



IBM Software Group

100% Data Availability....Costly Mistakes...What Are Your Hot Buttons with IMS Reorganization?

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ON DEMAND BUSINESS™

Agenda

- Are Database Reorganizations Needed?
- The Evolution of Reorganization Tools
- Problems for Reorganizations in Today's World



Why A Database Needs To Be Reorganized

- Performance
 - ▶ Fragmentation
 - ▶ Overflow
 - ▶ CI/CA Splits

- Space
 - ▶ Nearing Limitations
 - Current Definitions
 - z/OS Limitations
 - IMS Limitations
 - Reclaim

- DBD Changes



Are Database Reorgs Needed?

Don't Do Reorgs



- Poor Performance
- More Risk of Outages


Do Reorgs



- Better Performance
- Less Risk of Outages

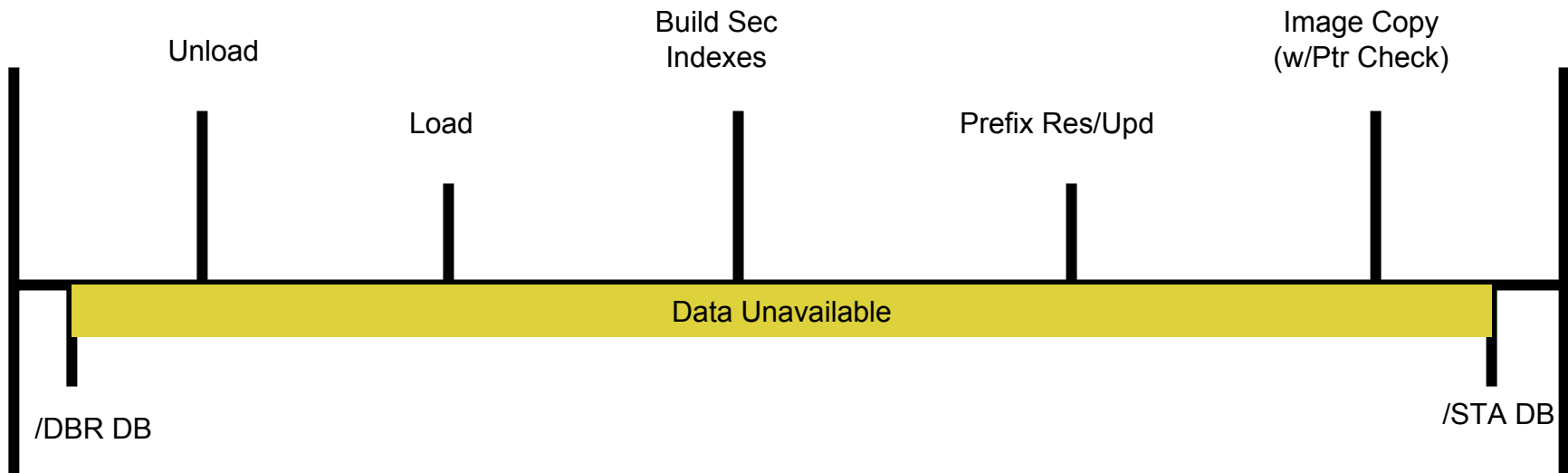


IBM IMS Reorganization Options

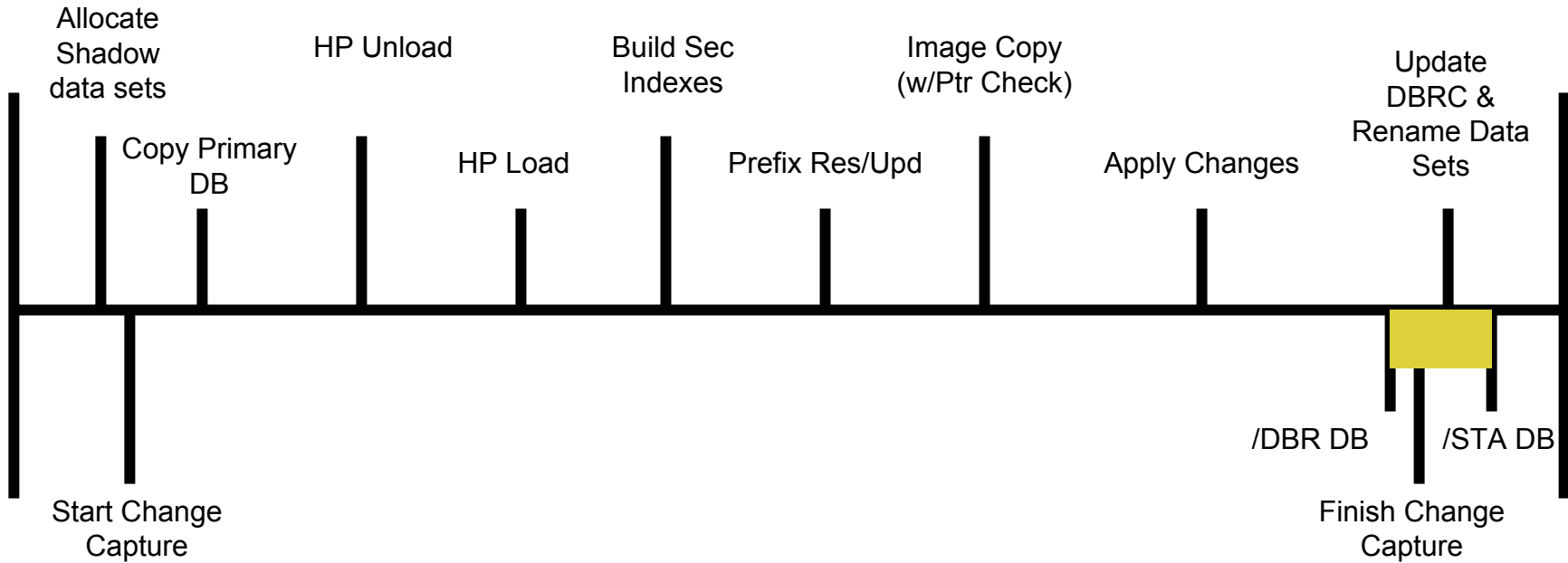
- 'Standard' IMS Utilities
 - ▶ DB must be offline
 - ▶ Get's the job done
 - ▶ No more \$\$\$ with IMS
- HP Utilities - Standalone
 - ▶ DB must be offline
 - ▶ High performance
- Parallel Reorg
 - ▶ DB still available for inquiry
 - ▶ High performance
 - ▶ Minimal impact to online systems
- **Online Reorganization Facility** 
 - ▶ Reorg when needed
 - ▶ Small outage
 - ▶ Minimal impact to online systems
 - ▶ Supports all full function DB types
- HALDB OLR
 - ▶ Must be HALDB
 - ▶ No outage, complete IMS recoverability
 - ▶ Somewhat expensive in resources used
 - ▶ No more \$\$\$ with IMS



