IBM Software Group

IMS Tools from IBM

Reorg Solutions

IMS V10 Update - Enhancements and Migration Planning
April 1-2, 2008
Columbus, OH

Rick Engel
IMS Tools for z/OS– Technical Sales Support
raengel@us.ibm.com

IBM IMS Tools Portfolio

IMS Database Administration

- →IBM Data Encryption for IMS and DB2 Databases
- →IMS Audit Management Expert
- →IMS HALDB Conversion and Maintenance Aid
- →IMS HD Compression Extended
- →IMS Library Integrity Utilities
- →IMS Sequential Randomizer Generator
- →IMS Database Repair Facility
- →IMS Parameter Manager
- →IMS Sysplex Manager

IMS Utilities Management

- →IMS DB Control Suite
- →IMS HP Fast Path Utilities
- →IMS HP Unload
- →IMS HP Load
- →IMS Index Builder
- →IMS HP Prefix Resolution
- →IMS Parallel Reorganization
- →IMS Online Reorganization Facility
- →IMS HP Pointer Checker
- →IMS Knowledge Base

IMS Recovery Management

- →IMS DEDB Fast Recovery
- →IMS Database Recovery Facility
- →IMS HP Change Accumulation
- →IMS HP Image Copy
- →IMS Recovery Expert
- →IBM Application Recovery Tool for IMS and DB2

IMS Performance Management

- →IMS Buffer Pool Analyzer
- →IMS Performance Analyzer
- →IBM Tivoli Omegamon XE for IMS
- →IMS Problem Investigator
- →IMS Network Compression Facility

IMS Transaction Management

- →IMS Command Control Facility
- →IMS ETO Support
- →IMS HP Sysgen Tools
- →IMS Queue Control Facility
- →IMS Workload Router

IMS Application Management

- →IMS Batch Backout Manager
- →IMS Batch Terminal Simulator
- →IMS Connect
- →IMS Connect Extensions
- →IMS MFS Reversal Utilities
- →IMS Program Restart Facility

Information Integration

- →IMS DataPropagator
- →Websphere Classic Replication Server
- →Websphere II Classic Federation
- →Websphere II Event Publisher for IMS, CA-IDMS, DB2, VSAM, Adabase

IMS Database Reorganization – Why ?

- Performance
  - Fragmentation
  - Overflow
  - CI/CA Splits
- Space
  - Nearing Limitations
    - Current Definitions
    - z/OS Limitations
    - IMS Limitations
    - Reclaim
- DBD Changes

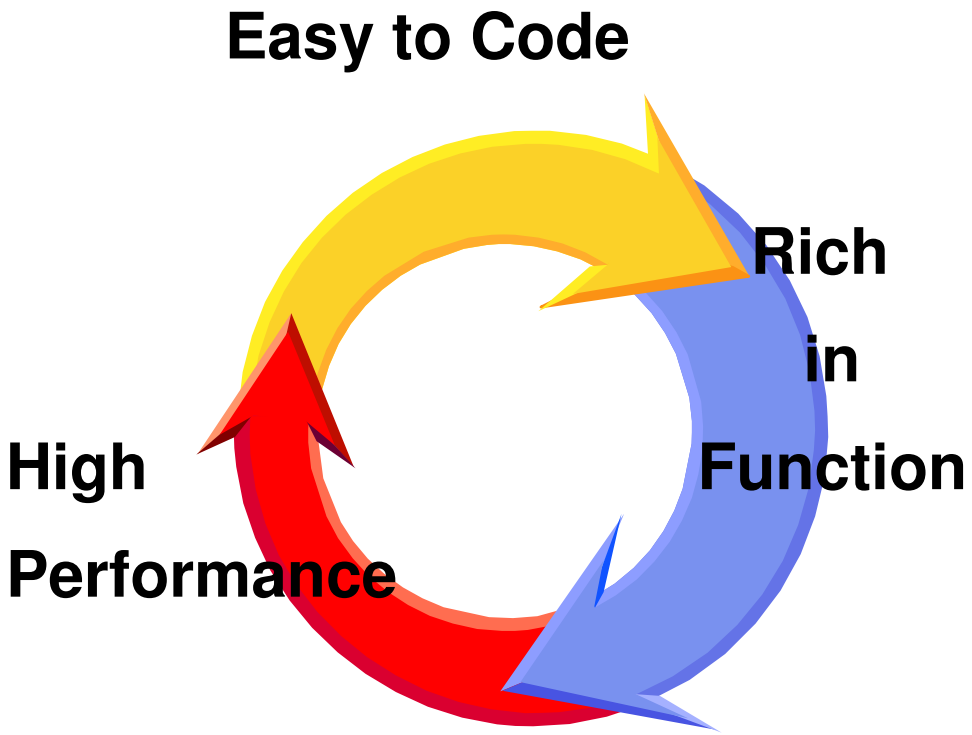
IMS Database Reorganization - Today

The process of performing an
IMS Database Reorganization is continuing to change
as batch windows shrink and applications
move closer to 7 X 24 operations.

What do you look for in a reorganization solution?

- High Performance
  - Minimized Elapsed time
  - Minimized CPU time
  - Parallelism
- Easy to code
  - Site Defaults
  - Dynamic allocation
  - Easy control cards
- Rich in function
  - Need utilities for more than reorganization
    - Application use
    - Recovery
    - Fault tolerant

