IBM Information On Demand 2007

Recovery Strategy: Fast Replication IC or CA

Cedric Chen, IBM
cedchen@us.ibm.com
Session: 1335

Act.Right.Now.

IBM INFORMATION ON DEMAND 2007
October 14 – 19, 2007
Mandalay Bay
Las Vegas, Nevada

Session: TMS1335

Session Title: IMS DB Recovery Strategy: Fast Replication IC Compared with CA

Cedric Chen

IBM

cedchen@us.ibm.com

URL for IMS Tools Manuals:
http://www-306.ibm.com/software/data/db2imstools/imstools-library.html

Disclaimer

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

IMS Tools Backup & Recovery Solution

- **The IBM IMS Tools Backup & Recovery Solution is an effective and efficient way to ensure your IMS data is recovered quickly and accurately.**
- **These 5 tools combine to form an integrated and automated solution to meet your recovery needs**
  - IMS High Performance Image Copy
  - IMS High Performance Change Accumulation Utility
  - IMS Database Recovery Facility
  - IMS Index Builder
  - IMS High Performance Pointer Checker & IMS HP Fast Path Utilities

Backup & Recovery

HPIC | HPCA | DRF | Index Builder | HPPC or DEDB PC

Objectives

- Provide tips in using IMS High Performance Image Copy V4
- Provide tips in using IMS High Performance Change Accumulation V1.4
- Provide tips in using IMS Database Recovery Facility V3
- Compare DRF V3 performance using Fast Replication IC versus Change Accumulation

IBM Information On Demand 2007

IMS High Performance Image Copy V4 Tips

Act.Right.Now.

IBM INFORMATION ON DEMAND 2007
October 14 – 19, 2007
Mandalay Bay
Las Vegas, Nevada

HPIC V4 - Highlights

New types of image copy processes, Advanced Copy and High Performance I/O greatly reduce the process time:

- **Advanced Copy Services**
  - **Standard HPIC Format Image Copy**
    - Concurrent Copy
  - **Fast Recovery Image Copy**
    - SnapShot Copy
    - FlashCopy
    - Concurrent Copy
- **High Performance I/O**
    - Use EXCP I/O for OSAM database
    - Use Media Manager for VSAM database

HPIC V4 – Advanced Copy Services

- **Advanced Copy Services**
  - Advanced copy services allow HPIC to produce faster image copies and to reduce unavailability time for IMS databases.
    - Reducing the time that the database data set is unavailable
    - Reducing the time to generate the image copy
    - Reducing the time required to recover a database data set
  - Fast Recovery Image Copy
    - If your system has a capability of SnapShot Copy or FlashCopy, it is recommended that the feature be used.

HPIC V4 – Compression Routines

- Compression consumes more CPU, tradeoff is between media and CPU cycles

- COMPRTN keyword specifies routine to compress: There are four routines - FABJCMP1,2,3,4

- Recommended: COMPRTN=FABJCMP3
  - “1” compresses repeating characters
  - “2” compresses free space
  - “3” compresses both repeating characters and free space
  - “4” is required to compress DEDB with SDEP segments

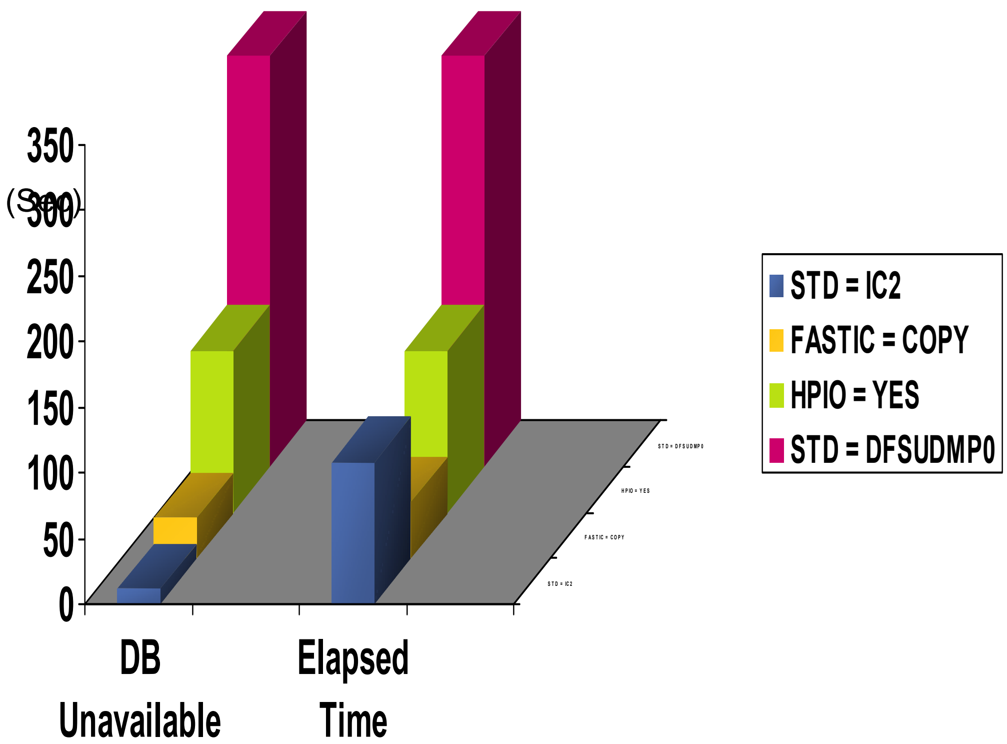
- When tape IDRC is used, only FABJCMP2 is applicable.

HPIC V4 versus Standard DFSUDMP0

Environment

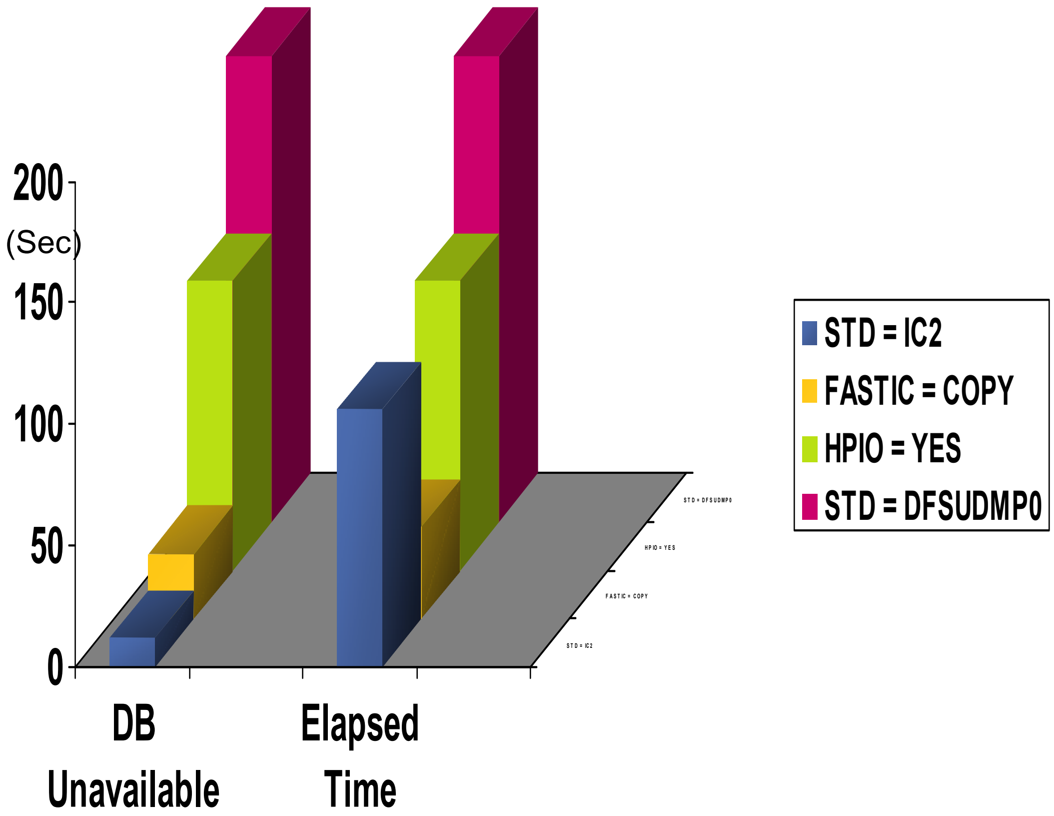
Hardware	Software	Database
• CPU -- 2-cp 2084 • DASD -- ESS-F20	• z/OS 1.6 • IMS V8 • HP IC V4.1 and V3.2	• PHIDAM/VSAM • 3,893,360 segments • 561,440 roots • Size: 2,620 CYLs

HPIC V4 vs DFSUDMP0/DFSUDMT0 PHIDAM/VSAM (no IC compression)



- Comparison
  - STD DFSUDMP0
    - Elapsed Time (sec): 312
    - DB Unavailable (sec): 312
  - HPIO = YES vs STD DFSUDMP0
    - Elapsed Time (sec): 123
      - 2.5 times faster
    - DB Unavailable (sec): 123
      - 2.5 times less CPU
  - FASTIO = COPY vs STD DFSUDMP0
    - Elapsed Time (sec): 43
      - **7.3 times faster**
    - DB Unavailable (sec): 31
      - **10.1 times less CPU time**

HPIC V4 vs DFSUDMP0/DFSUDMT0 PHIDAM/OSAM (no IC compression)



- Comparison
  - STD DFSUDMP0
    - Elapsed Time (sec): 192
    - DB Unavailable (sec): 192
  - HPIO = YES vs STD DFSUDMP0
      - Elapsed Time (sec): 119
        - 1.7 times faster
    - DB Unavailable (sec): 119
      - 1.7 times less CPU
  - FASTIO = COPY vs STD DFSUDMP0
    - Elapsed Time (sec): 38
      - **5.1 times faster**
    - DB Unavailable (sec): 27
      - **7.3 times less CPU time**

A Performance Comparison with Various Compression Options

- Environment
  HW
    CPU – 4-cp 2094
    DASD – DS8000
  SW
    z/OS 1.7
    IMS V9
    HPIC V4.1
  DB
    PHIDAM/OSAM
    3,893,360 segments
    561,440 roots
    #cyls in HD: 2,619

