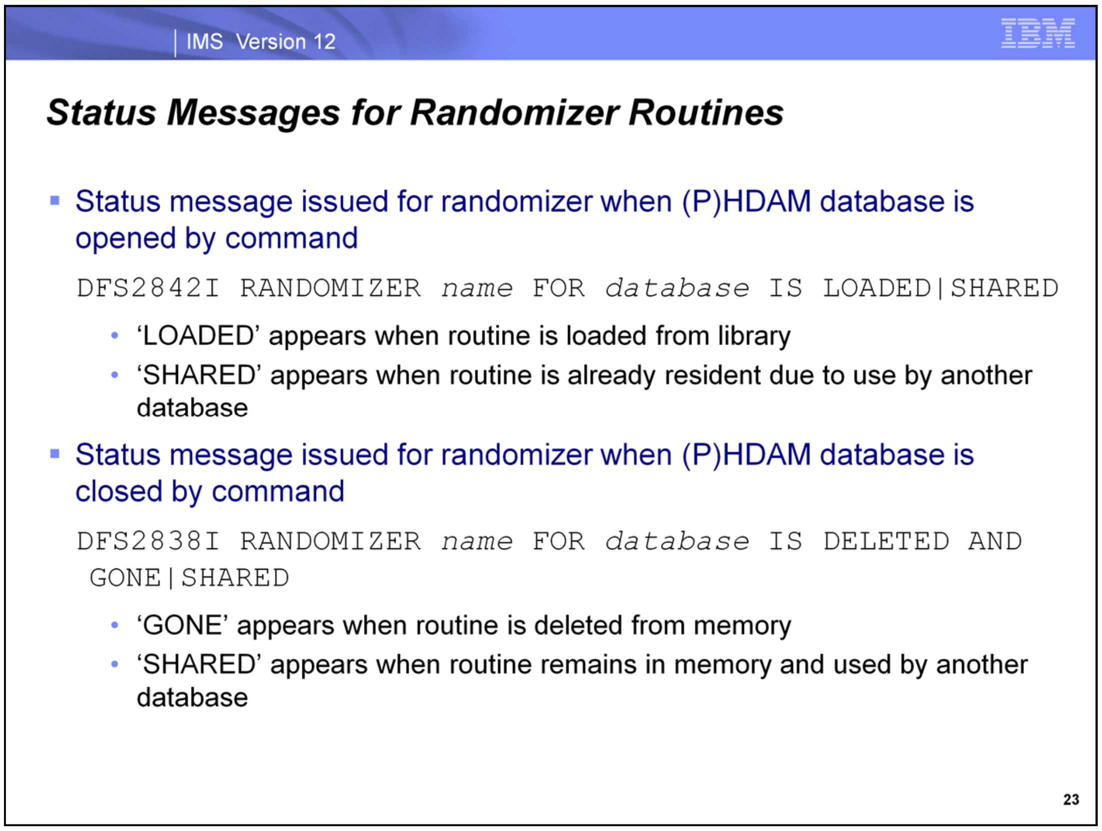
- Benefits
  - Improved buffer pool management
    - Provides ability to change specifications dynamically for better usability
    - Eliminate system down time for modifications to buffer pool definitions

With IMS 12, users can add, change and delete full function buffer pools. This support is provided using new specifications in the DFSDFxxx proclib member in conjunction with the UPDATE POOL command. With this support, full function buffer pools can be altered without restarting IMS. IMS is able to internally quiesce application update activity to allow the UPDATE POOL command to complete with very little disruption to transaction workloads.



Miscellaneous Database Enhancements

- Miscellaneous Enhancements
  - Display status of randomizers and partition selection exit routines
  - Improved information with lock timeouts
  - Batch Data Sharing Abend Elimination
  - Increased VSAM pools from 16 to 255
  - CA Reclaim Support
  - New command codes for sequential search
  - CICS threadsafe support
  - IRLM 2.3


IMS Version 12

Status Messages for Randomizer Routines

- Status message issued for randomizer when (P)HDAM database is opened by command

  DFS2842I RANDOMIZER *name* FOR *database* IS LOADED|SHARED

  - 'LOADED' appears when routine is loaded from library
  - 'SHARED' appears when routine is already resident due to use by another database
- Status message issued for randomizer when (P)HDAM database is closed by command

  DFS2838I RANDOMIZER *name* FOR *database* IS DELETED AND GONE|SHARED

  - 'GONE' appears when routine is deleted from memory
  - 'SHARED' appears when routine remains in memory and used by another database

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If an HDAM or PHDAM database is opened as the result of a command, message DFS2842I is issued. Either LOADED or SHARED appears in the message. LOADED appears when the routine is loaded as a result of the open of the database. SHARED appears when the routine is already in memory due to its use by another database. When the database is closed as the result of a command, either GONE or SHARED appears in the message. GONE appears when the routine is deleted from memory. SHARED appears when the routine remains in memory due to its use by another database.

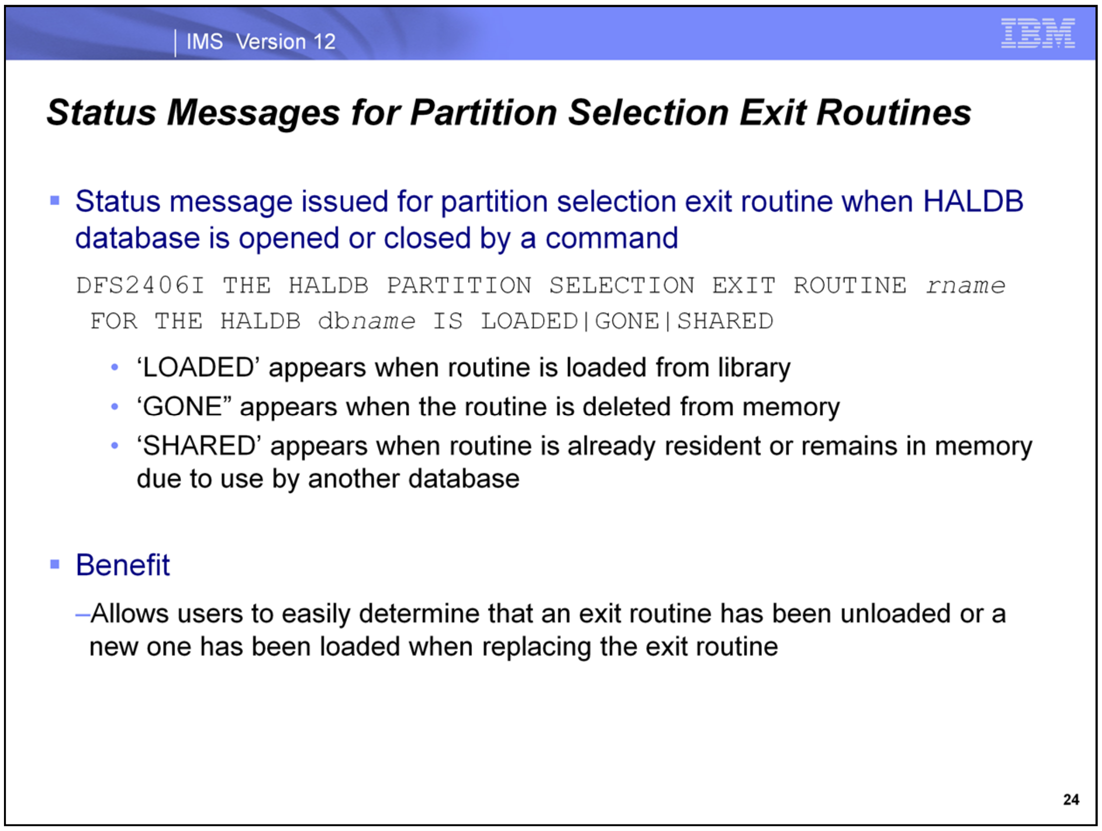
The DFS2842I message is issued for full function databases as a result of the following commands:

/START DB *dbname* OPEN
UPDATE DB NAME(*dbname)* START(ACCESS) OPTION(OPEN)

The DFS2838I message is issued for full function databases as a result of the following commands:

/DBR DB *dbname*
/DBD DB *dbname*
/STO DB *dbname*
/STA DB *dbname*
UPDATE DB NAME(*dbname)* STOP(ACCESS\UPDATES\SCHD*)*
UPDATE DB NAME(*dbname*) START(ACCESS)

The *dbname* in these commands may be a HALDB partition name.



IMS Version 12

Status Messages for Partition Selection Exit Routines

- Status message issued for partition selection exit routine when HALDB database is opened or closed by a command

```
DFS2406I THE HALDB PARTITION SELECTION EXIT ROUTINE rname
 FOR THE HALDB dbname IS LOADED|GONE|SHARED
```

  - 'LOADED' appears when routine is loaded from library
  - 'GONE" appears when the routine is deleted from memory
  - 'SHARED' appears when routine is already resident or remains in memory due to use by another database

- Benefit

  –Allows users to easily determine that an exit routine has been unloaded or a new one has been loaded when replacing the exit routine

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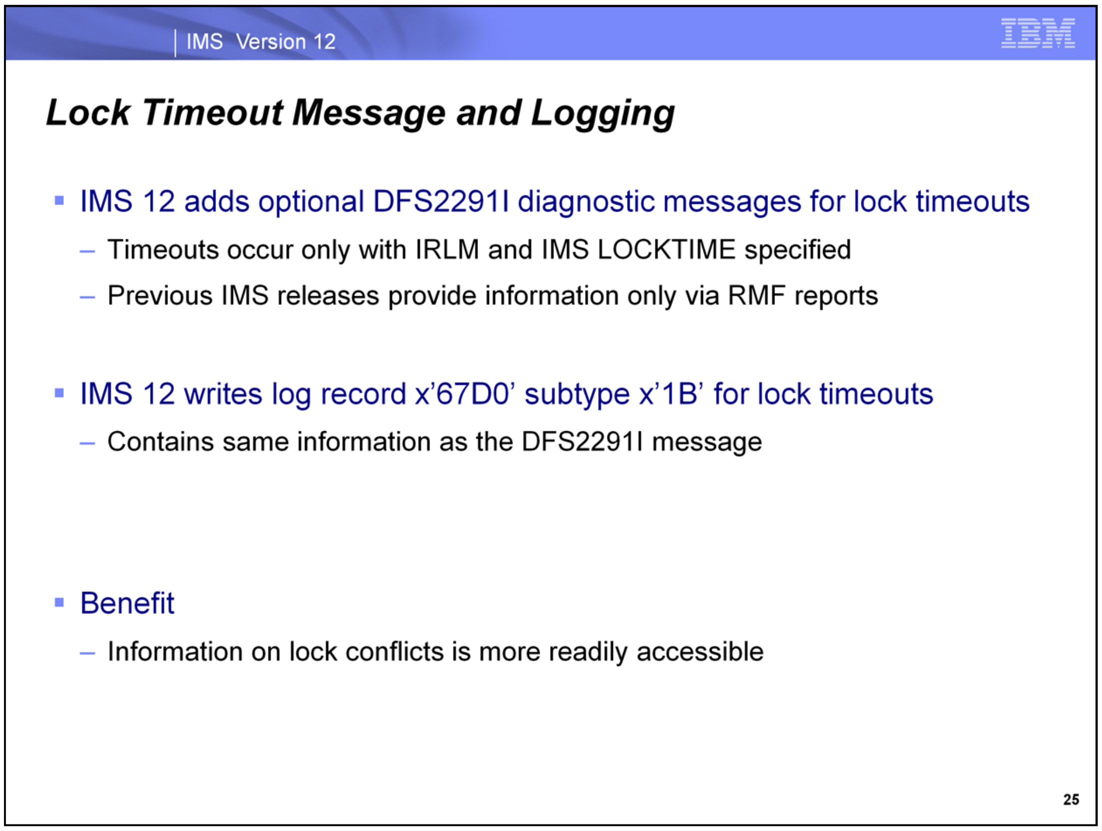
If a HALDB database uses a partition selection exit routine the DFS2406I message is issued when the database is opened or closed as the result of a command. When the database is opened, either LOADED or SHARED appears in the message. LOADED appears when the routine is loaded as a result of the open of the database. SHARED appears when the routine is already in memory due to its use by another database. When the database is closed, either GONE or SHARED appears in the message. GONE appears when the routine is deleted from memory. SHARED appears when the routine remains in memory due to its use by another database.

