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IBM® z/OS® Regular to Large Volume Migration - White Paper

Second Edition

Abstract

This paper discusses the Consolidated Service Test experience in migrating data from various 3390 volumes to larger 3390 volumes. Information is provided on techniques to migrate from a direct access storage device (DASD) with smaller source volumes to an Enterprise Storage Server® (ESS) device with Large Volume support and z/OS V1R10 Extended Address Volume Support.

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1 Introduction

This paper provides information on the procedures, Consolidated Service Test (CST) experience and sample JCL to migrate from a DASD storage device with smaller source volumes to an Enterprise Storage Server (ESS) device with Large Volume and Extended Address Volume (EAV) support. This migration allows for no application outage by taking advantage of Extended Remote Copy (XRC), DFSMSdss™ Data Set Level FlashCopy®, DFSMShsm™, Softek™ Transparent Data Migration Facility (TDMF™) and Softek z/OS DatasetMobility Facility (zDMF) software. The paper provides techniques to move data directly to larger volumes. It also provides ways to move the data from the original DASD device to 'interim' volumes of the same size on the new ESS and then utilize FlashCopy to move the data from the 'interim' volumes onto larger volumes on the same new ESS. Techniques to grow volumes in place with Dynamic Volume Expansion and further reduce addressing needs through use of HyperPAV are also discussed.

2 Overview

The preparation steps in this process setup the environment and identify prerequisites needed. The XRC steps provide a method to move the data from the target volumes to the interim volumes without needing to shutdown applications. The last step in the XRC process and FlashCopy steps will require the application using the volumes to be quiesced. Experience during CST showed that during the quiesce window, the XRC step completed in less than a minute. The DFSMSdss copy step can take from less than a minute to more than an hour, depending on the number of data sets involved. The logical copy occurs almost instantly but there is overhead for catalog searches that can be long running if thousands of data set names are part of the volumes or storage group being processed. Use of zDMF as part of your approach will also require an application restart in order to reclaim the physical space allocated to the original source data sets. If your situation requires only TDMF to complete the data movement, then it is possible that no application outage or quiese will be required.

There are other alternatives to using XRC, TDMF or zDMF that may or may not work better in a particular environment. If a different approach is used to get the data onto the new ESS from a previous device, then steps described in sections for XRC, TDMF and zDMF can be skipped. Whatever technique is used, it is still necessary to quiesce the application prior to issuing the DFSMSdss copy commands or completing the zDMF processing.

Samples jobs that are used to accomplish this migration are included. They can be used as a means to perform batch updates, especially when dealing with volume ids that do not have a pattern or sequence to them. They represent one of many alternatives to accomplish this movement, so it is possible to use other techniques to obtain the same results depending on the environment.

3 Planning Considerations

This process was used a few years ago to move from an ESS 2105 model with 800 volumes that were 3339 cylinders in size to an ESS 2105 model with 320 volumes, ranging in size from 1113 cylinders up to 32760 cylinders.

Recently, this process was used to consolidate volumes from an ESS 2105 and an ESS 2107 onto a new ESS 2107 storage server. This involved over 900 volumes ranging in size from 1113 cylinders up to 64554 cylinders.

The 2107 storage server had 8 lss's where the data movement was from like to like sizes retaining the same volser. This made them good candidates for non-disruptive TDMF movement. There were a total of 328 volumes, so they were easily processed by one TDMF session

The remaining movement of over 600 volumes involved various size increases and consolidation from 3339, 10,017, 15200 cylinder volumes to 32,277 and 64,554 cylinder volumes.

The majority of the time was spent in the planning phase of this process. One of the first considerations is if there are enough interim volumes on the new ESS to map to the number of volumes the largest application uses. To help understand some potential situations, consider the following environment.

Source ESS

20 3390 Mod 3 volumes, 3339 cylinders, volume id SR3000 to SR3009 and SR3100 to SR3109 with corresponding addresses, 3000 to 3009 and 3100 to 3109

Target ESS

10 3390 Mod 3 volumes, 3339 cylinders, volume id IM9900 to IM9910, addresses 9900 to 9909
4 3390 Mod 9 volumes, 64,554 cylinders, volume id TG9000 to TG9003, addresses 9000 to 9003

If the application outage time is not a concern, just do a DFSMSdss data set copy from the source volumes, SR3000 to SR3009 directly to the larger target volumes, TG9000 to TG9003. The outage will be the time it takes DFSMSdss to physically copy all the data.

If application outage time is a concern and application A is completely contained on 10 source volumes, SR3000 to SR3009, then planning is straight forward. Use XRC or TDMF to duplicate these volumes on the interim volumes IM9990 to IM9910. Once they have exact copies, then quiesce the application, run FlashCopy and once it logically completes, resume the application. This can significantly shorten the application outage required. This is discussed in more detail below in the section on FlashCopy Steps

If application outage time is a concern and application A is completely contained on 20 source volumes, SR3000 to SR3009 and SR3100 to SR3109, then the planning is more involved since there are not enough interim volumes to duplicate all the source volumes at one time. Other considerations are things like multiple volume data sets and scheduling multiple outage windows. These situations are discussed further in the FlashCopy Steps below.

The discussions and examples below will make use of this simple model, but the concepts will apply to much larger situations, like the one tested in CST with over 1000 volumes.

The CST test moved SMS managed volumes and data sets. If non-SMS data is being moved, the steps that can be skipped are noted and modified examples are included where this processing would differ from moving SMS data.

4 Recommended Service and Maintenance

a. Target ESS requires FlashCopy Version 2 license to perform DFSMSdss Data Set Level FlashCopy
b. XRC License is required for the Source and Target ESS if this method is used to move data from the source to interim volumes
c. zDMF z/OS v3.1 and z/OS v1.10 if you are moving to EAV devices.
d. TDMF z/OS v5.1 and z/OS v1.10 if you are moving to EAV devices.
e. This link provides information on preparing to use HyperPAV on your DS8000™.

   http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/BOOKS/iea2f190/2.8?ACTION=MATCHES&REQUEST=hyperpav&TYPE=FUZZY&SHELF=EZ2ZO10L.bks&DT=20080604011027&CASE=&searchTopic=TOPIC&searchText=TEXT&searchIndex=INDEX&rank=RANK&ScrollTOP=FIRSTHIT#FIRSTHIT

f. Dynamic Volume Expansion requirements
   • M/T2107 Release 3 with LIC for DVE
   • z/OS V1R7 or later or z/OS V1R10 (for EAV support)
   • PTF for APAR OA20043 (for SMF 22 record and ENF64 support)
   • PTF for APAR OA21113/OA21216 (for device support)
   • PTF for APAR PK57851 (for ICKDSF)
   • PTF for APAR OA21574 (for DFSMShsm).

5 Preparation Steps

a) Ensure proper backups have been taken

Take whatever steps local processes call for to backup the application data prior to beginning data movement.

b) Initialize and vary the new target volumes online, TG9000 to TG9003.

Consider the number of data sets these new larger volumes may hold, and plan the size of the VTOC accordingly.

c) Add Large Volumes from the target ESS to the SMS Storage Group where the data is being moved to.

This step can be skipped if the data is not SMS managed. This now allows SMS to start to use the new larger volumes to perform new data set allocations.

d) Add Large Volumes to the SMS COPY POOL BACKUP Storage Group used on the target ESS

If you are using DFSMShsm Fast Replicate or DB2® Point in Time techniques to manage flash copy sessions, be sure to add corresponding volumes with the correct size into your SMS COPY POOL BACKUP Storage Group from the ESS where you plan to move this data to.