The Offline Reorg Process



The Online Reorg Process – with shadow data sets






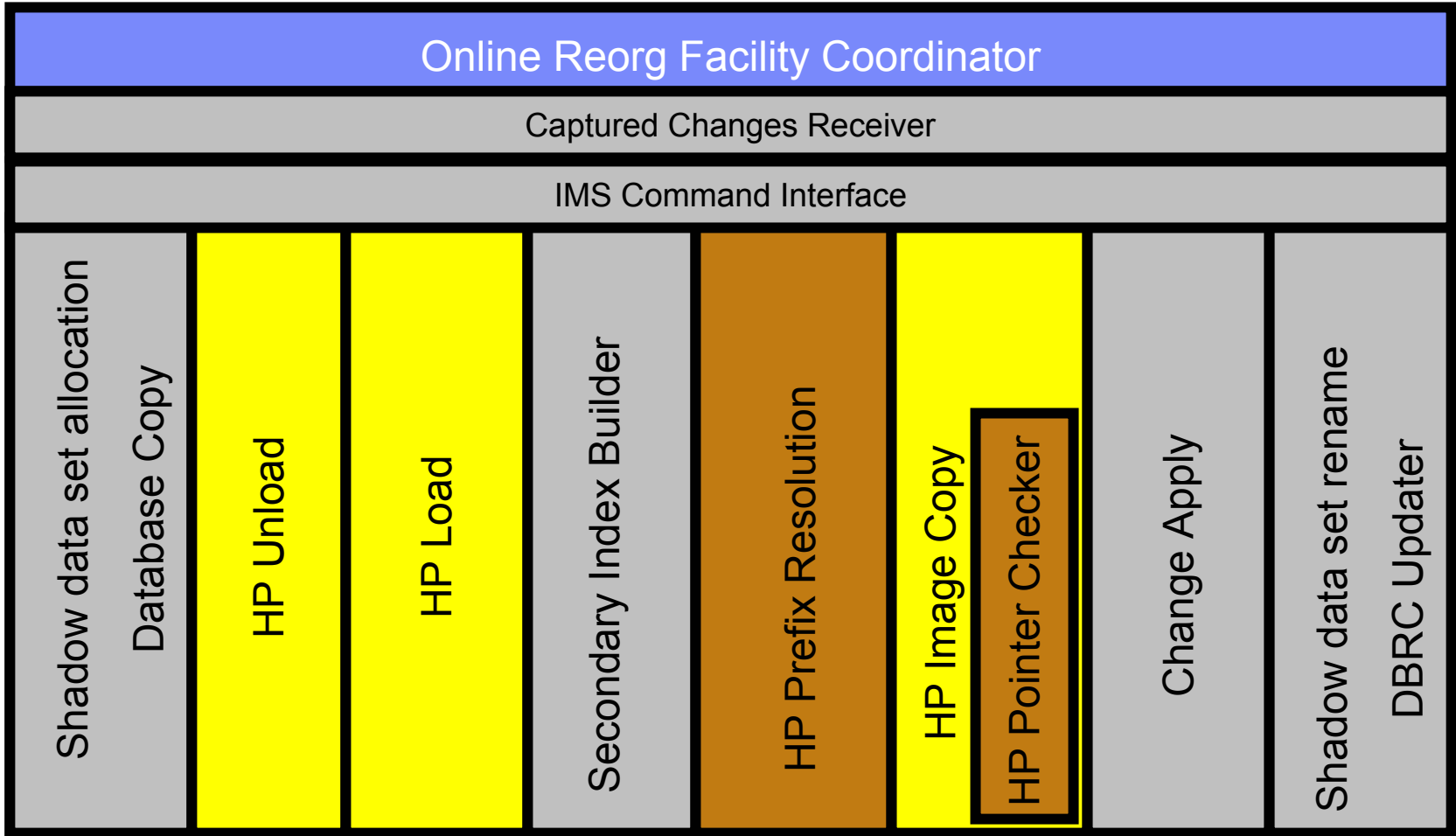
IMS Online Reorg Facility with HP Tools

- IMS Online Reorg Facility integrates with the following HP Utilities
 - ▶ IMS High Performance Unload V1 (5655-E06)
 - ▶ IMS High Performance Load V2 (5655-M26)
 - ▶ IMS High Performance Image Copy V4 (5655-N45) or
IMS High Performance Image Copy V3 (5655-K96)
 - ▶ IMS High Performance Pointer Checker V2 (5655-K53) (optional)
 - ▶ IMS High Performance Prefix Resolution V3 (5655-M27) (if logicals)
 - ▶ IMS Tools Online System Interface (TOSI)



