FDRSOS & UPSTREAM/SOS

CONCEPTS & FACILITIES GUIDE

FDRSOS & UPSTREAM/SOS

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INTRODUCTION

CONCEPTS & FACILITIES GUIDES

For more than 30 years, Innovation Data Processing has been producing high-quality Storage Management Software. Over the years, its products have evolved into today's ultra high-speed, safe, reliable storage management solutions for OS/390, z/OS, LAN and Open Systems Data.

It all started with the **FDR Storage Management Family**, of which over 5000 licenses have now been sold worldwide. The FDR Family is the complete Storage Management System for OS/390 and z/OS.

FDR has become the industry standard for fast, reliable backups of MVS OS/390 data.

ABR adds a layer of automation to the standard functions of FDR, providing advanced backup facilities like *Incremental Backup* and *Application Backup* and *Archiving*.

COMPAKTOR and **FDRREORG** further enhance the suite by adding intelligent and powerful reorganization processes, for whole DASD volumes and for Sequential, PDS and VSAM datasets.

FDREPORT provides extensive customized DASD Management Reporting to suit many needs and purposes.

FDRCLONE is an extension to ABR, providing the ability to "clone" volumes and/or datasets on a test or disaster recovery system. It includes **FDRDRP**, a utility that can reduce ABR full-volume recovery time by up to 80%.

FDRINSTANT enables FDR/ABR to take *non-disruptive backups* of offline volumes, created by the latest DASD Subsystem features like StorageTek/IBM SnapShot Copy, EMC^2 TimeFinder/BCV, HDS ShadowImage and IBM FlashCopy.

FDRPAS (FDR Plug and Swap) allows for the non-disruptive movement of OS/390 disk volumes from one disk device to another. When new disk subsystems are installed, active online disk volumes can be swapped to drives in the new subsystem without disrupting normal operations or requiring a re-IPL. This allows a 24 x 7 installation, with no window for major re-configurations and hardware changes, to install and activate new hardware.

THE FDR/UPSTREAM FAMILY OF PRODUCTS builds on the strengths of the FDR Storage Management Family, providing a fast, safe and reliable solution to backing up Open Systems data from file servers and workstations, across a network connection to disk or tape on the OS/390 host. If the Open Systems data is resident on an EMC^2 Symmetrix with Enterprise Storage Platform (ESP), **FDRSOS** and **FDR/UPSTREAM/SOS** products provide additional performance enhancements to the backup and restore process by utilizing high-speed mainframe channels.

IAM is Innovation's alternative to VSAM KSDS, ESDS and (as a cost option) AIX files. It eliminates VSAM performance bottlenecks and reduces VSAM file sizes by more than 50%.

FATS/FATAR and **FATSCOPY** are a set of multi-purpose tape subsystem Media Integrity tools that allow for online tape certification, verification and erasure, as well as the ability to analyze and copy tapes.

INTRODUCTION

CONCEPTS & FACILITIES GUIDES

Each of the Innovation products are described in a range of Concepts & Facilities Guides that have been created by the Innovation UK office, but which are available *free of charge* from your local office (see back cover for details).

In this particular guide, we take a look at **FDRSOS** and **UPSTREAM/SOS** product suite.

PART ONE provides a brief introduction to the powerful and unique features of the suite, made possible by the successful teaming agreement between Innovation Data Processing and EMC^2.

PART TWO looks in detail at **FDRSOS**, describing how it can be used to backup to an MVS OS/390 Host the Open Systems logical disk volumes that are resident in an EMC Symmetrix.

PART THREE describes how **UPSTREAM/SOS** adds some very powerful and flexible File-Level backup and restore facilities to the suite.

Any comments or suggestions regarding this guide can be directed to:
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PART ONE

GENERAL OVERVIEW

Introduction

FDRSOS and ***UPSTREAM/SOS*** offer several options for a high-speed, flexible backup of Open Systems data stored on an EMC Symmetrix 3000, 5000 or 8000-series Storage Subsystem. These backups, which avoid the network, can be taken at either a Volume-level or Incremental/File-level, are directed to an MVS OS/390 host system for safe, reliable storage and retention. When required, individual files, directories and whole volumes can be restored. In the event of a disaster, whole servers and workstations can be recreated.

Almost all of the popular server/workstation operating systems in use today are supported by ***UPSTREAM/SOS***, including:

- *Microsoft Windows NT, 2000, XP, ME, 98*
- *AIX*
- *Sun Sparc and Intel Solaris*
- *HP-UX*
- *Compaq Tru 64*
- *IBM OS/390 Unix*
- *X86 and S/390 Linux*
- *OS/2*
- *Novell Netware*

FDRSOS supports any Open Systems platforms that resides on the Symmetrix (with the exception of AS/400).

As well as the standard files and documents belonging to popular end-user workstation applications, such as Word Processing and Spreadsheet packages, critical corporate data located on the Symmetrix can also be secured with ***FDRSOS*** and ***UPSTREAM/SOS***, such as:

- *Lotus Notes Domino (R4, R5 and R6)*
- *IBM DB2 UDB (Universal Database Server)*
- *Microsoft Exchange and Exchange 2000*
- *Microsoft SQL Server and SQL Server 2000*
- *SAP R/3*
- *Oracle*
- *BMC SQL-BackTrack (which supports Sybase, Informix and Oracle)*

PART ONE

GENERAL OVERVIEW

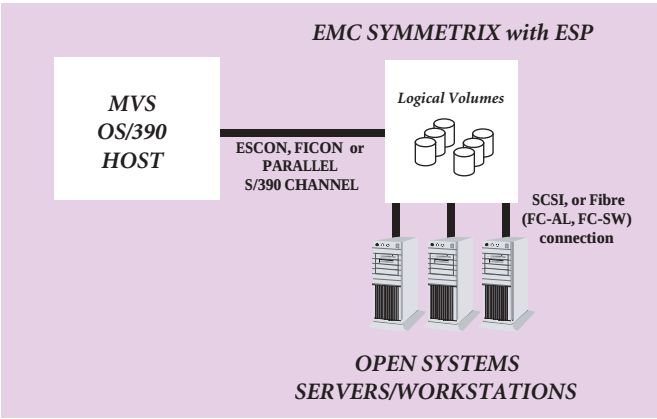
How Does It Work?

FDRSOS and ***UPSTREAM/SOS*** have been created as part of a teaming agreement between Innovation Data Processing and EMC^2 Corporation.

Under its side of the agreement, EMC provides its customers with the Symmetrix 3000, 5000 and 8000-series ICDA (Integrated Cached Disk Array) Storage Subsystems. Individual servers and workstations can be attached to the Symmetrix using SCSI or Fibre (FC-AL or FC-SW) connections. Instead of each server or workstation having its own separate local storage device, it has allocated one or more "logical volumes" within the Symmetrix (also known as "hyper volumes" or "splits"). A logical volume is usually (but not always) a partition of a Symmetrix physical disk, 2-10GB or greater in size.

This utilization of the Symmetrix for Open System storage allows customers to consolidate their disk usage onto a single platform, with all the associated benefits, such as reduced costs, ease of maintenance and administration. It also leverages the benefits of utilizing tape subsystems for both OS/390 and Open Systems backups.

As shown in the summary diagram below, EMC also offers its Symmetrix customers the Enterprise Storage Platform (ESP). This optional feature, which resides in the Symmetrix, allows access to the Open System logical volumes from an MVS OS/390 host, via an S/390 Escon/Parallel connection.



Despite the existence of the S/390 channel connection, standard MVS OS/390 utilities and access methods are unable to read from or write to the Open System logical volumes in the Symmetrix. This is because they do not contain data in a format that is recognizable by MVS OS/390, nor do they have the requisite OS VTOC's which would allow them to be brought online to the MVS system. As such, these logical volumes must remain *offline* to MVS at all times.

However, under its part of the teaming agreement, Innovation Data Processing has produced ***FDRSOS*** and ***UPSTREAM/SOS***. This unique software suite utilizes special I/O techniques to backup and restore the Open Systems logical volumes in the Symmetrix while they remain *offline* to MVS. The backup data is transmitted from the Symmetrix, across the high-speed S/390 channel, for eventual storage and retention under the MVS host. If you have a SAN (Storage Area Network) connecting your open systems machines to the Symmetrix, FDRSOS and UPSTREAM/SOS are ideal solutions, taking advantage of the connectivity and bandwidth the SAN affords.