PHIDAM /OSAM	HPIO = NO	HPIO = Y COMP = N	HPIO = Y FAB-JCMP1	HPIO = Y FAB-JCMP2	HPIO = Y FAB-JCMP3
Elapsed Tm (sec)	39	25	34	34	21
CPU/ SRB (sec)	1.5	1.5	16.3	1.8	8.7
EXCPs	315,248	82,178	51,815	99,193	51,058
IC-Out in Cyls	2,619	2,619	1,072	2,125	1,055

NOTE: For DEDB with SDEP DB compression, FABJCMP4 is required

A Performance Comparison: HPIC V4 with FASTIC=COPY and DUMP (10/2009)

- Environment
  - HW
    CPU – 4-cp 2094
    DASD – 2xDS8000 boxes
  - SW
    z/OS 1.7
    IMS V9
    HPIC V4.1
  - DB
    PHIDAM/OSAM
    3,893,360 segments
    561,440 roots
    #cyls in HD: 2,619

	-------- HP IC V4.1 FASTIC= ----------			
PHIDAM/ OSAM	COPY Same Box	COPY Different Box	DUMP Same Box	DUMP Tape
Elapsed Tm (sec)	4	48	34	167
DB unavailable (sec)	3	3	3	5
CPU/SRB (sec) + IEESYSAS	0.3	0.3	13.0	11.6
EXCPs IC-OUT	--	--	78,569	78,569

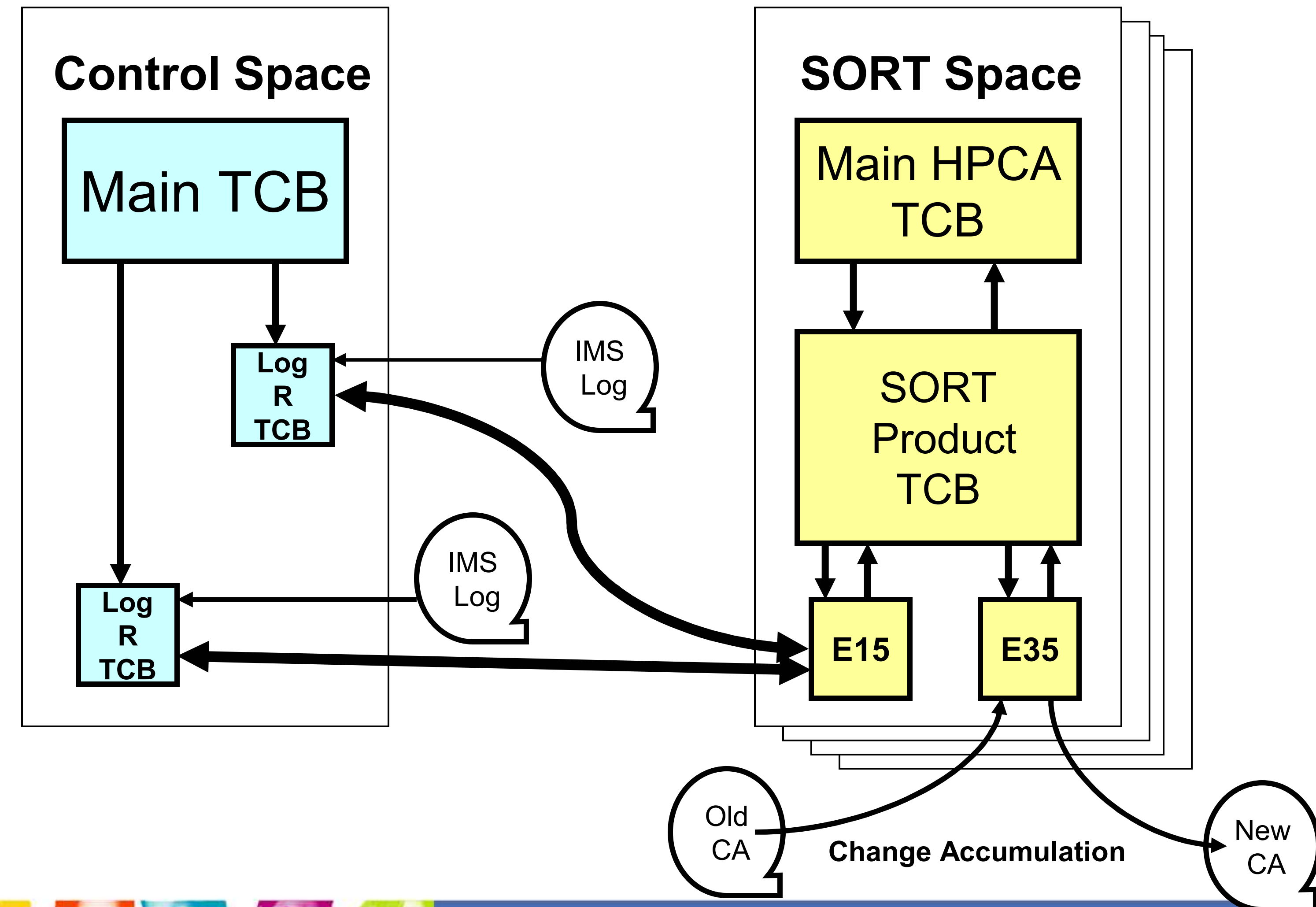
IMS High Performance Change Accumulation V1.4 Tips

Act.Right.Now.

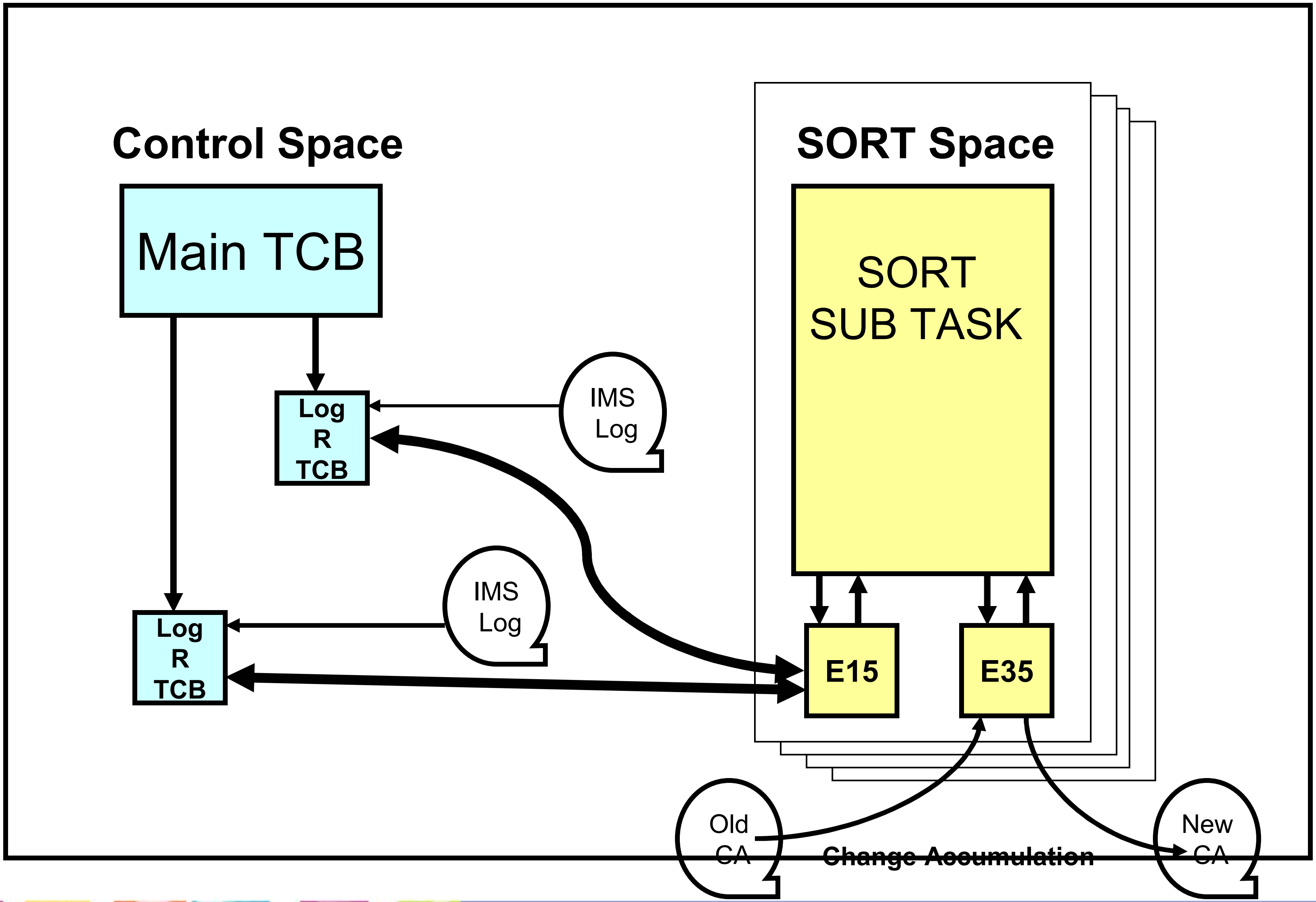
HPCA V1.4 – Highlights

- **Simplified setup and configuration using a single address space**
- **Improved elapsed time performance**
- **Reduction or elimination of cross-memory data transfers**
  - **Single address space approach**
- **In-memory spill files using 64-bit addressing**
  - **Always limit the 64-bit storage usage by using MEMLIMIT= parameter**
  - **Need to monitor local paging**