SAMPLE JOB to add target volumes to Storage Group:

NAVADD uses the DFSMS™ NaviQuest program to add new target volumes, TG9000 to TG9003, to the storage group CSTDB. After the job completes, issue the command 'SETSMS SCDS(scdsname)' to activate the changes. This can be a big time saver over adding volumes manually. This job ran 4 hours to add 310 volumes during this test

TEST NOTES: Information on NaviQuest can be found in *Maintaining Your SMS Environment, Document Number:SG24-5484-00* at the following link,

http://w3.itso.ibm.com/abstracts/sg245484.html?Open

```
//NAVADD JOB ,'SERVICE TEST - INIT',MSGCLASS=H,
//      CLASS=J,MSGLEVEL=(1,1),REGION=4M,NOTIFY=
/*JOBPARM SYSAFF=*
//*
//MYLIB JCLLIB ORDER=SYS1.SACBCNTL
//ADDVOL1 EXEC ACBJBAOB,PLIB1='SYS1.DGTPLIB',TABL2=MCKENNY.TEST.ISPTABL
//SYSUDUMP DD SYSOUT=*
//TEMPFILE DD DSN=&&VOLADDS,DISP=(NEW,KEEP),UNIT=3390,
//            SPACE=(CYL,(5,1)),LRECL=80,RECFM=F,BLKSIZE=80
//SYSTSIN  DD *
PROFILE PREFIX(IBMUSER)
ISPSTART CMD(ACBQBAI9) BATSCRW(132) BATSCRD(27) BREDIMAX(3)+
BDISPMAX(99999999)
```

```
/*
//VOLALT  DD  *
//VOLDEL  DD  *
/*
//VOLADD  DD  *
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(TG9000) SG(CSTDB) STATUSALL(ENABLE)

SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(TG9001) SG(CSTDB) STATUSALL(ENABLE)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(TG9002) SG(CSTDB) STATUSALL(ENABLE)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(TG9003) SG(CSTDB) STATUSALL(ENABLE)
/*
//ADDVOL2 EXEC ACBJBAOB,PLIB1='SYS1.DGTPLIB',TABL2=MCKENNY.TEST.ISPTABL
//SYSUDUMP DD  SYSOUT=*
//SYSTSIN  DD DSN=&&VOLADDS,DISP=(OLD,DELETE)
//
```

e) DISABLE source volumes in the storage group being moved.

Run this NaviQuest job to DISABLE all the old source volumes for new allocations. This can be run once the target volumes are available and enabled and well before starting to move data. Any new data set allocated on the new larger volumes reduces the number that will be needed to move from the old source volumes. After the job completes, issue the command 'SETSMS SCDS(scdsname)' to activate the changes.

SAMPLE JOB to disable target volumes in Storage Group:

```
//NAVALT JOB ,'SERVICE TEST - INIT',MSGCLASS=H,
//      CLASS=J,MSGLEVEL=(1,1),REGION=4M,NOTIFY=
/*JOBPARM SYSAFF=*
//*
//MYLIB JCLLIB ORDER=SYS1.SACBCNTL
//ADDVOL1 EXEC ACBJBAOB,PLIB1='SYS1.DGTPLIB',TABL2=MCKENNY.TEST.ISPTABL
//SYSUDUMP DD SYSOUT=*
//TEMPFILE DD DSN=&&VOLADDS,DISP=(NEW,KEEP),UNIT=3390,
//            SPACE=(CYL,(5,1)),LRECL=80,RECFM=F,BLKSIZE=80
//SYSTSIN  DD *
PROFILE PREFIX(IBMUSER)
ISPSTART CMD(ACBQBAI9) BATSCRW(132) BATSCRD(27) BREDIMAX(3)+
BDISPMAX(99999999)
/*
//VOLALT  DD  *
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3000) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3001) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SC3002) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3003) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3004) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3005) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3006) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3007) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3008) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3009) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3100) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3101) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3102) SG(CSTDB) STATUSALL(DISNEW)
```

```
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3103) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3104) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3105) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3106) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3107) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3108) SG(CSTDB) STATUSALL(DISNEW)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3109) SG(CSTDB) STATUSALL(DISNEW)
/*
//VOLDEL  DD  *
/*
//VOLADD  DD  *
/*
//DELVOL2 EXEC ACBJBAOB,PLIB1='SYS1.DGTPLIB',TABL2=MCKENNY.TEST.ISPTABL
//SYSUDUMP DD  SYSOUT=*
//SYSTSIN  DD DSN=&&VOLADDS,DISP=(OLD,DELETE)
//
```

6 TDMF Steps

The 2107 box had 8 lss's that were all like to like in size, so they were good candidates for TDMF. There were 328 total devices total, so they all fit in one session.

In this example, DFSM01 was the source volume and XX4000 was the target volume.

When TDMF moves the data, it relabels the target volume's volser to that of the source volume, and relabels the source volume's volser to a new volser. In the OPTIONS parameter, RELABEL(TD) was specified, therefore XX4000 became DFSM01 and DFSM01 became TD3009.

Since CST consists of a multiple system syslex, the AGENT jobs were started on all of the systems that DFSM01 was enabled to: SI0, SJ0, SK0, SL0,SM0, SN0, SP0, SQ0. Then the MASTER job was started on system SO0. All of the jobs were submitted from SO0TSO so 'JOBPARM SYSAFF= 'was added to each job's JCL to ensure that it ran on the desired system.

SAMPLE JOB for the TDMF AGENT

```
//TDMF1CSJ JOB 'JOBCARD','CST DS8K MIGRATION',MSGCLASS=H,
//         NOTIFY=&SYSUID,CLASS=A,MSGLEVEL=(1,1),REGION=0M
/*JOBPARM SYSAFF=SJ0
//*         ************************************************************
//*         * These "AGENT" systems' jobs are REQUIRED on all         *
//*         * systems sharing the source and target volumes in the    *
//*         * migration process.                                      *
//*         *                                                         *
//*         ************************************************************
//STEP1   EXEC PGM=TDMFMAIN,PARM=AGENT,TIME=1439
//STEPLIB  DD  DISP=SHR,DSN=SYS2.TDM410.TDMLLIB
//SECCOM   DD  DISP=SHR,DSN=SYS2.TDM410.TDMLLIB
//SYSCOM   DD  DISP=SHR,DSN=SYS2.TDM410.SESSION6.COMMDS
//SYSPRINT DD  SYSOUT=*
//SYSUDUMP DD  SYSOUT=*
//SYSSNAP  DD  SYSOUT=*
//SYSIN    DD  *
/*
//
```

SAMPLE JOB for the TDMF MASTER

```
//TDMF1CSO JOB 'JOBCARD','TDMF MASTER',MSGCLASS=H,NOTIFY=&SYSUID,
//         CLASS=A,MSGLEVEL=(1,1),REGION=0M
/*JOBPARM SYSAFF=SO0
//STEP1   EXEC PGM=TDMFMAIN,PARM=MASTER,TIME=1439
//STEPLIB  DD  DISP=SHR,DSN=SYS2.TDM410.TDMLLIB
//SECCOM   DD  DISP=SHR,DSN=SYS2.TDM410.TDMLLIB
//SYSCOM   DD  DISP=SHR,DSN=SYS2.TDM410.SESSION1.COMMDS
//SYSPRINT DD  SYSOUT=*
//DSFPRINT DD  SYSOUT=*
//SYSUDUMP DD  SYSOUT=*
//SYSSNAP  DD  SYSOUT=*
//SYSIN    DD  *
```

```
 SESSION SESSION1
       MASTER(SO0)
       AGENT(SI0 SJ0 SK0 SL0 SM0
             SN0 SP0 SQ0)
       SYSCOM(SYS2.TDM410.COMMDS)
       OPTIONS(CONCURRENT(12 ACTIVE) FASTCOPY PAV RELABEL(TD))
 MIGRATE DFSM02 XX411F OPTIONS(PACING(FULLSPEED))
 MIGRATE DFSM03 XX4728 OPTIONS(PACING(FULLSPEED))
/*
```

The CST experience in moving volumes with TDMF ranged from 20 to 40 minutes on two separate sets of 78 volumes each consisting of various size volumes and varying ranges of volume utilization.