Commands which might cause the DFS2406I message to be issued include:

/START DB *HALDBmaster* OPEN
UPDATE DB NAME(*HALDBmaster)* START(ACCESS) OPTION(OPEN)
UPDATE DB NAME(*HALDBmaster*) STOP(ACCESS|UPDATES|SCHD)
/DBR DB *HALDBmaster*
/DBD DB *HALDBmaster*

These messages are especially useful when replacing a shared exit routine. They clearly indicate if the old routine has been deleted and if a new routine has been loaded.


IMS Version 12

Lock Timeout Message and Logging

- IMS 12 adds optional DFS2291I diagnostic messages for lock timeouts
  - Timeouts occur only with IRLM and IMS LOCKTIME specified
  - Previous IMS releases provide information only via RMF reports
- IMS 12 writes log record x'67D0' subtype x'1B' for lock timeouts
  - Contains same information as the DFS2291I message
- Benefit
  - Information on lock conflicts is more readily accessible

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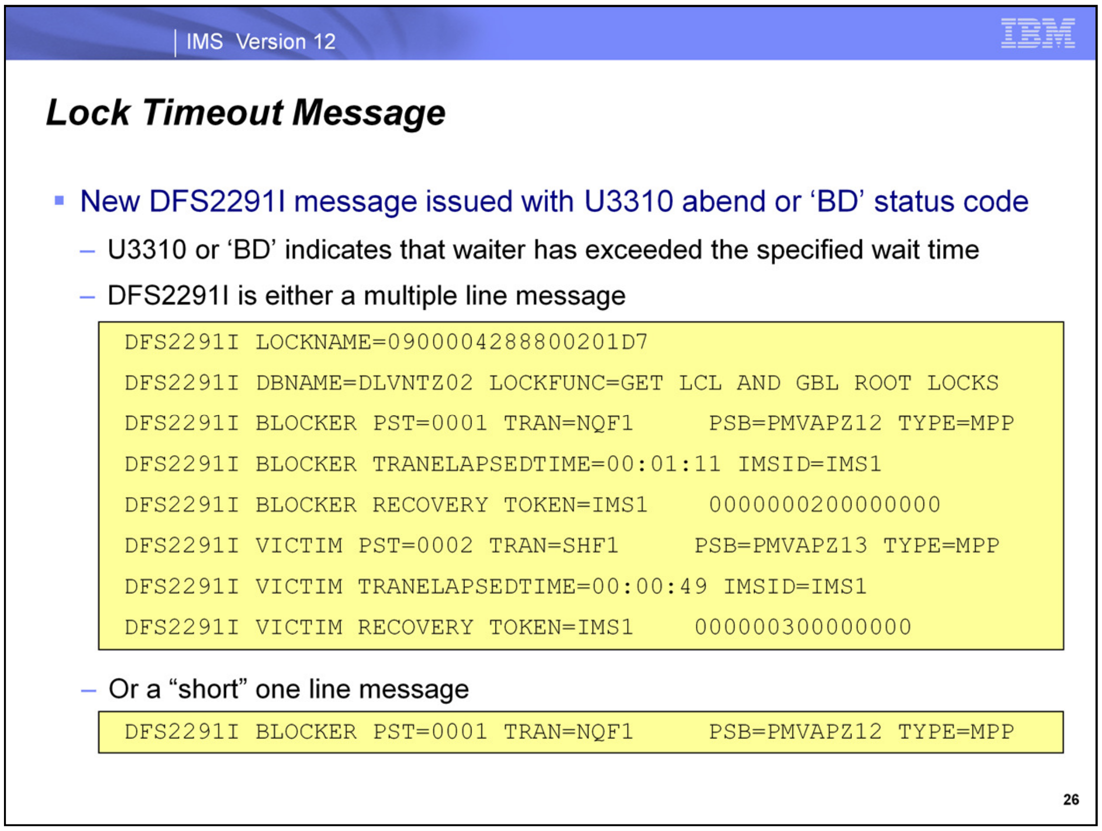
The RMF II ILOCK (IRLM Long Lock Detection) Report includes information about the waiters and blockers when a lock request exceeds the IRLM TIMEOUT value. If the wait for a lock exceeds the IMS LOCKTIME value when using the IRLM, the waiter is abended with a U3310 or a 'BD' status code is returned to the program. The U3310 or 'BD' is determined by the "STATUS' or "ABEND' specification on the LOCKTIME specification in IMS. IMS 12 adds an IMS message to provide more readily available diagnostic information.

Long lock timeouts cause IMS to write a x'67D0' subtype x'1B' log record. This log record contains the same information that is included in the DFS2291I message. This message is documented on the next page.



Lock Timeout Message

- New DFS2291I message issued with U3310 abend or 'BD' status code
  - U3310 or 'BD' indicates that waiter has exceeded the specified wait time
  - DFS2291I is either a multiple line message

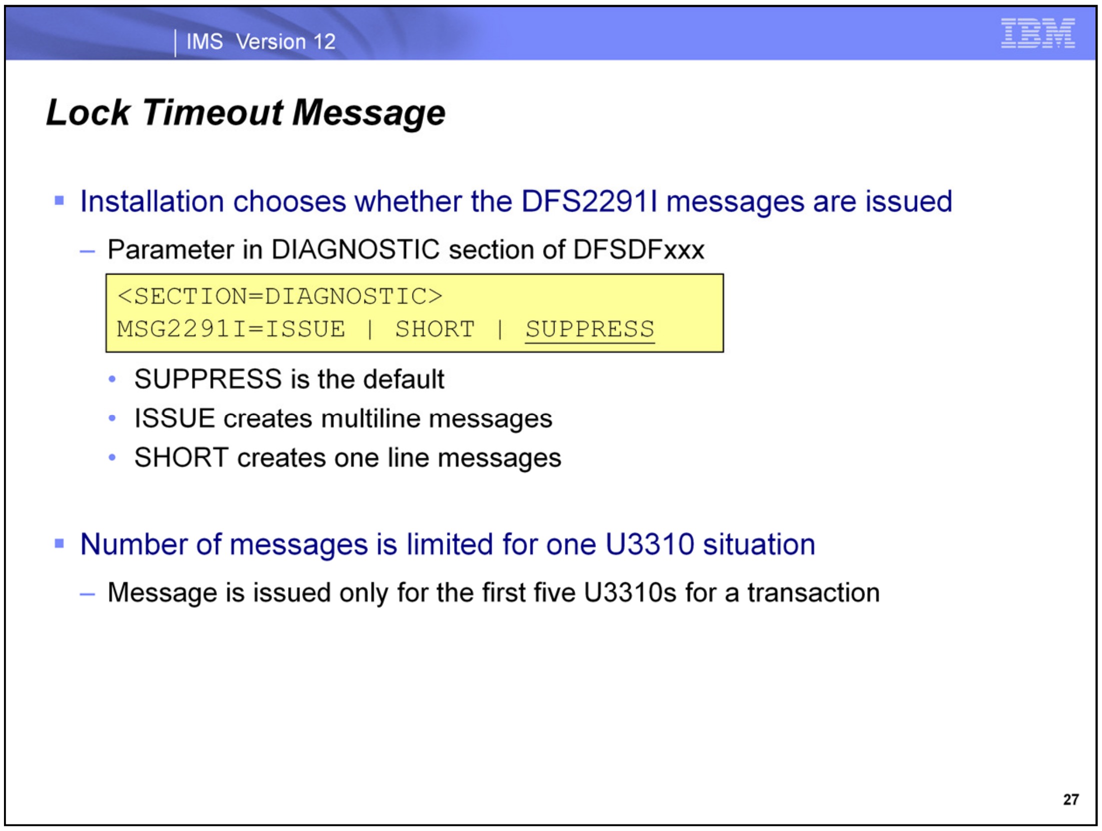
```
DFS2291I LOCKNAME=0900004288800201D7
DFS2291I DBNAME=DLVNTZ02 LOCKFUNC=GET LCL AND GBL ROOT LOCKS
DFS2291I BLOCKER PST=0001 TRAN=NQF1     PSB=PMVAPZ12 TYPE=MPP
DFS2291I BLOCKER TRANELAPSEDTIME=00:01:11 IMSID=IMS1
DFS2291I BLOCKER RECOVERY TOKEN=IMS1    0000000200000000
DFS2291I VICTIM PST=0002 TRAN=SHF1     PSB=PMVAPZ13 TYPE=MPP
DFS2291I VICTIM TRANELAPSEDTIME=00:00:49 IMSID=IMS1
DFS2291I VICTIM RECOVERY TOKEN=IMS1    000000300000000
```

  - Or a "short" one line message

```
DFS2291I BLOCKER PST=0001 TRAN=NQF1     PSB=PMVAPZ12 TYPE=MPP
```

This shows examples of the DFS2291I message. The first example is for the multiple line message. If there are other waiters for the same lock, they are also listed with the word "WAITER" where "VICTIM" appears in this example. The second example is for the single line or "short" message. The IMSID= field is added by IMS 12 APAR PM30851. For batch jobs the IMSID value is blanks.

In this example transaction NQF1 using PSB PMVAPZ12 holds a local and global root lock in database DLVNTZ02. This transaction's elapsed time is now 1 minute and 11 seconds. Transaction SHF1 using PSB PMVAPZ13 is waiting on this lock. Its elapsed time is now 49 seconds.