HPCA Multi-address Space Architecture



HPCA Single Address Space Architecture

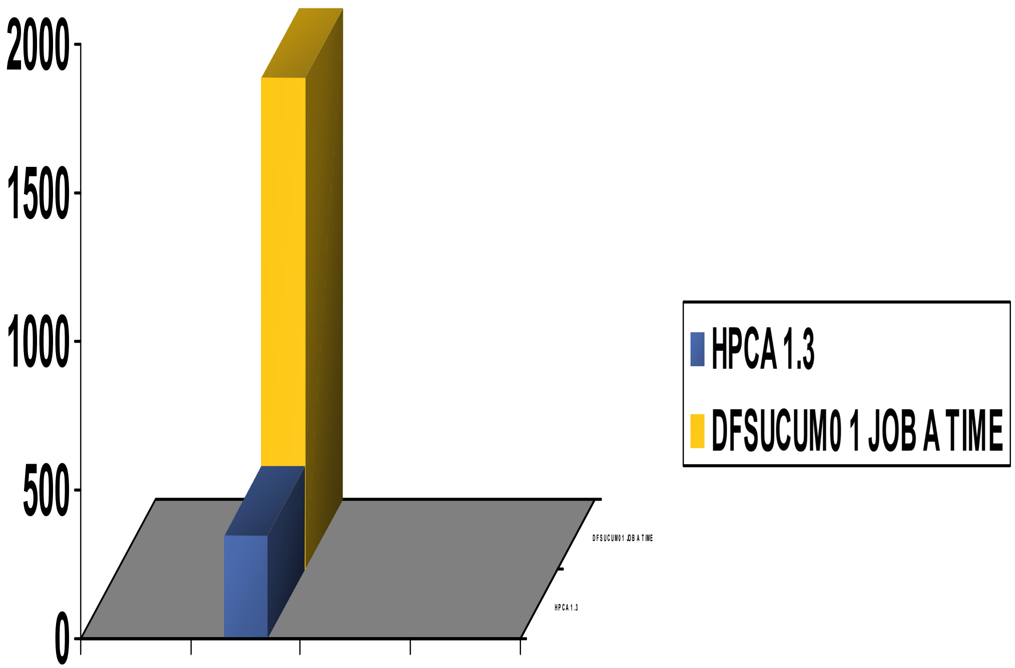


HPCA V1.3 vs Standard CA

Environment

Hardware	Software	Database
• CPU -- 4-cp 2064 • DASD -- ESS-F20, DS8000, RVA • 32 SLDS with 200 CYLs each on various DASD	• z/OS 1.6 • IMS V8 • HPCA 1.3	• 86 DEDB areas • 8 CAGRPs • Area size: 2,200 CYLs

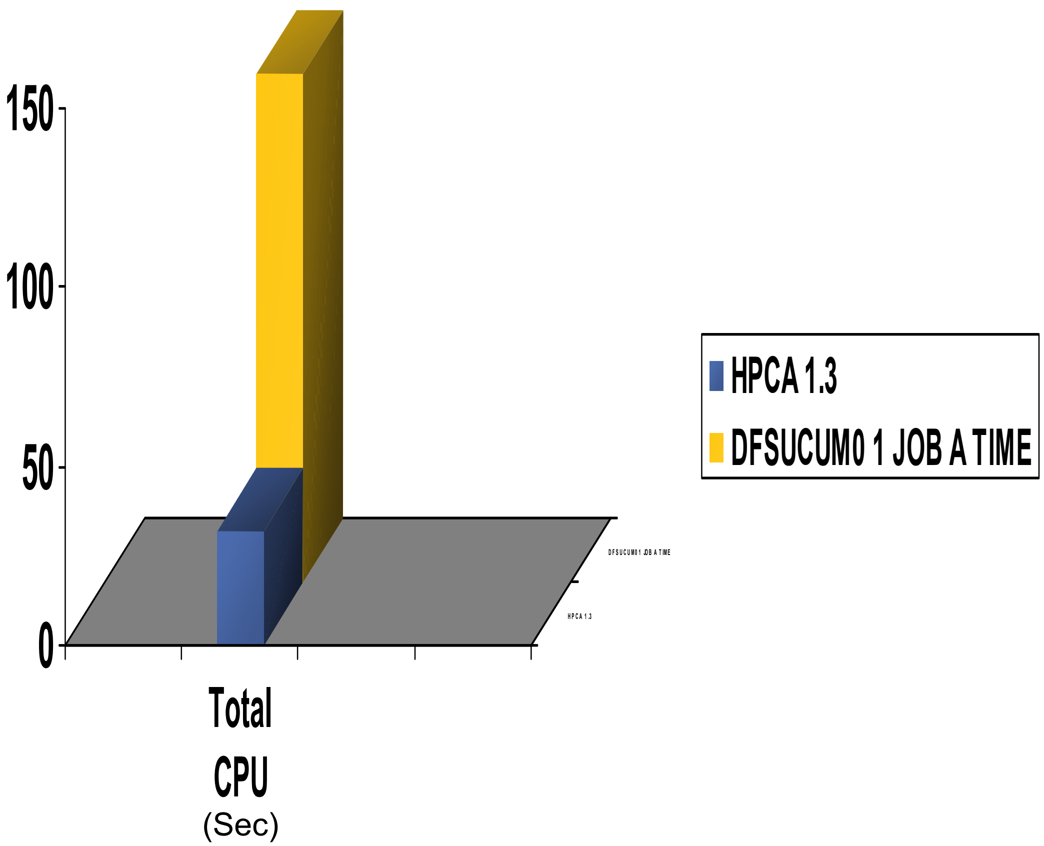
HPCA V1.3 vs Standard CA In Elapsed Time



Elapsed Time
(Sec)

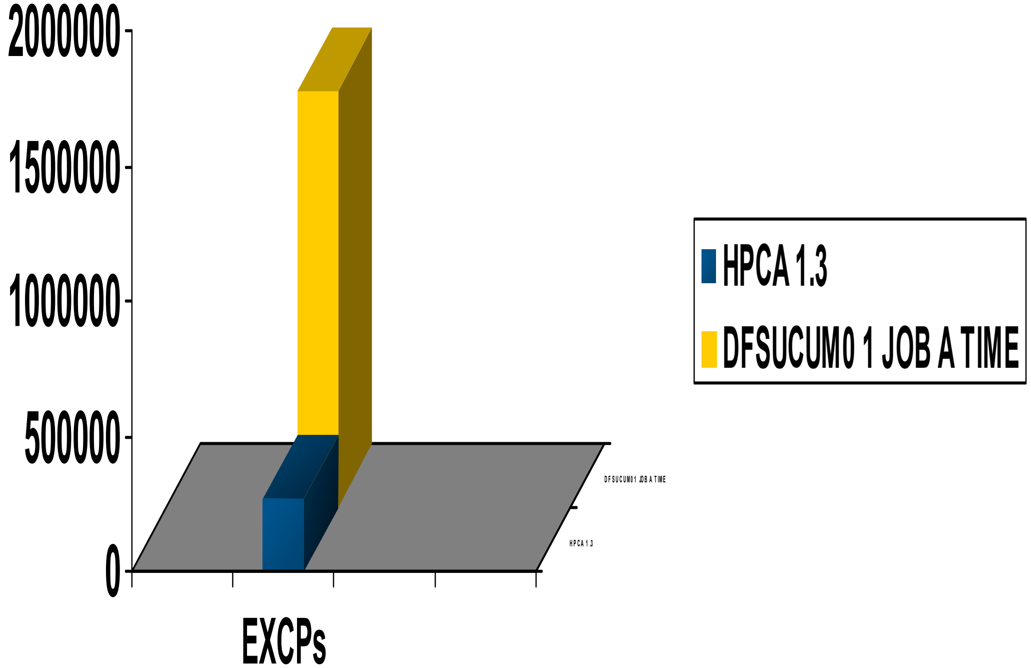
- STD DFSUCUM0
  - 1 CA job a time, 8 serial submissions
    - Elapsed Time (sec): 1,648
- HPCA 1.3 (P.Sorts=8) vs STD DFSUCUM0
  - 1 CA job on system, 1 Async Batches
    - Elapsed Time (sec): 352
      - **4.7 times faster**

HPCA V1.3 vs Standard CA In CPU



- STD DFSUCUM0
  - 1 CA job a time, 8 serial submissions
    - TCB: 16.45x8
    - SRB: 1.26x8
    - Total (TCB+SRB): 141.68
- HPCA 1.3 (P.Sorts=8)
  - 1 CA job on system, 1 Async Batches
    - TCB: 29.92
    - SRB: 2.03
    - Total (TCB+SRB): 31.95
      - **4.4 times less CPU time**

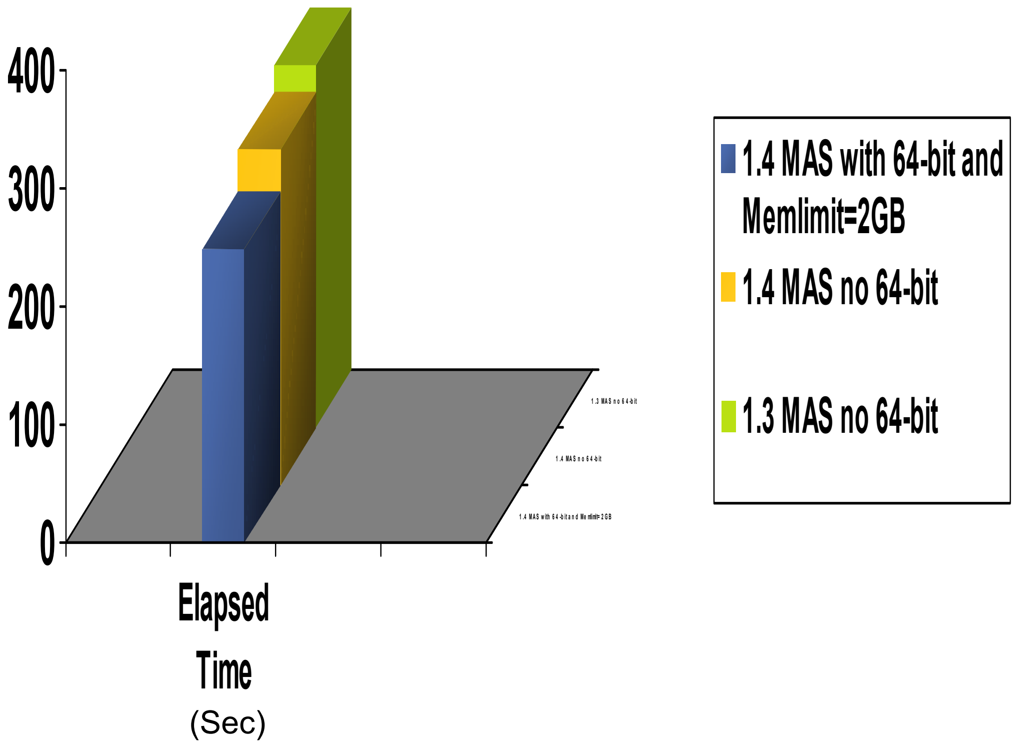
HPCA V1.3 vs Standard CA In EXCPs



(Counts)