Complete reorganization solution

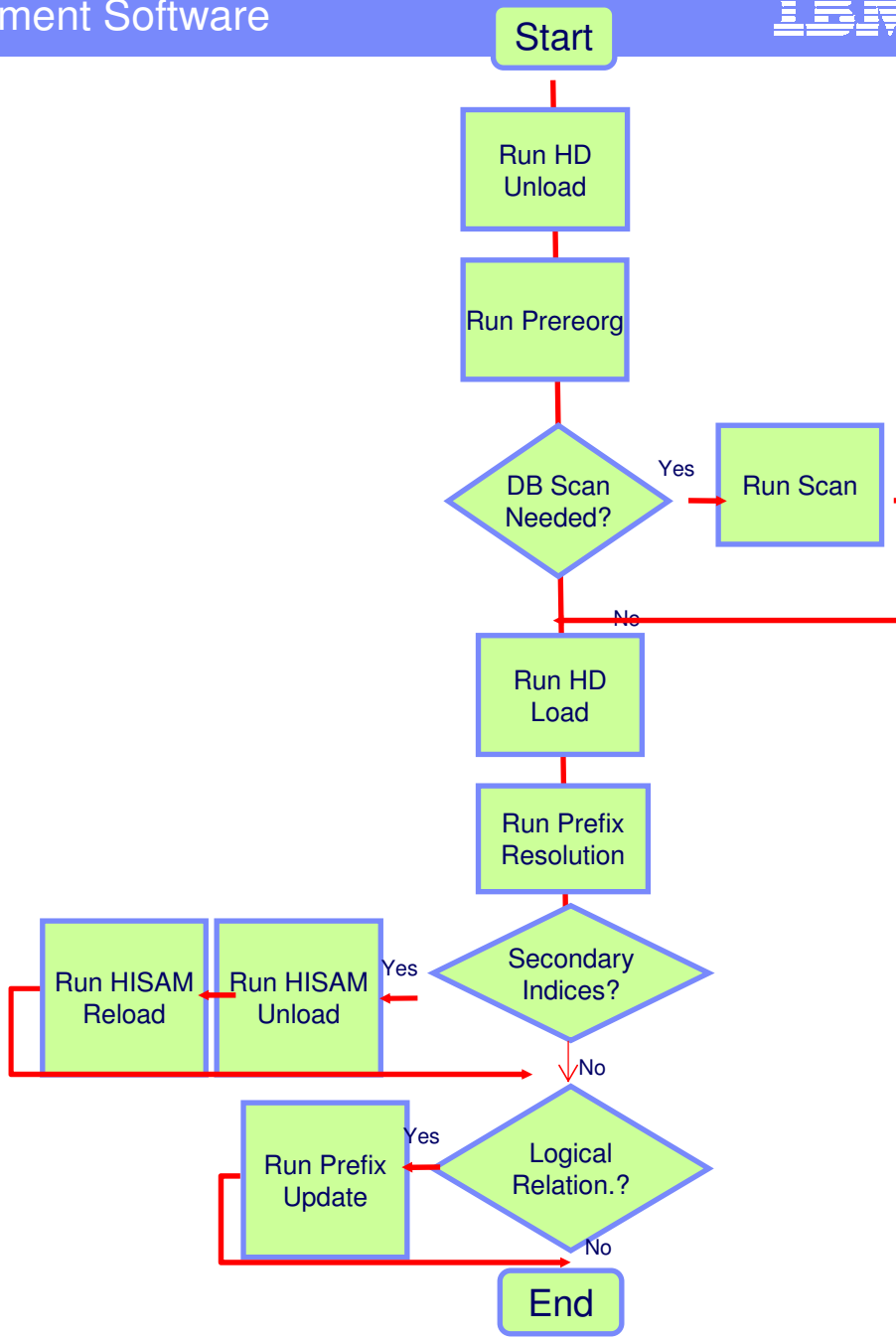


Everything you need for the reorganization

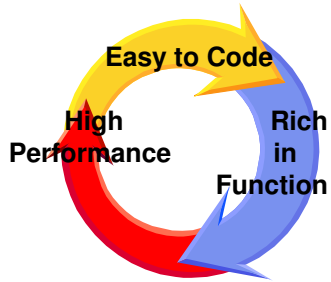
Standard IMS Full Function Reorganization Process

…reorganization the old-fashioned way

- Standard IMS Utilities
  - HD Reorganization Unload
  - HD Reorganization Reload utility
  - Database Prereorganization Utility
  - Database Scan Utility
    - Used to scan DBs that are not reorganized but are involved in LR with DBs that are being reorganized
  - For External/Internal Logical Relationships:
    - Database Prefix Resolution Utility
    - Database Prefix Update Utility
  - For each individual secondary Index:
    - HISAM Reorganization Unload
    - HISAM Reorganization Reload



Full Function Reorganization Toolsets …Two Integrated IMS Tools choices



1

Reorg Utility Set

IMS Parallel Reorg

- HP Unload
- HP Load
- Index Builder #
- HP Prefix Resolution #
- HP Image Copy #
- HP Pointer Checker #
- Program Restart Facility #

2

Online Reorg Utility Set

Online Reorg Facility

- HP Unload #
- HP Load #
- HP Prefix Resolution #
- HP Image Copy #
- HP Pointer Checker #
- Program Restart Facility #

 # optional integrated functions

Reorg Utility Set

….when ease of use / speed / function is important

1

Reorg Utility Set

IMS Parallel Reorg … “IPR”