IMS Version 12

Lock Timeout Message

- Installation chooses whether the DFS2291I messages are issued
  - Parameter in DIAGNOSTIC section of DFSDFxxx

```
<SECTION=DIAGNOSTIC>
MSG2291I=ISSUE | SHORT | SUPPRESS
```

  - SUPPRESS is the default
  - ISSUE creates multiline messages
  - SHORT creates one line messages
- Number of messages is limited for one U3310 situation
  - Message is issued only for the first five U3310s for a transaction

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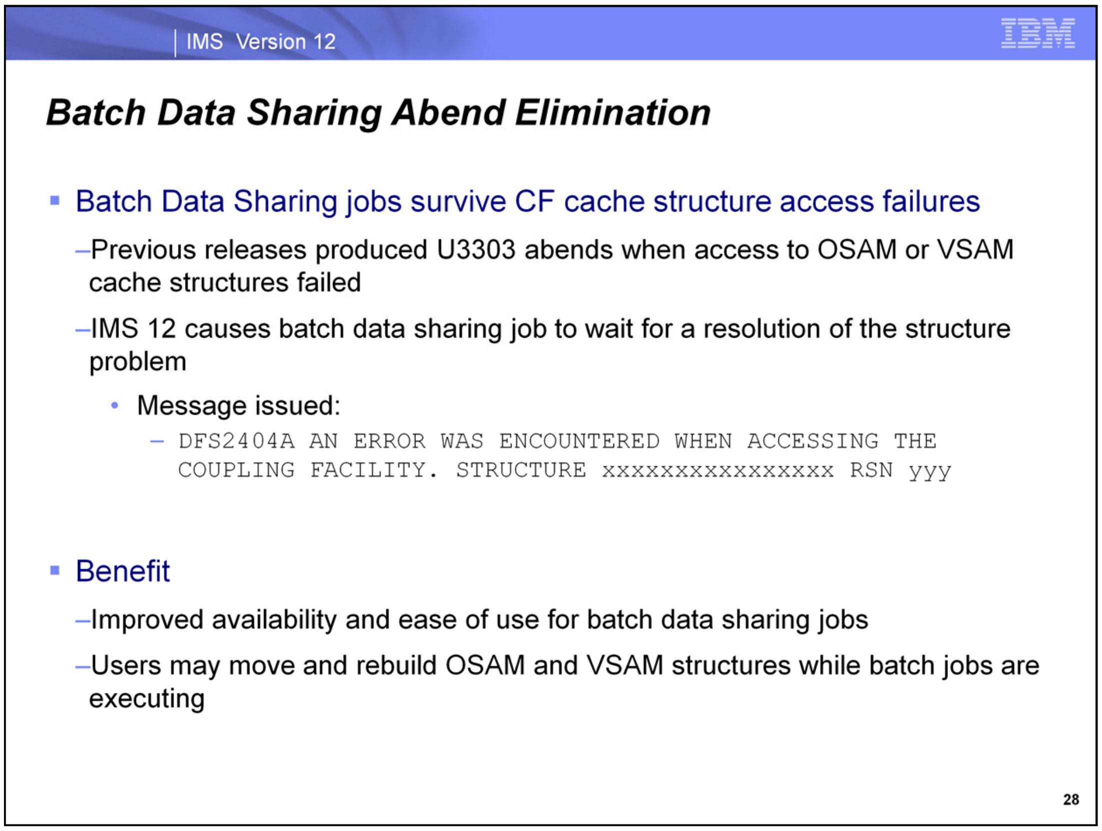
The DFS2291I messages are only issued if they are requested by specifying MSG2291I=ISSUE or MSG229I=SHORT in the DIAGNOSTIC section of the DFSDFxxx member. ISSUE causes multiple line messages to be issued. SHORT causes one line messages to be issued.

It is possible that the retry of a transaction after a timeout will result in another timeout. This could occur multiple times. The DFS2291I message will be issued only for the first five U3310 abends for an input message.



Batch Data Sharing Abend Elimination

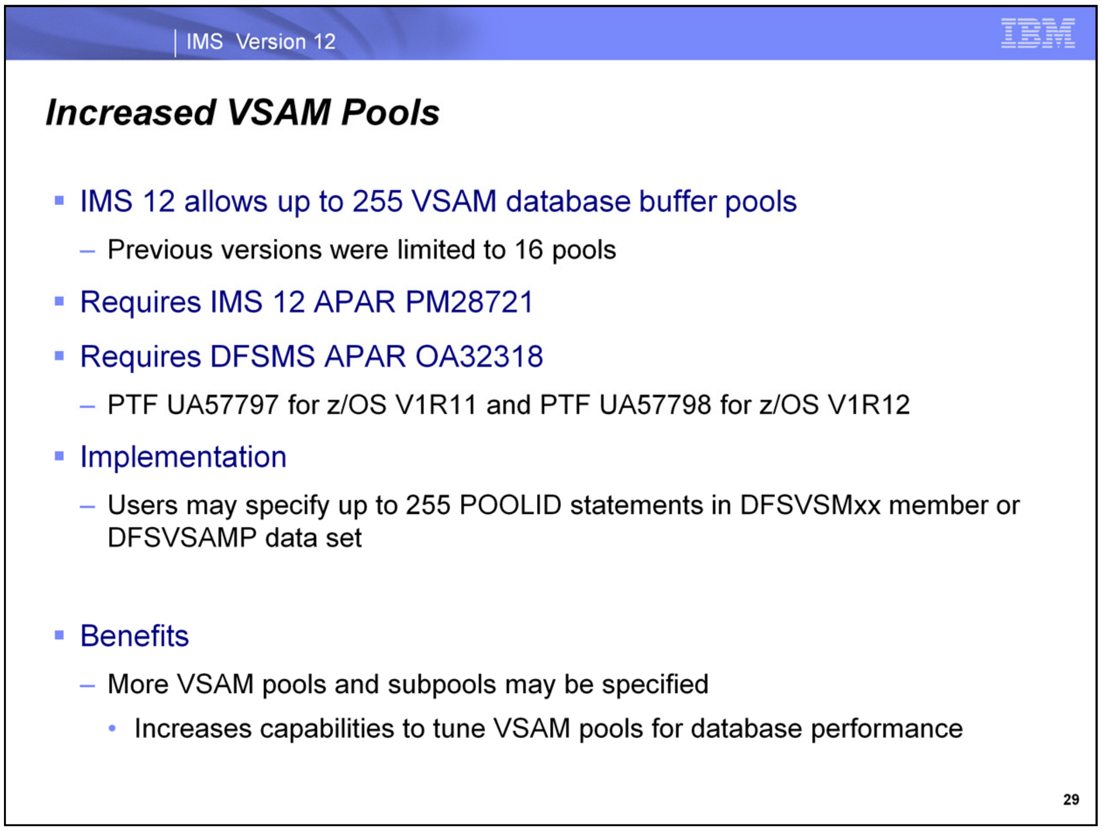
- Batch Data Sharing jobs survive CF cache structure access failures
  - Previous releases produced U3303 abends when access to OSAM or VSAM cache structures failed
  - IMS 12 causes batch data sharing job to wait for a resolution of the structure problem
    - Message issued:
      - `DFS2404A AN ERROR WAS ENCOUNTERED WHEN ACCESSING THE COUPLING FACILITY. STRUCTURE xxxxxxxxxxxxxxxx RSN yyy`
- Benefit
  - Improved availability and ease of use for batch data sharing jobs
  - Users may move and rebuild OSAM and VSAM structures while batch jobs are executing

In previous versions of IMS a batch data sharing job would abend with a U3303 when an OSAM or VSAM cache structure access failed. For example, an access attempt while a structure was being rebuilt would fail. This problem did not occur with online systems. They survived access failures. They waited for the resolution to the structure access problem. IMS 12 allows batch jobs to survive when these structure accesses fail. Like online systems, they wait for the resolution to the problem. When the problem is resolved, the batch jobs continue processing. For example, when a rebuild of a structure completes, the batch jobs continue.

If the batch job detects the failure, it issues the new DFS2404A message. The reason code in the message is used to identify the type of failure that occurred when the batch job attempted to access the structure.

This enhancement allows users to rebuild their OSAM and VSAM cache structures while their data sharing batch jobs are executing. This may be done to address coupling facility failures or to move structures between coupling facilities for reconfigurations. In previous versions of IMS, batch jobs did not survive these rebuilds.

This enhancement does not eliminate all U3303 abends for batch jobs. It only eliminates those caused by cache structure access failures.



IMS Version 12

Increased VSAM Pools

- IMS 12 allows up to 255 VSAM database buffer pools
  - Previous versions were limited to 16 pools
- Requires IMS 12 APAR PM28721
- Requires DFSMS APAR OA32318
  - PTF UA57797 for z/OS V1R11 and PTF UA57798 for z/OS V1R12
- Implementation
  - Users may specify up to 255 POOLID statements in DFSVSMxx member or DFSVSAMP data set
- Benefits
  - More VSAM pools and subpools may be specified
    - Increases capabilities to tune VSAM pools for database performance

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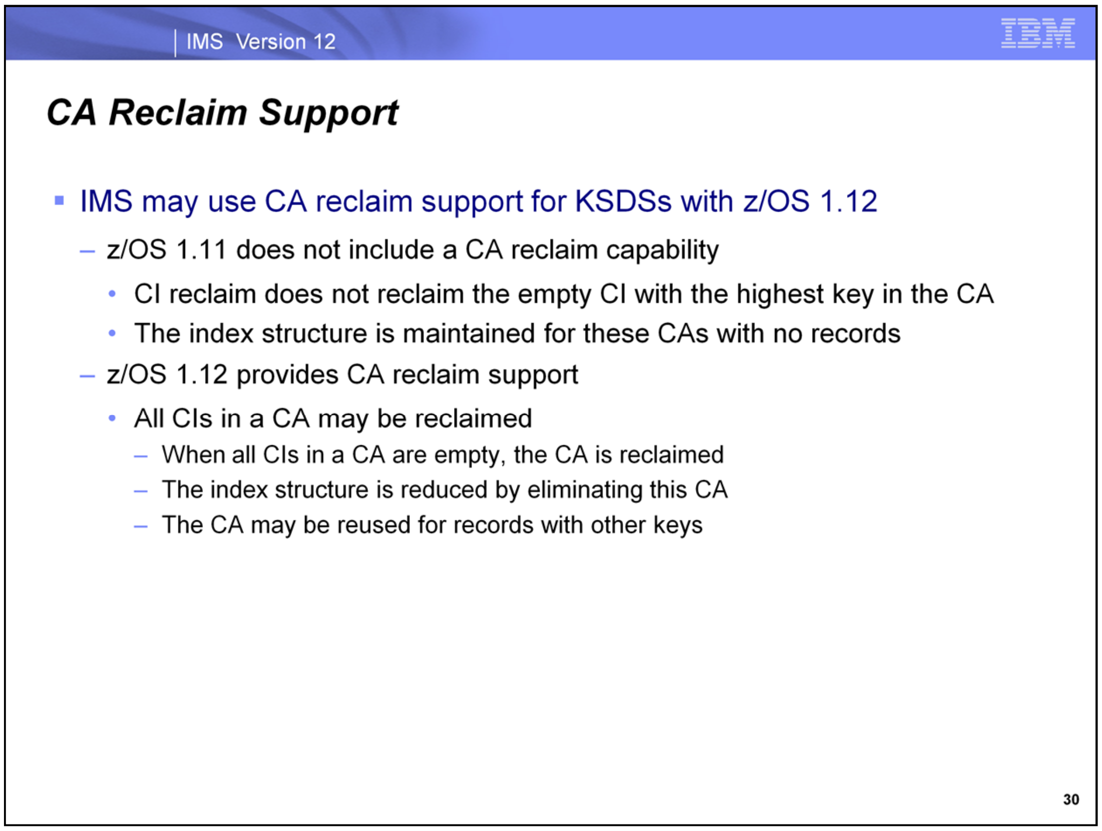
Previous versions of IMS allowed only 16 VSAM full function database buffer pools to be defined for an IMS online system, batch job, or utility. IMS 12 expands this to 255 for online systems and 254 for batch jobs and utilities. Each buffer pool may have separate subpools for different buffer sizes and for data and index components.

VSAM buffer pools are defined with POOLID statements in the DFSVSMxx member or DFSVSAMP data set. IMS 12 allows users to specify up to 255 of these POOLID statements.

The additional buffer pools give users more flexibility in tuning their systems for full function database performance.