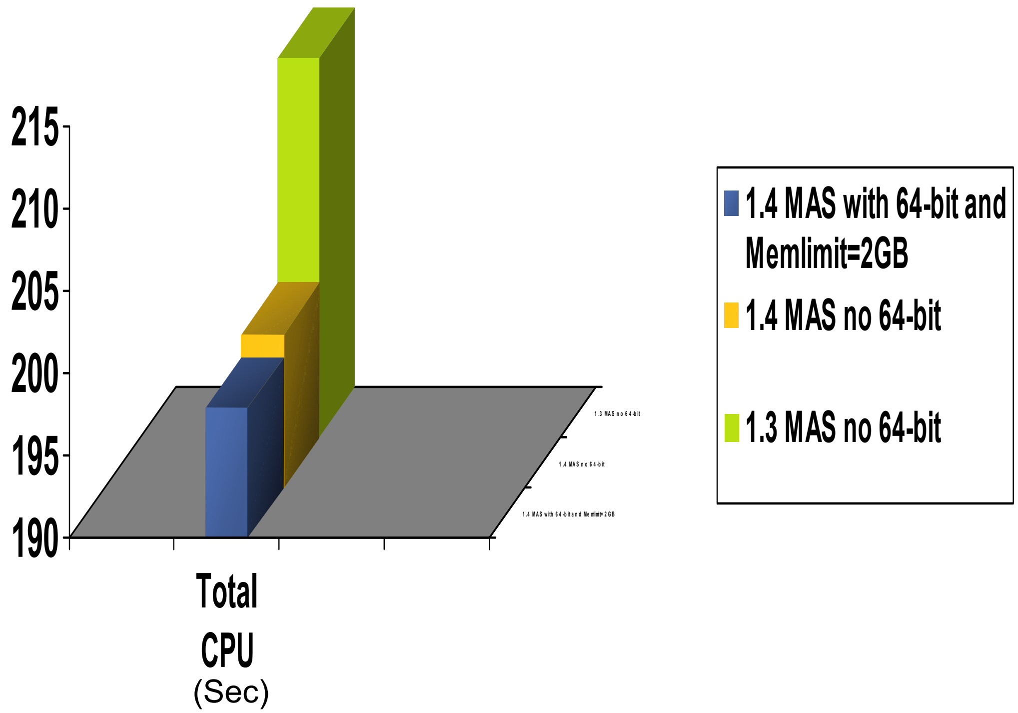
- STD DFSUCUM0
  - 1 CA job a time, 8 serial submissions
    - EXCPs: 1.538M
- HPCA 1.3 (Parallel Sorts=8)
  - 1 CA job on system, 1 Async Batches
    - EXCPs: 265,398
    - **5.8 times less DASD IO**

HPCA V1.4 MAS comparison in Elapsed Time



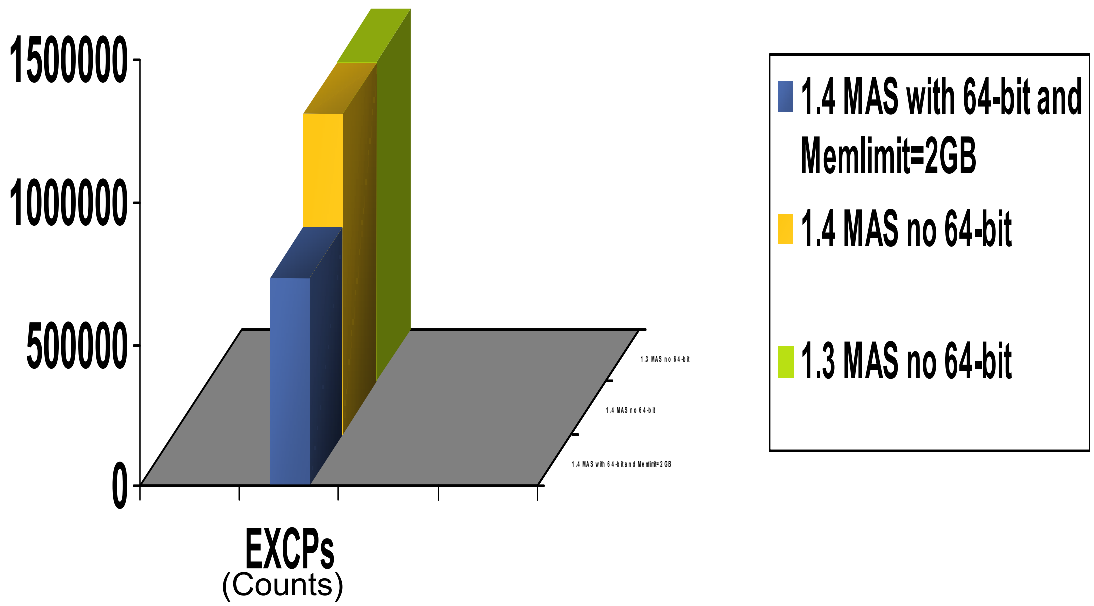
- **1.3 MAS No 64-bit**
  - Elapsed time (sec) = 306
- **1.4 MAS no 64-bit**
  - Elapsed time (sec) = 284
    - **7% faster**
- **1.4 MAS with 64-bit and Memlimit=2GB**
  - Elapsed time (sec) = 250
    - **19% faster**

HPCA V 1.4 MAS Comparison in CPU (TCB + SRB)



- **1.3 MAS no 64-bit**
  - TCB: 209.71 secs
  - SRB: 3.32 secs
  - Total: 213.03 secs
- **1.4 MAS no 64-bit**
  - TCB: 195.74 secs
  - SRB: 3.63 secs
  - Total: 199.37 secs
    - **6.4% less CPU**
- **1.4 MAS with 64-bit and Memlimit=2GB**
  - TCB: 194.89 secs
  - SRB: 3.00 secs
  - Total: 197.89 secs
    - **7.1% less CPU**

HPCA V 1.4 MAS comparison in Total EXCPs



- **1.3 MAS No 64-bit**
  - EXCPs: 1126K
- **1.4 MAS no 64-bit**
  - EXCPs: 1126K
    - **0% less DASD IO**
- **1.4 MAS with 64-bit and Memlimit=2GB**
  - EXCPs: 729K
    - **35.2% less DASD IO**

HPCA V1.4 MAS Performance Comparisons

HPCA & CAGRP1 Job	Elapsed Tm (mm:ss)	CPU (mm:ss.ms)	SRB (seconds)	Total EXCPs
1.3 MAS No 64-bit	05:06	03:29.71	3.32	1,125,698
1.4 MAS No 64-bit	04:44 (7% faster)	03:15.74 (6.7% less CPU)	3.63 (9.3% slower)	1,125,702 (same)
1.4 MAS W 64-bit & 2GB (memlimit)	04:10 (19% faster)	3:14.89 (7.1% less CPU)	3.00 (9.6% faster)	729,355 (35.2% less EXCP)

IMS Database Recovery Facility V3 Tips

Act.Right.Now.

IMS DRF V3 - Enhancements

- **Submitting IMS Commands**
  - DBR local or global
  - START local or global

- **Increased Tools Integration**
  - Automatic invocation of HPIC, HPPC, DEDB PC

- **Automatic Delete/Define of Database Data Sets**
  - Output data sets are created as part of the recovery process

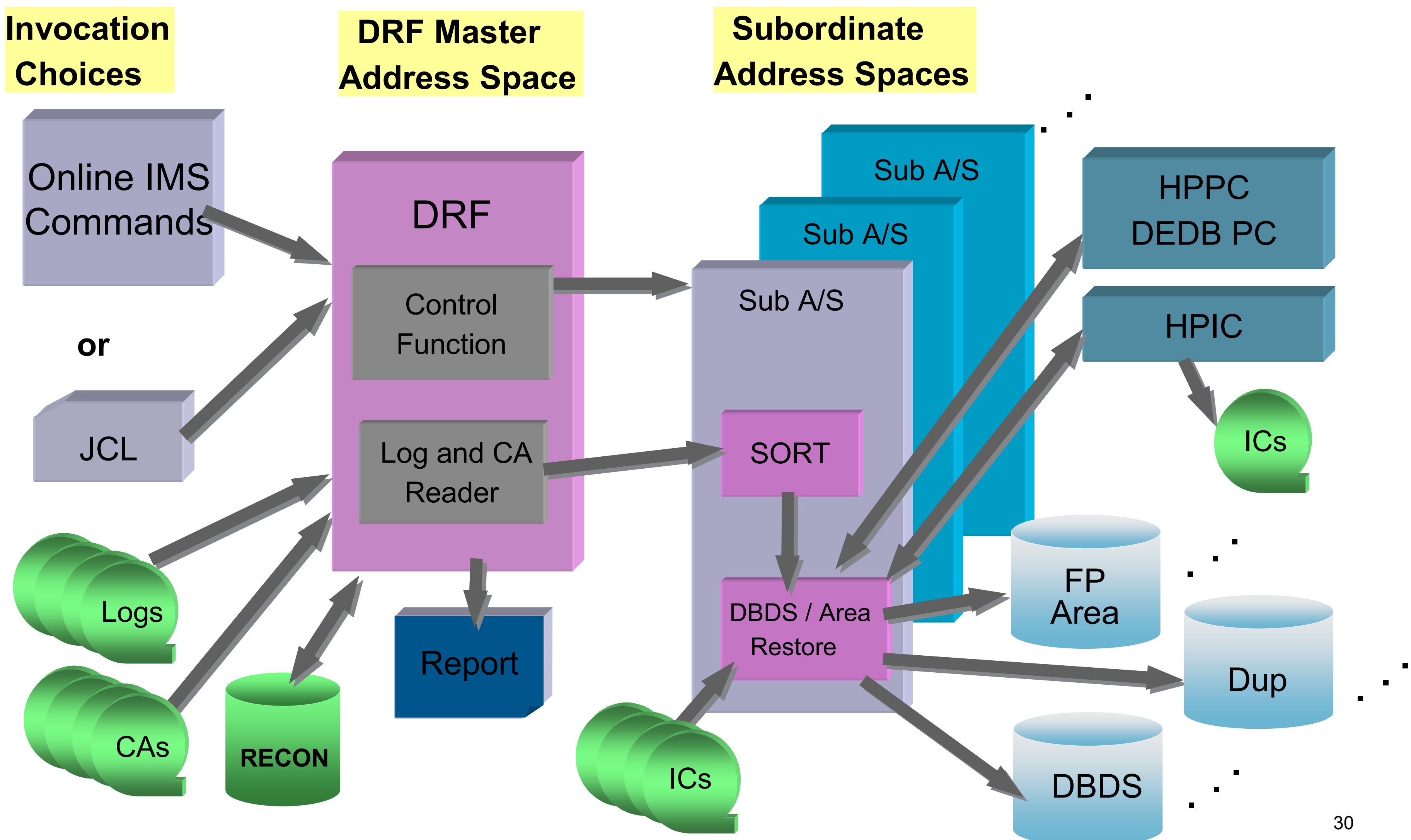
- **Database Copy Generation**
  - Creation of copies of database data sets without accessing production copies
  - Input is image copy, change accumulation, and log data sets
  - Copies can be created to any point in time via PITR as long as inputs are available

IMS DRF V3 – Enhancements (Cont.)