PART TWO

GENERAL OVERVIEW

The Advantage of FDRSOS and UPSTREAM/SOS

Open Systems servers and workstations with data stored on the Symmetrix could, potentially, utilize a standard MVS-based LAN backup package like Innovation's own FDR/UPSTREAM to transmit backup data to the MVS OS/390 host. However, these systems invariably use network links such as Token Ring or Ethernet for the transmission of data, which are often susceptible to limitations in bandwidth or performance-bottlenecks within the network.

FDRSOS and ***UPSTREAM/SOS*** avoid these potential problems by capitalizing on the exceptional performance of an S/390 channel connection between the Symmetrix and the MVS OS/390 host for the transmission of *all backup and restore data*.

So the advantage of ***FDRSOS*** and ***UPSTREAM/SOS*** is high-speed performance with no network traffic for backup or restore data. The network will only be used for synchronization between host and client.

Many gigabytes of data can be backed up in an hour, allowing customers to take secure and reliable backups of all their critical corporate data that has been located within the Symmetrix.

Let's take a look at ***FDRSOS*** and ***UPSTREAM/SOS*** in more detail now, beginning first with ***FDRSOS***…

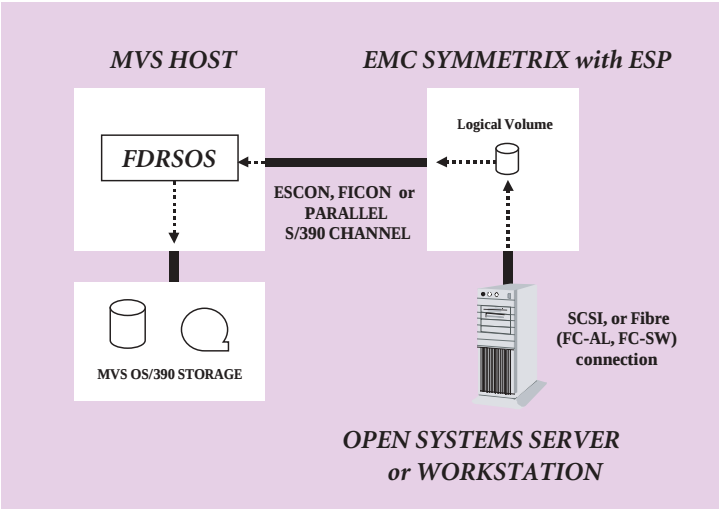
PART TWO

FDRSOS

Introduction

As described in Part One, the physical disks in an EMC Symmetrix can be sub-divided into “logical volumes” which are then allocated to individual Open Systems servers and workstations. These logical volumes can be backed up and restored by ***FDRSOS*** at very high speeds (see benchmark figures on page 10), across an S/390 channel connection to an MVS OS/390 host. ***FDRSOS*** backups are output directly to MVS Tape or DASD. All of the Data Management strengths of IBM’s S/390 hardware and MVS OS/390 software can be utilized to provide high-speed, well-managed backups of the Open Systems data.

Here is a diagram summarizing ***FDRSOS*** operations:



As you can see, the ***FDRSOS*** software runs entirely on the MVS OS/390 host. Aside from the Enterprise Storage Platform (ESP) in the Symmetrix, no additional software (or hardware) is required for ***FDRSOS*** to operate, although some system-specific utility programs are provided for additional functionality and automation of backups and restores.

How does FDRSOS gain access to the Logical Volumes?

Each separate logical volume in the Symmetrix that is to be backed up by ***FDRSOS*** is first defined to the MVS I/O configuration (IOGEN). This is a simple *one-time task*. The logical volume is allocated a device address, just like a normal MVS disk, and it is defined to the system as a standard DASD device.

The *OFFLINE* keyword is specified in the IOGEN entry for the logical volume to prevent any attempts to bring it online during an MVS IPL. As outlined in Part One, standard MVS utilities cannot process the data on an Open System logical volume and any attempt to bring one online would result in various MVS error messages being produced. We also recommend that the SHARE keyword be coded in the IOGEN entry.

The MVS DEVSERV command (*e.g.* DS PATHS,1E0,16) can then be used to display the new addresses that have been generated for the Open Systems logical volumes and verify that their ‘offline’ connectivity to MVS has been completed successfully. Once a logical volume has been allocated with its MVS address, ***FDRSOS*** can use the special I/O techniques mentioned in Part One to read (and write) data from the logical volume while it remains offline to the MVS system.

PART TWO

FDRSOS

Logical Volume Identification

To assist with the identification of each logical volume in the Symmetrix, ***FDRSOS*** includes a 'LABEL' command that writes a six-character "MVS-like" label (volser) on a reserved area on the disk. This label is not used or recognized by the Open System, but ***FDRSOS*** copies it into the MVS UCB, allowing it to reference the disk via the label instead of the MVS device address.

The following example job shows how easy it is to run the LABEL command. The logical volume with an MVS device address of 01E0 is to be given a label of "OPEN#1".

Example: Labeling an Open Systems Logical Volume

```
//LABEL      EXEC PGM=FDRSOS,REGION=0M
//SYSPRINT    DD  SYSOUT=*
//SYSIN       DD  *

     LABEL TYPE=SOS,PRINT=STATUS
     MOUNT UNIT=01E0,SETVOL=OPEN#1
```

When assigning the labels, it is generally advisable to choose values that are meaningful, preferably indicating the contents of the logical volume. Unfortunately, logical volumes are often identified by their SCSI addresses, which are rarely used and often not known by the system users, who may recognize them by some other form of identification. Some volumes may be known just by a drive letter (*e.g.* the "C" drive), while others are identified by a system-assigned identification (*e.g.* "hdisk3") or mount point name. This identification is often known only to that system and it is not recorded on the actual disk volume itself.

To assist with the correct identification (via MVS) and labeling of each logical volume, ***FDRSOS*** provides a PRINT=STATUS command (illustrated in the LABEL example above) which can be used to identify the format of the volume, using internal indicators and operating system footprints. If the volume type is successfully identified, PRINT=STATUS will display this, together with any other volume identification, volume group information and mount points etc. The details will vary depending on the type of Open System that created the logical volume.

Here is an example of a PRINT=STATUS report against a **SUN SOLARIS** logical volume, which has been defined in "slices". Note that the "backup" slice defines the entire 2GB logical volume. The 'usr' slice is the area used for data files.

```
FDR216 STATUS OF SOS SCSI VOLUME UNIT=01E6 VOL=E#01E6 - SYM-NUMBER=X'00F0-0026'
FDR216 - UNIT=01E6 IS AN SUN SOLARIS VOLUME WITH A VOLUME NAME--->NO NAME
FDR216 - UNIT=01E6 -WITH A LABEL----->EMC-SYMMETRIX-5063 cyl 4428 alt 2 hd 15 sec 64
FDR216 - UNIT=01E6 -SLICE 00 (ROOT)   123 MB SIZE MOUNT POINT--->/
FDR216 - UNIT=01E6 -SLICE 01 (SWAP)   128 MB SIZE
FDR216 - UNIT=01E6 -SLICE 02 (BACKUP) 2,076 MB SIZE MOUNT POINT--->/
FDR216 - UNIT=01E6 -SLICE 06 (USR)    671 MB SIZE MOUNT POINT--->/usr
FDR216 - UNIT=01E6 -SLICE 07 (ALTTRK) 257 MB SIZE MOUNT POINT--->/export/home
FDR216 - UNIT=01EC -SLICE 06 (USR)    257 MB SIZE--->/export/home
```

FDRSOS

And here is an example of a PRINT=STATUS against a **Windows NT** logical volume which may or may not have been further partitioned by NT. The number and size of each partition is displayed (in this case there is only one) together with the partition format (NTFS).

```
FDR216 STATUS OF SOS SCSI VOLUME UNIT=01FD VOL=E#01FD - SYM-NUMBER=X'00F0-003D'
FDR216 - UNIT=01FD HAS A PC/UNIX PARTITION TABLE WITH A SIGNATURE OF 147E84E7
FDR216 - UNIT=01FD PARTITION 1 OCCUPIES SECTOR 32 TO 2,119,679 - 1,035 MB SIZE
FDR216 - UNIT=01FD --OEM ID--->NTFS TYPE--->NTFS VOLID--->D4FD-D067 NAME--->DATABASE1
```

Once the FDRSOS LABEL has been written to the logical volume, it can be displayed from MVS via the standard “D U” operator command. For Windows NT/2000, or AIX, it can also be displayed from the Open System with a special ***HOSTDISK*** program supplied with ***FDRSOS***.