Single Step Online Reorg

-  = HP Tool (req)
-  = HP Tool (opt)
-  = ORF component

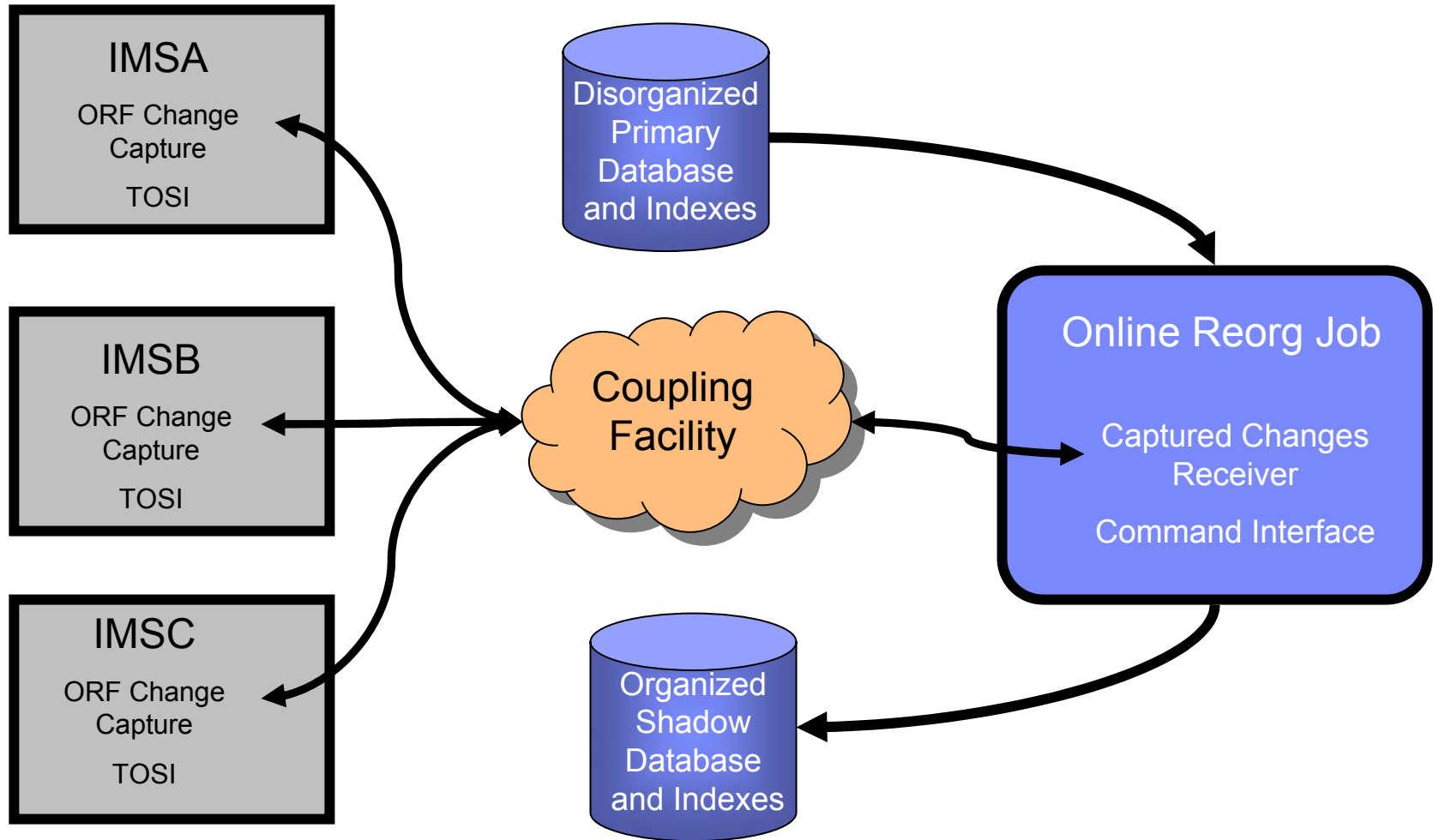


An Online Reorg for **All** Full Function Databases

- HDAM/HIDAM
- PHDAM/PHIDAM - HALDB
 - ▶ Entire database – all partitions
 - ▶ **Single** partition
- Secondary indexes
 - ▶ When primary DB reorganized
 - ▶ Index only
- Partitioned secondary indexes
 - ▶ Entire index
 - ▶ **Single** partition



Online Reorg in a Data Sharing Environment



Today's Problems

- Data Availability
 - ▶ When is the data being accessed?
 - ▶ Where is the data being accessed from?
 - ▶ Increased competition – more choices for consumers