- **Incremental Image Copy (ICR)**
  - Created via HPIC
  - Can run whether DB is DBRed or not

- **Allocate/Open Option on START VERIFY**
  - Logical and physical validation of data set availability prior to running the actual recovery job

IMS DRF V3 - Recovery Flow

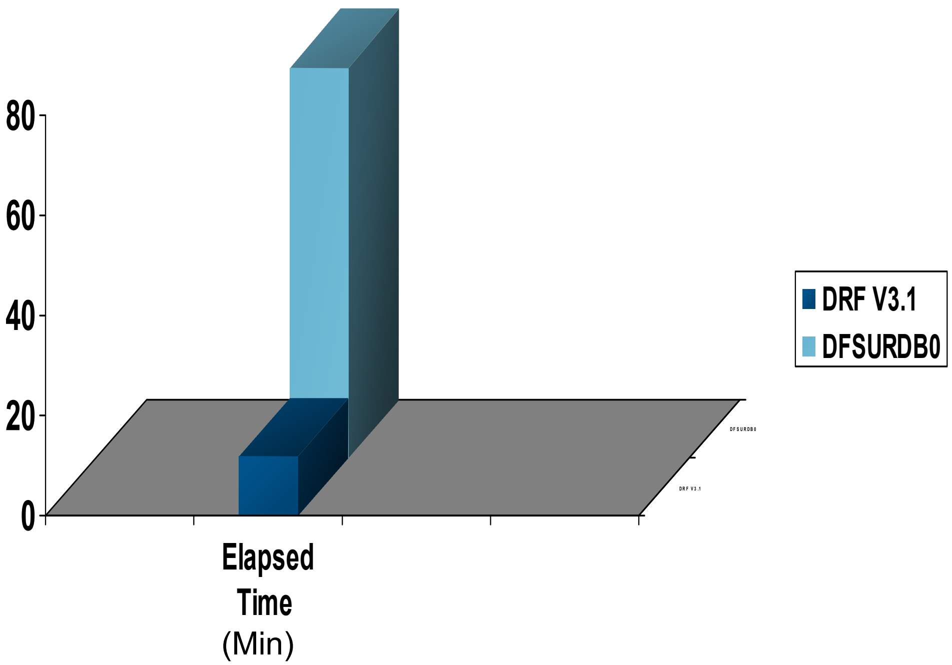


DRF V3.1 vs DFSURDB0

Environment

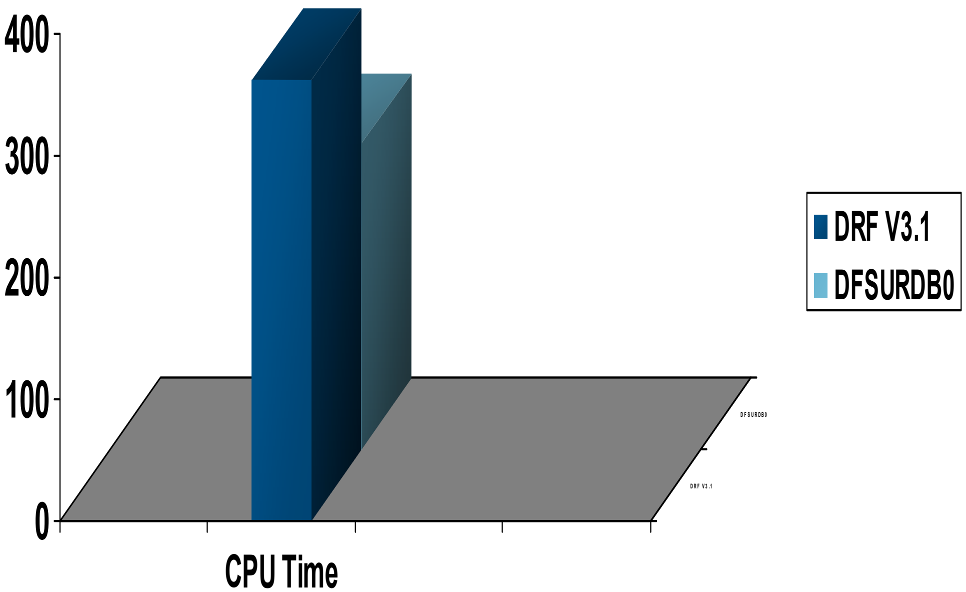
Hardware	Software	Database in online environment
• CPU -- 4-cp 2064 • DASD -- ESS-F20, DS8000, RVA	• z/OS 1.7 • IMS V9 • DRF V3.1	• PHIDAM/OSAM – 4-partition (1 GB each) and 2 secondary indexes

DRF V3.1 vs DFSURDB0 In Elapsed Time



- Comparison:
  - DFSURDB0
    - 1 DBDS recovery a time
    - Multiple passes through archived log for recovering HD partitions
    - Secondary indexes need to be recovered
    - ICs needed after recoveries
    - Elapsed time include: 4HD partition and, 2 secondary index recoveries, and 6 ICs

DRF V3.1 vs DFSURDB0 In CPU Time



(sec)

- Comparison:
  - DRF V3.1
    - One step operation HPIC, HPPC, HP DEDBPC, IB and DFSPREC0
    - Incremental image copy
    - Automatic Delete/Define of database & datasets
    - Stacked tape support
    - Submitting IMS commands via TOSI/XCF
    - CPU Time include 12 address spaces: DRFV3, 4 FRXI (HD recovery), 4 FRXP (primary indexes), 1 IB and 2 IB sorts

Fast Replication IC versus Change Accumulation Study

Act.Right.Now.

Topics

- Objectives of this study
- Change Accumulation highlights
- HPIC Fast Replication highlights
- Review Study Results
- Summary
- Q & A

Objectives

- Have DBAs rethink recovery strategy based on HPIC V4.1 Fast Replication
- Share results of SVL performance comparison study

Change Accumulation

- Designed to speed up DB Recovery
  - Accumulates changes to DB
  - Minimizes log processing during Recovery
- Recovery Input
  - Image Copy
  - Change Accumulation
  - Logs created subsequent to most recent Change Accumulation
- Continuous Process
  - Post-process most log data for it to be effective
  - Resource intensive insurance policy
  - Operational complexities

HPIC Fast Replication

- High availability backup solution
- Supports both concurrent and non-concurrent copy
- Almost no disruption for concurrent copy
- Minimal disruption for non-concurrent copy
- Allows for more frequent Image Copies
- Provides a faster and more efficient recovery process

Study Environment

Hardware

- 2-LPAR z990 (4-cp each) plus 2 ICFs(1-cp each)
- DS8000 for 24-AREA DEDBs and 4 SYSDAs;   ESS for others

Software

- zOS 1.7
- IMS V9
- DRF V3
- HPIC V4.1
- HPCA V1.4

FP workload

- 24-area TPCA (Banking Industry) application, Debit/Credit with SDEP insertion; running @ 1,000+ tx/sec (2-way IMSplex)