FDRSOS Backups

When the Open System logical volume has been correctly identified and labeled by ***FDRSOS*** it is then ready to be backed up. The following example shows an ***FDRSOS*** backup of the logical volume at 01E0, which we labeled as OPEN#1 in the previous LABEL job. The MOUNT statement identifies the volume. Two copies of the backup are being created (to the TAPE 1 and TAPE11 DD’s) and they are being written and cataloged onto 3490E cartridges.

Example: Dumping an Open Systems Logical Volume

```
//DUMP       EXEC PGM=FDRSOS,REGION=0M
//SYSPRINT     DD  SYSOUT=*
//FDRSUMM      DD  SYSOUT=*
//TAPE1        DD  UNIT=3490,DSN=BACKUP.VOPEN#1.C1,DISP=(,CATLG)
//TAPE11       DD  UNIT=3490,DSN=BACKUP.VOPEN#1.C2,DISP=(,CATLG)
//SYSIN        DD  *

     DUMP TYPE=FULL
     MOUNT VOL=OPEN#1
```

The end-of-job report for the above backup, which would be written to the SYSPRINT dataset, would look similar to the following:

```
FDR007 START TIME -- 16.18.11 -- UNIT=01E0 ,IN=D#OPEN#1,OUTPUT=TAPE1
FDR007 END   TIME -- 16.30.08 -- UNIT=01E0 ,IN=D#OPEN#1,OUTPUT=TAPE1
FDR122 OPERATION STATISTICS FOR SOS VOLUME OPEN#1
FDR122                        BYTES ON VOLUME          4,355,850,240
FDR122                        BYTES READ FROM DASD     4,355,850,240
FDR122                        BYTES ON BACKUP          4,364,783,536
FDR122                        DASD SECTORS BACKED UP       8,507,520
FDR122                        BACKUP BLOCKS WRITTEN           79,760
FDR122                        DASD EXCPS                       8,863
FDR122                        BACKUP FILE EXCPS                8,864
FDR122                        CPU TIME (SECONDS)              14.040
FDR122                        ELAPSED TIME (MINUTES)            12.4
FDR122                        BACKUP TIME(EXCLUDING MOUNTS)     12.0
FDR122 BACKUP COPY 1 ON TAPE DSN=BACKUP.VOPEN#1.C1
FDR122 VOL=900013,900014,900015
FDR122 BACKUP COPY 2 ON TAPE DSN=BACKUP.VOPEN#1.C2
FDR122 VOL=900022,900023,900024
FDR002 FDR DUMP SUCCESSFULLY COMPLETED VOL=OPEN#1
```

PART TWO

FDRSOS

More than one logical volume can be backed up in a single job. In the following example, three volumes will be dumped concurrently to three different tape drives. MOUNT statements have been used to select the volumes and to control which TAPEx DD the backups are to be written to. The backup files are MVS GDG's, allowing for easy retention/expiration. A job like this might be used to process volumes that need to be backed up at the same time, such as members of an AIX volume group or an EMC Meta Volume.

Example: Dumping multiple volumes concurrently

```
//DUMP         EXEC PGM=FDRSOS,REGION=0M
//SYSPRINT      DD  SYSOUT=*
//SYSPRINA      DD  SYSOUT=*
//SYSPRINB      DD  SYSOUT=*
//SYSPRINC      DD  SYSOUT=*
//FDRSUMM       DD  SYSOUT=*
//TAPEA         DD  DSN=BACKUP.OPEN1(+1),DISP=(,CATLG),UNIT=TAPE
//TAPEB         DD  DSN=BACKUP.OPEN2(+1),DISP=(,CATLG),UNIT=TAPE
//TAPEC         DD  DSN=BACKUP.OPEN3(+1),DISP=(,CATLG),UNIT=TAPE
//SYSIN         DD  *

     DUMP TYPE=FULL,MAXTASKS=3,PRINT=STATUS
     MOUNT VOL=EMC120,TAPEDD=A
     MOUNT VOL=EMC123,TAPEDD=B
     MOUNT VOL=EMC128,TAPEDD=C
```

FDRSOS Performance

The performance of an FDRSOS backup (or restore) can be influenced by many factors and it is impossible to provide 100% accurate figures. However, to give you some idea of the performance that should be expected from FDRSOS, the following chart shows the Average Dump Time of a 4.3GB volume, using various different types of Cartridge drives. Testing was performed on an MP-3000-H30 CPU and Symmetrix 8430 with two ESCON channel paths.

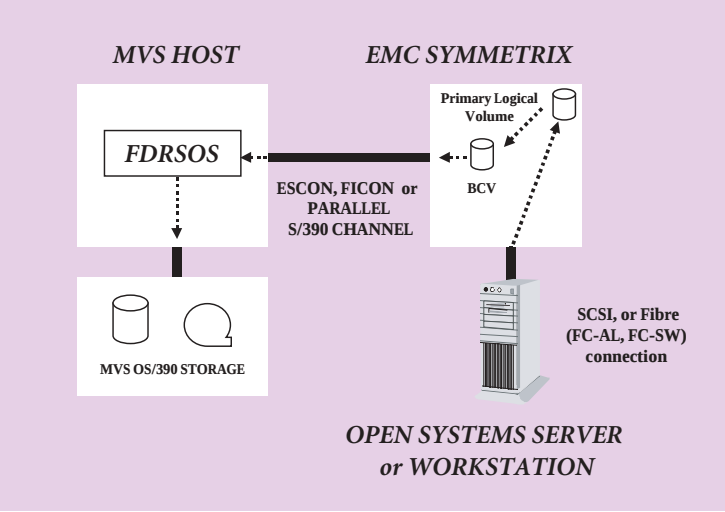
Media	Byte Capacity With Compression	Byte Capacity Without Compression	FDRSOS Notes	Avg Dump Time (Minutes)
➤ IBM MAGSTAR 30GB 60GB 120GB		10GB 20GB 40GB	IBM Magstar (3590) cartridges have several models. The 3590B cartridges (14MB/sec transfer rate) have a capacity of 10GB uncompressed (about 30GB compressed) and 20GB native capacity with Extended Length Cartridge. 3590E drives (9MB/sec transfer rate) have a capacity of 20GB native (about 60GB compressed) and an enhanced cart holds 40GB native (120GB compressed). A 4.3GB NT volume was backed up to 3590-B11 with 3590 A-50 controller in 5.7 minutes elapsed time for an average transfer rate of 12.73 MB/sec. Per hour transfer rate for one MAGSTAR tape unit exceeds 25 GB per hour per dump. A single Magstar cartridge can hold backups anywhere from 6-27 4.3GB volumes. Though the Magstar control units may have up to 4 tape drives, a control unit can only have two ESCON channel paths. Max throughput per Magstar subsystem, four (4) concurrent dumps, is about 100 GB per hour on ESCON channels.	5.7
➤ STORAGETEK 9840 T9940	 60GB 180GB	 20GB 60GB	StorageTek 9840 cartridges (10MB/sec transfer rate) have a capacity of 20GB uncompressed (60GB compressed). StorageTek T9940 cartridges (10MB/sec transfer rate), have a capacity of 60GB uncompressed (180GB compressed). The 9940 has one controller per tape drive. A 4.3GB NT volume was backed up to T9940 in 5.5 minutes elapsed for an average transfer rate of 13.19 MB/sec.	5.5
➤ TIMBERLINE (1000FT)	1600M	800M	STK Timberline cartridge drives have one tape transport per control unit, but are otherwise compatible with IBM 3490E, except that their transfer rate is 6MB/sec. The average time to backup 4.3GB to a Timberline Tape Drive is 11 minutes. Per hour transfer rate per control unit/drive is about 25GB per hour. Timberline uses the same tape cartridges as 3490E drives. 4.3GB backup requires 3 tapes.	11
➤ 3490E (1000FT)	1600M	800M	Average backup time for 4.3GB to 3490E tape is 14-19 minutes. Per hour transfer rate using 3490E tape drives with one control unit is about 15GB per hour on ESCON channels. 4.3GB backup requires 3 tapes.	14

PART TWO

FDRSOS

TimeFinder/BCV Support

As you can see from the figures on page 10, ***FDRSOS*** runs at a very high speed and is capable of backing up many Gigabytes of data in an hour—especially when multiple logical volumes are dumped concurrently, as illustrated in the example on page 10. Despite this incredible performance, it may still take ***FDRSOS*** several hours to backup a large application that is hundreds of Gigabytes, or even Terabytes in size. Updates to the Open Systems data would need to be suspended for the duration of this backup, but as 24 x 7 availability becomes more important, interruptions of this length may no longer be tolerable.