Considerations for COUPLE, SPOOL and PAGE datasets

Since COUPLE, SPOOL and PAGE data sets were part of the mix on the volumes being moved, these additional steps were necessary as part of this move:

There were 3 Coupling Facility Volumes, COUPLx, which were moved by

1. Initialized new target COUPLx volumes
2. Moved Alternate CDS first.
3. Switched ACTIVE to ALT.
4. Moved the PRIMARY.

In the case of 54 Page Volumes, PAGExx, the page volumes were moved non disruptively by following these steps:

1. All of the new target PAGE volume were initialized with volsers PAGExx.
   VTOCS and IX-VTOCS were allocated proportional to the size of each volume respectively.
2. The page data sets were moved manually using Page-Add/Page-Delete process for Locals.
3. Once all Page data sets were moved, old source volumes were reclaimed.

To move the 18 SPOOL volumes, SPLJxx, spool volumes were dynamically added on the new DASD and then the old spool volume were set to drain. This can take a few days since started tasks allocate spool space. The steps followed were:

1. All of the new target Spool volumes were initialized with volsers SPLJ2x
   VTOCS and IX-VTOCS were allocated proportional to the size of each volume respectively.
2. The spool data sets were drained and moved.

This is a list of other considerations and miscellaneous action items that were part of the TDMF planning and analysis:

1. IMS™ Write Ahead Data Sets are only an issue if you are going from ESCON® to parallel channels, which did not apply to us.
2. Catalogs were not an issue as the Auto-ICKDSF Option is set to NO (default).
3. Esoterics are not an issue.
4. GRS Considerations
   a. the following recommended parameter was used in GRSRNLxx.
      RNLDEF RNL(EXCL) TYPE(GENERIC) QNAME(TDMFRESV)

b. The SYSVTOC and SYSZVVDS resource names are the QNAMES for resource serialization of each volume's VTOC and VVDS. To ensure the data integrity of data sets being migrated, it is imperative that hardware reserves be converted to globally propagated ENQ requests.

6.2 After TDMF is finished, verify that all of the data sets have been moved and all of the data is there. An IEHLIST of the volumes just moved can be used to verify that everything has been moved.

The *Migrating to IBM System Storage DS8000* Redbook, listed under References at the end of this paper, has a chapter on using TDMF for z/OS that addresses other situations and best practices that were not encountered as part of this CST migration.

7 zDMF Steps

This is one of the techniques to move the data sets logically that are allocated and require nondisruptive movement. This was used to handle data movement of over 600 volumes that involved various size increases and consolidation from 3339, 10,017, 15200 cylinder volumes to 32,277 and 64,554 cylinder volumes.

zDMF was also a necessary option in the following unique scenario. The CST environment had a volume naming standard requiring all DB2 volumes to be named with a 'DB' prefix followed by the respective 4-digit physical address. All of the new DB2 volumes had to be migrated to new addresses on the new DS8000, therefore, all DB2 data had to be moved at the 'logical level'. In adherence to this naming practice, migrating this data at the 'physical level' (or volume level) would have resulted in volume names (vol ser's) that did not match the new volume address.

For this reason, a recommended best practice for volume labeling is to avoid using physical addresses within the volume name. While this practice is both practical and convenient for 'free space' or 'available' packs, it is not practical for production volumes because it limits future nondisruptive migration options to 'logical level' techniques and methods.

The first step was to move as much data as possible using DFSMShsm to handle any of the unallocated data residing on these volumes using this command:

```
MIGRATE VOLUME(DB900A MIGRATE(0)) CONVERT
```

SAMPLE JOB for the DFSMShsm Migrate Convert

```
//CONVERT  JOB  CONSOLE,
//         MSGCLASS=P,MSGLEVEL=(1,1),CLASS=A,
//         TIME=1440
//MIGRATE   EXEC PGM=IKJEFT01
//SYSTSPRT  DD  SYSOUT=*
//SYSPRINT  DD  SYSOUT=*
//SYSTSIN   DD  *
 HSEND MIGRATE VOLUME(DB900A MIGRATE(0)) CONVERT
 HSEND MIGRATE VOLUME(DB900B MIGRATE(0)) CONVERT
 HSEND MIGRATE VOLUME(DB900C MIGRATE(0)) CONVERT
 HSEND MIGRATE VOLUME(DB900D MIGRATE(0)) CONVERT
 HSEND MIGRATE VOLUME(DB900E MIGRATE(0)) CONVERT
 HSEND MIGRATE VOLUME(DB900F MIGRATE(0)) CONVERT
 HSEND MIGRATE VOLUME(DB9000 MIGRATE(0)) CONVERT
 HSEND MIGRATE VOLUME(DB9001 MIGRATE(0)) CONVERT
/*
```

One of the exceptions received in processing this command were

```
ARC0734I ACTION=SPCMGMT FRVOL=DB9000 TOVOL=   *** 920
ARC0734I (CONT.) TRACKS=         0 RC=  45, REASON=    5, AGE= 371,
```

```
ARC0734I (CONT.) DSN=CST2DB2.DSNDBD.LGP02.X2A02.I0001.D655
```

Which indicated the management class attribute COMMAND-OR-AUTO-MIGRATE=COMMAND restricts migration of this SMS-managed data set. To correct that, Management Class Command or Auto Migrate needed to be updated for these data sets to BOTH from COMMAND.

Some also failed with REASON= 8, indicating a SMS-managed data set is not eligible for migration because it is checkpointed and the minimum number of days since the date last referenced has not elapsed. This was adjusted from the default value of 5 to 1 using this DFSMShsm PATCH command:

```
PATCH .MGCB.+70 X'nn'VERIFY(.MGCB.+70 X'01')
```

Care should be taken in these steps to adjust Management Class or Patch DFSMShsm so that data that needs to remain on Primary DASD is not inadvertently migrated. This was accomplished in CST by issuing the DFSMShsm command to HOLD AUTOMIGRATION on all the systems in the DFSMShsm plex while the MIGRATE CONVERT commands were running. Once MIGRATE CONVERT completed, Management Class and Days Last Referenced values where returned to their previous values and then the DFSMShsm command to RELEASE AUTOMIGRATION was issued.

The CST experience with DB2 data sets was that the DFSMShsm technique was able to move 19,489 of the total 42,303 data sets still remaining on the source volumes. In the case of CST, this processing completed on these 400 volumes in a little over 2 hours.

As an alternative, DFSMSdss could also be used to move unallocated data. Steps and JCL for this can be found later in the FlashCopy Steps section.

zDMF was then used to move the remaining data sets that were allocated on the source volumes directly to the new target volumes. The data was broken down into various group definitions that were then managed using ISPF TSO panels through the various zDMF steps of Activation, Copy, Synchronization, Mirror and Diversion. In most cases, DB2 needed to be bounced to allow de-allocation of the original source volume data set for Completion.