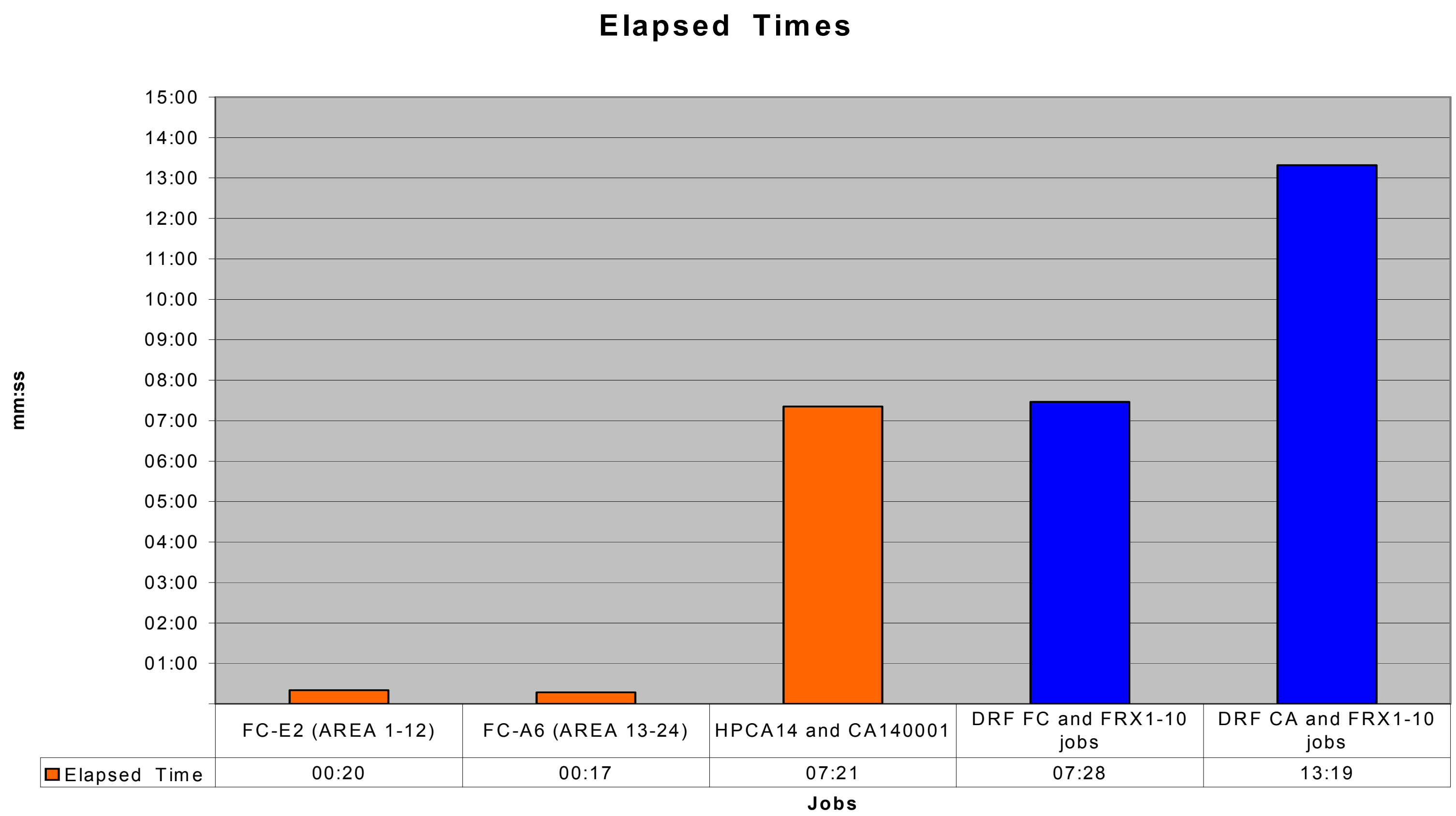
Study Methodology

1. 24 2200-cyl DEDB areas with base crisp HPIC4 ICs (COMPRTN=FABJCMP4 to conserve DASD space)
2. After 24+ hours of online stressing and with 64 SLDS/RLDS generated:
   - Made sure IMS chkpt were taken on 3 consecutive OLDS prior to run FlashCopy HPICs for all 24 areas and observe FC's impact to online tran rates
   - Then /CHE FREEZE 2 IMS.
3. Run DRF Recover-CURRENT with FC ICs and last 7 RLDS for IMZ1/IMZ2.
4. Deleted all FC ICs from the RECONs and ran HPCA 1.4 (max logs equal 64).
5. Ran DRF Recover-CURRENT with base CA Master and 7 remaining logs.

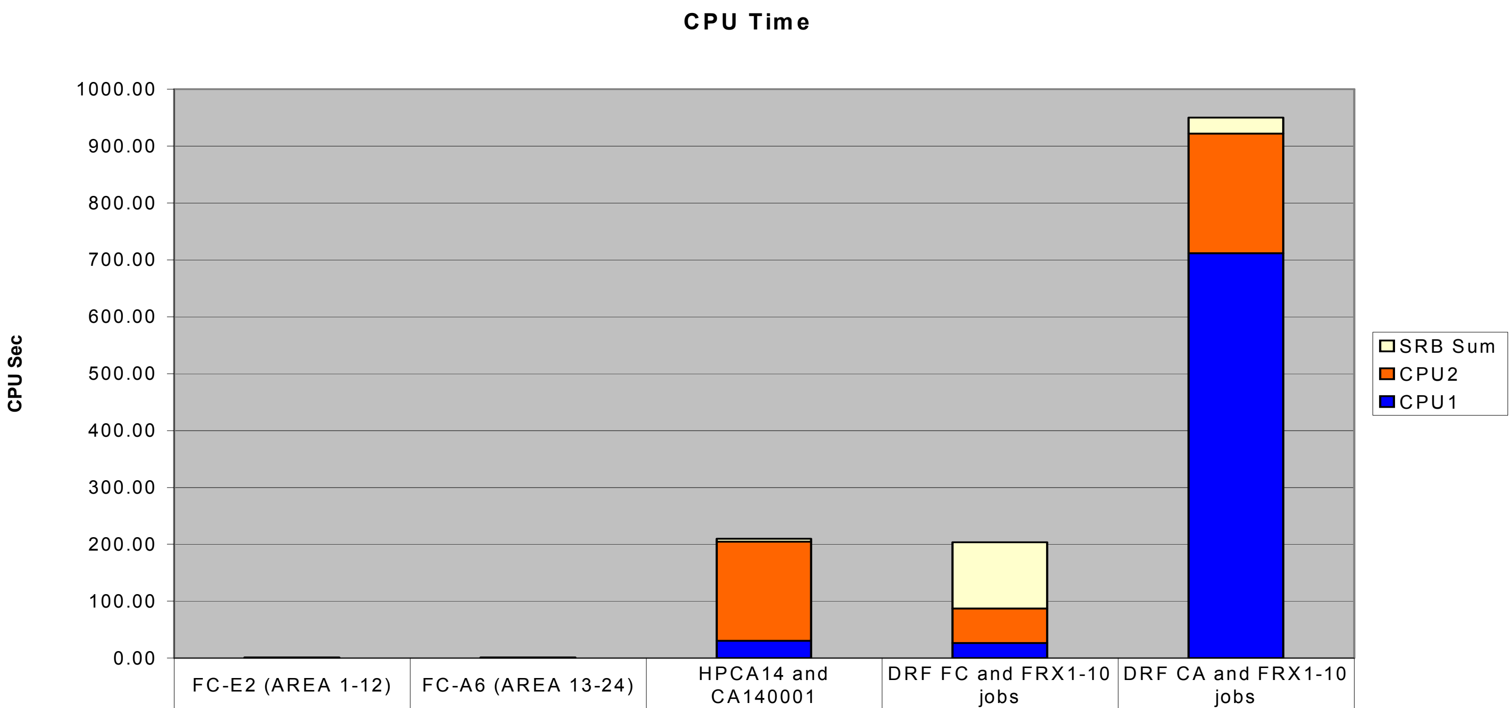
Study Observations

1. FlashCopy IC for 24 areas
   - Average FlashCopy IC elapsed time was .7 second
   - The impact to online tran rates running at a combined 1,100 tx/sec was less than 3% decrease.
2. DRF needs to go back only 2 prior chkpts when using CICs. (Only 1 prior chkpt for FF.) Thus eliminating the handling voluminous RLDS/SLDS.

FlashCopy/Change Accumulation/Recovery Performance



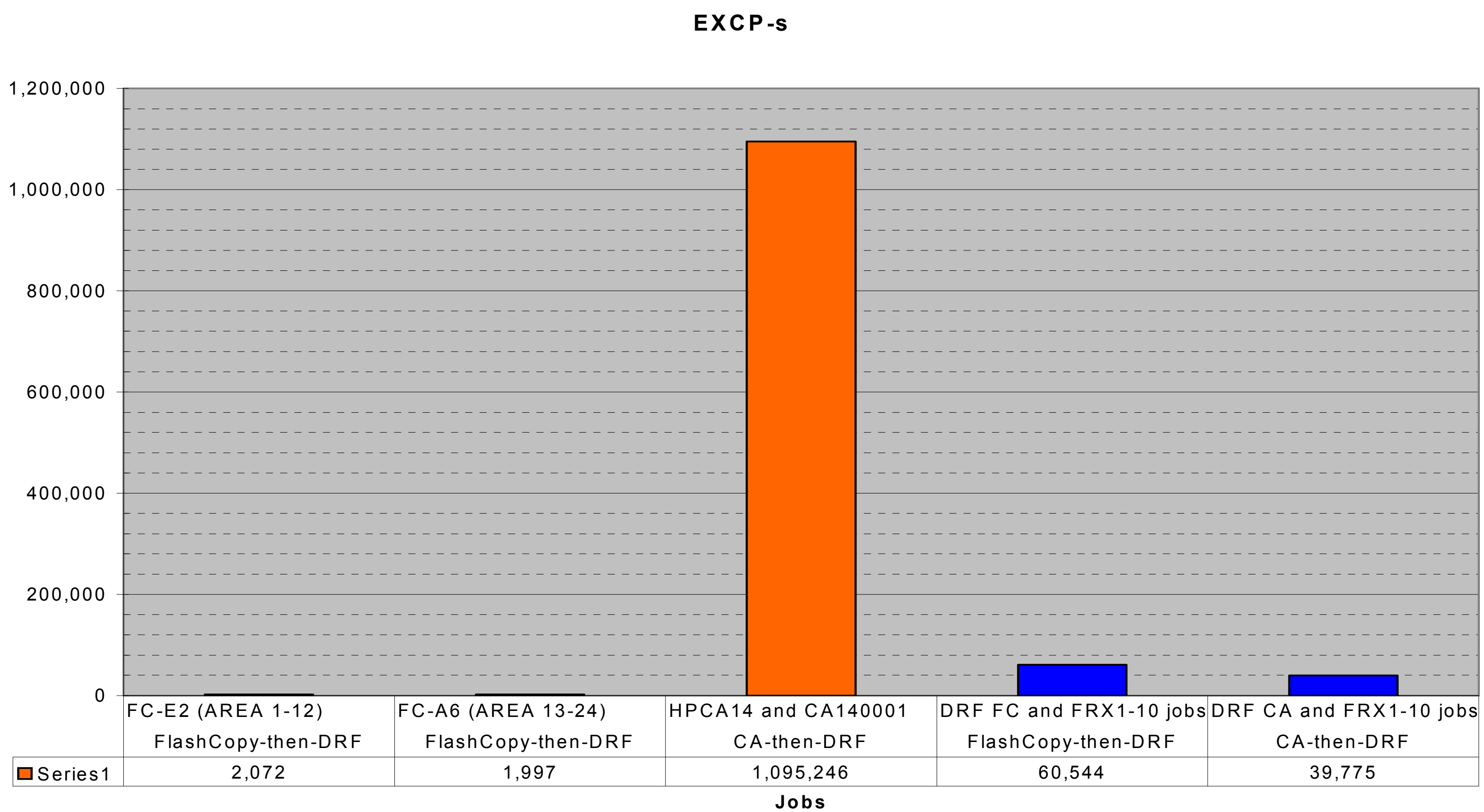
FlashCopy/Change Accumulation/Recovery Performance