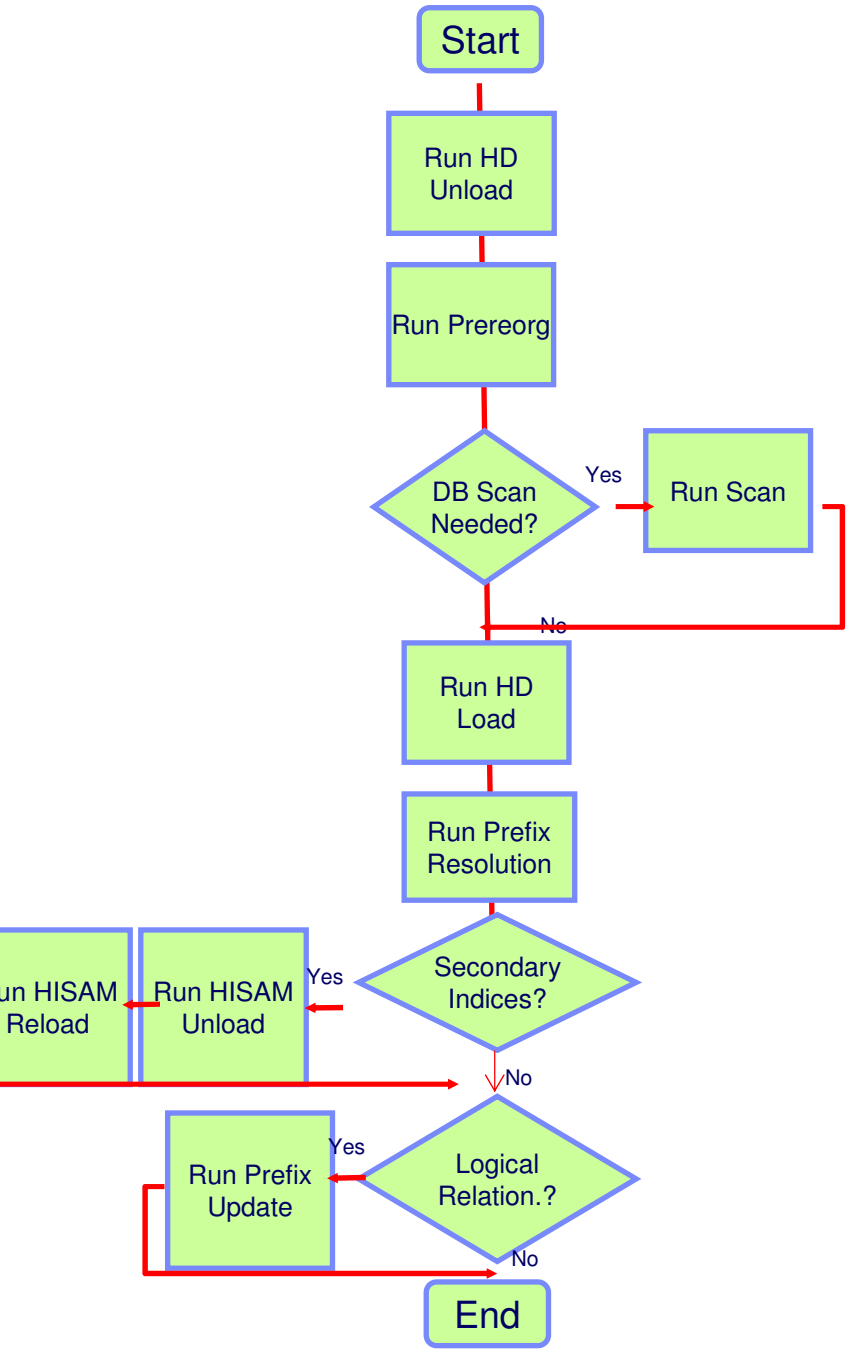
- HP Unload
- HP Load
- Index Builder
- HP Prefix Resolution #
- HP Image Copy #
- HP Pointer Checker #
- Program Restart Facility #

 # optional integrated functions

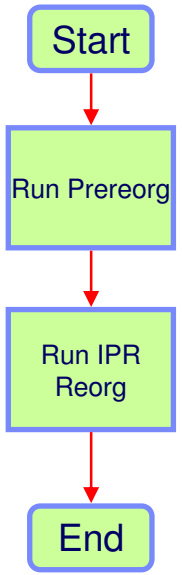
IMS Parallel Reorganization for z/OS

Benefits

- Run multiple reorganization tasks concurrently in a single job step
- JCL statements simpler for easier coding and modification
- Reduce the CPU time and elapsed time required to reorganize a database



Simplifying reorganization



Easy to Code

- Site Defaults
- Dynamic Allocation
- Integration of functions

Sample JCL Statements – IMS Parallel Reorg

```
//IPR       EXEC PGM=HPSGMAIN,PARM='DBD=YOURDBD,DBRC=Y'
//STEPLIB   DD DISP=SHR,DSN=TOOLS.LIBRARY
//           DD DISP=SHR,DSN=IMS.SDFSRESL
//IMS       DD DISP=SHR,DSN=IMS.DBDLIB
//IMSDALIB  DD DISP=SHR,DSN=IMS.DALIB
//HPSIN     DD *
(REORG)
   IMSCMD=YES
   DBSHARE=YES
   IC=YES
   INDEXBLD=YES
   NAMESWAP=YES
   DELOLDDS=YES
/*
//ICEIN     DD *
   GLOBAL    HDPC=(Y,HISTORY),ICHLQ=IMSICA
/*
//HISTORY   DD DISP=SHR,DSN=HDPC.HISTORY
```

The control statements for IPR Driver, IPR Unload, IPR Reload, Index Builder, and High Performance Prefix Resolution are specified in **HPSIN**.

The control statements for High Performance Image Copy are specified in **ICEIN**.

All SYSOUT streams for reports and statistics can be allocated dynamically

- You do not need to know the DD names for various utility outputs

Rich in Function

1. Multiple Unload formats
2. Multiple DB Type Support
3. Compression Support
4. Fault tolerance
5. Full HALDB Support
6. User Exits
7. Application Program Interface
8. Additional Utilities

