OSAM - "the Healthy Alternative to VSAM"

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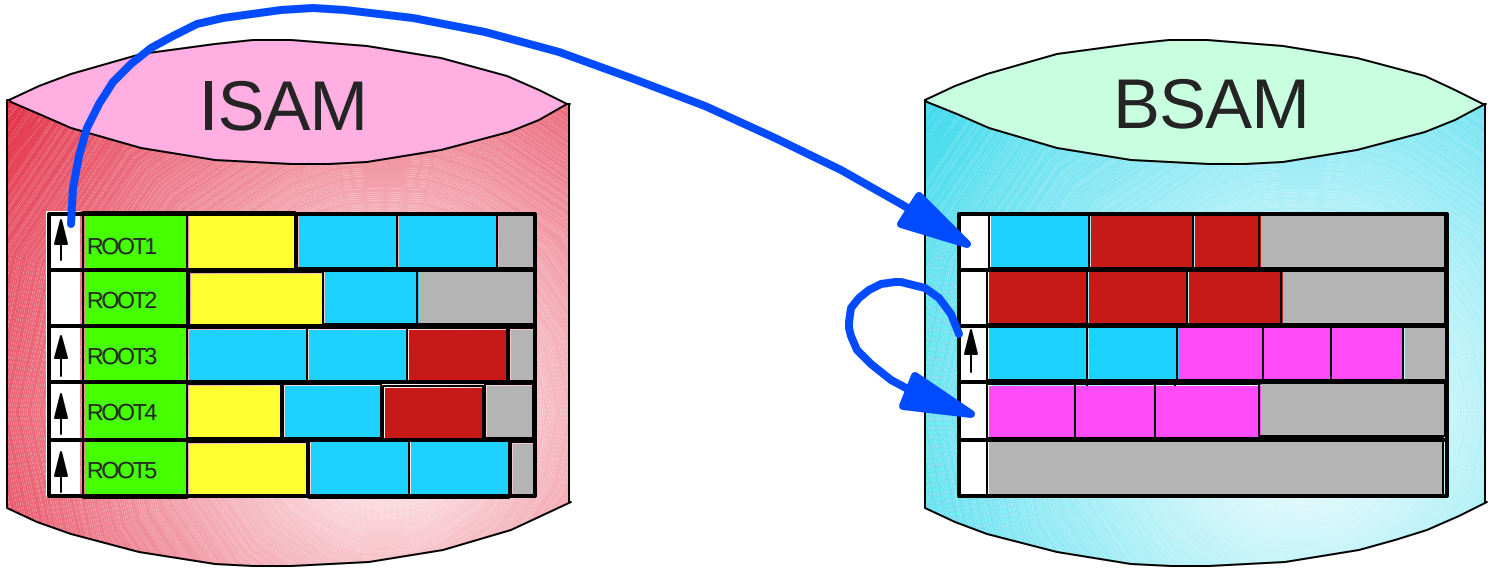
Origins of OSAM

Before VSAM there was ISAM

- Indexed Sequential Access Method

HISAM DB

- Root at start of ISAM logical record
- Root Key = ISAM record key
- Dependent segments stored, in sequence, following root
  - as many as will fit in ISAM logical record
- Remaining dependent segments must go into a BSAM overflow dataset