	FC-E2 (AREA 1-12)	FC-A6 (AREA 13-24)	HPCA14 and CA140001	DRF FC and FRX1-10 jobs	DRF CA and FRX1-10 jobs
SRB Sum	0.03	0.03	5.02	116.37	28.17
CPU2	0.60	0.59	174.41	60.44	210.00
CPU1	0.52	0.49	30.36	26.59	712.00

Job

FlashCopy/Change Accumulation/Recovery Performance



	FC-E2 (AREA 1-12) FlashCopy-then-DRF	FC-A6 (AREA 13-24) FlashCopy-then-DRF	HPCA14 and CA140001 CA-then-DRF	DRF FC and FRX1-10 jobs FlashCopy-then-DRF	DRF CA and FRX1-10 jobs CA-then-DRF
Series1	2,072	1,997	1,095,246	60,544	39,775

FlashCopy vs Change Accumulation Performance

FlashCopy (HPIC)	Elapsed (seconds)	CPU (seconds)	SRB (seconds)	Total EXCPs
AREA 1-12	20	.52+ .60 IEESYSAS	.02+ .01 IEESYSAS	2,072
AREA13-24	17	.49+ .59 IEESYSAS	.02+ .01 IEESYSAS	1,997

HPCA	Elapsed Tm (mm:ss)	CPU (mm:ss)	SRB (seconds)	Total EXCPs
HPCA14 and CA140001	07:21	00:30.36+ 02:54.41	2.81+ 2.21	1,095,246

Recovery Performance

Type	Elapsed Tm (mm:ss)	CPU (mm:ss)	SRB (seconds)	Total EXCPs
DRF with Flashcopy	07:28	00:26.59+ 00:60.44 (10 FRX addrspc)	.44+ 115.93 (10 FRX addrspc)	60,544
DRF with Change Accumulation	13:19	11:52+ 03:30 (FRX1-10)	.30+ 27.87 (FRX1-10)	39,775

Summary

- **Study reveals compelling reasons to re-consider recovery strategy**
  - Major gains in efficiency and speed using Fast Replication
  - Major gains in efficiency and speed during Recovery
  - Reduced operational complexity

- **Consider impact of workload growth on future Change-Accum runs**
  - Resources required
  - Ability to keep-up

- **Doesn’t have to be all-or-nothing**
  - Start with high update activity databases
  - Phased migration

Summary (continued)

- **Consider using Fast Replication even if not using Change-Accum**
- **New IBM DS8000 high capacity option could be viable media for ICs**
  - Most customers have been using DASD for SLDS and RLDS
  - High capacity DS8000 uses 300GB Disk Drive Modules (DDM) to provide a total capacity over 192TB per box
    - An equivalent of several thousands of 3590 20GB cartridges(J) (depending on specifc 3590 tape drive model)
  - Dollars per TB kept declining
  - Could be great IC media to receive FlashCopy output

Supplement: JCL sample – HPIC V4 (1/3)

```
//HPICFP1  JOB  HPIC4,CLASS=A,MSGLEVEL=(1,1),REGION=0M,
//        MSGCLASS=E,TIME=1440
//*---------------------------------------------------------------------*/
//*                                                                     */
//*    JCL TO RUN HPICV4 FOR DBDSGRP=DEDBGP1 WHICH INCLUDE             */
//*        CCAREA01 THROUGH CCCAREA12.                                  */
//*                                                                     */
//*       'FASTIC=(REQ,COPY)' REQUESTS FLASHCOPY IS REQUIRED TO BE     */
//*        USED.                                                        */
//*                                                                     */
//*---------------------------------------------------------------------*/
//HPIC1   EXEC PGM=FABJMAIN
//STEPLIB   DD DISP=SHR,DSN=IMSTOOL.HPIC41.FAB.SHPSLMD0
//          DD DISP=SHR,DSN=IMTOOL1.CUST.COMPEXIT
//          DD DISP=SHR,DSN=IMTOOL1.I91RTS14.COMRESL
//*---------------------------------------------------------------------*
//* FOR IMS DATA SETS
//*---------------------------------------------------------------------*
//DFSRESLB  DD DISP=SHR,DSN=IMTOOL1.I91RTS14.COMRESL
//IMS       DD DISP=SHR,DSN=IMTOOL1.DRFV3.DBDLIB
//SYSPRINT  DD SYSOUT=*
//DSSPRINT  DD SYSOUT=*
//*---------------------------------------------------------------------*
//* FOR IC HASH CHECK INPUT
//*---------------------------------------------------------------------*
//DBDEFCTL  DD DUMMY
//*---------------------------------------------------------------------*
//* REPORTS
//*---------------------------------------------------------------------*
//PRIMAPRT  DD SYSOUT=*
//STATIPRT  DD SYSOUT=*
//VALIDPRT  DD SYSOUT=*
//SNAPPIT   DD SYSOUT=*
//DFSPRINT  DD SYSOUT=*
```

Supplement: JCL sample – HPIC V4 (2/3)

```
//*------------------------------------------------------------------*
//* FOR WORK DATA SETS
//*------------------------------------------------------------------*
//FSESTAT   DD UNIT=SYSDA,SPACE=(CYL,(2,2))
//*
//RECON1   DD  DSN=IMTOOL1.DRFV3.RECON91,DISP=SHR
//RECON2   DD  DSN=IMTOOL1.DRFV3.RECON92,DISP=SHR
//IMSDALIB DD  DSN=IMTOOL1.DRFV3.DYNALL,DISP=SHR
//SYSPRINT DD SYSOUT=*
//DFSVSAMP DD DSN=IMTOOL1.IMS.PROCLIB(BUFS40),DISP=SHR
//SYSPRINT DD SYSOUT=*
//ICEPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//*
//ICEIN    DD *
 GLOBAL  DBRC=Y,DSN=&ICHLQ..&DDN..FC1,
         STORCLAS=GSYES,FASTIC=(REQ,COPY),
         ICHLQ=FP4,SPACE=(CYL,2000,400,RLSE),UNIT=SYSDA
 GROUP   FUNC=CIC,DBDSGRP=DEDBGP1,ICOUT=*
/*
//HPICFP2  JOB  HPIC4,CLASS=A,MSGLEVEL=(1,1),REGION=0M,
//        MSGCLASS=E,TIME=1440
//*-----------------------------------------------------------------*/
//*                                                                 */
//*    JCL TO RUN HPICV4 FOR DBDSGRP=DEDBGP2 WHICH INCLUDE          */
//*       CCAREA13 THROUGH CCCAREA24.                               */
//*                                                                 */
//*       'FASTIC=(REQ,COPY)' REQUESTS FLASHCOPY IS REQUIRED TO BE   */
//*       USED.                                                     */
//*                                                                 */
//*-----------------------------------------------------------------*/
//HPIC1   EXEC PGM=FABJMAIN
//STEPLIB   DD DISP=SHR,DSN=IMSTOOL.HPIC41.FAB.SHPSLMD0
//          DD DISP=SHR,DSN=IMTOOL1.CUST.COMPEXIT
//          DD DISP=SHR,DSN=IMTOOL1.I91RTS14.COMRESL
```

Supplement: JCL sample – HPIC V4 (3/3)

```
//*-------------------------------------------------------------------*
//* FOR IMS DATA SETS
//*-------------------------------------------------------------------*
//DFSRESLB  DD DISP=SHR,DSN=IMTOOL1.I91RTS14.COMRESL
//IMS       DD DISP=SHR,DSN=IMTOOL1.DRFV3.DBDLIB
//SYSPRINT  DD SYSOUT=*
//DSSPRINT  DD SYSOUT=*
//*-------------------------------------------------------------------*
//* FOR IC HASH CHECK INPUT
//*-------------------------------------------------------------------*
//DBDEFCTL  DD DUMMY
//*-------------------------------------------------------------------*
//* REPORTS
//*-------------------------------------------------------------------*
//PRIMAPRT  DD SYSOUT=*
//STATIPRT  DD SYSOUT=*
//VALIDPRT  DD SYSOUT=*
//SNAPPIT   DD SYSOUT=*
//DFSPRINT  DD SYSOUT=*
//*-------------------------------------------------------------------*
//* FOR WORK DATA SETS
//*-------------------------------------------------------------------*
//FSESTAT   DD UNIT=SYSDA,SPACE=(CYL,(2,2))
//*
//RECON1   DD  DSN=IMTOOL1.DRFV3.RECON91,DISP=SHR
//RECON2   DD  DSN=IMTOOL1.DRFV3.RECON92,DISP=SHR
//IMSDALIB DD  DSN=IMTOOL1.DRFV3.DYNALL,DISP=SHR
//SYSPRINT DD SYSOUT=*
//DFSVSAMP DD DSN=IMTOOL1.IMS.PROCLIB(BUFS40),DISP=SHR
//SYSPRINT DD SYSOUT=*
//ICEPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
//*
//ICEIN    DD *
 GLOBAL  DBRC=Y,DSN=&ICHLQ..&DDN..FC1,
        STORCLAS=GSYES,FASTIC=(REQ,COPY),
        ICHLQ=FP4,SPACE=(CYL,2000,400,RLSE),UNIT=SYSDA
 GROUP   FUNC=CIC,DBDSGRP=DEDBGP2,ICOUT=*
/*
```