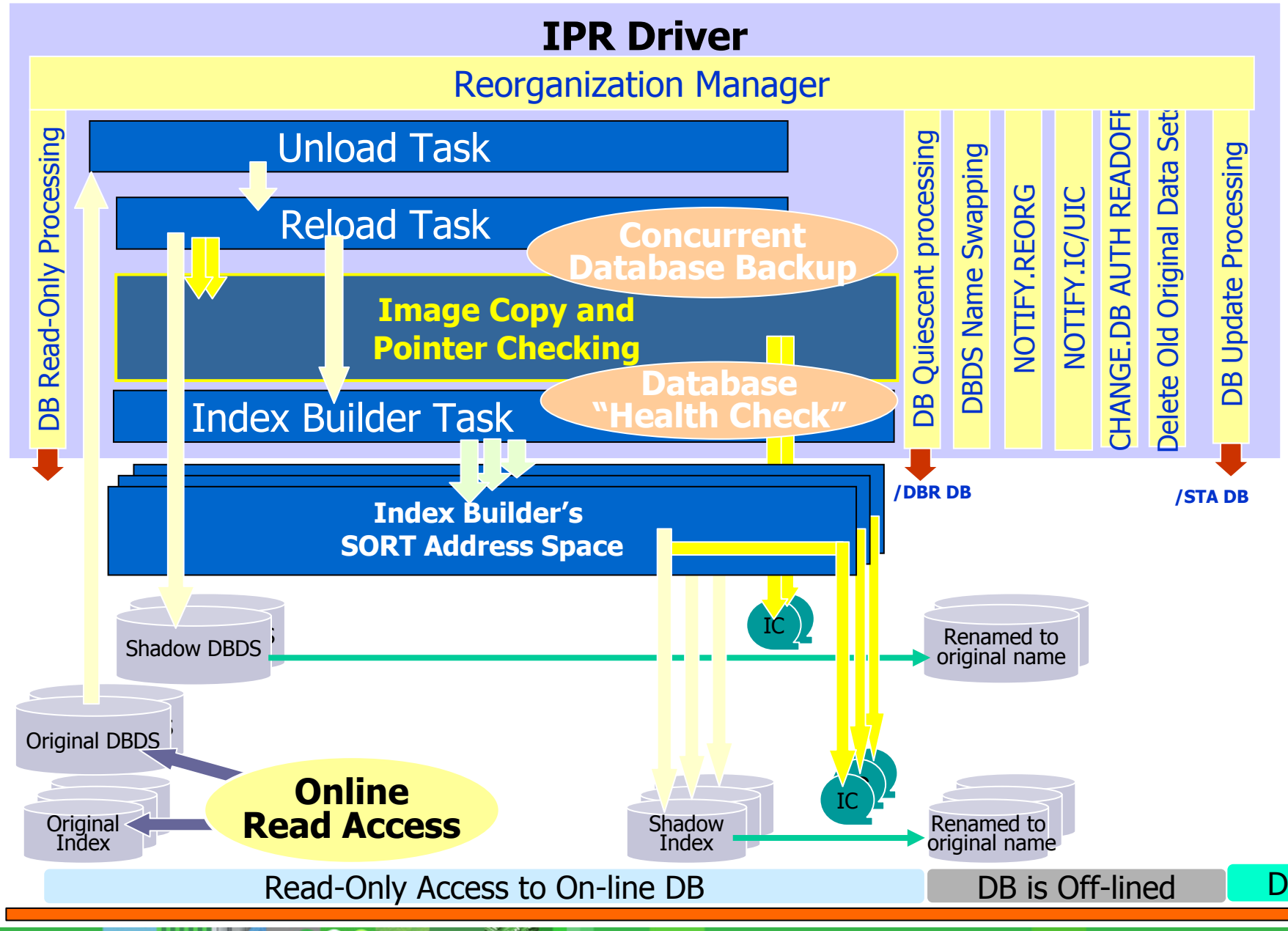
Delivering High Performance

- Reduced Elapsed and CPU times
  - Self Optimization and use of Dataspace
  - Pre-tuned with defaults
  - Use of parallel processing and overlapping processing steps
- Parallelism
  - Index Builder
  - HP Prefix Resolution
  - HP Image Copy
  - HP Pointer Checker

Adding in the "POWER" of parallelism

- One-step Reorganization
- Automated IMS Commands / DBRC processing
- Reduced elapsed times

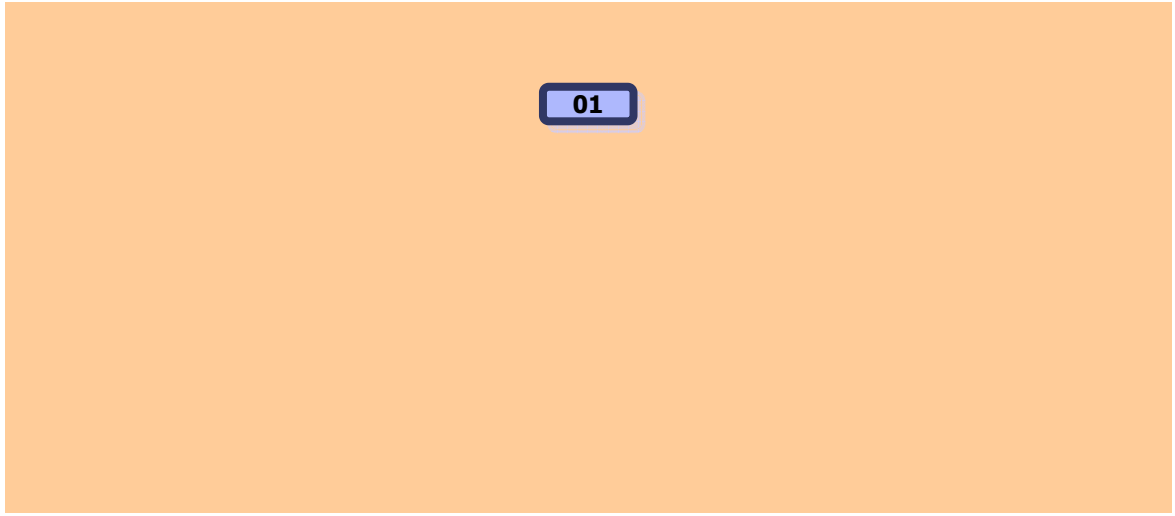
Reorganization in Parallel – The "Big Picture"