To overcome this problem, ***FDRSOS*** supports the use of Business Continuance Volumes (BCV's), available via the TimeFinder feature of the EMC Symmetrix. BCV's are extra mirrors of primary volumes that, unlike conventional mirrors, can be split from the primary, creating an instant *frozen* copy of the volume.

As illustrated in the diagram, ***FDRSOS*** can then backup the frozen BCV mirror while updates continue on the primary volume.

An ***FDRSOS*** backup employing BCV's only requires the Open System to be quiesced for a short period of time—just a few seconds while each BCV is split from its primary volume. FDRSOS can then start to backup the BCV's without any time pressure, while the 'live' copies of the data on the prime volumes are immediately made available to users once again.

To assist in quiescing the volume or application, UPSTREAM/SOS can be used to run scripts or programs on the Open System. Using tools included with FDRSOS and UPSTREAM/SOS, together with EMC TimeFinder tools, scripts can be created which quiesce volume(s), split the BCV's, and then return the primary volume(s) to normal operation. The UPSTREAM/SOS "run job" command can be used to execute these scripts.

FDRSOS can then perform the backup without affecting the primary volume. "Conditional Processing" and "Notification" services provide extensive control and feedback to the whole process.

FDRSOS includes its own commands to control the establishing and splitting of the BCV prior to running the backup. In the first step of the following example job, a BCV is being established (at address 01F3) for the OPEN#1 volume. The Symmetrix hardware will copy all the data from OPEN#1 to 01F3 as a background task. BCV=WAIT tells ***FDRSOS*** to wait until this synchronization is complete.

FDRSOS

The second step then splits the BCV from the OPEN#1, creating a frozen copy on 01F3, ready to be backed up. Once the frozen copy has been created, ***FDRSOS*** can then use this as the backup instead of the primary volume.

```
//ESTAB     EXEC PGM=FDRSOS,REGION=0M
//SYSPRINT   DD SYSOUT=*
//SYSIN      DD *

   ESTABLISH TYPE=SOS,BCV=WAIT
   MOUNT VOL=OPEN#1,BCVUNIT=01F3

//SPLIT     EXEC PGM=FDRSOS,REGION=0M
//SYSPRINT   DD SYSOUT=*
//SYSIN      DD *

     SPLIT TYPE=SOS
     MOUNT  VOL=OPEN#1
```

The following example shows an ***FDRSOS*** backup job using the BCV that was created and split from OPEN#1 in the previous illustration. As you can see, the job looks very similar to the 'standard' dump job for OPEN#1 on page 9, with a MOUNT statement selecting the OPEN#1 volume. The only difference is the BCV=(USE,RET) statement, telling ***FDRSOS*** to use the BCV for OPEN#1 as the input for the backup.

Example: FDRSOS backup from a BCV

```
//DUMP     EXEC PGM=FDRSOS,REGION=0M
//SYSPRINT  DD  SYSOUT=*
//SYSPRIN1  DD  SYSOUT=*
//FDRSUMM   DD  SYSOUT=*
//TAPE1     DD  DSN=BACKUP.VOPEN#1.C1,UNIT=TAPE,DISP=(,CATLG)
//SYSIN     DD  *

     DUMP TYPE=FULL,BCV=(USE,RET)
     MOUNT VOL=OPEN#1
```

The actual address of the BCV does *not* have to be specified because ***FDRSOS*** can determine this automatically. The 'RET' tells ***FDRSOS*** to re-establish the BCV with the primary copy of OPEN#1 when the backup has completed. The data that was updated on the primary while the BCV was split will then be copied across to the BCV.

With the BCV re-established, the next time that OPEN#1 needs to be backed up, only a SPLIT will be required. Normally, the SPLIT and DUMP steps would be combined into a single two-step job, with BCV=WAIT coded on the SPLIT step to ensure that the SPLIT has completed successfully before the dump begins. In some situations, the SPLIT may be done some time in advance of the DUMP—perhaps if the optimum time to briefly quiesce the Open System does not coincide with the best time to use the MVS Tape Drives for the backup.

Note: It is not mandatory to have a dedicated BCV for each primary volume to be backed up. If separate groups of primary volumes are backed up at different times of the day, a 'pool' of BCV's can be used.

PART THREE

UPSTREAM/SOS

FDRSOS Restores

Restoring from an ***FDRSOS*** backup is just as easy as running the backup itself. The following example job shows a restore from a backup of the OPEN#1 logical volume. The TAPE1 DD points to the backup file and the DISK1 DD points back to the OPEN#1 primary volume as the target for the restore. (Note: The Open System that owns the logical volume does *not* have to be active or connected to the Symmetrix at the time of the FDRSOS restore).

Example: Restoring an Open Systems Logical Volume

```
//RESTORE   EXEC PGM=FDRSOS,REGION=0M
//SYSPRINT   DD SYSOUT=*
//FDRSUMM    DD SYSOUT=*
//TAPE1      DD DSN=BACKUP.VOPEN#1.C1,DISP=OLD
//DISK1      DD UNIT=3390,VOL=SER=OPEN#1,DISP=OLD
//SYSIN      DD *

     RESTORE TYPE=FULL
```

The important point to note here is that the backup from which this restore is run could be created either by the ‘standard’ backup job on page 9, or the ‘BCV’ backup example on page 12. This is because a BCV is truly a duplicate of its primary volume, including the MVS label written by the ***FDRSOS*** LABEL command. Thus, a backup of a BCV is *exactly* the same (in terms of content) as a backup of the primary volume and requires no special considerations during restore.

Summary

With FDRSOS, Open System logical volumes in the EMC Symmetrix can be backed up and restored using JCL and control statements that are both straightforward and easy-to-use. ***FDRSOS*** backups and restores can be done at *very high-speed*—without suffering from traditional network connection bottlenecks and without further adding to network utilization and congestion. In the event of a disaster, **FDRSOS** restores can be done without requiring the Open Systems to be active or connected to the Symmetrix.

If the TimeFinder/BCV option is available in the Symmetrix, ***FDRSOS*** can take full advantage of this powerful feature to drastically reduce the downtime of critical applications during the backup process.

FDRSOS backup files are created as standard MVS sequential (PS) datasets. As such, they can be controlled by DFSMS, the MVS Security System (*e.g.* RACF) and by the MVS Tape Management System (TMS), allowing a secure and automated control, retention and expiration of backups.

As you will discover in Part Three, ***FDRSOS*** backups can be integrated with ***UPSTREAM/SOS*** to provide a *complete* backup and restore system for Open System data stored on the EMC Symmetrix.

PART THREE

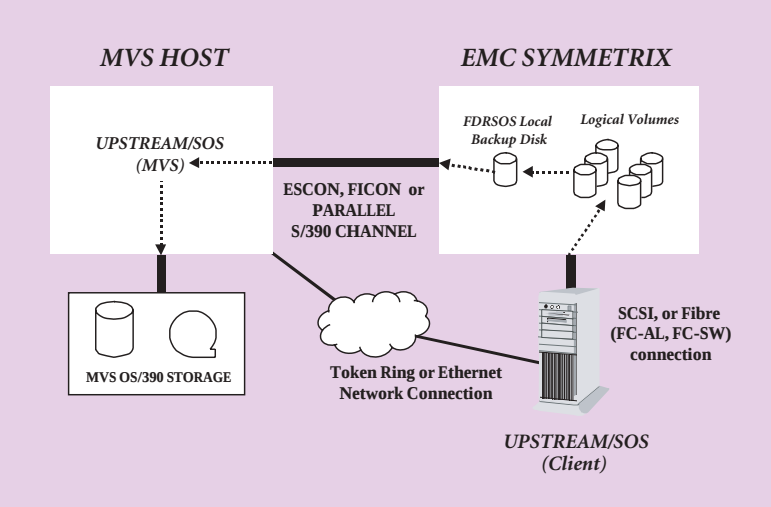
UPSTREAM/SOS

Introduction

In Part Two, we saw how ***FDRSOS*** can be used to backup and restore *whole* logical volumes across the Symmetrix's S/390 connection to the MVS OS/390 host. In this section of the guide we are going to see how the other component of the suite - ***UPSTREAM/SOS*** - works in concert with ***FDRSOS*** to provide high-speed file-level or online database backups and restores, also utilizing the S/390 channel connection.