SAMPLE zDMF Group Definition

```
GROUP(ALLDB2) -
  MODE(LMIGR()) -
  TOLERATE_ALLOCATION_FAILURE(YES) MAXRC(8) -
  REPLACE(YES)
SOURCE_VOLUME_LIST DB9VOLS ( -
  DB9* -
  )
SET -
  ALLOCSEQ(SIZE) -
  TRACE(YES) -
  SPHERE(YES) -
  SOURCE ( -
    DSN (CST2DB2.DSNDB*.DSNDB06.**) -
    SOURCE_VOLUME_LIST (DB9VOLS) -
    EXCLUDE ( -
     SYS1.** -
     ) -
```

```
   ) -
 TARGET ( -
   DSN (T7.**) -
   STORAGECLASS(CST2) -
   )
```

The *Migrating to IBM System Storage DS8000* Redbook, listed under References at the end of this paper, has a chapter on Logical Data Migration Facility that addresses other situations and best practices that were not encountered as part of this CST migration.

8 XRC STEPS

8.1 If any of these volumes are already in an active XRC session, then they cannot be put in a second XRC session to migrate them. If this situation exists, first remove them from this active XRC session before proceeding. Additional planning is necessary to determine mirroring requirements for this data once it is moved to the larger volumes.

Start a XRC migration session to move data from the source devices to the interim volumes of the same size on the target device. Enough XRC secondary volumes are needed on the interim ESS in the same size as the source volumes. The XRC session should have utility volumes as readers for each source SSID where XRC source volumes are located. ALL the XRC jobs in the following steps should be run from the same image in the sysplex.

SAMPLE JOB to start XRC Migration session:

```
//XRCINIT  JOB  ,REGION=0K,
//         MSGCLASS=H,MSGLEVEL=(1,1),CLASS=A,NOTIFY=&SYSUID,
//         TIME=1440
//*
//* XRC START THIS JOB STARTS AN XRC SESSION, XRCSB0 AND THEN
//*           ADDS 1 UTILITY VOLUME AND 10  VOLUME PAIRS
//*           TO THE SESSION.  IF ADDING ADDTIONAL VOLUME PAIRS
//*           INSURE THAT THERE IS A UTILITY VOLUME FOR THAT
//*           SSID, OR TIMEOUTS WILL BE EXPERIENCED
//*
//XRCSTART  EXEC PGM=IKJEFT01
//SYSTSPRT  DD  SYSOUT=*
//SYSPRINT  DD  SYSOUT=*
//SYSTSIN   DD  *
 XSTART XRCSB0 SESSIONTYPE(MIGRATE) ERRORLEVEL(VOLUME)
 XSET XRCSB0 SCSYNC(25) SYNC(25) PAGEFIX(600) COPY(FULL)
 XADDPAIR XRCSB0 VOLUME(SR300F,XRCUTL)
 XADDPAIR XRCSB0 VOLUME(SR3000 IM9900)
 XADDPAIR XRCSB0 VOLUME(SR3001 IM9901)
 XADDPAIR XRCSB0 VOLUME(SR3002 IM9902)
 XADDPAIR XRCSB0 VOLUME(SR3003 IM9903)
 XADDPAIR XRCSB0 VOLUME(SR3004 IM9904)
 XADDPAIR XRCSB0 VOLUME(SR3005 IM9905)
 XADDPAIR XRCSB0 VOLUME(SR3006 IM9906)
 XADDPAIR XRCSB0 VOLUME(SR3007 IM9907)
 XADDPAIR XRCSB0 VOLUME(SR3008 IM9908)
 XADDPAIR XRCSB0 VOLUME(SR3009 IM9909)
/*
```

The following messages appear in the system log for each volume pair as XRC proceeds followed by a ANTX8120I once all the volumes are in DUPLEX status.

```
VARY 9900,OFFLINE

ANTI8023I QUICK INITIALIZATION STARTED FOR XRC VOLUME PAIR(SR3000,IM9900)
ANTI8024I XRC VOLUME PAIR(SR3000,IM9900) IN DUPLEX STATUS AT TIME OF
2003.114 21:26:38.733596
```

```
ANTX8120I 10 VOLUMES IN SESSION(XRCSB0) ARE NOW DUPLEX
```

use the XRC Query command to check progress on the XRC synchronization process during this time.

SAMPLE JOB and Output from Query XRC Sessions during initialization:

```
//XRCWEDQ   JOB  (ACCOUNT),'ADRDSSU COPY',REGION=0M,
//     CLASS=J,MSGCLASS=H,NOTIFY=MCKENNY
//*
//* XRC QUERYS AN XRC SESSION
//*
//XRCSTART  EXEC PGM=IKJEFT01
//SYSTSPRT  DD  SYSOUT=*
//SYSPRINT  DD  SYSOUT=*
//SYSTSIN   DD  *
  XQUERY XRCSB0 VOL(ALL) DETAIL


ANTQ8200I XQUERY STARTED FOR SESSION(XRCSB0) ASNAME(ANTAS001) 071
ANTQ8202I XQUERY VOLUME_DETAIL REPORT - 002
ANTQ8216I PRIM   SEC     ERROR  SYNCH          RES  THD       SC SC
ANTQ8217I VOL    VOL     LEVEL    % STA CMD OP CNT  CNT  SSID SN ID
ANTQ8203I ------------------------------------------------------------
ANTQ8218I SR3000 IM9900 VOLUME   28 CPY        0003 0500 1220 -- 01
ANTQ8218I SR3001 IM9901 VOLUME   28 CPY        0002 0500 1220 -- 01
ANTQ8218I SR3012 IM9902 VOLUME   29 CPY        0002 0500 1220 -- 01
ANTQ8218I SR3003 IM9903 VOLUME   29 CPY        0001 0500 1220 -- 01
ANTQ8218I SR3014 IM9904 VOLUME   29 CPY        0001 0500 1220 -- 01
ANTQ8218I SR3015 IM9905 VOLUME   29 CPY        0001 0500 1220 -- 01
ANTQ8218I SR3006 IM9906 VOLUME   29 CPY        0000 0500 1220 -- 01
ANTQ8218I SR3007 IM9907 VOLUME   27 CPY        0000 0500 1220 -- 01
ANTQ8218I SR3008 IM9908 VOLUME   29 CPY        0000 0500 1220 -- 01
ANTQ8218I SR3009 IM9909 VOLUME   28 CPY        0000 0500 1220 -- 01
ANTQ8218I SR300F XRCUTL          -- UTL        0000 0000 1220 -- 01
ANTQ8238I TOTAL=11  DUP=0  CPY=10  PND=0  SUS=0  SEQ=0  UTL=1
ANTQ8231I DATA CONSISTENT(2004.079 16:10:56.691046)  DELAY(00:00:01.76)
ANTQ8232I SESSIONTYPE(MIGRATE)  ERRORLEVEL(VOLUME)  HLQ(SYS1)
ANTQ8233I DEFAULT TIMEOUT(STORAGE_CONTROL_DEFAULT)
ANTQ8201I XQUERY VOLUME_DETAIL REPORT COMPLETE FOR SESSION(XRCSB0)
```