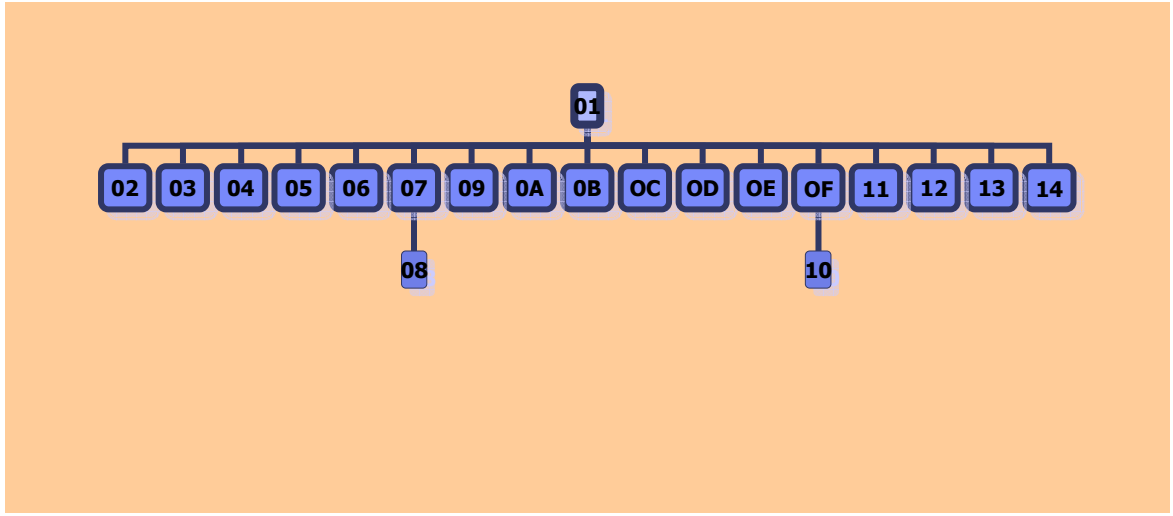
Disclaimer

IMS Tools Performance Studies results contained in this document were obtained in a controlled lab environment, therefore, the results that can be obtained in other operating environment might vary significantly. Users of this document should verify the applicability of data for their specific environment .

Test DB descriptions

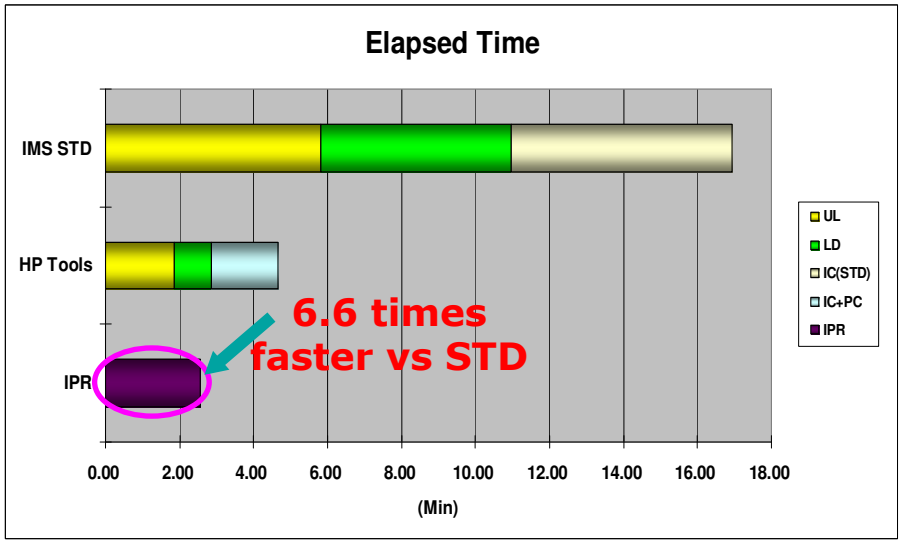


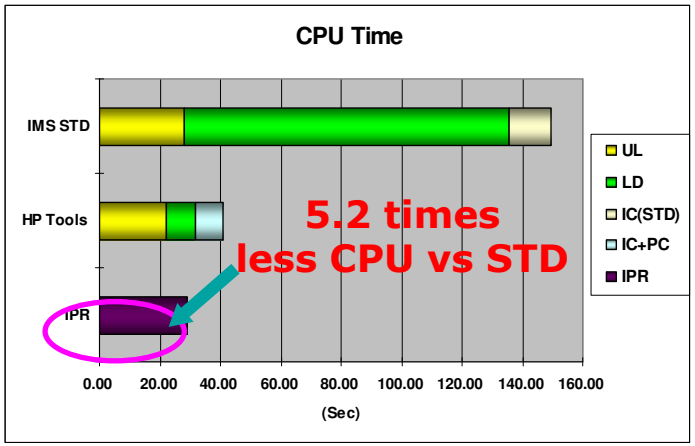
- Root Only DB
  - 11 million occurrences
  - 1100 cylinders (0.8GB)
  - HIDAM/VSAM
  - No secondary indexes



- 20 Segment types DB
  - 49 million occurrences
  - 1700 cylinders (1.3GB)
  - HIDAM/OSAM
  - 2 secondary indexes

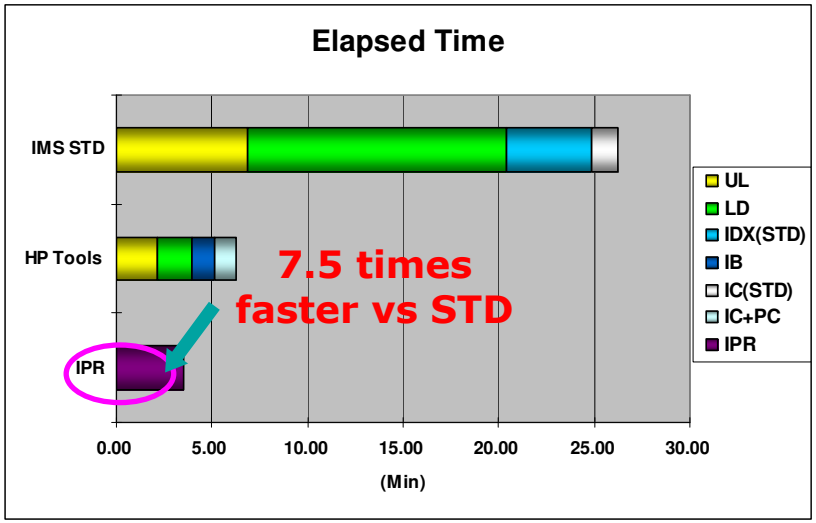
Test Result (HIDAM/VSAM Root only)