In a moment, we will look at the various types of backups that can be taken with ***UPSTREAM/SOS*** and we will also see how the individual backup files can be controlled once they reach the OS/390 host. But first we are going to take a look at the two components that make up ***UPSTREAM/SOS***.

The following diagram summarizes the ***UPSTREAM/SOS*** system:



As you can see, UPSTREAM/SOS consists of two components:

- **UPSTREAM/SOS Repository (MVS)**
  This component resides on the OS/390 host. It runs as a standard MVS started task with multiple subtasks and is responsible for the creation, retention and expiration of backups. It is also where the main configuration control files for ***UPSTREAM/SOS*** reside, together with the backup recording mechanism and history files. It can be controlled by normal MVS Operator commands and also includes a full set of ISPF panels, which provide status monitoring and batch initiation services.

- **UPSTREAM/SOS (Client)**
  This component resides on the Open System and it is responsible for accessing Open System files and databases during the backup and restore. A full set of GUI panels is provided to allow for the creation of individual backup and restore tasks, as well as a point for the optional control of the MVS component.

As illustrated in the diagram, these two components interact during the backup and restore process utilizing an "FDRSOS Local Backup Disk" in the Symmetrix.

PART THREE

UPSTREAM/SOS

The FDRSOS Local Backup Disk

The FDRSOS Local Backup Disk is the key to ***UPSTREAM/SOS's*** use of the SAN and S/390 channel for its data transfer:

- **For backups**, instead of transferring data across the relatively slow Token Ring or Ethernet network connection, the Client component writes blocks of data to the FDRSOS Local Backup disk, across a fast SCSI, FC-AL or FC-SW connection. The MVS component, which also has a connection to the FDRSOS Local Backup disk via the S/390 channel, then follows behind the Client component, reading the blocks of data and writing them to MVS Tape or DASD.
- **For restores** the process is reversed. The Host component reads data from the backup media (MVS Tape or DASD) and transmits it through the Local Backup volume to the UPSTREAM/SOS client, which then restores the data files to their required location on the server or workstation.

So, for both backups and restores, the Token Ring or Ethernet network connection shown in the diagram on page 14 is only used to coordinate access of the shared Local Backup disk by the two components. All of the actual data is transmitted through the FDRSOS Local Backup disk, using the SCSI/Fibre and S/390 connections for optimum performance.

Creating An FDRSOS Local Backup Disk

The creation of an FDRSOS Local Backup Disk is very simple. In the example job below, a logical volume in the Symmetrix with an MVS address of 01FC is labeled as LOCAL1. This step is necessary because it must be initialized with an FDRSOS label before it can be created as a Local Backup Disk, which is done with the subsequent LOCALBACKUP TYPE=INIT step.

Example: Creating an FDRSOS Local Backup Disk

```
//LABEL    EXEC PGM=FDRSOS,REGION=0M
//SYSPRINT  DD  SYSOUT=*
//SYSIN     DD  *

    LABEL  TYPE=SOS
    MOUNT  UNIT=01FC,SETVOL=LOCAL1

//LOCALB   EXEC PGM=FDRSOS,REGION=0M
//SYSPRINT  DD  SYSOUT=*
//SYSIN     DD  *

    LOCALBACKUP TYPE=INIT
    MOUNT  VOL=LOCAL1
```

As described earlier, the Open System server or workstation must also have a SCSI, FC-AL or FC-SW connection to the FDRSOS Local Backup disk. For Windows NT/2000, or AIX systems, the special ***HOSTDISK*** program supplied with FDRSOS, which was mentioned on page 9, can be used to ensure that the correct Open System volume is formatted and that the connection via the Open System is functioning correctly.

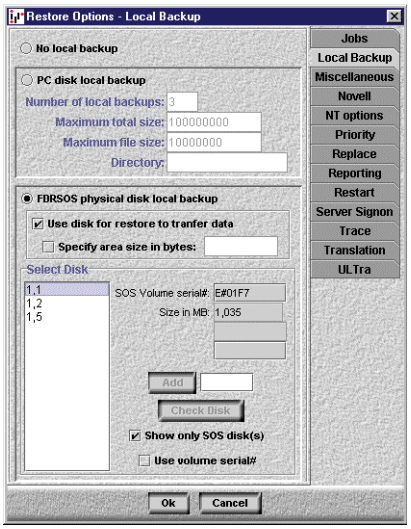
Once the FDRSOS Local Backup disk has been created and both the MVS and Open System have access to it, it is then available for selection within backup and/or restore specifications.

PART THREE

UPSTREAM/SOS

Specifying The Local Backup Disk

Requesting the utilization of an FDRSOS Local Backup disk, on either a backup or a restore, is very straightforward, and it forms part of the overall backup/restore specification. Below is an example of a *restore* definition, using the UPSTREAM/SOS **Director** panels (see 'note' below). The "Local Backup" tab of the pop-up panel has been clicked to reveal the settings for the FDRSOS Local Backup disk.



*Note: The **Director** provides a Windows Explorer-like interface in environments where none previously existed, such as UNIX and NetWare file servers. It can be used to specify and initiate UPSTREAM functions locally, or on another Client. For more information on The Director (and the general specification of UPSTREAM/SOS backups) see "Defining UPSTREAM/SOS Backups" later.*

Allocation & Utilization of the Local Backup Disk

When an ***UPSTREAM/SOS*** backup or restore is initiated, space is automatically allocated on the FDRSOS Local Backup disk.

- **For backups**, space is allocated based on the estimated size of the backup and a maximum size specified by the user. If space becomes short, the size allocated will be reduced, based on a percentage also specified by the user. If the amount of space allocated is insufficient to hold the entire backup, ***UPSTREAM/SOS*** "wraps through" it, reusing the space after the MVS component has processed the blocks of data and written them off to Tape or DASD.

Note: Each individual backup can have its own space on the disk, allowing multiple backups to be stored, even from different servers or workstations. However, for optimum performance, it is not generally recommended that backups be run simultaneously to the same local backup disk.

- **For restores**, UPSTREAM/SOS automatically allocates a data area on the Local Backup disk using the same rules as for the backup, although this can be overridden (via the DASDOVERRIDE parameter) to reduce the number of "wraps", which can have a detrimental effect on performance.

Having discussed the general utilization of the UPSTREAM/SOS Local backup disk, let's now take a look in more detail at the backup process and some of the key features offered by UPSTREAM/SOS…

PART THREE

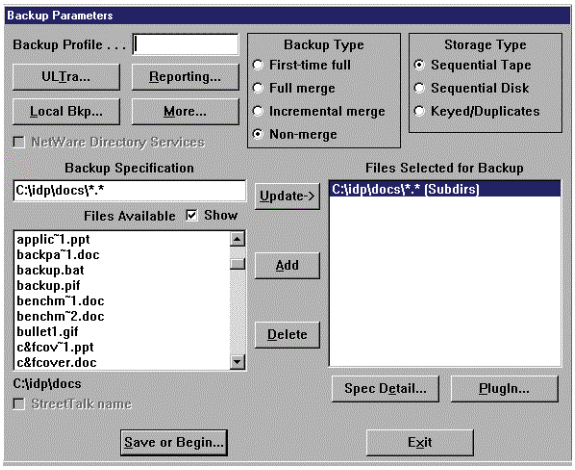
UPSTREAM/SOS

Defining UPSTREAM/SOS Backups

Various options are available for defining UPSTREAM/SOS backups and you can choose the one that best suits your own specific requirements.

Option 1: Using the "Local" Client GUI panels for Windows

The ***UPSTREAM/SOS*** (Client) component includes a set of GUI panels that can be used to create and store the Full Merge and Incremental backup tasks. It is beyond the scope of this document to show the panels in any detail, or to describe the mechanism employed to control the creation and retention of backups for each server or workstation. However, to illustrate Client panels, here is an example of the main panel that is used to create a backup task:



The **Backup Profile (top left)** identifies this particular backup specification. It is imperative to have only one backup profile per set of file specifications. A given drive or directory should only be identified by a single backup profile.