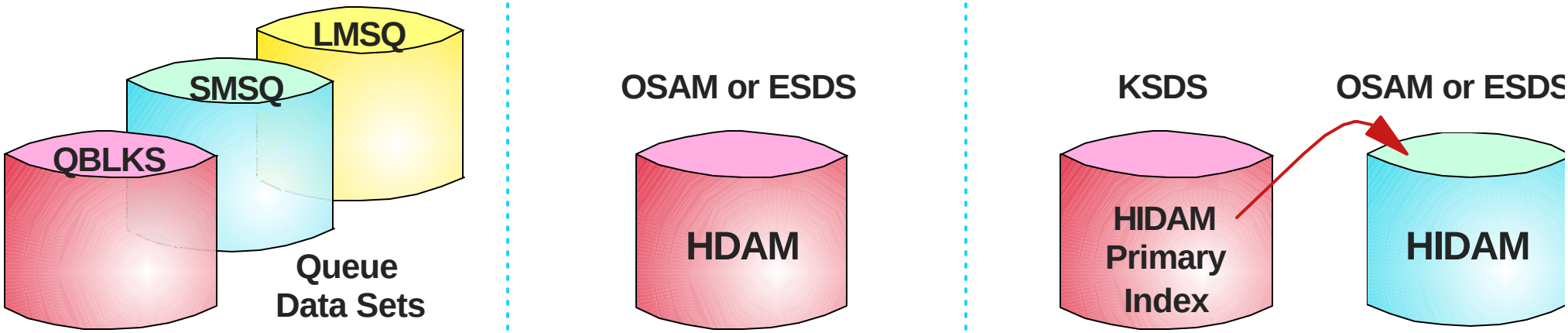


The IMS code written to access segments in the BSAM overflow

➡ **OSAM (Overflow Sequential Access Method)**

Where IMS *Now* Uses OSAM

- **Message Queue Data Sets**
- **Optionally for HDAM, PHDAM, HIDAM and PHIDAM data**



- Some customers say "VSAM is an IBM strategic access method, but OSAM is not."
- But IMS is strategic and OSAM is an essential part of IMS.
- Therefore, talk of OSAM being "non-strategic" is not true

Features and Benefits of OSAM for Databases

- **Base Performance**
  - Specific purpose (rather than general purpose) software
  - Buffering
  - Syncpoint processing
    - chained writes
    - parallel writes
  - “Background Write”
- **OSAM Sequential Buffering**
- **OSAM 8GB Data Sets**
- **Cached data in Coupling Facility (CF)**

OSAM Base Functions

Specific Purpose Software

- **OSAM has been written for specific IMS usage**
  - optimised for these specific functions
  - only 7 modules
- **Compare with VSAM, which is a general purpose access method**
- **Basic Law of Computing**
  - "*The more specific the function, the more efficient the process*"
- **Benefit**
  - **reduced CPU cost**
  - **less maintenance**
    - **maintenance done within IMS**

OSAM Blocks and Buffers

- **OSAM Blocksize can be any value up to 32,752**
  - VSAM CISIZE is multiple of 512 up to 8K, and multiple of 2K up to 30K
- **There is one OSAM buffer-pool containing any number of subpools**
  - **a subpool is a set (4 to 32,767) of buffers of the same size**
  - **buffer sizes are 512, 1K, 2K or multiple of 2K upto 32K**
    - VSAM buffersizes more than 4K must be multiples of 4K
  - **any number of sub-pools can have same buffer size**
    - VSAM allows a maximum of 16 (for non-index CIs)
  - **Database Data Set can be assigned to a specific sub-pool**
  - **subpool parameters specified with IOBF=... in DFSVSMxx**
- **Multiple OSAM sub-pools with same size buffers are encouraged**
  - **especially in online systems**
  - **enables more parallelism in IMS buffer management**
  - **reduces buffer-search cost for HD Space Search**

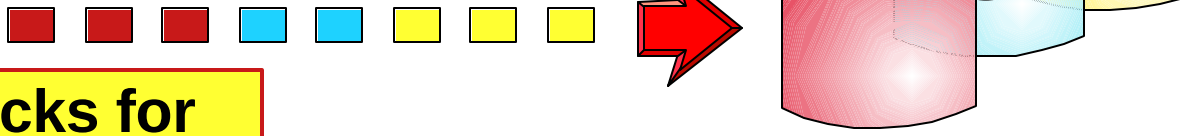
In summary, OSAM offers more flexibility for blocksize, buffersize, and dedicated subpools

OSAM Syncpoint Processing

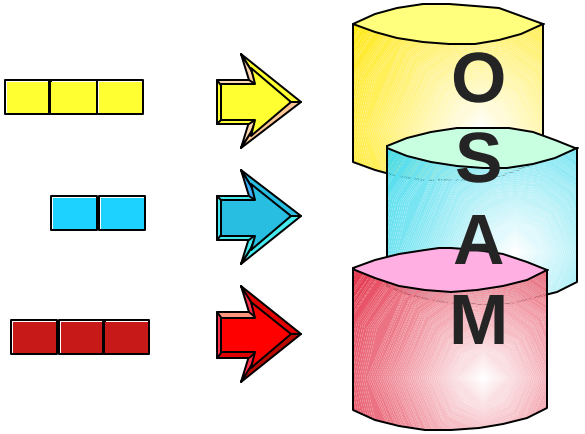
For transactions, BMPs and checkpointing batch programs