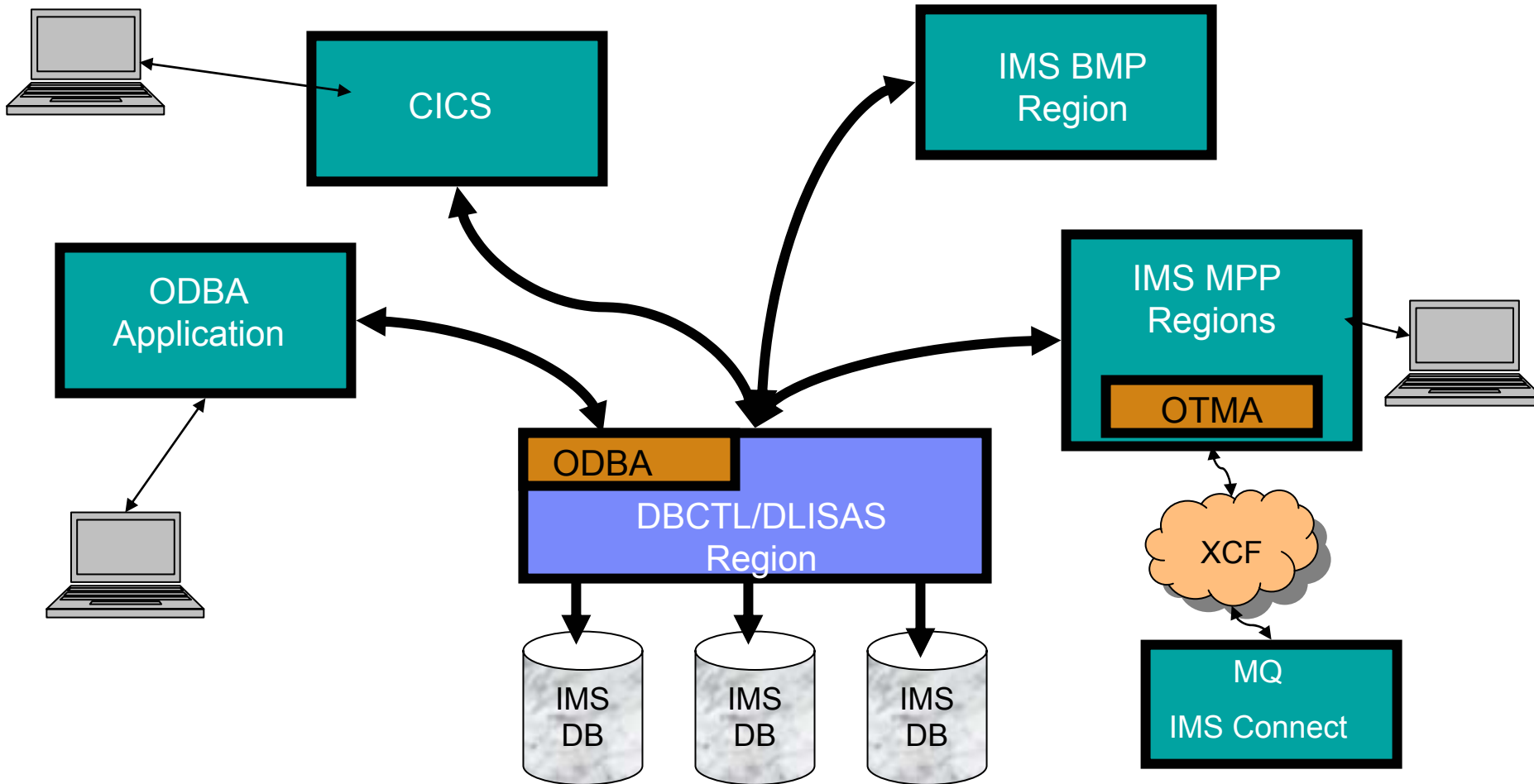
- Who Runs These Reorgs
 - ▶ IMS skills
 - ▶ IMS Reorg Process versus Other DBMS
 - ▶ Do They Know the End Users?



Maintaining Data Availability



Who's Accessing IMS Data?



Database Being Accessed by BMPs

- BMPs must be stopped when ORF needs to STOP or DBR a DB
 - ▶ Potentially 'long running'
 - ▶ Interface with Program Restart Facility or ORF region controller front-end
 - New BMPs are 'paused' until DB is restarted
 - Existing BMPs – next CHKP
 - HALDB – BMP is paused until DB is restarted
 - Non-HALDB –
 - pseudo U3303
 - Job restarted from last checkpoint after DB is restarted



Data Being Accessed by IMS Terminals

- New transaction arrives when DB is DBR'd
 - ▶ Transaction placed on suspend queue
 - Exit/Automation to process suspend queue and reissue transaction
 - /STA DB will requeue message
 - ▶ Takeover WINDOW to reduce impact