IMS Version 12

CA Reclaim Support

- IMS may use CA reclaim support for KSDSs with z/OS 1.12
  - z/OS 1.11 does not include a CA reclaim capability
    - CI reclaim does not reclaim the empty CI with the highest key in the CA
    - The index structure is maintained for these CAs with no records
  - z/OS 1.12 provides CA reclaim support
    - All CIs in a CA may be reclaimed
      - When all CIs in a CA are empty, the CA is reclaimed
      - The index structure is reduced by eliminating this CA
      - The CA may be reused for records with other keys

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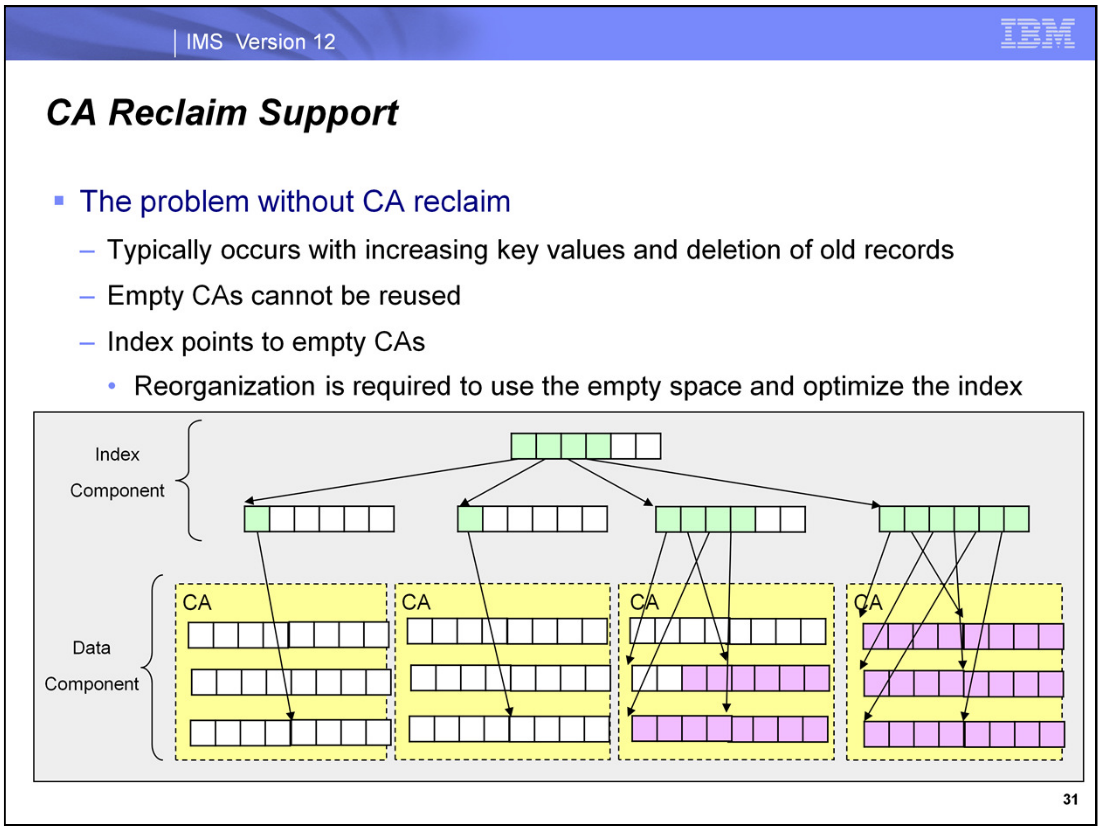
When IMS database KSDS records are erased with z/OS 1.11 and previous releases, VSAM CI reclaim does not reclaim the empty CI that has the highest key of the CA. This otherwise empty CA occupies the index structure as if it was not empty. If an application re-inserts records with the erased keys or keys of nearby values, those empty CAs are reused. However, if the application erases a range of keys and does not reuse those keys or only inserts records with ever higher keys, VSAM does not reclaim or reuse those empty CAs with lower keys. The failure to reclaim the CAs not only results in wasted disk space but also could cause performance problems in index search because much of the index structure could be populated with those empty index records.

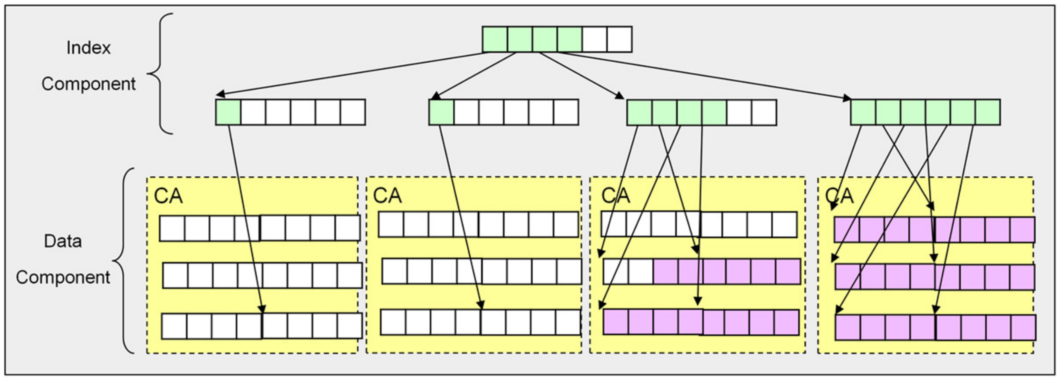
The CA Reclaim feature in z/OS 1.12 allows free CA space to be reused. With CA Reclaim, space fragmentation caused by erasing records from a KSDS will be minimized to reduce the need to reorganize the data set. When the freed CAs are placed in a free chain to be reused, the index structure can be shrunk to facilitate quicker data accesses. When space is needed for a new CA, a CA from the free chain is reused so there will be fewer calls to EOV to extend the KSDS.

There is no requirement for all of the systems in a sysplex to be at the same z/OS release level. z/OS 1.10 and z/OS 1.11 have compatibility maintenance so that they may process data sets for which CA reclaim is being used with z/OS 1.12. However, CA reclaim is only processed on systems that have z/OS 1.12.



CA Reclaim Support

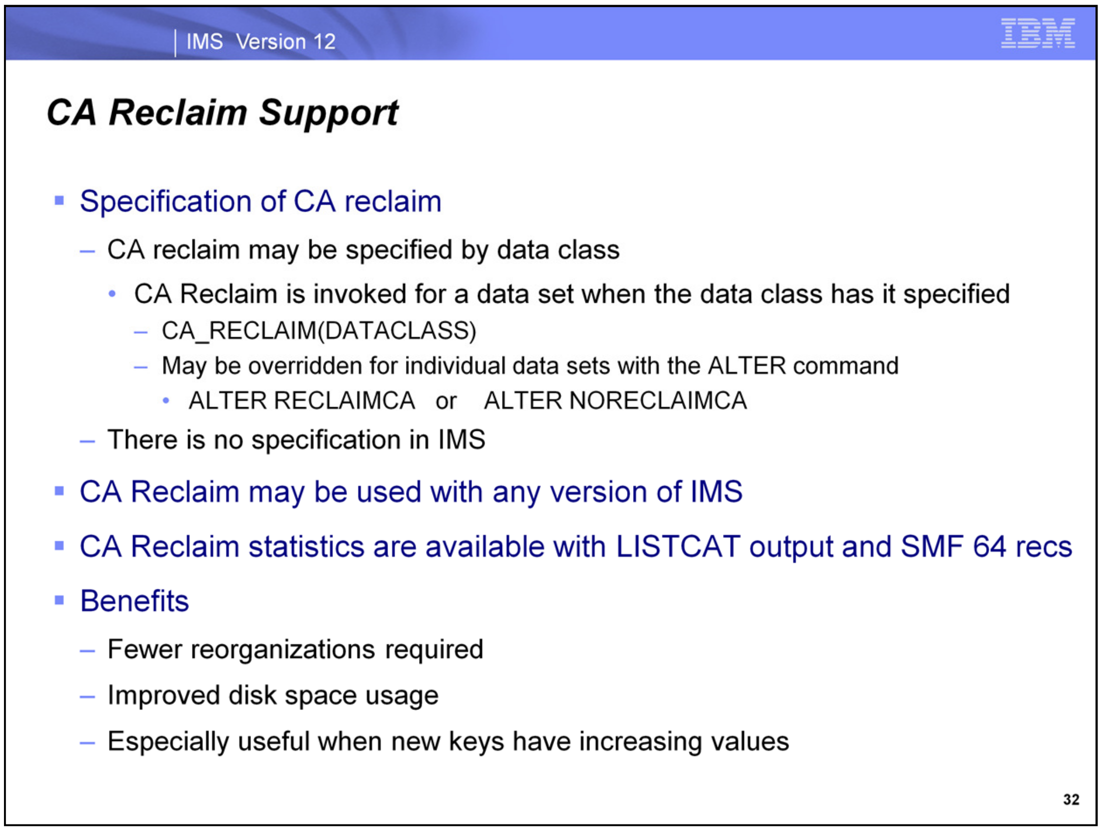
- The problem without CA reclaim
  - Typically occurs with increasing key values and deletion of old records
  - Empty CAs cannot be reused
  - Index points to empty CAs
    - Reorganization is required to use the empty space and optimize the index



This slide illustrates a problem that may occur when CA reclaim is not available. The problem typically occurs when new records have increasing key values and old records are deleted. The CAs which contained the old records become empty in the sense that they contain no records. CIs in the CA are reclaimed when all of their records are deleted with one exception. The reclaimed CIs are available for the insertion of records in the same CA. They are not available for use by another CA. The exception is that the CI with highest key in the CA is not reclaimed. The index entry pointing to this CI is maintained.

When many records with low valued keys are deleted, many CAs may be unused. Nevertheless, they cannot be reused. This may consume a lot of space as new records are inserted and old records are deleted. Even though the total number of records in the data set does not grow, the data set must grow. The index continues to point to these empty CAs. Sequential processing from the beginning of the data set may have to read many index entries before it finds an actual record.

Without CA reclaim the solution to this problem is to reorganize the data set. This requires a database outage with the exception of HALDB Online Reorganization for PHIDAM primary indexes. HALDB Online Reorganization allocates a new primary index.


IMS Version 12

CA Reclaim Support

- Specification of CA reclaim
  - CA reclaim may be specified by data class
    - CA Reclaim is invoked for a data set when the data class has it specified
      - CA_RECLAIM(DATACLASS)
      - May be overridden for individual data sets with the ALTER command
        - ALTER RECLAIMCA or ALTER NORECLAIMCA
  - There is no specification in IMS
- CA Reclaim may be used with any version of IMS
- CA Reclaim statistics are available with LISTCAT output and SMF 64 recs
- Benefits
  - Fewer reorganizations required
  - Improved disk space usage
  - Especially useful when new keys have increasing values

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CA reclaim is invoked under z/OS 1.12 when the data set is defined with a data class for which CA reclaim is specified. No IMS external is required to exploit this function. It occurs automatically for all IMS versions when they execute under z/OS 1.12 or later and CA reclaim is specified for the data set.

The SYS1.PARMLIB IGDSMSxx member determines if CA reclaim may be used by a system. CA_RECLAIM(NONE) is the default and disables CA reclaim in the system. CA_RECLAIM(DATACLASS) allows CA Reclaim for data sets. When CA Reclaim is allowed for a system it is used for a KSDS if its data class has CA_Reclaim(Y) specified when the KSDS is defined. CA_Reclaim(Y) is the default for data classes. CA Reclaim is disabled for KSDSs when they are defined when CA_Reclaim(N) is specified for the data class.