The type of backup (Incremental, Full Merge etc) is selected from the **Backup Type** box.

The selection of MVS media (tape or DASD) to hold the backup is made via the **Storage Type** box.

The selection of which files or directories to backup is made via the **Backup Specification** and **Files Available** boxes. The files and directories that have been selected for backup are displayed in the **Files Selected For Backup** box. The selection and specification of the FDRSOS Local Backup disk is made in a separate panel, accessed via the **Local Bkp** command button, and additional features, like Ultra and Reporting (see 'Additional Features' later) can be selected by the other command buttons shown on the panel.

All of the information entered into the Client GUI panels can be saved into what is known as a *parameter file*, (commonly called a .DAT file) allowing the function to be repeated without having to re-enter the information. Parameter files have a particular value in automated and unattended processing and "Host-Initiated" backups (see 'Automation and Control' later). If, for example, you wish to run *daily* incremental and *weekly* full merge backups, a separate parameter file can be created for each of the two types of backups.

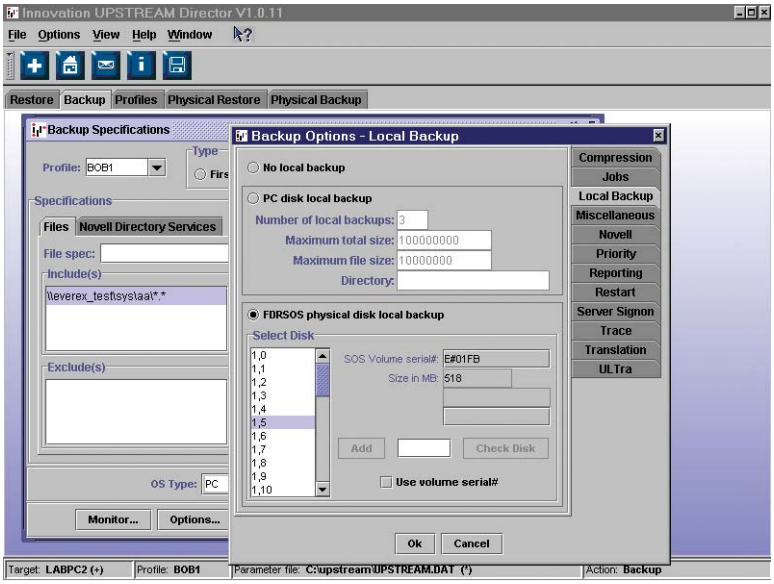
Option 2: Using the UPSTREAM "Director" Panels

UPSTREAM/SOS also includes a facility called the "Director", which provides system-wide distributed control and operation of UPSTREAM/SOS functions. Taking advantage of the cross-platform nature of Java, the **Director** runs on many of the current platforms supported by ***UPSTREAM/SOS*** including:

- All UNIX systems (with X-Server support)
- Microsoft Windows NT, 2000, XP, ME, 98
- Novell file server Java consoles or the Novell X-Client

The **Director** provides a Windows Explorer-like interface (*i.e.* a GUI facility) in environments where none previously existed, such as UNIX and NetWare file servers. The **Director** operates by performing inter-process communications between the Client and MVS components. It can be used to specify UPSTREAM functions locally, or on another Client.

We've already seen one example of a **Director** panel for the specification of the Local backup disk during a restore. Here is a similar panel for the specification of a Local Backup disk during an actual backup…

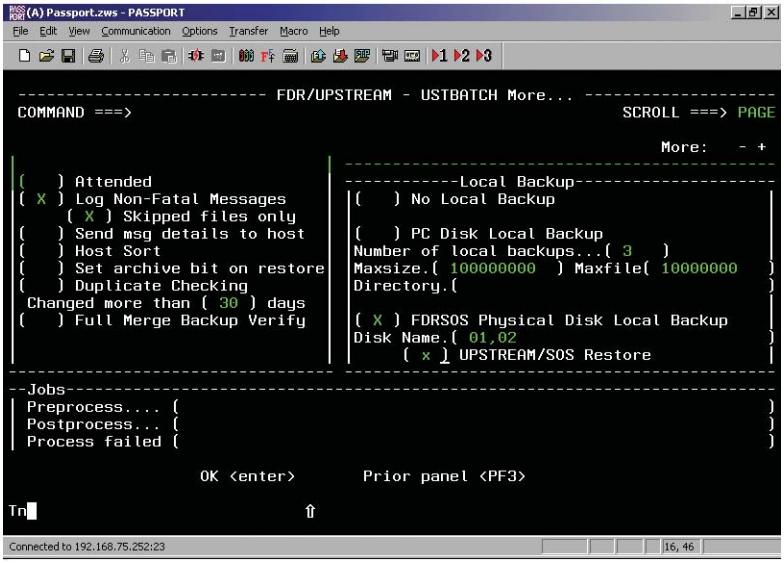


Note: The capabilities of the Director stretch far beyond just a simple replacement for the local Client GUI panels.

More examples of the facilities provided by the Director can be seen in "UPSTREAM/SOS Restores" and "Automation and Control" later, and full details can be found in the Director section of the UPSTREAM/SOS Client manual.

Option 3: Using the MVS ISPF Panels

UPSTREAM/SOS backups can also be controlled from the MVS OS/390 host, using a similar set of panels under ISPF. The backup specifications are saved as JCL, which can then be submitted by the MVS Host Job Scheduling System. Selection of the FDRSOS Local Backup disk can be by Local system disk name, or by the MVS Host volser.



Option 4: Using a combination

You can even use a *combination* of **Director** or Local Client GUI panels, together with MVS Host-specified overrides. This allows you to MVS Host-initiate your backups, which have been defined via the Director/Client panels and saved in the .DAT file(s), and optionally override some or all of the specifications at the time of initiation.

For example, you could build a parameter file with the **Director** to identify which files need to be backed up, and then setup MVS Host jobs (using the ISPF panels) to determine the *type* of UPSTREAM/SOS backup to be run.

PART THREE

UPSTREAM/SOS

UPSTREAM/SOS Backups—The Merge Process

As you would expect of an efficient, high-performance backup system, ***UPSTREAM/SOS*** offers the facility for taking incremental backups—the process whereby only changed files are backed up each day, after an initial full backup has been taken of the whole system. However, unlike other backup systems, ***UPSTREAM/SOS*** goes one step further by providing an intelligent and highly efficient *merge* process within its backups.

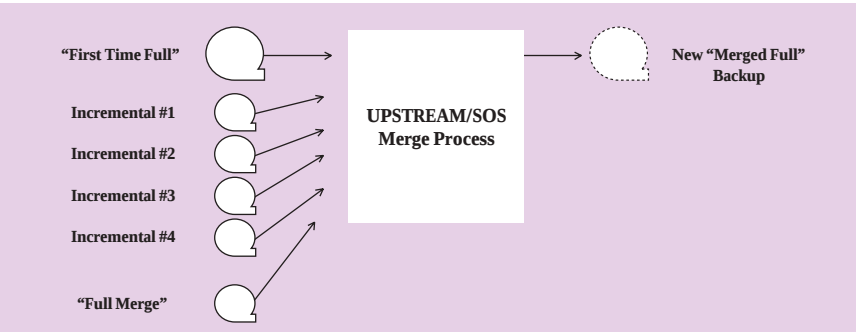
The merge technique still requires a *First-Time Baseline Full* backup to be taken of all the files belonging to the entity being backed up, which may be a single directory or perhaps a complete workstation or server drive within the Symmetrix. Depending on the amount of data to be processed, this full backup may take some time to complete, but ***UPSTREAM/SOS's*** utilization of the FDRSOS Local Backup disk and S/390 connection ensure that all the data is transmitted and stored at the OS/390 host as quickly and efficiently as possible.

Once the First-Time Baseline Full has been taken, ***UPSTREAM/SOS*** then runs daily *Incremental* backups to secure all of the changed files for that day, (optionally, with the exception of Unix systems, turning off the archive bits for PC backups as it goes). This process is standard for most Incremental Backup systems, but where ***UPSTREAM/SOS*** differs is when the next Full backup would ordinarily be run—which is usually once a week. Instead of once again transmitting *all* of the files to the OS/390 host, a process known as a *Full Merge* backup is run.