8.2 Once pairs are in Duplex Mode, quiesce the applications before issuing the XEND command.

SAMPLE JOB and Output from Query XRC Sessions now in DUPLEX MODE:

```
//XRCWEDQ   JOB  (ACCOUNT),'ADRDSSU COPY',REGION=0M,
//     CLASS=J,MSGCLASS=H,NOTIFY=MCKENNY
//*
//* XRC QUERYS AN XRC SESSION
//*
//XRCSTART  EXEC PGM=IKJEFT01
//SYSTSPRT  DD  SYSOUT=*
//SYSPRINT  DD  SYSOUT=*
//SYSTSIN   DD  *
```

```
  XQUERY XRCSB0 VOL(ALL) DETAIL

ANTL8800I   XQUERY XRCSB0 VOL(ALL) DETAIL
ANTQ8200I XQUERY STARTED FOR SESSION(XRCSB0) ASNAME(ANTAS001) 151
ANTQ8202I XQUERY VOLUME_DETAIL REPORT - 002
ANTQ8216I PRIM   SEC     ERROR  SYNCH          RES  THD       SC SC
ANTQ8217I VOL    VOL     LEVEL    % STA CMD OP CNT  CNT  SSID SN ID
ANTQ8203I ------------------------------------------------------------
ANTQ8218I SR3000 IMX900 VOLUME      DUP        0000 0500 1220 -- 01
ANTQ8218I SR3001 IM9901 VOLUME      DUP        0000 0500 1220 -- 01
ANTQ8218I SR3002 IM9902 VOLUME      DUP        0000 0500 1220 -- 01
ANTQ8218I SR3003 IM9903 VOLUME      DUP        0000 0500 1220 -- 01
ANTQ8218I SR3004 IM9904 VOLUME      DUP        0000 0500 1220 -- 01
ANTQ8218I SR3005 IM9905 VOLUME      DUP        0000 0500 1220 -- 01
ANTQ8218I SR3006 IM9906 VOLUME      DUP        0000 0500 1220 -- 01
ANTQ8218I SR3007 IM9907 VOLUME      DUP        0000 0500 1220 -- 01
ANTQ8218I SR3008 IM9908 VOLUME      DUP        0000 0500 1220 -- 01
ANTQ8218I SR3009 IM9909 VOLUME      DUP        0000 0500 1220 -- 01
ANTQ8218I XX7001 XRCUTL          -- UTL        0000 0000 1220 -- 01
ANTQ8238I TOTAL=11  DUP=10  CPY=0  PND=0  SUS=0  SEQ=0  UTL=1
ANTQ8231I DATA CONSISTENT(2004.079 21:56:59.828661)   IDLE(00:00:51.0)
ANTQ8232I SESSIONTYPE(MIGRATE)  ERRORLEVEL(VOLUME)  HLQ(SYS1)
ANTQ8233I DEFAULT TIMEOUT(STORAGE_CONTROL_DEFAULT)
ANTQ8201I XQUERY VOLUME_DETAIL REPORT COMPLETE FOR SESSION(XRCSB0)
-                                      --TIMINGS (MINS.)--
```

SAMPLE JOB and output from XRC XEND for Migration Session

```
//XRCEND   JOB  (ACCOUNT),'ADRDSSU COPY',REGION=0M,
//     CLASS=J,MSGCLASS=H,NOTIFY=MCKENNY
/*JOBPARM SYSAFF=SI0
//* XRC ENDS AND XRC SESSION
//*
//XRCSTART  EXEC PGM=IKJEFT01
//SYSTSPRT  DD  SYSOUT=*
//SYSPRINT  DD  SYSOUT=*
//SYSTSIN   DD  *
  XEND XRCSB0 NOVERIFY
/*


ANTL8800I   XEND XRCSB0 NOVERIFY
ANTX8050I XRC SESSION(XRCSB0) NOT ACTIVE.  ISSUE XSTART COMMAND
```

8.3 Vary off all the old volumes first. If in a sysplex, issue the command with Route All*, RO *ALL,V (3000-3009),OFFLINE*. Then issue the command *RO *ALL,D U,,,3000,10* to insure all the source devices are off-line. If some volumes are pending off-line, applications may still hold a reserve on the volumes and these applications need to be stopped first before issuing the XRECOVER to allow the volumes to progress to off-line. Once all the volumes are off-line, then run the XRC RECOVER This completes the XRC process and CLIPS 'to' volumes to 'from' volumes.

At this point issue the command *RO *ALL,V(9900-9909),OFFLINE* and once that completes issue

the command *RO *ALL,V(9900-9909),ONLINE* since the XRC recover only CLIPS the volumes for the system it was run on. This will reflect that change for all systems in the sysplex.

SAMPLE JOB and Output from XRECOVER command

```
//XRCRECV  JOB  (ACCOUNT),'ADRDSSU COPY',REGION=0M,
//     CLASS=J,MSGCLASS=H,NOTIFY=MCKENNY
/*JOBPARM SYSAFF=SI0
//* XRC RECOVER XRC SESSION -
//*  THIS CHANGES THE SECONDARY PACK NAMES
//*  TO THE SAME AS THE PRIMARY PACK NAMES
//*
//*
//XRCSTART  EXEC PGM=IKJEFT01
//SYSTSPRT  DD  SYSOUT=*
//SYSPRINT  DD  SYSOUT=*
//SYSTSIN   DD  *
  XRECOVER XRCSB0

ANTR8108I XRECOVER STARTED FOR SESSION(XRCSB0) AT STARTING CONSISTENCY_
ROUP TIME(2004.079 22:23:51.560127), HLQ(SYS1)
ANTQ8200I XQUERY STARTED FOR SESSION(XRCSB0) ASNAME(ANTAS001) 476
ANTQ8202I XQUERY RECOVER REPORT - 002
ANTQ8271I ------ORIGINAL-------
ANTQ8274I PRIMARY  SECONDARY STA CON CLP  ------TIMESTAMP---------
ANTQ8203I ------------------------------------------------------------
ANTQ8275I SR3000   IM9900    DUP YES YES
ANTQ8275I SR3001   IM9901    DUP YES YES
ANTQ8275I SR3002   IM9902    DUP YES YES
ANTQ8275I SR3003   IM9903    DUP YES YES
ANTQ8275I SR3004   IM9904    DUP YES YES
ANTQ8275I SR3005   IM9905    DUP YES YES
ANTQ8275I SR3006   IM9906    DUP YES YES
ANTQ8275I SR3007   IM9907    DUP YES YES
ANTQ8275I SR3008   IM9908    DUP YES YES
ANTQ8275I SR3009   IM9909    DUP YES YES
ANTQ8237I TOTAL=10   DUP=10   PND=0   SUS=0
ANTQ8231I DATA CONSISTENT(2004.079 22:23:51.560127)
ANTQ8232I SESSIONTYPE(MIGRATE)  ERRORLEVEL(VOLUME)  HLQ(SYS1)
ANTQ8201I XQUERY RECOVER REPORT COMPLETE FOR SESSION(XRCSB0)
IEE302I 9900     ONLINE
IEE302I 9901     ONLINE
IEE302I 9902     ONLINE
IEE302I 9903     ONLINE
IEE302I 9904     ONLINE
IEE302I 9905     ONLINE
IEE302I 9906     ONLINE
IEE302I 9907     ONLINE
IEE302I 9908     ONLINE
IEE302I 9909     ONLINE
IEF196I IGD104I SYS1.XCOPY.XRCSB0.STATE                    RETAINED,
IEF196I DDNAME=ANTJSTAT
IGD104I SYS1.XCOPY.XRCSB0.STATE                      RETAINED,
     DDNAME=ANTJSTAT
080  ANTR8102I XRECOVER COMPLETE FOR SESSION(XRCSB0) AT RECOVERED CONSISTENCY
```

```
      _GROUP TIME(2004.079 22:23:51.560127)
000   IEF404I IEESYSAS - ENDED - TIME=17.30.12
```

9 FlashCopy Steps

9.1 Invoke DFSMSdss data set fast replication to move the data to the larger volumes.

This step will FlashCopy Interim volumes just created by the XRC session to new larger volumes in storage group CSTDB. For SMS volumes, data sets will move to the TG9000 to TG9003 volumes in storage group CSTDB since all the other volumes in storage group CSTDB are DISABLED for new allocation. For NON-SMS volumes, data sets will only move to the OUTDYNAM volumes specified.