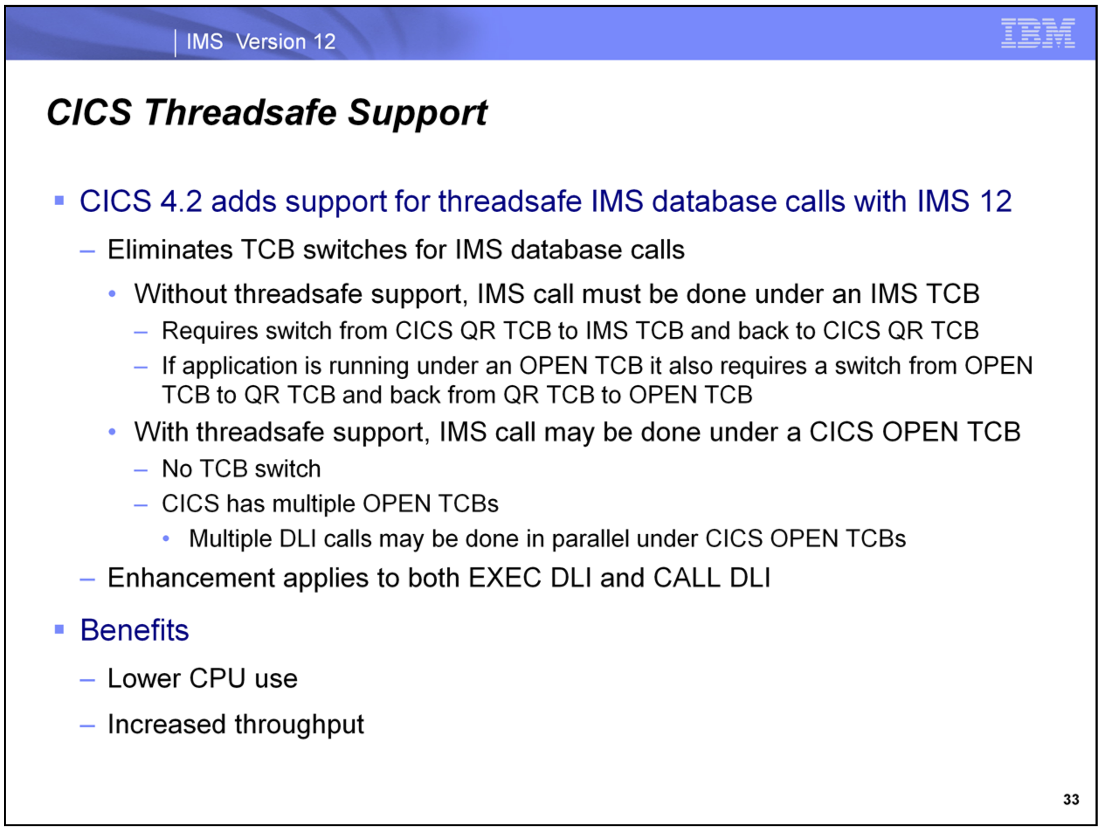
CA Reclaim may be enabled or disabled for individual data sets with the ALTER RECLAIMCA or ALTER NORECLAIMCA command. The ALTER command will take effect at the first OPEN following the CLOSE of all open ACBs for the data set.

CA Reclaim statistics are included with IDCAMS LISTCAT output in z/OS V1R12. The number of CAs reclaimed (REC-DELETED) and reused (REC-INSERTED) are in the INDEX component of a LISTCAT. Without CA Reclaim support, these numbers were always 0. CA Reclaim statistics are also available in SMF type 64 records.

The benefits of CA Reclaim include:

- Fewer reorganizations are required. They are not needed since CA reclaim is able to use the space from the CAs with deleted records for CAs with other keys.
- Disk space usage is improved. Data sets for which large ranges of keys are deleted do not have to grow to provide space for new records which can use the old space.

These benefits are especially useful for databases where new records with increasing key values are added while old records are deleted. They also apply to other data sets where all of the records in the key range for a CA are deleted.



CICS Threadsafe Support

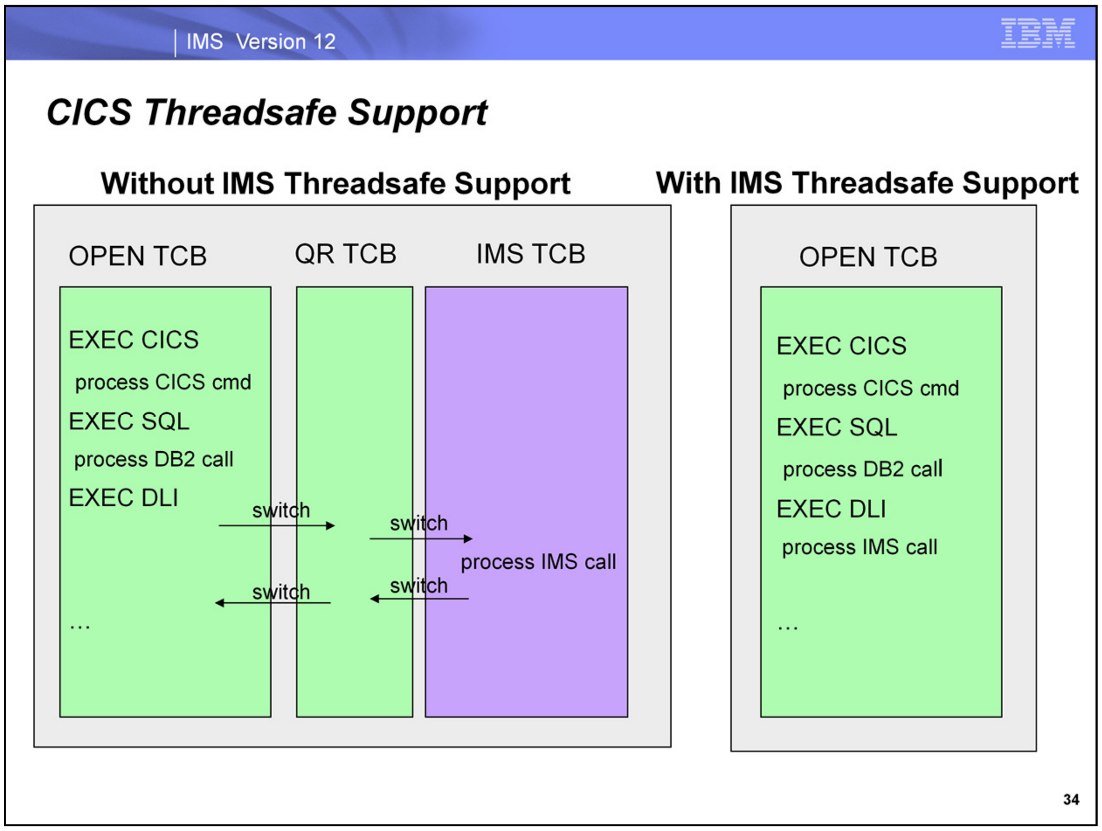
- CICS 4.2 adds support for threadsafe IMS database calls with IMS 12
  - Eliminates TCB switches for IMS database calls
    - Without threadsafe support, IMS call must be done under an IMS TCB
      - Requires switch from CICS QR TCB to IMS TCB and back to CICS QR TCB
      - If application is running under an OPEN TCB it also requires a switch from OPEN TCB to QR TCB and back from QR TCB to OPEN TCB
    - With threadsafe support, IMS call may be done under a CICS OPEN TCB
      - No TCB switch
      - CICS has multiple OPEN TCBs
        - Multiple DLI calls may be done in parallel under CICS OPEN TCBs
  - Enhancement applies to both EXEC DLI and CALL DLI
- Benefits
  - Lower CPU use
  - Increased throughput

CICS Transaction Server Version 4 Release 2 includes threadsafe support for IMS database calls. This potentially eliminates TCB switches for IMS calls and saves the CPU usage associated with TCB switches.

Without threadsafe support calls for IMS databases require a switch to an IMS TCB for processing the call and a switch back to a CICS PCB when IMS completes call processing. Threadsafe support allows the IMS call processing to be done under the CICS TCB. In fact, without this support many IMS database calls from CICS require four TCB switches. This depends on the CICS application program execution environment. Without the treadsafe support for IMS, all IMS calls must be switched from the CICS QR (quasireentrant) TCB to the IMS TCB. If the application is processing under a CICS OPEN TCB, this requires a switch from the OPEN TCB to the QR TCB to the IMS TCB. When call processing is completed by IMS there are switches from the IMS TCB to the QR TCB to the OPEN TCB. This is four TCB switches for an IMS call.

Threadsafe support already exists for DB2, MQ, CICS Sockets, XPLINK and many CICS commands. This support is provided for applications executing under a CICS OPEN TCB. It provides two benefits. First, it avoids TCB switches for processing these requests. Second, it allows the concurrent dispatching of these requests. There is only one QR TCB in a CICS address space. Multiple requests running under a QR TCB cannot be dispatched concurrently. For these reasons, it may be likely that CICS transactions which use these services along with IMS calls are running under an OPEN TCB. These transactions are likely to benefit most from the threadsafe support for IMS.

Threadsafe support applies to IMS database access using either the EXEC DLI or the CALL DLI interface in CICS.

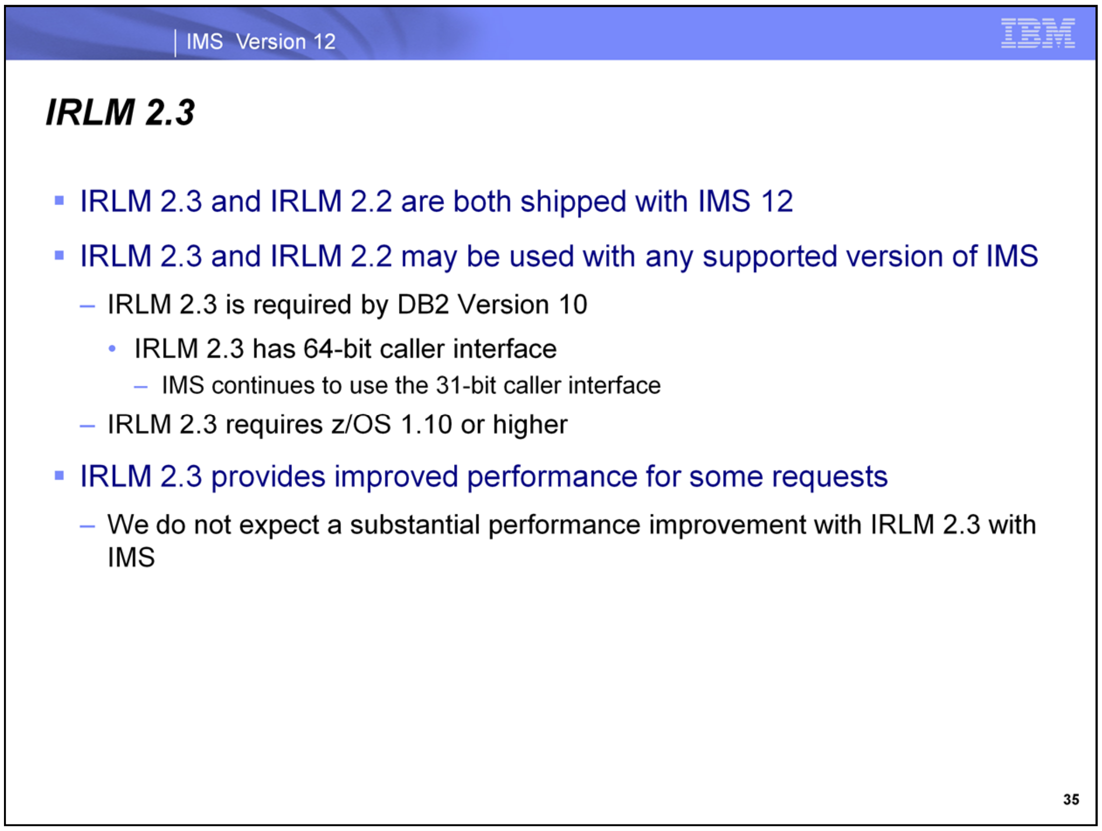


CICS Threadsafe Support

This illustrates the difference between accessing IMS from a CICS application without the use of threadsafe support and with the use of threadsafe support.