➡ **All IMS DB Writes should take place at Syncpoint time**

- **VSAM writes each buffer individually**
  - **one at a time**



- **OSAM chains together blocks for same dataset using a single I/O**
  - For non-page-fixed subpool, limited to 49 blocks per SIO
- **OSAM does parallel writes**
  - **for multiple subpools**
  - **to multiple volumes**
  - **and in parallel with VSAM**



- **Benefit**
  - **Reduced Elapsed Time & Region Occupancy**

OSAM Sequential Buffering

- **Sequential Buffering**
  - **Chained Reads (10 consecutive blocks) instead of single-block reads**
    - assumes if you need the first block, you will also need the immediately following ones
  - **Look-ahead reading (asynchronous read-ahead)**
    - while processing current sequential set of blocks, read the next set
      - data required by application is always in buffers
- **OSAM Sequential Buffering (OSAM SB)**
  - **'Enabled' by the user**
  - **Dynamically switched on/off by IMS, according to the estimated/measured benefit**
- **Reads data into special OSB buffer sets**
  - **Does not interfere with normal OSAM buffers**
  - **Copies buffer to normal OSAM buffer when needed instead of waiting to retrieve it from DASD**

OSAM Sequential Buffering

- **Exploited by**
  - **BMPs (and theoretically, MPPs)**
  - **Stand-alone Batch**
  - **Utilities**
    - Online IC, Unload, Scan, Prefix Update, Surveyor, HALDB Online Reorg,etc

Benefit

- **Totally sequential processes can run in less than a third of the time**
- **All jobs with some element of sequential processing will see benefit**

OSAM SB compared with HSSR

- **High Speed Sequential Retrieval (HSSR)**
  - Component of IMS High Performance Unload tool
  - Includes an API
    - transparent to programmer
  - Supports VSAM and OSAM
  - **BUT**
    - **Only for stand-alone batch**
    - **Only a restricted set of DL/1 calls allowed with HSSR PCB**
- **OSAM SB**
  - totally transparent
  - no programming restrictions
  - all environments and program types

OSAM "Background Write"

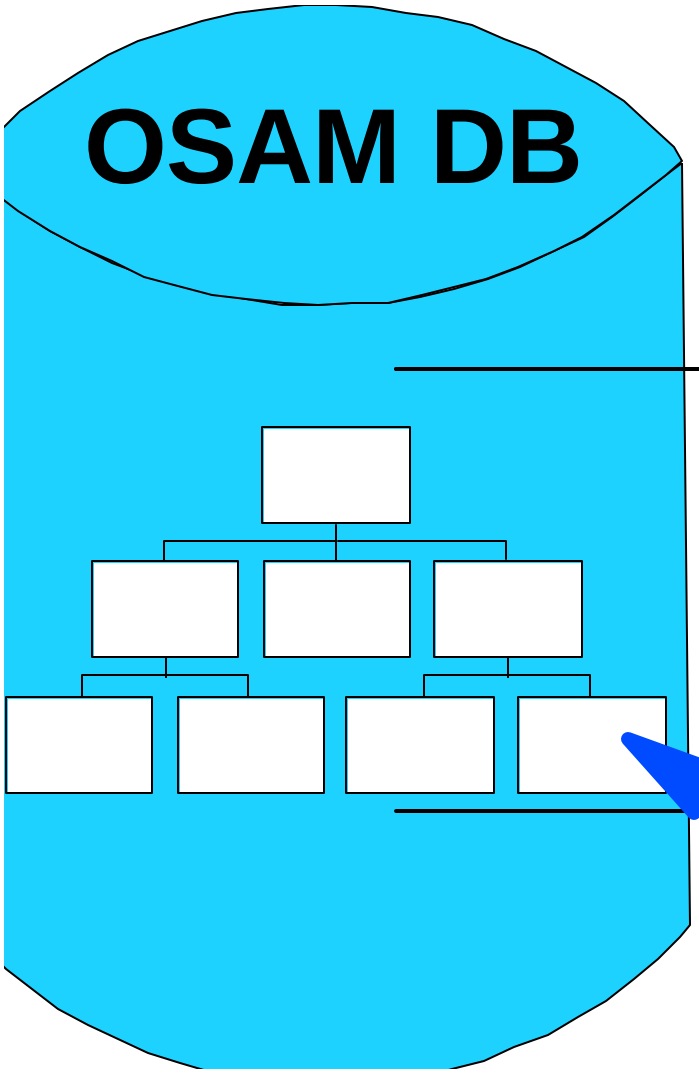
Prior to IMS V6, the one significant benefit offered by VSAM was Background Write