Data Being Accessed by CICS Terminals

- SCHEDULE PSB request when DB is DBR'd
 - ▶ ORF detects that it has DBR'd the DB
 - Thread is put into wait
 - ▶ Takeover WINDOW to reduce impact
- Typically short lived



Data Being Accessed through ODBA

- APSB request when DB is DBR'd
 - ▶ ORF detects that it has DBR'd the DB
 - Application TCB is put into wait
 - ▶ Takeover WINDOW to reduce impact

- Typically short lived



Controlling /DBR Time

TAKEOVER.WINDOW parameter

- ▶ Can be used to specify a time range when ORF can issue /DBR to put shadow data sets online
 - Can reduce potential impact to incoming requests

- ▶ Begin time - Earliest time of day that takeover will start
 - ORF job 'idles' with DB still online

- ▶ End time - Latest time of day that takeover will start



Installation of New Maintenance

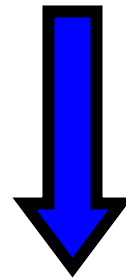
- No IMS downtime required to implement new maintenance
 - ▶ IMS online systems must be recycled to initially install ORF
 - ▶ After initial activation in an IMS subsystem, future maintenance implemented through batch job

- ORF Reorg jobs verify online IMS systems
 - ▶ If online system sharing recon, ORF must be activated
 - ▶ Will verify all online systems at 'acceptable' maintenance level



Data Availability -> End Result

No Matter Where Data is Being Accessed From



User may experience a brief delay,
but data is still available



Addressing Today's (or Tomorrow's) IMS DBA



IMS DBA Trends

- Many retiring
- Few new DBAs
- Often administer multiple DBMSs
- Often responsibility left to non-DBA



IMS Reorg Process versus Other DBMSs

- Multi-step process versus single command
 - ▶ REORG TABLESPACE
 - ▶ REORG INDEX

Remember the steps for an IMS reorg

- Online versus Offline
- JCL complexity

Where is IMS data being accessed from?



Single Step Online Reorg

```
//ORFSTEP EXEC PGM=HRFREORG
//STEPLIB DD DSN=your.orf.load,DISP=SHR
// DD DSN=your.userlib,DISP=SHR <=== USER ROUTINES
// DD DSN=IMSUTIL.SHPSLMD0,DISP=SHR <=== IMS HP TOOLS
// DD DSN=IMS.vrmm.SDFSRESL,DISP=SHR
//IMSDALIB DD DSN=your.mdalib,DISP=SHR
//IMS DD DSN=your.dbdlib,DISP=SHR
//IEFRDER DD DISP=SHR,DSN=your.IEFRDER <=== ORF BATCH LOG
//*
//*
//HRFSYSIN DD *
REORG
ICDYN(Y) ICNUM(1) ICHLQ(your.ic.hlq) ICMID(1) ICID(1) ICTRLR(5) -
DATACLAS(DATABASE) STORCLAS(DATABASE) -
DBD(dbdname)
//*
```

This is only
thing to
specify.

Ease of Use


- In most cases can use same JCL for all databases
- No need to determine what reorg steps are needed
 - ▶ What data sets need to be image copied (RECOV vs NONRECOV)?
 - ▶ Are there secondary indexes to rebuild?
 - ▶ Does prefix resolution need to be run?
- Forces Image Copy after Reorg
- Determines what IMS systems are sharing the DB (if any)
 - ▶ Same JCL can run whether IMS systems are up or not
 - ▶ Automatically issues IMS command to take DB offline when needed
 - ▶ Restores DB to same state prior to reorg



Controlling Shadow Data Set Definition

■ Automation

- ▶ Data sets dynamically allocated
 - Dataset attributes are copied from original
 - Using the same SMS construct
 - Using the same VOLSERS (non-SMS)
 - No need for creating IDCAMS statements



Prevents
Mistakes

■ Control

- ▶ Data sets are preallocated by user
 - Allows datasets to be moved or resized
 - Dataset attributes must be set by user



Flexibility



Questions?