On the left you can see a CICS application which invokes a CICS command (a CICS service), accesses DB2, accesses IMS, invokes another CICS command and accesses DB2 again. The CICS commands and DB2 accesses are done under the OPEN TCB. Without threadsafe support the IMS call first causes a switch to the QR TCB and then a switch to an IMS TCB. IMS processes the call under its TCB. After the call is processed, another switch is required to the CICS QR TCB. Finally, there is a switch to the CICS OPEN TCB.

On the right you can see the same CICS application with threadsafe support. All of the processing is done under the CICS OPEN TCB. This eliminates four TCB switches for the IMS database call.


IMS Version 12

IRLM 2.3

- IRLM 2.3 and IRLM 2.2 are both shipped with IMS 12
- IRLM 2.3 and IRLM 2.2 may be used with any supported version of IMS
  - IRLM 2.3 is required by DB2 Version 10
    - IRLM 2.3 has 64-bit caller interface
      - IMS continues to use the 31-bit caller interface
  - IRLM 2.3 requires z/OS 1.10 or higher
- IRLM 2.3 provides improved performance for some requests
  - We do not expect a substantial performance improvement with IRLM 2.3 with IMS

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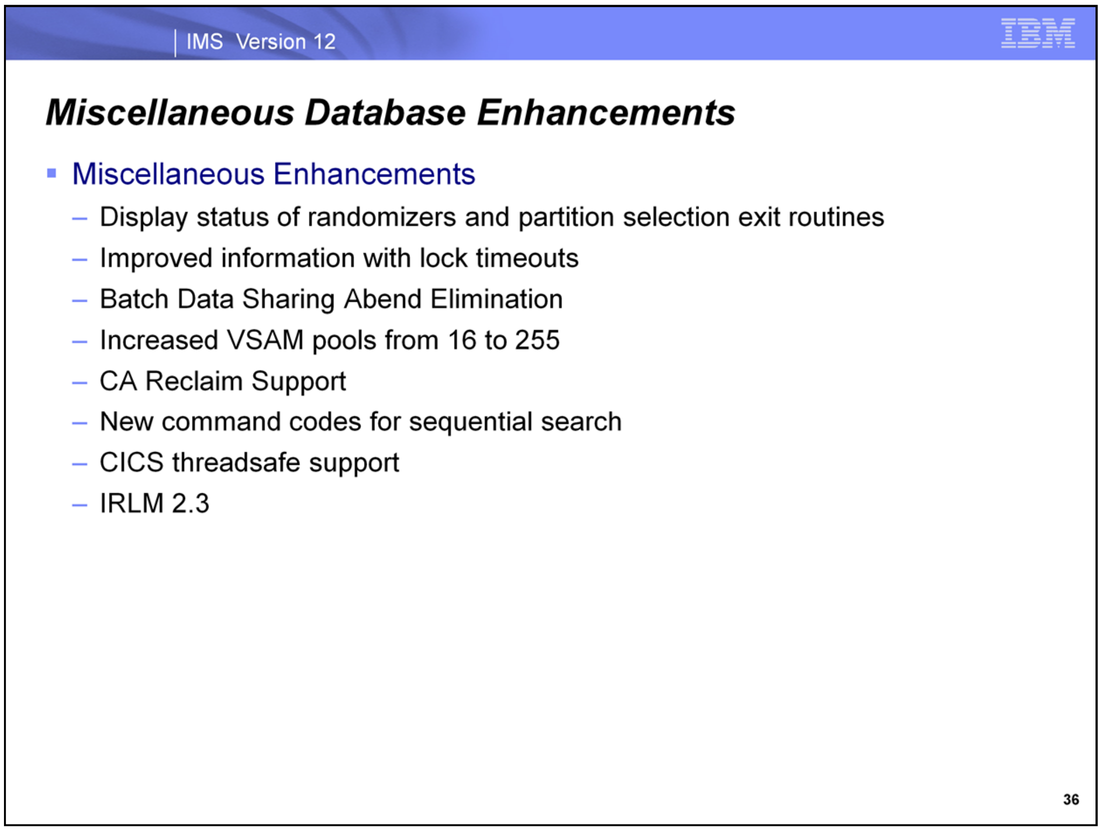
Both IRLM 2.2 and IRLM 2.3 are delivered with IMS 12. Both of these IRLMs may be used with any supported version of IMS.

IRLM 2.3 is required by DB2 Version 10; however, IRLM 2.2 may be used by the IMS database manager when DB2 is using IRLM 2.3. IRLM 2.3 supplies a 64-bit caller interface that is required by DB2 Version 10. IMS does not use this interface.

IRLM 2.3 must run under z/OS 1.10 or higher.

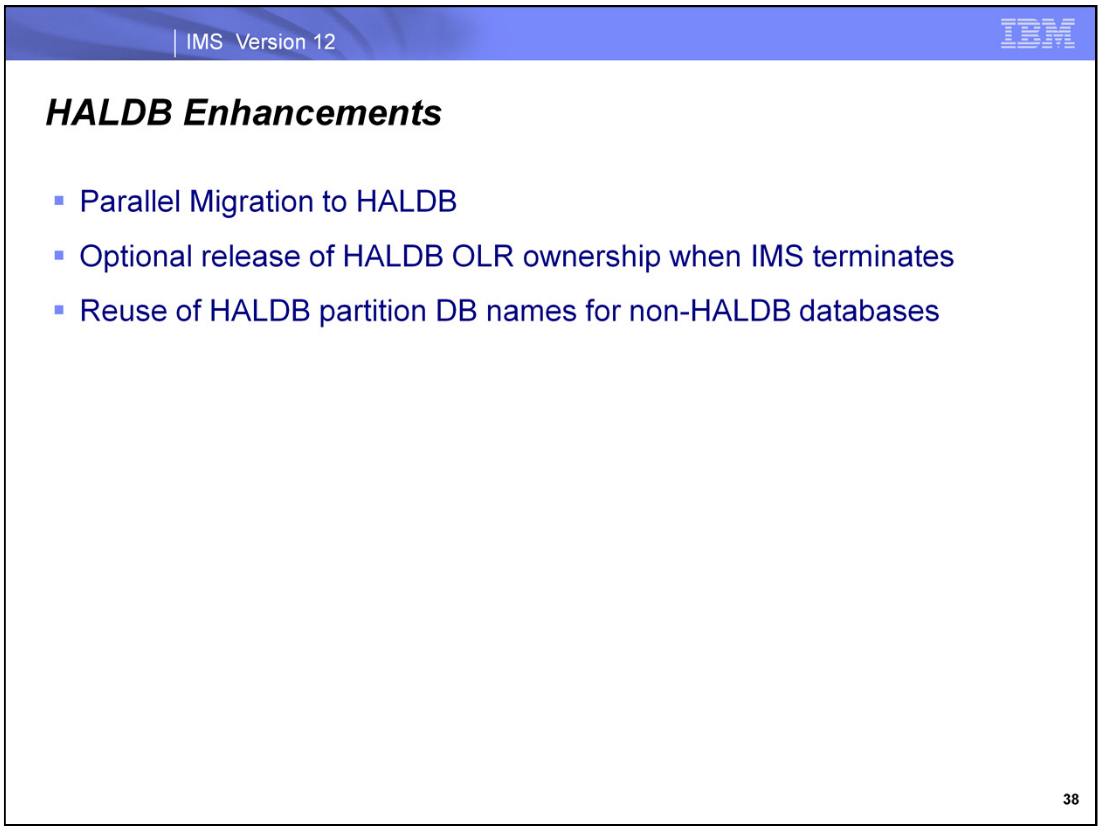
IRLM 2.3 provides some improved performance; however, we do not expect substantial performance improvements with IMS.



Miscellaneous Database Enhancements

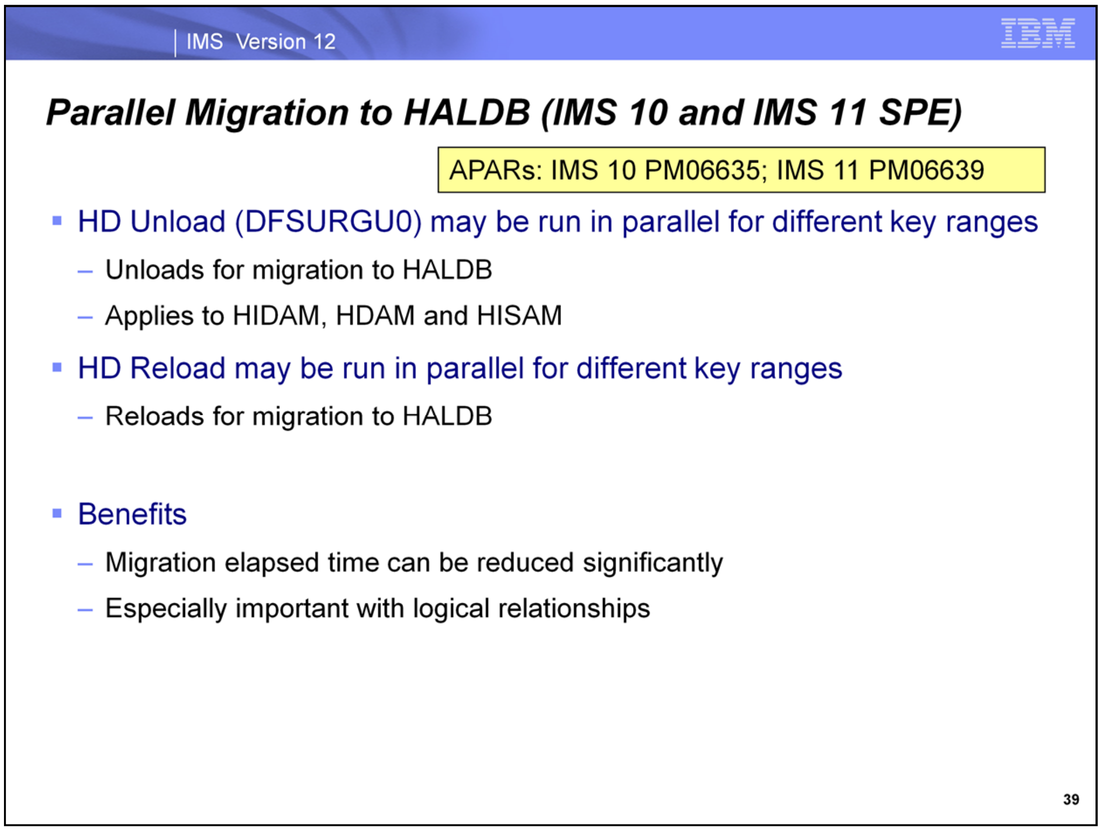
- Miscellaneous Enhancements
  - Display status of randomizers and partition selection exit routines
  - Improved information with lock timeouts
  - Batch Data Sharing Abend Elimination
  - Increased VSAM pools from 16 to 255
  - CA Reclaim Support
  - New command codes for sequential search
  - CICS threadsafe support
  - IRLM 2.3

HALDB Enhancements



HALDB Enhancements

- Parallel Migration to HALDB
- Optional release of HALDB OLR ownership when IMS terminates
- Reuse of HALDB partition DB names for non-HALDB databases