- For batch jobs (typically, though not exclusively) and especially if running without checkpointing, when all a subpool's buffers are updated and another read is needed, space must be made in the subpool. This is a "forced write" situation.
- However, with VSAM background write enabled, when IMS notices that a subpool is completely full of altered buffers, a specified percentage of the least recently used buffers would be written out by an asynchronous background lower-priority task
- This prevents the program having to wait for "forced writes to make space"

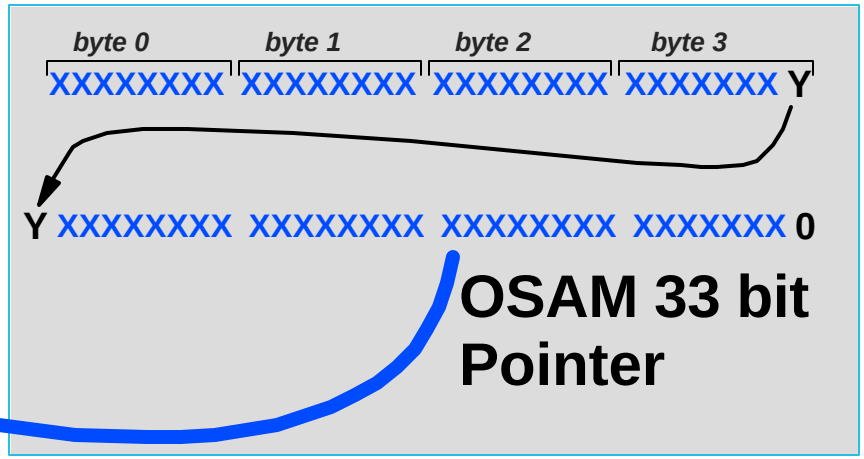
- **OSAM "Background Write" introduced in IMS Version 6**
- **The OSAM facility is for stand-alone batch only, and is <u>not</u> a true "background" write**
- **When a forced write for space is needed by a batch program**
  - **OSAM issues a synchronous chained write of all the buffers in the subpool**
  - **Similar to an application CHKP for just the subpool!**