The simplest situation is with SMS managed volumes where all the volumes for the storage group now reside on the interim volumes. So CSTDB previously consisted of TG3000 to TG3009 on addresses 3000 to 3009 and has successfully duplicated that data on interim volumes IM9900 to IM9909, on addresses 9900 to 9909. Now use the first sample job below, FLASHA that uses the DFSMSdss key word STORGRP to select the input volumes and move the data from these interim volumes to the large volume target data sets on TG9000 to TG9003.

This is also be true for the situation with Non-SMS managed volumes where all the volumes for an application now reside on the interim volumes, TG3000 to TG3009 on address 3000 to 3009. In this case use the third sample job below, FLASHC that uses the DFSMSdss key words LOGINDYNAM and OUTDYNAME to move the data to the large target volumes TG9000 to TG9003

Both of these cases should incur the smallest window of disruption for the application. Once the DFSMSdss job completes restart the application that was using these volumes. The data movement will be handled by the hardware using the FlashCopy 2 feature. With data set level FlashCopy, there are overhead operations before the DFSMSdss job can complete. The bulk of this time is spent on such things as selecting volumes, selecting free space on the selected volumes, creating VTOC and catalog entries and locating data sets on the source volumes. For small number of data sets and volumes, this overhead in not significant. But for large numbers, this can be a significant time.

In the case where all the data sets qualified for Fast Replication, the following results were observed during CST testing. 195 data sets were moved across 10 source volumes in 2.5 minutes. When a storage group containing 366 data sets across 20 source volumes, it took 4.5 minutes. In another case, 400 data sets were moved across 40 source volumes in 5.5 minutes. In a larger sample, 1305 data sets were moved that were part of a large storage group with over 1000 volumes in 1 hour and 15 minutes. This time was impacted by data sets that were encountered that did not qualify for fast replication. Alternatives for this situation are discussed next which could show how a move of this size could be managed with a smaller outage window.

This time can increase when DFSMSdss has to use a utility, such as IDCAMS to move a data set. In that case it does not use FlashCopy so the all the data must be moved before the job can complete. One situation where this can occur if z/OS v1r3 or above is being run and a data set is copied that was defined

in a previous release. This can causes the CI size that Catalog calculates for the target data set on the new release to be different than the CI size that Catalog originally calculated when the source data set was defined on the old release. When the CI size of the source data set is different than the CI size of the target data set, DFSMSdss must use IDCAMS to copy the data set.

If a limited outage window is planned, specify the keyword FASTREPLICATION(REQUIRED) . This will fail the copy of any data set that can not be moved with the fast replication technique. Restart the application after the DFSMSdss job completes, using both the interim volumes and target volumes for processing. Then analyze the data sets remaining on the interim volumes to determine if they could be moved with the application running, or assess how long it may take to move them without fast replication when the next outage can be scheduled. If using this technique, do not proceed with the next steps until movement is completed of all the data from the interim volumes.

There are some other considerations on what target volumes may be used and when Fast Replication will be invoked by DFSMSdss.

In the case where there are not enough interim volumes to map to the source volumes, then there is still data on other original source DASD devices in the storage group that has not been moved. In this situation include LOGINDYNAM with all the target volumes on the new ESS that the copy function is to be limited to. In the example, this is the case where CSTDB consists of 20 source volumes, SR3000 to SR3009 and SR3100 to SR3109. Since only 10 interim volumes are available, part of the data for CSTDB remained on the original source DASD and will not be eligible for DFSMSdss data set level FlashCopy (only data sets residing on the same ESS can qualify for fast replication). If CSTDB does not contain any multiple volume data sets, this is similar to the situation above where STORGRP is specified. The keyword LOGINDYNAM will limit the selection of source data sets to the interim volumes which should be eligible for fast replication. Now use the second sample job below, FLASHB that uses the DFSMSdss key word LOGINDYNAM to select the input volumes and move the data from these interim volumes to the large volume target data sets. The same cautions about DFSMSdss invoking utilities mentioned in the discussion above will apply.

If the storage group CSTDB contains multiple volume data sets, then there are some additional planning steps. The SELECTMULTI(ANY) keyword will move the entire multiple volume data set to preserve data integrity. If part of a data set resides on volume SR3000 and part on volume SR3102, data on volume SR3102 is copied even though it was omitted from the LOGINDYNAM list. This will cause the DFSMSdss job to run longer since this data cannot be moved with Fast Replication. In order to avoid the impacts this will cause to the outage window there are a few options.

Once again, specify the keyword FASTREPLICATION(REQUIRED) . This will fail the copy of any data set that can not be moved with the fast replication technique. Restart the application after the DFSMSdss job completes, using both the interim volumes and target volumes for processing. Then analyze the data sets remaining on the interim volumes to determine if they could be moved with the application running, or assess how long it may take to move them without fast replication when the next outage can be scheduled

Attempt to select all the volumes that are part of the multiple volume data sets and insure they are part of the interim volume mix. This can work if there are a few multiple volume data sets. It may not be

possible with a large number of multiple volume data sets, since as volumes are added to complete one multiple volume set, it may pull in a volume with another multiple volume data set on it that is not fully contained in the interim mix. Eventually the point is reached where more interim volumes are required than the ability to provide them.

The other choice is to add more interim volumes. If reaching this point is anticipated in the migration from regular to large volumes, then start by moving the largest storage group that contains multiple volumes first. This may allow the ability to initially define enough interim volumes as well as target volumes to contain this move. Once it is complete, delete the RAID array that contains these extra interim volumes and reconfigure it with larger volumes to support the next storage group move.(in this planning, remember it is only possible to reclaim entire RAID arrays, not individual volumes.) In this example, this would mean adding IN9900 to IN9909 to handle the 10 additional volumes required.

This above discussion is also be true for the situation with Non-SMS managed volumes where the application consists of 20 non-SMS volumes and there are only 10 interim volumes, TG3000 to TG3009 available. The consideration would be the same, but in all cases, still use the third sample job below, FLASHC that uses the DFSMSdss key words LOGINDYNAM and OUTDYNAME to move the data to the large target volumes TG9000 to TG9003

One other consideration encountered during CST testing was how to deal with data sets with guaranteed space. The DFSMSdss copy will preserve this attribute, however if applications have specific volser coded using the old volume name, they may need to be updated.