Parallel Migration to HALDB (IMS 10 and IMS 11 SPE)

APARs: IMS 10 PM06635; IMS 11 PM06639

- HD Unload (DFSURGU0) may be run in parallel for different key ranges
  - Unloads for migration to HALDB
  - Applies to HIDAM, HDAM and HISAM
- HD Reload may be run in parallel for different key ranges
  - Reloads for migration to HALDB
- Benefits
  - Migration elapsed time can be reduced significantly
  - Especially important with logical relationships

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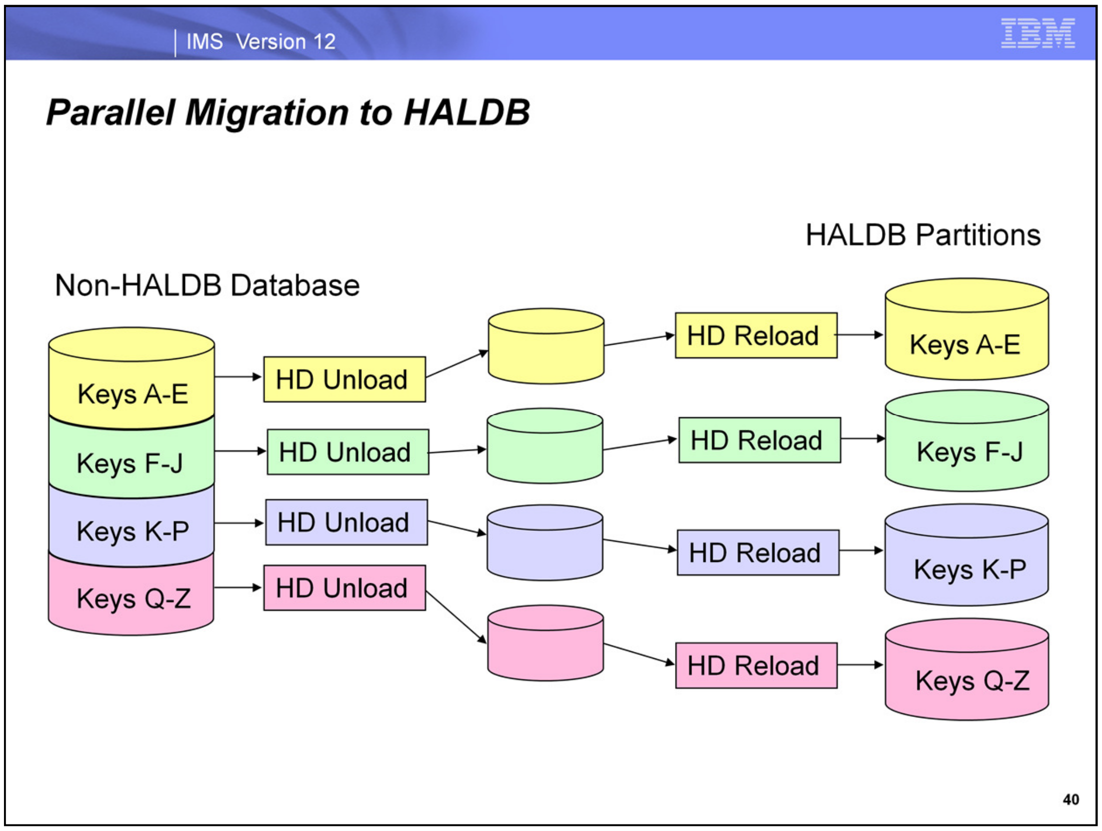
The IMS Unload utility (DFSURGU0) has been enhanced in IMS 10, IMS 11 and IMS 12 to allow unloads of key ranges of an HDAM, HIDAM or HISAM database when migrating to HALDB. Multiple unloads for the same database may be run in parallel. This can significantly reduce the elapsed time for a migration to HALDB. This is especially important for databases with logical relationships since their unloads for migration may require a long time.



Parallel Migration to HALDB

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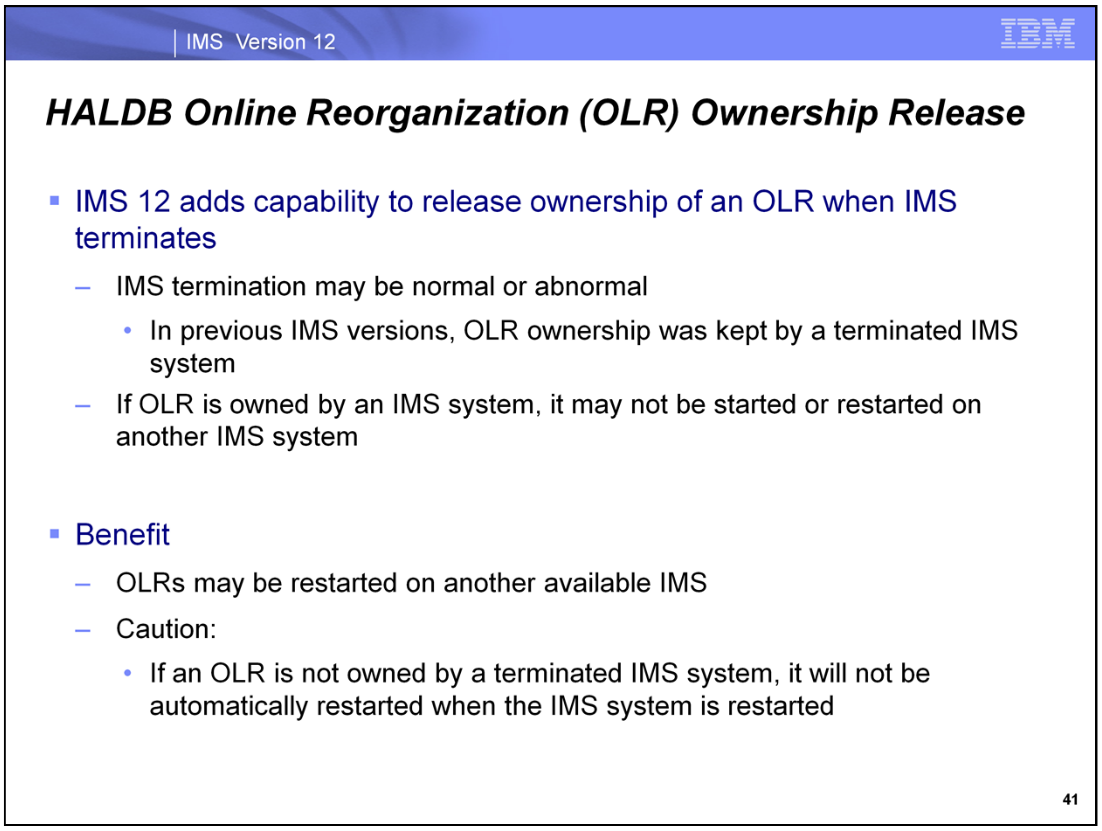
This picture illustrates the improved process. The four HD Unload jobs process different key ranges in the non-HALDB database. They are run in parallel. Their individual outputs are fed to four different HD Reload jobs which load the four partitions in the new HALDB database. The reload jobs are also run in parallel. This significantly reduces the elapsed time of the migration. It should be approximately one fourth the elapsed time that would be required without the parallel running jobs.

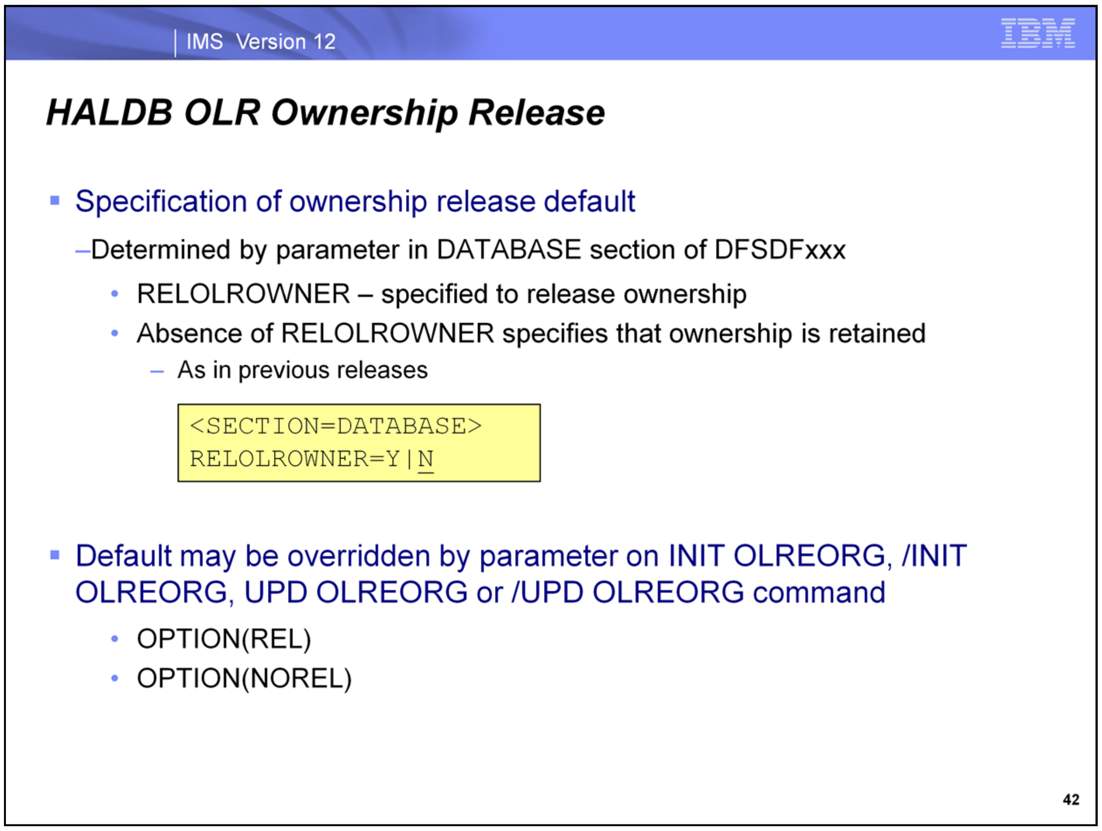


HALDB Online Reorganization (OLR) Ownership Release

- IMS 12 adds capability to release ownership of an OLR when IMS terminates
  - IMS termination may be normal or abnormal
    - In previous IMS versions, OLR ownership was kept by a terminated IMS system
  - If OLR is owned by an IMS system, it may not be started or restarted on another IMS system

- Benefit
  - OLRs may be restarted on another available IMS
  - Caution:
    - If an OLR is not owned by a terminated IMS system, it will not be automatically restarted when the IMS system is restarted

IMS 12 provides an option for the release of ownership of a HALDB Online Reorganization when the IMS system on which it is executing terminates. The termination may be either a normal or abnormal termination of IMS. If ownership is released, the OLR may be restarted on another IMS system. If ownership is not released, the OLR cannot be restarted on another IMS system.