OSAM 8GB Datasets

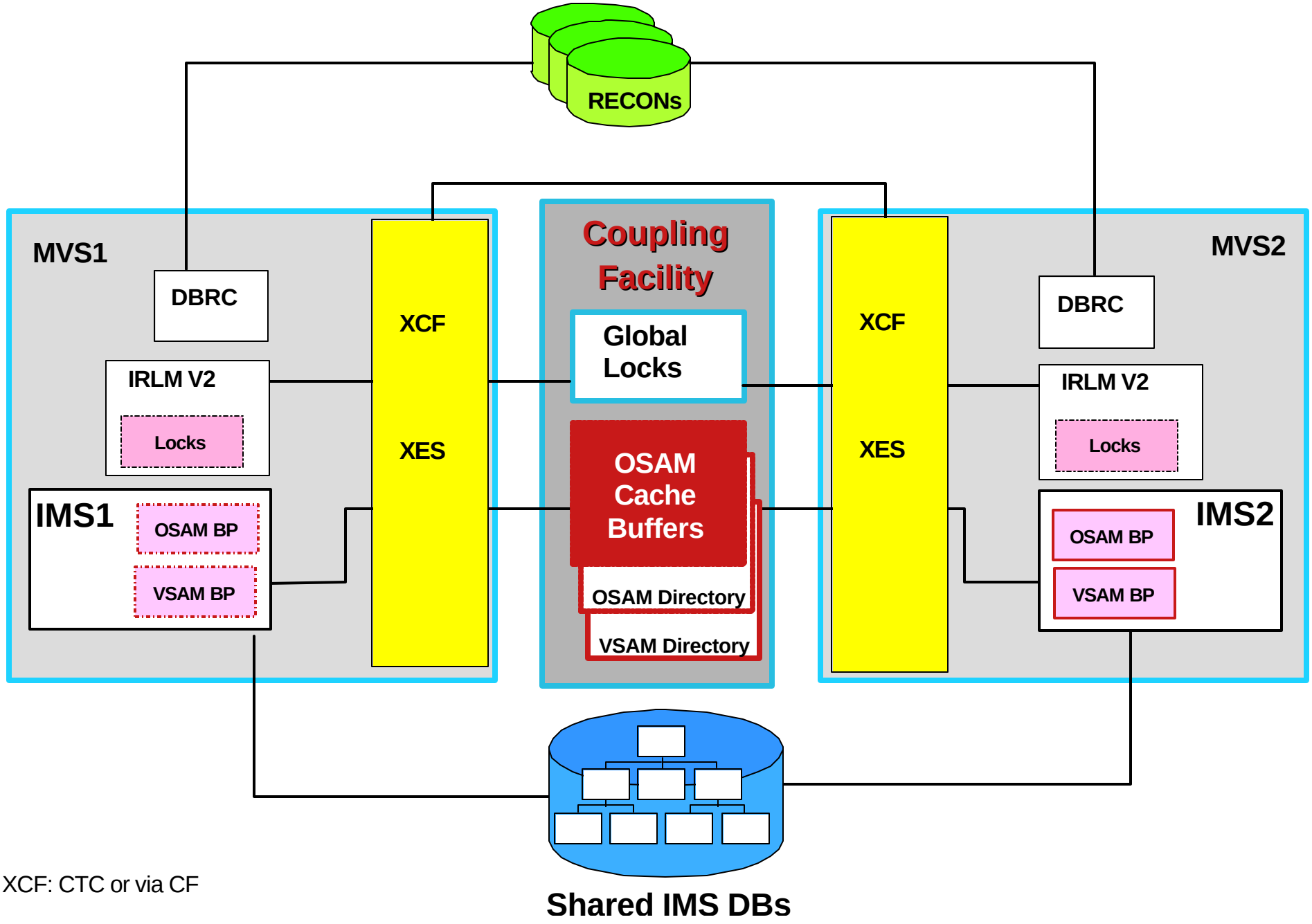
- **Unlike VSAM which has a 4GB dataset limit, OSAM datasets can be up to 8GB in size**
  - Non-HALDB only



- If blocksize is even, pointer values are always even
  - ➡ Rightmost bit is ZERO
  - ➡ Can be used as high-order 33rd bit



Caching OSAM Data in the CouplingFacility



XCF: CTC or via CF

Caching OSAM Data in the CouplingFacility

Objective:

- For small, highly volatile, shared OSAM DBs, reduce impact of OSAM re-read activity due to buffer invalidation
  - replace DASD I/O with CF Access

Utilizes store-through cache

- When application reads data from DASD, it is copied (as a user option) into the Coupling Facility
- At application commit, changed data written first to DASD, and then to Coupling Facility
  - before locks released

Caching is a user specified option

- Specified at the OSAM subpool level
  - IOBF statement in DFSVSMxx
- Choice of cache updated data only or cache all referenced data

“Every Silver Lining has a Cloud”

- **Only VSAM allows a subpool to be defined to include buffers in Hiperspace**
  - **Hiperspace buffers explicitly exploit “Expanded Storage”, but this is of little relevance these days**
  - **The main benefit of hiperspace is when the IMS system often performs “buffer search” as part of the HD Space Search algorithm**
    - **VSAM only searches the main (non-hiperspace) part of the subpool**
    - **gives you all the benefits of a very large subpool without the costs of searching through the whole pool**
- **OSAM requires care when allocating datasets**
  - **especially when multi-volume**
    - **details on following slides**

Allocating OSAM Database Data Sets

- The number of OSAM Secondary Extents is limited
  - between 52 and 60 (dependent on blocksize)
- OSAM can use JCL or Access Method Services (AMS) to allocate database data sets
- Allocating multi-volume OSAM database data sets must be done carefully
  - There are different rules for SMS managed DASD and non-SMS managed DASD
- Care is also required in *reusing* an OSAM multi-volume data set
  - You potentially could leave an EOF on a volume that is not used on a reload

Allocating OSAM Database Data Sets

- Allocating a single-volume OSAM database data set using JCL
  - JCL uses IEFBR14

```
//ALLOC1  EXEC  PGM=IEFBR14
//DD1      DD   DSN=HIGHNODE.MIDNODE.LOWNODE,
//              DISP=(NEW,CATLG),
//              SPACE=(CYLS,(200,100)),
//*  add UNIT and VOLSER if needed
//*  add SMS parameters if needed
//*  do not code DCB parameters
/*
```