If this is the first time data is being moved to an ESS device, consider the following information regarding Guaranteed Space. With the IBM ESS, the '*Guaranteed Space'* attribute of a storage class with specific volser is no longer required for data sets other than those that need to be separated, such as the DB2 online logs and BSDS, or those that must reside on specific volumes because of their naming convention, such as the VSAM RLS sharing control data sets. The ESS storage controllers use the RAID architecture that enables multiple logical volumes to be mapped on a single physical RAID group. If required, data sets can still be separated on a physical controller boundary for availability beyond what is inherently built into the RAID architecture

SAMPLE JOB FLASHA to MOVE SMS volume data sets from interim volumes to larger target volumes using STORGRP:

```
//FLASHA JOB  (ACCOUNT),'ADRDSSU COPY',REGION=0M,
//      CLASS=A,MSGCLASS=H,NOTIFY=MCKENNY,TIME=1440
/*JOBPARM SYSAFF=SL0
//COPYIT   EXEC  PGM=ADRDSSU,PARM='UTILMSG=YES'
//SYSPRINT  DD  SYSOUT=*
//SYSIN DD *
  COPY DS(INCLUDE(**) EXCLUDE(SYS1.**)) -
       SELECTMULTI(ANY) -
       SPHERE DELETE PURGE -
       STORGRP(CSTDB)

/*
```

SAMPLE JOB FLASHB to MOVE SMS volume data sets from interim volumes to larger target volumes using LOGINDYNAM:

```
//FLASHB JOB  (ACCOUNT),'ADRDSSU COPY',REGION=0M,
//      CLASS=A,MSGCLASS=H,NOTIFY=MCKENNY,TIME=1440
/*JOBPARM SYSAFF=SL0
//COPYIT   EXEC  PGM=ADRDSSU,PARM='UTILMSG=YES'
//SYSPRINT  DD  SYSOUT=*
//SYSIN DD *
  COPY DS(INCLUDE(**) EXCLUDE(SYS1.**)) -
       SELECTMULTI(ANY) -
       SPHERE DELETE PURGE -
       LOGINDYNAM((SR3000), -
                  (SR3001), -
                  (SR3002), -
                  (SR3003), -
                  (SR3004), -
                  (SR3005), -
                  (SR3006), -
                  (SR3007), -
                  (SR3008), -
                  (SR3009))
/*
```

If working with NON-SMS volumes, then the following job should be used to move the data sets from the interim volumes to the target volumes

SAMPLE JOB FLASHC to MOVE NON-SMS Volume data sets from interim volumes to larger target volumes:

```
//FLASHC JOB  (ACCOUNT),'ADRDSSU COPY',REGION=0M,
//      CLASS=A,MSGCLASS=H,NOTIFY=MCKENNY,TIME=1440
/*JOBPARM SYSAFF=SL0
//COPYIT   EXEC  PGM=ADRDSSU,PARM='UTILMSG=YES'
//SYSPRINT  DD  SYSOUT=*
//SYSIN DD *
  COPY DS(INCLUDE(**) EXCLUDE(SYS1.**)) -
       SELECTMULTI(ANY) -
       SPHERE DELETE PURGE -
       CATALOG -
       LOGINDYNAM((SR3000), -
                  (SR3001), -
                  (SR3002), -
                  (SR3003), -
                  (SR3004), -
                  (SR3005), -
                  (SR3006), -
                  (SR3007), -
                  (SR3008), -
                  (SR3009)) -
         OUTDYNAM((TG9000), -
                  (TG9001), -
                  (TG9002), -
```

```
                  (TG9003))
/*
```

9.2 IEHLIST the volumes just flash copied to verify that everything has been moved.

The application can be restarted as soon as the DFSMSdss job completes. If the outage window and planning permit, run the IEHLIST command and attempt to process any data that may remain on the interim volumes. Once all the data is successfully moved from the interim volumes, if other volumes remain to move, continue with cleanup as appropriate and repeat the steps above until all the data is transferred.

SAMPLE JOB to verify all the data sets have been moved from the Interim volumes :

```
//IEHLIST1  JOB ,'JOBCARD ',MSGCLASS=H,
//      CLASS=J,MSGLEVEL=(1,1),REGION=4M,NOTIFY=
//STEP1    EXEC PGM=IEHLIST
//SYSPRINT DD SYSOUT=*
//DD0  DD UNIT=3390,VOL=SER=SR3000,DISP=SHR
//DD1  DD UNIT=3390,VOL=SER=SR3001,DISP=SHR
//DD2  DD UNIT=3390,VOL=SER=SR3002,DISP=SHR
//DD3  DD UNIT=3390,VOL=SER=SR3003,DISP=SHR
//DD4  DD UNIT=3390,VOL=SER=SR3004,DISP=SHR
//DD5  DD UNIT=3390,VOL=SER=SR3005,DISP=SHR
//DD6  DD UNIT=3390,VOL=SER=SR3006,DISP=SHR
//DD7  DD UNIT=3390,VOL=SER=SR3007,DISP=SHR
//DD8  DD UNIT=3390,VOL=SER=SR3008,DISP=SHR
//DD9  DD UNIT=3390,VOL=SER=SR3009,DISP=SHR
//SYSIN    DD *
 LISTVTOC VOL=3390=SR3000,FORMAT
 LISTVTOC VOL=3390=SR3001,FORMAT
 LISTVTOC VOL=3390=SR3002,FORMAT
 LISTVTOC VOL=3390=SR3003,FORMAT
 LISTVTOC VOL=3390=SR3004,FORMAT
 LISTVTOC VOL=3390=SR3005,FORMAT
 LISTVTOC VOL=3390=SR3006,FORMAT
 LISTVTOC VOL=3390=SR3007,FORMAT
 LISTVTOC VOL=3390=SR3008,FORMAT
 LISTVTOC VOL=3390=SR3009,FORMAT
 /*
```

10 Cleanup Steps

10.1 Remove the smaller mod 3's on the new ESS from the storage group and reinitialize them as necessary for addition storage group moves or other processing. After the job completes, issue the command 'SETSMS SCDS(scdsname)' to activate the changes.

Remove volumes from the SMS Storage Group for the original device if you are now using different volids on your new ESS. Also, if you are using DFSMShsm Fast Replicate or DB2 Point in Time techniques to manage flash copy sessions, be sure to remove corresponding volumes in your SMS COPY POOL BACKUP Storage Group from the original device that are no longer being used.

Also, remember to reinitialize the smaller mod 3's from the original device if it is to remain in service

SAMPLE JOB to delete volumes in Storage Group:

```
//NAVDEL JOB ,'SERVICE TEST - INIT',MSGCLASS=H,
//      CLASS=J,MSGLEVEL=(1,1),REGION=4M,NOTIFY=
/*JOBPARM SYSAFF=*
//*
//MYLIB JCLLIB ORDER=SYS1.SACBCNTL
//ADDVOL1 EXEC ACBJBAOB,PLIB1='SYS1.DGTPLIB',TABL2=MCKENNY.TEST.ISPTABL
//SYSUDUMP DD SYSOUT=*
//TEMPFILE DD DSN=&&VOLADDS,DISP=(NEW,KEEP),UNIT=3390,
//           SPACE=(TRK,(1,1)),LRECL=80,RECFM=F,BLKSIZE=80
//SYSTSIN  DD *
PROFILE PREFIX(IBMUSER)
ISPSTART CMD(ACBQBAI9) BATSCRW(132) BATSCRD(27) BREDIMAX(3)+
BDISPMAX(99999999)
/*
//VOLALT  DD  *
/*
//VOLDEL  DD  *
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3000) SG(CSTDB)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3001) SG(CSTDB)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3002) SG(CSTDB)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3003) SG(CSTDB)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3004) SG(CSTDB)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3005) SG(CSTDB)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3006) SG(CSTDB)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3007) SG(CSTDB)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3008) SG(CSTDB)
SCDSNAME('STSMS.CST.SCDS.PRIMARY') VOL(SR3009) SG(CSTDB)
/*
//VOLADD  DD  *
/*
//DELVOL2 EXEC ACBJBAOB,PLIB1='SYS1.DGTPLIB',TABL2=MCKENNY.TEST.ISPTABL
//SYSUDUMP DD  SYSOUT=*
//SYSTSIN  DD DSN=&&VOLADDS,DISP=(OLD,DELETE)
//
```