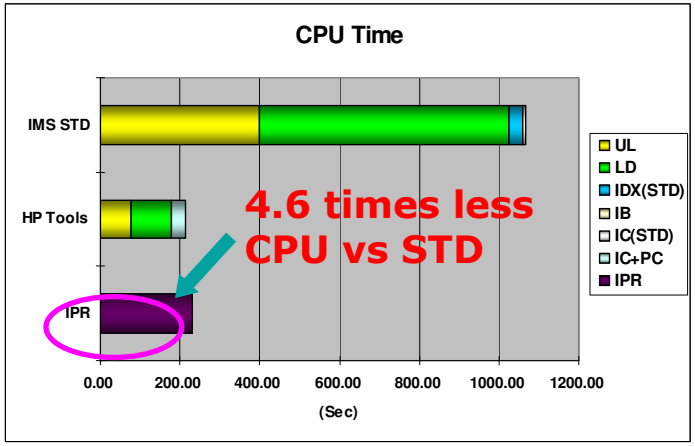




- Comparison:
  - Standard IMS Utilities
    - HD Unload
    - HD Reload
    - Image Copy
    - (No Pointer Checking)
  - High Performance Tools
    - HP Unload
    - HP Load
    - HP Image Copy
    - HP Pointer Checker
  - IPR
    - Unload+Reload+ImageCopy+ Pointer Checker
- Faster & less CPU (IPR vs STD)
  - Elapsed Time: **6.6 times faster**
  - CPU Time: **5.2 times less CPU time**

Test Result (HIDAM/OSAM 20 segment types)





- Comparison
  - Standard IMS Utilities
    - HD Unload (with OSAM SB)
    - HD Reload
    - HISAM Unload/Reload (For Secondary Indexes)
    - Image Copy (No Pointer Checking)
  - High Performance Tools
    - HP Unload
    - HP Load
    - Index Builder
    - HP Image Copy
    - HP Pointer Checker
  - IPR
    - Unload+Reload+IndexBuilder+ Image Copy+Pointer Checker
- Faster & less CPU (IPR vs STD)
  - Elapsed Time: **7.5 times faster** CPU Time: **4.6 times less CPU time**

But what about your databases that need to be up 24 hrs a day, 7 days a week?

How do we keep them performing?

When your Databases need to be available…

2 Online Reorg Utility Set

Online Reorg Facility … “ORF”

- HP Unload #
- HP Load #
- HP Prefix Resolution #
- HP Image Copy #
- HP Pointer Checker #
- Program Restart Facility #

 # optional integrated functions

IMS Online Reorganization Facility for z/OS

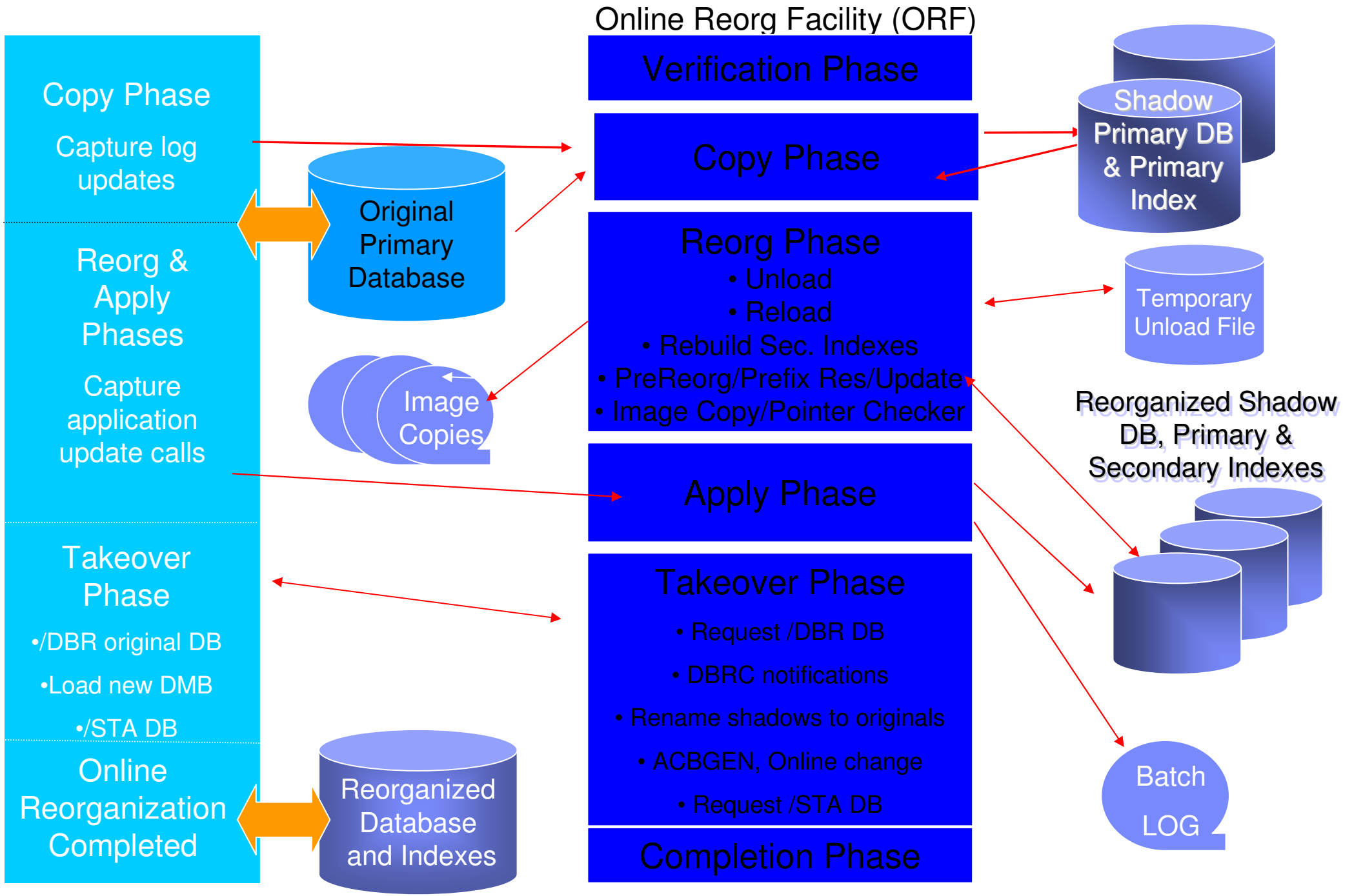
Benefits

- Increased Data Availability
  - Outage reduced from hours to seconds
- Minimal Overhead Added to Control Regions
- Automation of DBA tasks
  - Single step Reorg
    - Automatic determination of necessary reorganization steps
  - Same JCL for all databases
  - Changes implemented across all online systems
  - No manual intervention required after reorganization process
  - Flexible, automated control of the reorg
- Better DB performance
  - Can reorganize when needed