On a *Full Merge* backup, all the changed files are transmitted to the host—as they would be on an incremental—but they are accompanied by a directory entry for all the other files on the server or workstation that have been identified as being unchanged. Instead of wasting resources and time re-transmitting these unchanged files, ***UPSTREAM/SOS*** retrieves a copy of each one from the backups it already has stored at the Host. Under this mechanism, an unchanged file may be retrieved from a previous incremental backup (if it was updated earlier in the week) or from the previous full backup (if it had not been updated at all that week).

Using only MVS resources, ***UPSTREAM/SOS*** then combines all of the transmitted files, together with the unchanged files retrieved from old backups, and creates a new *merged* Full Backup containing an up-to-date copy of every file.

The following diagram summarizes this process.



This revolutionary *merge* process essentially eliminates the need to do regular (*i.e.* weekly) full backups. After the initial First-Time Full backup, only Incremental and Full Merge backups are required, saving time and resources

UPSTREAM/SOS not only transmits its backup (and restore) data at extremely high speeds via the FDRSOS Local Backup disk and S/390 connection, but it also ensures that only the files that really need to be transmitted are sent to the host!

PART THREE

UPSTREAM/SOS

Backup File Management

We have already described how the ***UPSTREAM/SOS*** backup files are transmitted through the Symmetrix, via the FDRSOS Local Backup Disk and across the S/390 channel to the MVS host. It is, of course, very important to provide a level of *management* for these backups once they reach the host. To do this, the MVS component of ***UPSTREAM/SOS*** utilizes various facilities available under the host:

- All backups, whether they go to MVS Tape or DASD, are cataloged in a standard ICF user catalog.
- The retention/expiration of these backups can be controlled by either RETPD/EXPDT, or by MVS GDG roll-off processing.
- If the backup files are being written to MVS DASD, they can be put under the control of DFSMS and can be directed to the appropriate Storage Group, as selected by the ACS routines. Alternatively, they can be allocated to a specific device(s), as determined by parameters set in the UPSTREAM/SOS configuration.
- If the backup files are being written to MVS Tape, they can be controlled by the Tape Management System (TMS) which will direct them to an appropriate tape and record all the required information in the TMS Control Files. The TMS can also control the offsite vaulting of these tapes, if required.
- Authorization for the allocation and usage of all UPSTREAM/SOS backup files can be controlled by the MVS Security system (*e.g.* RACF, ACF/2, Top-Secret).

UPSTREAM/SOS also has some of its own facilities that help with the management of its backups:

- Additional copies of backups (*e.g.* for Disaster Recovery) can be created with the **USTVAULT** feature. This is a very powerful facility, which can be used to create secondary tape copies of the backups for off-site storage.
- Another feature, called **USTMIGRT**, can automatically select and move backup files from MVS DASD to MVS Tape. This is particularly useful if backups are initially written to DASD (*i.e.* to facilitate a quicker restore in installations where no ACL/Robots exist, or when multiple backups need to be run in parallel because of an inadequate number of tape drives) but which must later be moved off to tape. Once the backups have been moved, the UPSTREAM database is changed to reflect the new location and the old DASD datasets are scratched. More importantly, any restores that are requested from backups that have been moved from DASD to Tape will always come direct from tape. This feature also allows tape stacking, as the backups from *multiple servers* can be stored on the same tape set.
- A facility called “Deferred Merge” is provided by **USTMERGE**. This is designed for situations when the Full Merge backup (described earlier) runs at a time when not enough MVS Tape drives are available to complete the process. The selection and transmission of the updated files from the Open System can be completed and the “backup” can be temporarily stored on MVS DASD, allowing the Open System to continue updating its files. When sufficient MVS Tape drives are available for the task, the final merge process from old backups can be completed to create the new Full Merge backup.

All of the above features combine to ensure the secure management of ***UPSTREAM/SOS*** backups. It is vital that these backups are created and stored safely at the OS/390 host with the minimum of resources and that they are retained for the required duration, readily available if/when a restore is requested. Let’s look in more detail now at UPSTREAM/SOS restore process…

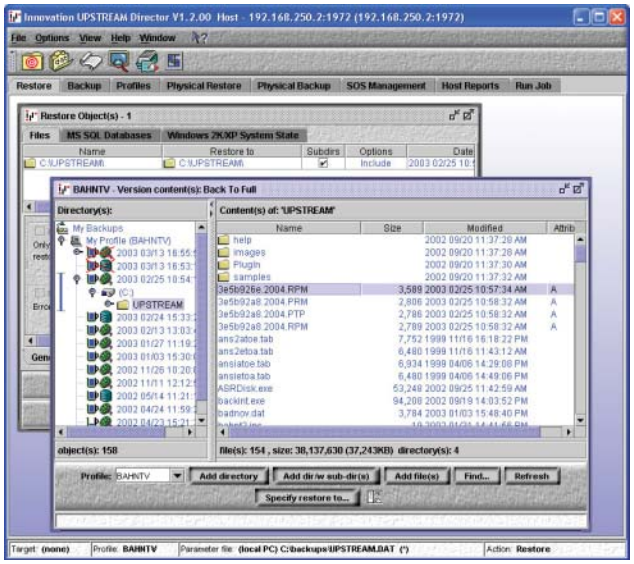
PART THREE

UPSTREAM/SOS

UPSTREAM/SOS Restores

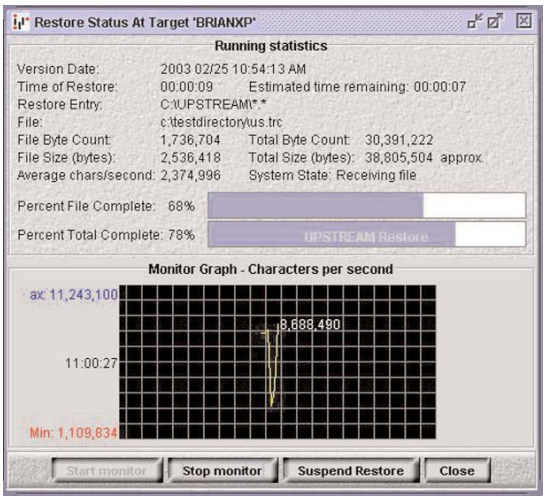
The restore capabilities of UPSTREAM/SOS are easy-to-use, yet powerful and flexible. Individual files, groups of files, directories, volumes and even whole servers/workstations can be restored from ***UPSTREAM/SOS*** backups. As outlined earlier, an FDRSOS Local Backup disk can be utilized for the restore, eliminating the need to transmit data across the network—the restore will occur ***within the Symmetrix***, with the files being copied across the SCSI, FC-AL or FC-SW connection.

Using the Director (or Client/GUI or ISPF) panels, ***UPSTREAM/SOS*** can display all files in a given directory for a single backup, or combine Incrementals and the Full backup into a single view. It is also possible to view all versions of a file currently being managed by ***UPSTREAM/SOS***, even across multiple Full backups. Below is an example of some backups being displayed via *The Director* GUI interface:



Having displayed the various backups for files, directories and subdirectories, the required versions can then be selected for restore, either to their original or a new location. Multiple selections can be made, and options are provided to prevent files from being restored if a copy already exists on the receiving disk.

The restore process can be tracked by a separate Director ‘status’ panel:



PART THREE

UPSTREAM/SOS

Utilizing the FDRSOS Full Backup during a Restore

As described in the Introduction, ***UPSTREAM/SOS*** file-level backups can be used in concert with ***FDRSOS*** Logical-Volume backups. Here is the recommended scenario:

- ***FDRSOS*** is used regularly (generally weekly) to provide a backup of each Logical Volume in the Symmetrix, as described in Part Two of this Guide.
- ***UPSTREAM/SOS*** Incremental backups are run *daily* to provide recovery to a given point.
- ***UPSTREAM/SOS*** Full Merge backups are also recommended so that selective file restores can be performed.

This powerful combination of backups is particularly useful in disaster recovery situations, or any other occasion when whole servers or workstations need to be recovered to a point as near up-to-date as possible:

- Each Logical Volume is first restored from its ***FDRSOS*** backup. This recovers the disk back to the point when the FDRSOS full was done (usually the weekend).
- Any files that have been modified since the FDRSOS backup was taken are then restored from the ***UPSTREAM/SOS*** backups. This makes the disk current, recovering it to the point of the last incremental (usually taken the previous night).