SAMPLE JOB to reinitialize old DASD and interim volumes

```
//CLIP1 JOB ,MSGCLASS=H,
//       CLASS=A,MSGLEVEL=(1,1),REGION=4M,NOTIFY=MCKENNY
/*JOBPARM SYSAFF=*
//*     IBM INTERNAL USE ONLY
//*****************************************************************
//** PROGRAM: ICKDSF                                              **
//*                                                               **
//** PURPOSE:                                                     **

//** OFFLINE  CLIPS A PACK                                        **
//**                                                              **
//*****************************************************************
//STEP1    EXEC PGM=ICKDSF
//SYSPRINT DD SYSOUT=*
//SYSABEND DD SYSOUT=*
//SYSIN    DD *
REFORMAT UNIT(3000) VOLID(NW3000) VERIFY(SR3000)
REFORMAT UNIT(3001) VOLID(NW3001) VERIFY(SR3001)
REFORMAT UNIT(3002) VOLID(NW3002) VERIFY(SR3002)
REFORMAT UNIT(3003) VOLID(NW3003) VERIFY(SR3003)
REFORMAT UNIT(3004) VOLID(NW3004) VERIFY(SR3004)
REFORMAT UNIT(3005) VOLID(NW3005) VERIFY(SR3005)
REFORMAT UNIT(3006) VOLID(NW3006) VERIFY(SR3006)
REFORMAT UNIT(3007) VOLID(NW3007) VERIFY(SR3007)
REFORMAT UNIT(3008) VOLID(NW3008) VERIFY(SR3008)
REFORMAT UNIT(3009) VOLID(NW3009) VERIFY(SR3009)
REFORMAT UNIT(9900) VOLID(NW9900) VERIFY(SR3000)
REFORMAT UNIT(9901) VOLID(NW9901) VERIFY(SR3001)
REFORMAT UNIT(9902) VOLID(NW9902) VERIFY(SR3002)
REFORMAT UNIT(9903) VOLID(NW9903) VERIFY(SR3003)
REFORMAT UNIT(9904) VOLID(NW9904) VERIFY(SR3004)
REFORMAT UNIT(9905) VOLID(NW9905) VERIFY(SR3005)
REFORMAT UNIT(9906) VOLID(NW9906) VERIFY(SR3006)
REFORMAT UNIT(9907) VOLID(NW9907) VERIFY(SR3007)
REFORMAT UNIT(9908) VOLID(NW9908) VERIFY(SR3008)
REFORMAT UNIT(9909) VOLID(NW9909) VERIFY(SR3009)
/*
```

11 HyperPAV Options

As part of the recent migration to larger volumes, consideration was given to use of HyperPAV for I/O to these larger volumes sizes. In HyperPAV mode, PAV-aliases are no longer statically bound to PAV-bases but are bound only for the duration of a single I/O operation, reducing the number of aliases required for an LCU. This enables applications to achieve equal or better performance compared to the original PAV feature.

As part of the setup, a device services command was issued to check that HyperPAV is in use on the target DS8000 and see that HYPERPAV ALIASES CONFIGURED = 128 is displayed as part of the response:

```
D M=DEV(311F)

RESPONSE=SL0
DEVICE 311F   STATUS=ONLINE
CHP                    CF   C8   C0   C1
ENTRY LINK ADDRESS     7208 35   0D   ..
DEST LINK ADDRESS      7213 12   1B   32
PATH ONLINE            Y    Y    Y    N
CHP PHYSICALLY ONLINE  Y    Y    Y    Y
PATH OPERATIONAL       Y    Y    Y    N
MANAGED                N    N    N    N
CU NUMBER              3102 3102 3102 3102
MAXIMUM MANAGED CHPID(S) ALLOWED:  0
DESTINATION CU LOGICAL ADDRESS = 11
SCP CU ND         = 002107.900.IBM.75.000000025031.0200
SCP TOKEN NED     = 002107.900.IBM.75.000000025031.1100
SCP DEVICE NED    = 002107.900.IBM.75.000000025031.111F
HYPERPAV ALIASES CONFIGURED = 123
```

This link provides information on preparing to use HyperPAV on your DS8000.

http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/BOOKS/iea2f190/2.8?ACTION=MATCHES&REQUEST=hyperpav&TYPE=FUZZY&SHELF=EZ2ZO10L.bks&DT=20080604011027&CASE=&searchTopic=TOPIC&searchText=TEXT&searchIndex=INDEX&rank=RANK&ScrollTOP=FIRSTHIT#FIRSTHIT

12 Dynamic Volume Expansion (DVE) Options

Another technique that is available if you need to expand the volumes size on your current DS8000 is to expand the volume using DVE. You can do this using the IBM DS8000 command line interface or graphical user interface. After moving to V1R10 of z/OS, the DVE technique was used to expand to larger EAV volumes using the command line interface CHCKDVOL (Change CKD Volume)command. Since this is a new model type, the first step was to change the volume model for address 311F to a 3390 model A:

```
CHCKDVOL –dev [machine-serial]
–datatype 3390-A 311F
```

Next, the CHCKDVOL command was used to expand the capacity of volume 311F to 262,668 cylinders:

```
CHCKDVOL –dev [machine-serial]
–cap 262668 311F
```

This causes the DS8000 to allocate additional space on the disk arrays to volume 311F. After the volume resize occurs, message IEA019I displays on the console to indicate it is necessary to update the VTOC and INDEX for volume 311F.

```
IEA019I D018,DB311F, VOLUME
CAPACITY CHANGE, OLD=00065520,
NEW=00262668
```

This ICKDSF job was then run to update the VTOC and VTOC INDEX.

```
//DVEDSF JOB
//DSFVOL EXEC PGM=ICKDSF
//VOLDD DD DISP=SHR,UNIT=3390,VOL=SER=DB311F
//SYSPRINT DD SYSOUT=*
//SYSIN DD *
  REFORMAT DDNAME(VOLDD) VERIFY(DB311F) REFVTOC
/*
```

Remember that the volume can remain online during the entire volume expansion procedure. However, any copy services relationships (FlashCopy, PPRC, or XRC) must be quiesced prior to volume expansion. The hardware will fail an attempt to expand a volume with active copy services relationships.

For more information on the CHCKDVOL command, see *IBM System Storage DS8000 Command-Line Interface User's Guide*, SC26-7916

13 Summary

The CST test experience in moving from regular to large volumes provides some insights into areas and situations that need to be considered to successfully accomplish this transfer. This experience has been incorporated into the discussions and examples provided in this paper. The most important element found during this CST testing was having a good plan in place before starting that addresses the unique aspects of the individual customer data and environment.

14 References

Title*: z/OS V1R10.0 DFSMS Advanced Copy Services* ***Document Number:*** *SC35-0428-14*

http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/BOOKS/ANTGR160/CCONTENTS?SHELF=EZ2ZO10L&DN=SC35-0428-14&DT=20080604133240

Title*: Maintaining Your SMS Environment* ***Document Number:****SG24-5484-00*

http://www.redbooks.ibm.com/abstracts/sg245484.html?Open

Title*: Migrating to IBM System Storage DS8000* ***Document Number:****SG24-7432-00*

http://www.redbooks.ibm.com/abstracts/sg247432.html?Open

Consolidated Service Test (CST) Web Site:

<http://www-1.ibm.com/servers/eserver/zseries/zos/servicetst/>

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