Example JCL – Online Reorg Facility

```
//ORFSTEP   EXEC PGM=HRFREORG
//STEPLIB    DD  DSN=your.orf.load,DISP=SHR                <=== ORF/HRF DIST LIB
//            DD  DSN=your.userlib,DISP=SHR                <=== USER ROUTINES
//            DD  DSN=IMSUTIL.SHPSLMD0,DISP=SHR            <=== IMS HP TOOLS
//            DD  DSN=your.vrmm.sdfsresl,DISP=SHR          <=== IMS RESLIB
//IMSDALIB   DD  DSN=your.mdalib,DISP=SHR
//IMS         DD  DSN=your.dbdlib,DISP=SHR                <=== IMS DBDLIB
//IMSACB      DD  DSN=your.acblib,DISP=SHR                <=== IMS ACBLIB
//*
//IEFRDER    DD  DISP=SHR,DSN=your.IEFRDER                <=== LOG DSN
//IEFRDER2   DD  DISP=SHR,DSN=your.IEFRDER2               <=== DUAL LOG (if needed)
//*
//HRFSYSIN   DD  *
 REORG  -
 ICDYN(Y) ICNUM(1) ICHLQ(your.ic.hlq) ICMID(1) ICID(1) ICTRLR(5) -
 DATACLAS(DATABASE) STORCLAS(DATABASE) -
 DBD(dbdname)
//*
```

Specify DBD


Online Reorg Facility (ORF)
Copy Phase
Capture log updates
Reorg & Apply Phases
Capture application update calls
Takeover Phase
•/DBR original DB
•Load new DMB
•/STA DB
Online Reorganization Completed
Verification Phase
Copy Phase
Reorg Phase
• Unload
• Reload
• Rebuild Sec. Indexes
• PreReorg/Prefix Res/Update
• Image Copy/Pointer Checker
Apply Phase
Takeover Phase
• Request /DBR DB
• DBRC notifications
• Rename shadows to originals
• ACBGEN, Online change
• Request /STA DB
Completion Phase
Original Primary Database
Image Copies
Reorganized Database and Indexes
Shadow Primary DB & Primary Index
Temporary Unload File
Reorganized Shadow DB, Primary & Secondary Indexes
Batch LOG

Operational Considerations

- BMPs must be stopped when ORF needs to STOP or DBR a DB
  - 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
- IMS terminal - 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
- CICS terminal - SCHEDULE PSB request when DB is DBR’d
  - ORF detects that it has DBR’d the DB
    - Thread is put into wait

Operational Considerations

- ODBA – APSB request when DB is DBR'd
  - ORF detects that it has DBR'd the DB
    - Application TCB is put into wait
- 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

Disclaimer

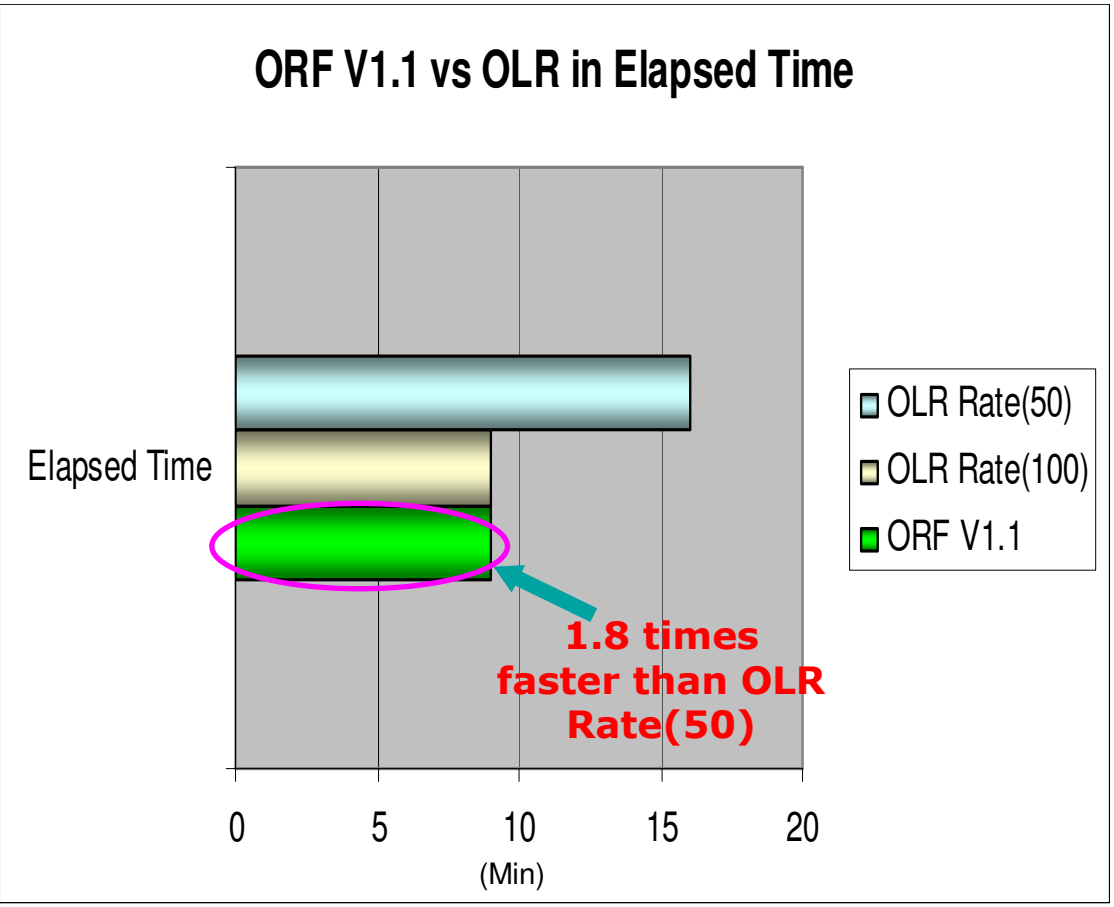
IMS Tools Performance Studies results contained in this document were obtained in a controlled lab environment, therefore, the results that can be obtained in other operating environment might vary significantly. Users of this document should verify the applicability of data for their specific environment .