Additional Information



Restrictions

- No support for Fast Path or HSAM databases
- No external logical relationships
- Logical relationships & HALDB
 - ▶ All partitions must be reorganized
- HIDAM root key can not be compressed
- Primary database must be RECOV



Sample Messages (Verification Phase)

Runtime Messages

Utility driver started

Control cards used in this run

REORG DBD(HDOPR0) -
ICDDN((HDOPR01,ICPR01))

Restart manager started

Verify input started

Allocating the shadow files

DELETE PECK.QA.HDOPR0.HDOPR01.S
IDC0550I ENTRY (A) PECK.QA.HDOPR0.HDOPR01.S DELETED
IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0

SET MAXCC=0

ALLOCATE -
DATASET('PECK.QA.HDOPR0.HDOPR01.S') -
NEW CATALOG DSORG(PS) -
VOLUME(DATA02) -
SPACE(1,1) -
CYLINDERS

IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0

IDC0002I IDCAMS PROCESSING COMPLETE. MAXIMUM CONDITION CODE WAS 0

Sample Messages (Copy Phase)

HRF01503I Joined XCF group ORFGROUP as member HDOPR0
HRF01108I Change capture interface connected to online subsystem QA8A
HRF01000I TOI-interface started
HRF01503I Joined XCF group TOIORF as member D00BA00A
HRF01108I AOI interface connected to online subsystem QA8A
HRF01000I Copy to shadow started
HRF01531I STO request for DBD HDOPR0 being issued
HRF01531I STO request for DBD HDOPR0 completed
HRF01531I STA request for DBD HDOPR0 being issued
HRF01531I STA request for DBD HDOPR0 completed
HRF01531I STO request for DBD HDOPR0 being issued
HRF01531I STO request for DBD HDOPR0 completed
HRF01531I STA request for DBD HDOPR0 being issued
HRF01531I STA request for DBD HDOPR0 completed
HRF01000I Copy to shadow ended, return code is 0

Sample Messages (Reorg & Apply Phases)

HRF01000I Reorg Unload started
HRF01079I HSSR region controller started
HRF01079I HSSR region controller ended
HRF01000I Reorg Unload ended, return code is 0
HRF01000I Reorg Reload started
HRF01112I Reloading DD HDOPR01 DSN PECK.QA.HDOPR0.HDOPR01.S
HRF01073I IMS region controller started
HRF01073I IMS region controller ended
HRF01000I Reorg Reload ended, return code is 0
HRF01000I Image copy started
HRF01000I IC1: HDOPR01 PECK.QA.HDOPR0.HDOPR01.IC
HRF01000I Image copy ended, return code is 0
HRF01000I Apply changes started
HRF01073I IMS region controller started
HRF01531I DBR request for DBD HDOPR0 being issued
HRF01531I DBR request for DBD HDOPR0 completed
HRF01073I IMS region controller ended
HRF01000I 209 Captured calls applied
HRF01000I Apply changes ended, return code is 0

Sample Messages (Takeover phase)

```
HRF01000I TAKEOVER started
HRF01532I Restart information saved
HRF01000I NOTIFY.REORG started TIMESTAMP=2004.227 14:35:42.9
HRF01000I NOTIFY.IC started TIMESTAMP=2004.227 14:35:43.4
HRF01000I NOTIFY.PRILOG started TIMESTAMP=2004.227 14:35:44.0
HRF01000I NOTIFY.ALLOC started TIMESTAMP=2004.227 14:35:44.5
HRF01000I DATA SET RENAME started
HRF01000I
HRF01000I ALTER IMS710A.HDOPR2.HDOPR21 -
HRF01000I NEWNAME(IMS710A.HDOPR2.HDOPR21.T)
HRF01000I IDC0531I ENTRY IMS710A.HDOPR2.HDOPR21 ALTERED
...
HRF01000I IDC0001I FUNCTION COMPLETED, HIGHEST CONDITION CODE WAS 0
HRF01000I START DB started
HRF01531I STA request for DBD HDOPR2 being issued
HRF01531I STA request for DBD HDOPR2 completed
HRF01531I STA request for DBD HDOSX21 being issued
HRF01531I STA request for DBD HDOSX21 completed
HRF01531I STA request for DBD HDOSX22 being issued
HRF01531I STA request for DBD HDOSX22 completed
HRF01000I LOG RECOVERY started
HRF01000I TAKEOVER ended, return code is 0
```