Allocating OSAM Database Data Sets

Allocating a single-volume OSAM database data set using AMS

- AMS uses IDCAMS and ALLOCATE control cards

```
//ALLOC1  EXEC  PGM=IDCAMS,REGION=4096K
//SYSPRINT DD   SYSOUT=*
//SYSIN    DD   *
  /*                                                  */
  /* DELETE OLD DATA SET IF IT EXISTS                 */
  /*                                                  */
  DELETE 'HIGHNODE.MIDNODE.ENDNODE'

  IF LASTCC <= 8 THEN SET MAXCC = 0

  /*                                                  */
  /*  ALLOCATE - WITH SMS PARAMETERS                  */
  /*                                                  */

  ALLOCATE DSN('HIGHNODE.MIDNODE.ENDNODE') -
           NEW CATALOG -
           DATACLAS(DCLAS) -
           MGMTCLAS(MCLAS) -
           STORCLAS(SCLAS) -
           SPACE(200 100) CYLINDERS
/*
```

Allocating OSAM Database Data Sets

Allocating a Multi-Volume OSAM database data set using JCL for non-SMS managed DASD

```
//         EXEC PGM=IEFBR14
//DD1       DD  DSN=HIGHNODE.MIDNODE.ENDNODE,
//               DISP=(NEW,KEEP),
//               SPACE=(CYL,(200,100)),
//               UNIT=3390,
//               VOL=SER=VOL111
//*
//         EXEC PGM=IEFBR14
//DD2       DD  DSN=HIGHNODE.MIDNODE.ENDNODE,
//               DISP=(NEW,KEEP),
//               SPACE=(CYL,(200,100)),
//               UNIT=3390,
//               VOL=SER=VOL222
//*
//         EXEC PGM=IEFBR14
//DD3       DD  DSN=HIGHNODE.MIDNODE.ENDNODE,
//               DISP=(NEW,KEEP),
//               SPACE=(CYL,(200,100)),
//               UNIT=3390,
//               VOL=SER=VOL333
//*
//         EXEC PGM=IEHPROGM
//SYSPRINT DD  SYSOUT=*
//DD1       DD  UNIT=3390,VOL=SER=VOL111,DISP=SHR
//DD2       DD  UNIT=3390,VOL=SER=VOL222,DISP=SHR
//DD3       DD  UNIT=3390,VOL=SER=VOL333,DISP=SHR
//SYSIN     DD  *
  CATLG DSNAME=HIGHNODE.MIDNODE.ENDNODE,VOL=3390=(VOL111,VOL222,VOL333)
```

- You must allocate and catalog the data set exactly as shown
- If you try
  VOL=SER=(VOL111,VOL222,VOL333)
  DISP=(NEW,CATLG)
  or
  VOL=(,,,3),DISP=(NEW,CATLG)
  you will get a primary extent only on the first volume
  - The other volumes will get only secondary extents

Allocating OSAM Database Data Sets

Allocating a multi-volume OSAM database data set using AMS for non-SMS managed DASD

```
//       EXEC PGM=IDCAMS,REGION=4096K
//SYSPRINT DD  SYSOUT=*
//SYSIN    DD  *
 DELETE 'HIGHNODE.MIDNODE.ENDNODE'
 IF LASTCC <= 8 THEN SET MAXCC = 0

 ALLOC  DSN('HIGHNODE.MIDNODE.ENDNODE') -
            NEW KEEP -
            SPACE(200,100) CYLINDERS -
            UNIT(3390) -
            VOL(VOL111)

 ALLOC  DSN('HIGHNODE.MIDNODE.ENDNODE') -
            NEW KEEP -
            SPACE(200,100) CYLINDERS -
            UNIT(3390) -
            VOL(VOL222)

 ALLOC  DSN('HIGHNODE.MIDNODE.ENDNODE') -
            NEW KEEP -
            SPACE(200,100) CYLINDERS -
            UNIT(3390) -
            VOL(VOL333)

 DEFINE NONVSAM -
       (NAME('HIGHNODE.MIDNODE.ENDNODE') -
       VOL(VOL111,VOL222,VOL333) -
       DEVT(3390,3390,3390))
/*
```

Allocating OSAM Database Data Sets

Beware!