ORF V1.1 vs V9 OLR

Environment

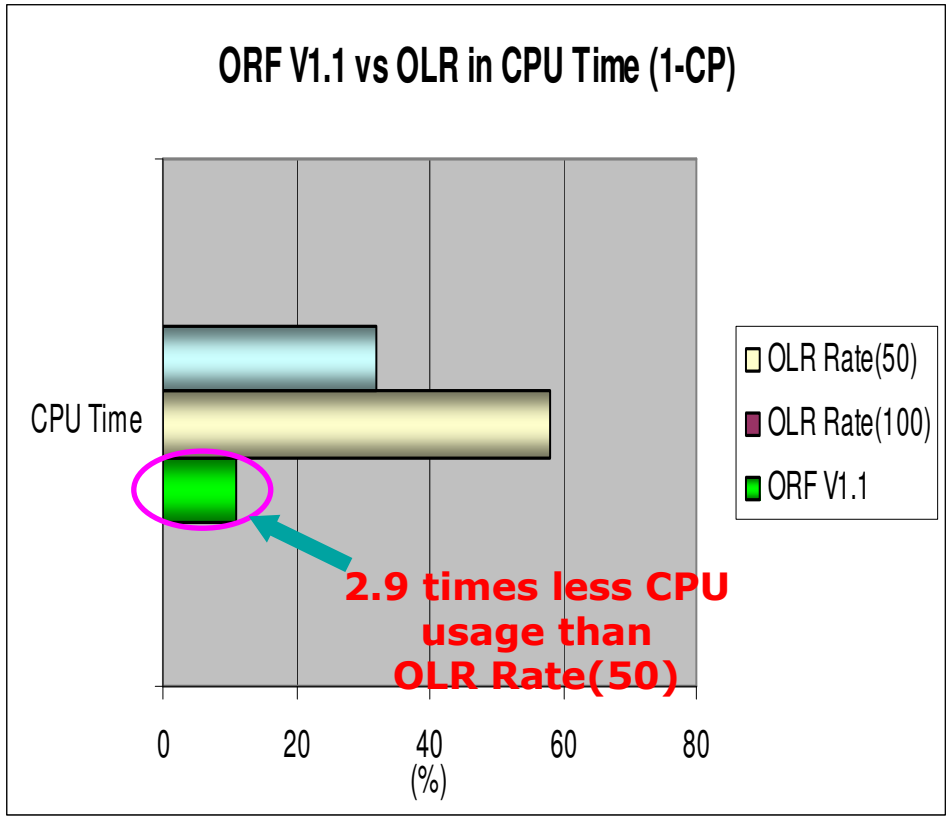
Hardware	Software	Database in online environment
▪ CPU -- 4-cp 2064 ▪ DASD -- ESS-F20, DS8000, RVA	▪ z/OS 1.6 ▪ IMS V9 ▪ ORF V1.1	▪ PHIDAM/OSAM – 1GB being updated online at 3-4 tran/sec

ORF V1.1 vs V9 OLR in Elapsed Time



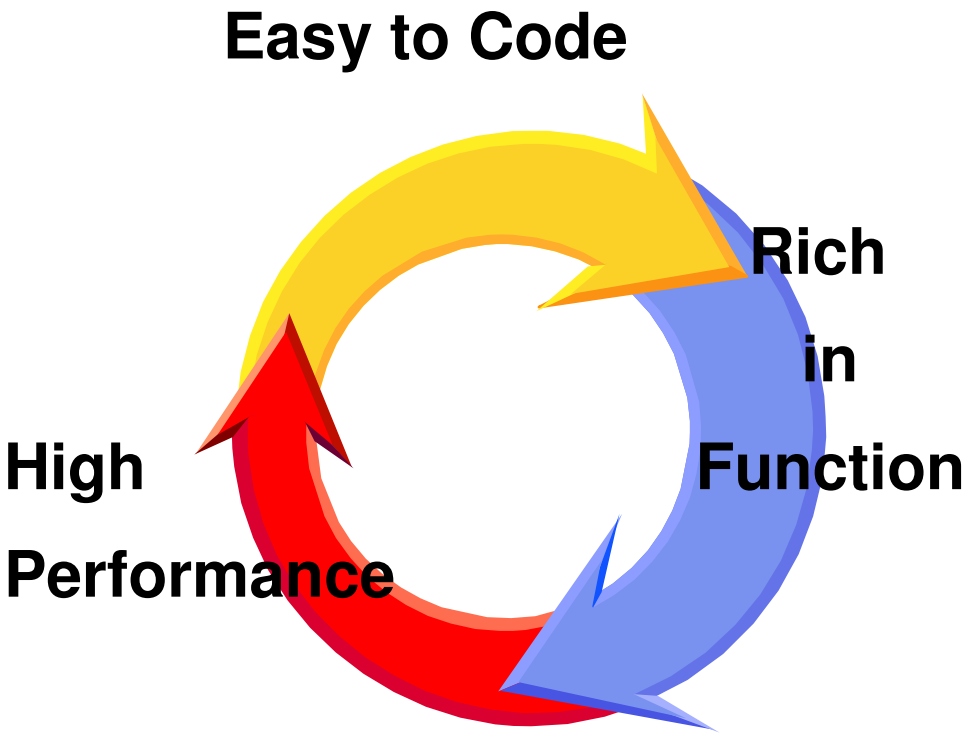
- Comparison:
  - OLR
    - 100% online
    - Significant CPU usage
      - Rate (50): IRLM/OSAM/VSAM structure access 1,151 acc/sec
      - Rate (100): IRLM/OSAM/VSAM structure access 2,091acc/sec
      - XES path-length
    - Significant OLDS logging
      - 1.4 GB (in logging) for a 1GB DB

ORF V1.1 vs V9 OLR in CPU Time



- Comparison:
  - ORF
    - Almost 100% online
    - Much less CPU
      - **NO** CF access & XES path-length
    - **No** OLDS logging
    - Faster and less CPU
      - **1.8 times faster than OLR Rate(50)**
      - **2.9 times less CPU usage than OLR Rate(50)**
    - Much higher concurrent ORF processing

Complete reorganization solution



Any Questions?