Supplement: JCL sample – HPCA V1.4 (1/3)

```
//HPCA14   JOB 'HPCA14',MSGCLASS=E,MSGLEVEL=(1,1),CLASS=A,
// TIME=1440,REGION=0M
//*
//**********************************************************************
//*
//*   JCL to process HPCA for CAGRP GRPNAME=CAGRP1 which updates
//*       for CCAREA01 through CCAREA24.
//*
//* 'MEMLIMIT=2048' request 2GB of 64-bit storage for spill file
//*
//**********************************************************************
//HPCMAIN  EXEC PGM=HPCAMAIN,PARM='CA14,LIST',REGION=0M
//*
//STEPLIB  DD DISP=SHR,DSN=IMSTOOL.HPCA14.SHPCLMD0
//         DD DISP=SHR,DSN=IMTOOL1.I91RTS14.COMRESL
//*
//RECON1   DD DISP=SHR,DSN=IMTOOL1.DRFV3.RECON91
//RECON2   DD DISP=SHR,DSN=IMTOOL1.DRFV3.RECON92
//*
//IMS      DD  DSN=IMTOOL1.DRFV3.PSBLIB,DISP=SHR
//         DD  DSN=IMTOOL1.DRFV3.DBDLIB,DISP=SHR
//*
//HPCACTL  DD  DISP=SHR,DSN=HPCA1.CONTRL14
//HPCPRINT DD  SYSOUT=*
//HPCACOLP DD  DISP=SHR,DSN=HPCA1.REPORT14(HPCACOLP)
//HPCACOLS DD  DISP=SHR,DSN=HPCA1.REPORT14(HPCACOLS)
//HPCACSV  DD  DISP=SHR,DSN=HPCA1.REPORT14(HPCACSV)
//HPCAHTML DD  DISP=SHR,DSN=HPCA1.REPORT14(HPCAHTML)
//HPCAXML  DD  DISP=SHR,DSN=HPCA1.REPORT14(HPCAXML)
//HPCDBRPT DD  DISP=SHR,DSN=HPCA1.REPORT14(HPCDBRPT)
//*
//HPCMSG00 DD  SYSOUT=*
//HPCAPROC DD  DISP=SHR,DSN=IMTOOL1.PROCLIB3
//JCLPDS   DD  DISP=SHR,DSN=HPCA1.JCLPDS14
//SYSPRINT DD  DISP=SHR,DSN=HPCA1.SYSPRT14
//JCLOUT   DD  DISP=SHR,DSN=HPCA1.JCLOUT14
//SYSOUT   DD  DISP=SHR,DSN=HPCA1.SYSOUT14
```

Supplement: JCL sample – HPCA V1.4 (2/3)

```
//HPCSYSIN DD  *
     ID              = CA14
     List
     Unit             = 3390
     MAXIMUM LOGS      = 64
     MEMLIMIT          = 2048
     PARALLEL LOGS     = 5
     PARALLEL SORTS     = 1
*    Procedure Name     = HPCSTASK
     Spill BLKSIZE      = 26624
     Select Logs        = PRILOG

* sort Parameters
               SORT.SMF = SHORT
              SORT.FILSZ = 23000000
            SORT.MAINSIZE = 32
             SORT.HIPRMAX = O
      SORT.DYNALLOC COUNT = 2
* CA Spill File Definations

     CA.unit           = VIO
     CA.SPACE          = CYLS
     CA.PREFIX         = NODLET1.DRFV3FF
     CA.PRIMARY        = 220
*    CA.DATACLAS       = STANDARD
*    CA.MGMTCLAS       = DEPT11
*    CA.STORCLAS       = BIG
     CA.SECONDARY      = 400
     CA.UNIT COUNT     = 2

* FP Spill File Definations

     FP.unit           = SYSDA
     FP.SPACE          = CYLS
     FP.PREFIX         = NODLET1.DRFV3FP
     FP.PRIMARY        = 500
*    FP.DATACLAS       = STANDARD
*    FP.MGMTCLAS       = DEPT11
     FP.STORCLAS       = GSYES2
```

Supplement: JCL sample – HPCA V1.4 (3/3)

```
 FP.SECONDARY      = 4000
    FP.UNIT COUNT     = 2

    UNIT              = VIO

*  Gen.Warn           =  (Stop/Ignore/Defer)
    GEN.LIST          = 4
    GEN.Warn          = Stop

*   GEN.GENJCL        = MEMBER(CAJCL)
*   GEN.GENJCL        = DEFAULTS(KEYR919E)
*
*
         Sum.Files = YES
    Sum.REPORT Class = *
         Sum.Sort = YES
*
*  ******************************************
*  ***        Gen Groups go here         ***
*  ******************************************
*
//GENJCLIN DD *
    GENJCL.CA GRPNAME(CAGRP1) MEMBER(CAJCL) DEFAULTS(KEYR919E)
/*
```

Supplement: JCL sample – DRF V3 (1/3)

```
//DRFJCL1  JOB  REGION=0M,MSGLEVEL=(1,1),MSGCLASS=E
//*
//*********************************************************************
//*                                                                   *
//*  JCL to DRF-recover the DBDSGRP=DEDBGRPA which include            *
//*      CCAREA01 through CCAREA24.                                   *
//*                                                                   *
//*      OUTPUT(DUP)--Specifies DB Copy Generation                    *
//*           ICR --Specifies Incremental Image Copy                  *
//*           PRO --Specifies recovery of Production DB               *
//*           BOTH--Specifies both PRO and DUP                        *
//*                                                                   *
//*********************************************************************
//*-------------------------------------------------------------------*
//*   FRXJCL3P PROC FOR DATABASE RECOVERY FACILITY                    *
//*          DRFV3 PROC for RPTTYPE=SEP                               *
//*-------------------------------------------------------------------*
//FRXJCL3P PROC RGN=0M,
//           DRFRES='IMSTOOL.DRF31.FRX.SFRXRESL',
//           HPICRES='IMSBLD.IMSTOOL.DRFV3R1.HPICV4.SFRXRESL',
//           HPPCRES='IMSBLD.IMSTOOL.DRFV3R1.HPPC.SFRXRESL',
//           DEPCRES='IMSBLD.IMSTOOL.DRFV3R1.DEDBPC.SFRXRESL',
//           IBRES='IMSBLD.IMSTOOL.DRFV3R1.HPIB.SFRXRESL',
//           DRFMBR=T1,
//           BPECFG=FRXBPECF,
//           DRFPROC=DRFV3R,
//           DCB='DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118),OUTLIM=0'
//*****************************************************************
//*  BRING UP A RECOVER DATA MANAGER                              *
//*****************************************************************
//STEP1    EXEC PGM=FRXSDR00,
//     PARM='DRF,BPECFG=&BPECFG,DRFMBR=&DRFMBR,DRFPROC=&DRFPROC',
//     REGION=&RGN,TIME=1440
//STEPLIB  DD  DSN=&DRFRES,DISP=SHR
//         DD  DSN=&HPICRES,DISP=SHR
//         DD  DSN=&HPPCRES,DISP=SHR
//         DD  DSN=&DEPCRES,DISP=SHR
//         DD  DSN=&IBRES,DISP=SHR
//         DD  DSN=IMTOOL1.I91RTS14.COMRESL,DISP=SHR
```

Supplement: JCL sample – DRF V3 (2/3)

- //IMSDALIB DD DSN=IMTOOL1.DRFV3.DYNALL,DISP=SHR
- //PROCLIB DD DSN=IMTOOL1.IMS.PROCLIB,DISP=SHR
- // DD DSN=IMTOOL1.PROCLIB,DISP=SHR
- //DBDLIB DD DSN=IMTOOL1.DRFV3.DBDLIB,DISP=SHR
- //RECON1 DD DSN=IMTOOL1.DRFV3.RECON91,DISP=SHR
- //RECON2 DD DSN=IMTOOL1.DRFV3.RECON92,DISP=SHR
- //SYSIN DD DUMMY
- //SYSPRINT DD SYSOUT=*
- //SYSUDUMP DD SYSOUT=*
- //REPORT DD SYSOUT=*,&DCB
- //*---*
- //* DRF DD's for IAUs: *
- //* FRXWTO - only required when RPTTYPE=SEP *
- //*---*
- //FRXWTO DD SYSOUT=*,&DCB
- //DFSRESLB DD DSN=IMTOOL1.I91RTS14.COMRESL3,DISP=SHR
- //IMS DD DSN=IMTOOL1.DRFV3.DBDLIB,DISP=SHR
- //*---*
- //* HPIC DD's for IAUs when RPTTYPE=SEP *
- //*---*
- //ICEPRINT DD SYSOUT=*,&DCB
- //ICERPRT DD SYSOUT=*,&DCB
- //DFSPRINT DD SYSOUT=*,&DCB
- //*---*
- //* HPPC DD's for IAUs when RPTTYPE=SEP *
- //*---*
- //PRIMAPRT DD SYSOUT=*,&DCB
- //EVALUPRT DD SYSOUT=*,&DCB
- //SUMMARY DD SYSOUT=*,&DCB
- //STATIPRT DD SYSOUT=*,&DCB
- //VALIDPRT DD SYSOUT=*,&DCB
- //SNAPPIT DD SYSOUT=*,&DCB
- //*---*

Supplement: JCL sample – DRF V3 (3/3)

```
//* DEDB PC DD's for IAUs when RPTTYPE=SEP                    *
//*-----------------------------------------------------------*
//FABARPRT DD SYSOUT=*,&DCB
//FABAMSG  DD SYSOUT=*,&DCB
//FABASNAP DD SYSOUT=*,&DCB
//*-----------------------------------------------------------*
//* IB DD's for IAUs when RPTTYPE=SEP                         *
//*-----------------------------------------------------------*
//IIUSNAP  DD SYSOUT=*,&DCB
//IIUSOUT  DD SYSOUT=*,&DCB
//IIUSTAT  DD SYSOUT=*,&DCB
//IIUPRINT DD SYSOUT=*,&DCB
//*-----------------------------------------------------------*
//* DFSPREC0 DD's for IAUs when RPTTYPE=SEP                   *
//*-----------------------------------------------------------*
//PRPRINT  DD SYSOUT=*,&DCB
//*
//         PEND
//*
//FRXJCL01 EXEC FRXJCL3P
//SYSIN DD *
 REPORT(RPTTYPE=SEP,DRFUNIT=SYSDA,DRFHLQ=IMTOOL1)
 OUTPUT(PRO)
 ADD DBDSGRP(DEDBGRPA)
 START ERROR(CONT)
/*
//*******************************************************************/
//*  FRXDRFT1 has following parameters specified                    */
//*******************************************************************/
//*  M$G$(TEST)
//*  READNUM(10,10)
//*  SORTPARM(NUM(10),HIPRMAX(OPTIMAL),MAINSIZE(100),-
//*     ASPREF(FRXI),AVGRLEN(1024),FILSZ(400000))
//*  SPSIZE(1024)
```

IBM

END of 1335

Act.Right.Now.