- **Multi-volume OSAM database data sets on non-SMS DASD can not be backed up with IMS Image Copy 2**
  - Each data set has a sequence number of 1
  - DF/DSS can not process this

```
 PARTIAL IEHLIST OUTPUT

                CONTENTS OF VTOC ON VOL VOL111  <THIS VOLUME IS NOT SMS MANAGED>
---------------DATA SET NAME----------------  SER NO  SEQNO  DATE.CRE  DATE.EXP
HIGHNODE.MIDNODE.ENDNODE                      VOL111      1  2005.227    00.000

                CONTENTS OF VTOC ON VOL VOL222  <THIS VOLUME IS NOT SMS MANAGED>
---------------DATA SET NAME----------------  SER NO  SEQNO  DATE.CRE  DATE.EXP
HIGHNODE.MIDNODE.ENDNODE                      VOL222      1  2005.227    00.000

                CONTENTS OF VTOC ON VOL VOL333  <THIS VOLUME IS NOT SMS MANAGED>
---------------DATA SET NAME----------------  SER NO  SEQNO  DATE.CRE  DATE.EXP
HIGHNODE.MIDNODE.ENDNODE                      VOL333      1  2005.227    00.000
```

Allocating OSAM Database Data Sets

- **Allocating a multi-volume OSAM database data set using JCL for SMS managed DASD**
  - **You must use an SMS storage class with the Guaranteed Space attribute**
  - **You must specify the volume serial numbers**
    - If you do not do these two things you will get a primary extent only on the first volume
    - The other volumes will get only secondary extents

```
//       EXEC PGM=IEFBR14
//DD123    DD  DSN=HIGHNODE.MIDNODE.ENDNODE,
//                 DISP=(NEW,CATLG),
//                SPACE=(CYL,(200,100)),
//                UNIT=3390,
//                VOL=SER=(VOL111,VOL222,VOL222),
//                STORCLAS=GTDSPACE
/*
```

Allocating OSAM Database Data Sets

- **Allocating a multi-volume OSAM database data set using AMS for SMS managed DASD**

```
//       EXEC PGM=IDCAMS,REGION=4096K
//SYSPRINT DD  SYSOUT=*
//SYSIN    DD  *

  DELETE 'HIGHNODE.MIDNODE.ENDNODE'

  IF LASTCC <= 8 THEN SET MAXCC = 0

  ALLOC  DSN('HIGHNODE.MIDNODE.ENDNODE') -
            NEW CATALOG -
            SPACE(200,100) CYLINDERS -
            UNIT(3390) -
            VOL(VOL111 VOL222 VOL333) -
            STORCLAS(GTDSPACE)
/*
```

Allocating OSAM Database Data Sets

Good News

- **Multi-volume OSAM database data sets on SMS DASD can be backed up with IMS Image Copy 2**
  - Each data set has the proper sequence number

```
 PARTIAL IEHLIST OUTPUT

                CONTENTS OF VTOC ON VOL VOL111  <THIS IS AN SMS MANAGED VOLUME>
---------------DATA SET NAME----------------  SER NO  SEQNO  DATE.CRE  DATE.EXP
HIGHNODE.MIDNODE.ENDNODE                      VOL111      1  2005.227    00.000

                CONTENTS OF VTOC ON VOL VOL222  <THIS IS AN SMS MANAGED VOLUME>
---------------DATA SET NAME----------------  SER NO  SEQNO  DATE.CRE  DATE.EXP
HIGHNODE.MIDNODE.ENDNODE                      VOL222      2  2005.227    00.000

                CONTENTS OF VTOC ON VOL VOL333  <THIS IS AN SMS MANAGED VOLUME>
---------------DATA SET NAME----------------  SER NO  SEQNO  DATE.CRE  DATE.EXP
HIGHNODE.MIDNODE.ENDNODE                      VOL333      3  2005.227    00.000
```

Summary

- **OSAM is more efficient than VSAM**
  - less CPU
  - chained writes
  - parallel writes
  - chained and look-ahead reading with OSAM SB

Reduced Online Region Occupancy
Reduced Batch Elapsed Times

- **OSAM supports up to 8GB datasets** (for non-HALDB)
- **OSAM allows Coupling Facility caching for volatile shared DBs**

★ If performance or cost are key factors in your system

➡ **USE OSAM**