To facilitate the second stage of the restore process (*i.e.* restoring back to the point of the FDRSOS backup) ***UPSTREAM/SOS*** utilizes what is known as an FDRSOS 'Timestamp File' during the backup process. This is a zero-length file that can be written into the highest level directory that has been selected for backup. The Timestamp File contains a date and time and is essentially a signature on the disk to indicate when the last ***UPSTREAM/SOS*** backup was performed.

During the restore process, ***UPSTREAM/SOS*** offers an option called 'Restore Back To FDRSOS Full'. After the logical volume (including the Timestamp File) has been restored from the ***FDRSOS*** backup, ***UPSTREAM/SOS*** extracts the modification date/time from the Timestamp File and is then able to restore only the files that were backed up after that point.

This feature ensures the fastest possible restore of the server or workstation, recovering it right back to the point of the most recent backup. Depending on the interval between the taking of ***FDRSOS*** backup and the occurrence of the disaster, a large majority of the files will be restored directly by the ***FDRSOS*** logical volume restore, leaving ***UPSTREAM/SOS*** to restore just the remainder of the files.

FDRSOS Physical Disk Restore

UPSTREAM/SOS also includes a feature, called *FDRSOS Physical Disk Restore*, which allows it to restore data from ***FDRSOS*** backups to a server or workstation disk <u>outside</u> a Symmetrix. This is not a file restore facility—only complete physical disks can be restored.

This facility is provided because the restore scenario described above assumes that an EMC Symmetrix will be available as the target of the initial ***FDRSOS*** restore. It would need to have the ESP feature installed and also be configured for access from both the OS/390 host and the Open System server/workstations(s) that are to be recovered.

This would not ordinarily present a problem when restoring at the home site, where the original Symmetrix would still be available. However, in a disaster recovery situation, a Symmetrix may not be available and ***FDRSOS*** restores would not ordinarily be possible. The *Physical Disk Restore* feature eliminates this potential problem.

PART THREE

UPSTREAM/SOS

Automation and Control

The performance and flexibility of UPSTREAM/SOS are complemented by a range of options, allowing for both the automation and a complete control of the backup and restore processes. Let's take a closer look at these options now.

Automation

We have already seen how ***UPSTREAM/SOS*** backups and restores can be initiated via the Client/Director GUI panels, as well ISPF panels provided with the MVS component. Although these facilities are all useful for initiating and testing ***UPSTREAM/SOS*** tasks, a more *automated* method is needed for regular daily production backups.

The following options are possible, and in many instances recommended:

- Automatic initiation from the ***MVS host***.

  This would be done with a standard MVS batch job, started via the host job scheduling system (if available) or UPSTREAM/SOS's own MVS scheduler. UPSTREAM/SOS also has the ability to perform JCL condition code checking if the option CONV=WAIT is coded.

- Automatic initiation from the ***Client***.

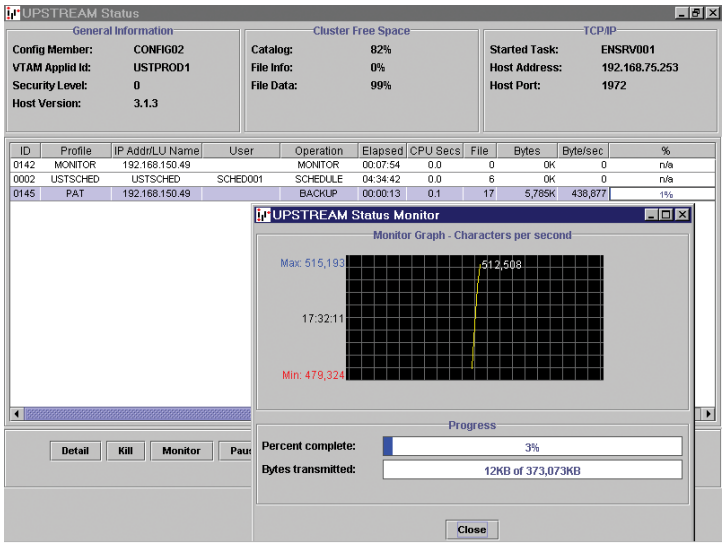
  This would be done via the Open System's scheduling facilities (if available) or through the scheduling feature provided with the Client component of UPSTREAM/SOS.

Regardless of the method used to initiate the backups, the selection of the *type* of backup (*i.e.* full or incremental) and the specification of the files to be backed up would ordinarily be done, as described earlier, via the GUI panels and saved in a '.DAT' parameter file. If required, some or all of those parameters can then be overridden at execution time.

Control

As well as providing facilities for the creation and initiation of backups and restores, the Director panels can also be used to monitor the progress of an UPSTREAM/SOS task, either running locally, or on another client server/workstation with UPSTREAM/SOS Client installed.

Here's an example of a Director panel tracking the status of a backup (profile of "PAT") which is running out on the network at TCP/IP address 192.168.150.49. The backup has been running for 13 seconds and is currently 3% complete.



PART THREE

UPSTREAM/SOS

Additional Features of UPSTREAM/SOS

This Concepts and Facilities Guide has concentrated on the basic features of ***backup*** and ***restore***. However, UPSTREAM/SOS is a feature-rich product that provides numerous other facilities to assist with the management and control of Open Systems data resident on the EMC Symmetrix. Here is a summary of some of the additional features provided within the product:

- **Online Database Backup**
  UPSTREAM/SOS includes agents which support the backup across the SAN and S/390 channel of a wide variety of databases including Oracle, Microsoft Exchange and SQL Server and Lotus Notes Domino. For IBM DB2 and SAP, multi-session backups/restores are now available, allowing a single database to be backed up in parallel, which may improve the performance for large databases.

  UPSTREAM/SOS also supports BMC's SQL-BackTrack, allowing UNIX system backups of Oracle, Sybase and Informix, as well as Windows NT backups of Oracle.

- **Duplicate Files**
  Using a feature called ADFS (Automatic Duplicate File Suppression), UPSTREAM/SOS can avoid backing up files that are duplicated across multiple servers or workstations.

  This saves on transmission time during the backups and also reduces host storage requirements. A single copy of each duplicated file can be stored in a repository at the OS/390 host.

- **PC Workstations**
  The ULTra (UPSTREAM LAN Transport) facility allows individual workstations to be backed up without requiring full SNA/APPC or TCP/IP communications with the OS/390 host. Instead, ULTra contacts LAN-attached workstations using advanced IPX/SPX, NetBIOS or TCP/IP peer-to-peer communications.

  This reduces configuration, installation and training time when backing up a large number of PC workstations with UPSTREAM/SOS.

- **File Transfer**
  The File Transfer facility of UPSTREAM/SOS allows native files to be transferred between a workstation/server and the OS/390 host. Text and binary files are supported for the transfer and a choice of host file formats is provided (*e.g.* GDG's, PDS members, flat files etc).

  This feature makes UPSTREAM/SOS a powerful tool for interchanging data between different computer systems.

- **Migration**
  As free disk space on workstations and LAN servers becomes critically low, UPSTREAM/SOS can detect and then backup and delete any files that have not been used for a period of time. The migrated files can be restored from the OS/390 host at any time.

  Files migrated from a Novell server can be automatically recalled when a user accesses them, providing true mainframe-like Storage Management facilities.

PART THREE

UPSTREAM/SOS

Summary

FDRSOS *and* ***UPSTREAM/SOS*** provide all the facilities required for fast and efficient backups of Open Systems data stored on an EMC Symmetrix:

- The backup and restore processes can be fully automated.
- The UPSTREAM/SOS Client/Director GUI panels and MVS ISPF panels allow users to monitor and control these processes from their chosen/preferred operating system platform and from anywhere in the network.
- The combined use of the FDRSOS Local Backup Disk and the S/390 channel allow for regular (*i.e. daily*) incremental backups of very large Open Systems Volumes in the Symmetrix. These can be used to complement the weekly full volume ***FDRSOS*** backups, allowing both Logical Volume restores and File-Level Restores.
- ***FDRSOS*** and ***UPSTREAM/SOS*** backups can be included in the company's corporate Disaster Recovery plan, allowing for a more comprehensive (*i.e.* up-to-date) recovery of Open Systems data in the event of a disaster.

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