IMS Version 12

HALDB OLR Ownership Release

- Specification of ownership release default
  - Determined by parameter in DATABASE section of DFSDFxxx
    - RELOLROWNER – specified to release ownership
    - Absence of RELOLROWNER specifies that ownership is retained
      - As in previous releases

```
<SECTION=DATABASE>
RELOLROWNER=Y|N
```

- Default may be overridden by parameter on INIT OLREORG, /INIT OLREORG, UPD OLREORG or /UPD OLREORG command
  - OPTION(REL)
  - OPTION(NOREL)

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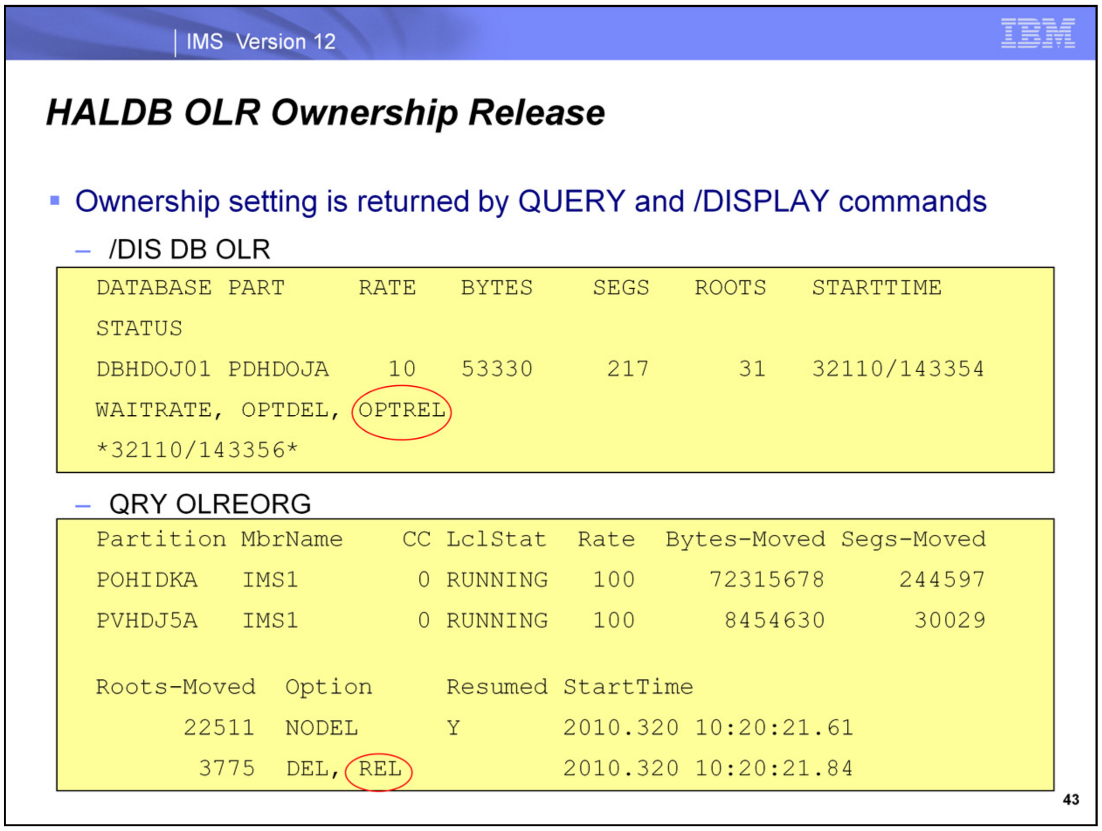
The option is specified by including a RELOLROWNER=Y statement in the DATABASE section of the DFSDFxxx PROCLIB member. RELOROWNER=N is the default and does not release ownership when the IMS system terminates. The RELOLROWNER= value may be overridden by specifying OPTION(REL) or OPTION(NOREL) on the INIT OLREORG, /INIT OLREORG, UPD OLREORG or /UPD OLREORG command.

When RELOLROWNER=Y or OPTION(REL) is not specified, OLR is automatically restarted when the terminated IMS system is restarted. When RELOLROWNER=Y is specified OLR is not automatically restarted unless it was overridden with OPTION(NOREL) on the command. If the OLR is not automatically restarted by IMS restart, it must be restarted with the INIT OLREORG or /INIT OLREORG command.


IMS Version 12

HALDB OLR Ownership Release

- Ownership setting is returned by QUERY and /DISPLAY commands
  - /DIS DB OLR

```
DATABASE PART      RATE   BYTES    SEGS   ROOTS   STARTTIME
STATUS
DBHDOJ01 PDHDOJA     10   53330     217      31   32110/143354
WAITRATE, OPTDEL, OPTREL
*32110/143356*
```

  - QRY OLREORG

```
Partition MbrName    CC LclStat  Rate  Bytes-Moved Segs-Moved
POHIDKA   IMS1        0 RUNNING   100     72315678     244597
PVHDJ5A   IMS1        0 RUNNING   100      8454630      30029

Roots-Moved  Option     Resumed StartTime
      22511  NODEL      Y       2010.320 10:20:21.61
       3775  DEL, REL           2010.320 10:20:21.84
```

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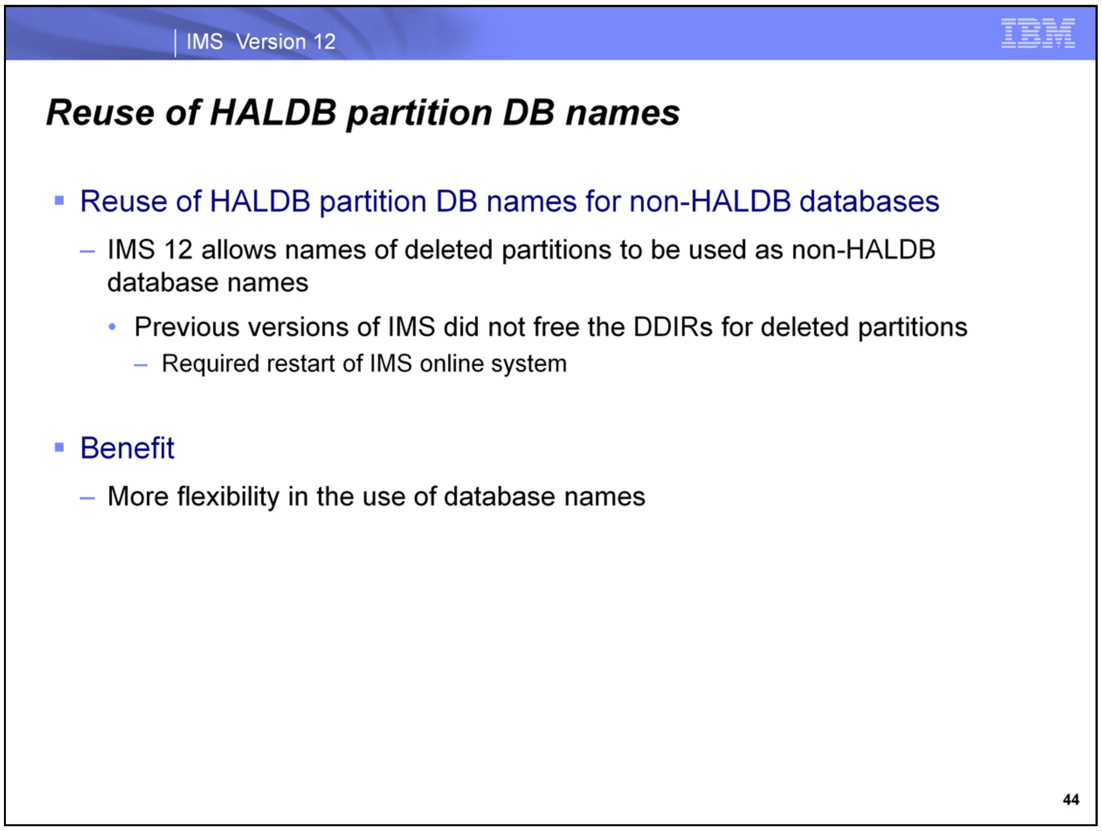
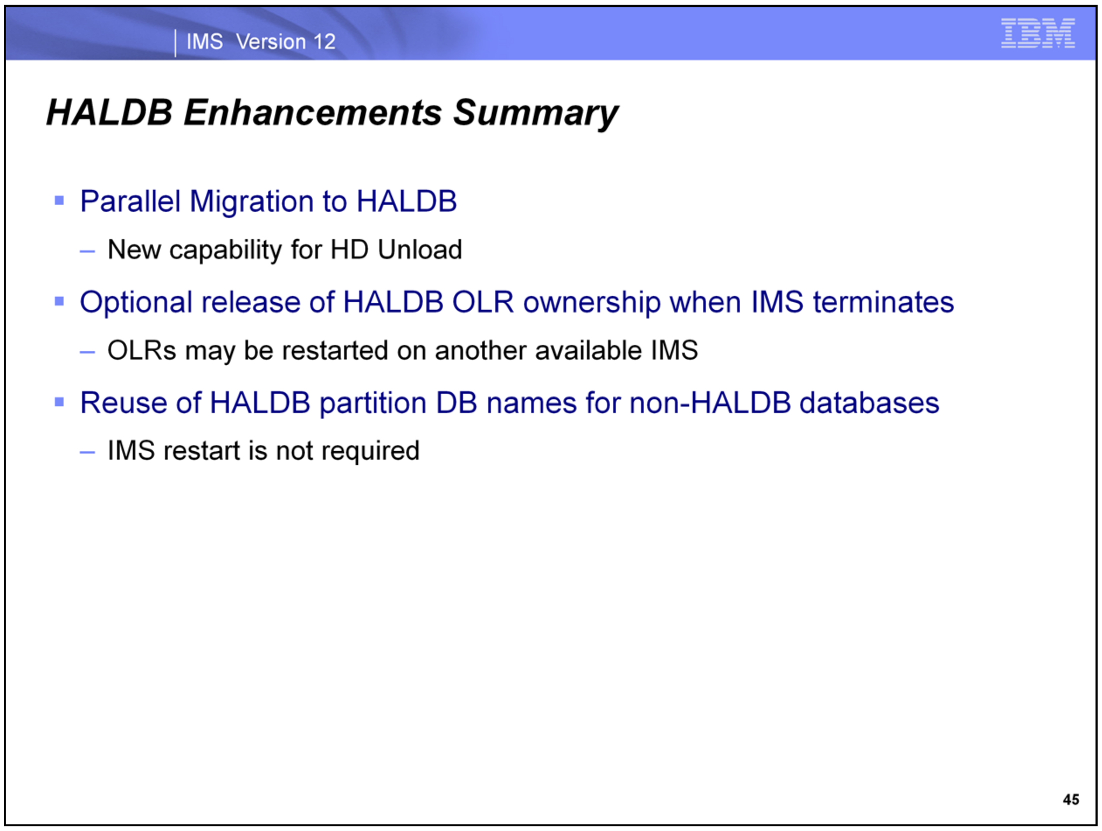
The ownership release status is shown in the response to /DIS DB OLR an QRY OLREORG commands as shown on this slide.



Reuse of HALDB partition DB names

- Reuse of HALDB partition DB names for non-HALDB databases
  - IMS 12 allows names of deleted partitions to be used as non-HALDB database names
    - Previous versions of IMS did not free the DDIRs for deleted partitions
      - Required restart of IMS online system
- Benefit
  - More flexibility in the use of database names

Each database and each HALDB partition uses a DDIR control block in the IMS system. In versions previous to IMS 12 the deletion of a HALDB partition did not delete it's DDIR in an online system. This prevented the reuse of the partition name as a database name. IMS 12 has changed this. The deletion of the partition will result in the deletion of its DDIR. This allows the unused partition name to become a database name



HALDB Enhancements Summary

- Parallel Migration to HALDB
  - New capability for HD Unload
- Optional release of HALDB OLR ownership when IMS terminates
  - OLRs may be restarted on another available IMS
- Reuse of HALDB partition DB names for non-HALDB databases
  - IMS restart is not required