

FDR/ UPSTREAM

C O N C E P T S & F A C I L I T I E S G U I D E

FDR/UPSTREAM

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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, 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, EMC² 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 EMC² 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 is 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 **FDR/UPSTREAM**.

PART ONE is a general overview of the product, outlining its capabilities and the advantages that it holds over its competitors. This overview is designed for managers and anyone else who needs to get a quick understanding of the key features of the product.

PART TWO is a technical description of FDR/UPSTREAM, designed for people who need a more detailed understanding of how the product functions. It looks in more detail at the backup and restore facilities, highlighting (among other things) the unique merge incremental process and the powerful and flexible restore capabilities.

Any comments or suggestions regarding this guide can be directed to:
support@fdrinnovation.com

PART ONE

GENERAL OVERVIEW

Introduction

FDR/UPSTREAM is a high-speed Storage Management and Disaster Recovery tool for Open Systems data stored on LAN Servers and workstations. Almost all of the popular server and workstation operating systems in use today are supported by FDR/UPSTREAM, including:

- Microsoft Windows NT, Windows Server 2003, 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

FDR/UPSTREAM offers several options for a high-speed and flexible backup. These backups, which can be taken at either a Volume level or an Incremental/File level, are directed to an MVS OS/390 or z/OS host system for safe, reliable storage and retention. When required, individual files and directories can be restored. In the event of a disaster, whole servers and workstations can be recreated.

As well as providing backup and restore services for standard files and documents, FDR/UPSTREAM is also 'database aware' and includes specially developed agents which provide online 'hot' backup facilities for:

- 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
- Novell GroupWise

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

Security for all your Corporate Critical Open Systems Data

In many organizations, often due to tactical and/or physical considerations, increasing amounts of corporate critical data are now being stored and maintained *outside* the OS/390 host. This de-centralization of corporate data storage makes it much harder for Storage Administrators to provide the same high level of Storage Management service across all platforms. FDR/UPSTREAM offers a solution to this problem by using the existing OS/390 infrastructure to provide a single, centralized point of control for *all* Open Systems backups.

- It utilizes OS/390's high-quality, robust disk/tape media for its backups, which are stored in compressed format for optimum efficiency.
- It makes full use of the tried-and-tested OS/390 system services such as the Tape Management System (for the control, retention and movement of its backup tapes), the Job Scheduling System (for the initiation of its backups), and the Security System (for the control of access to its backup and restore facilities).

PART ONE

GENERAL OVERVIEW

High-Speed Backups

FDR/UPSTREAM has been designed to backup Open Systems data as quickly and as efficiently possible. It offers several choices for the transmission of data to the OS/390 or z/OS host:

- It can use **TCP/IP** (Transmission Control Protocol/Internet Protocol), which is a simple way of establishing internal communication links and communicating with external networks such as the Internet.
- For companies that have invested in high-performance network connections such as **GB Ethernet**, or ESCON channel connections via **Netfinity, Polaris (or other) Adapters**, FDR/UPSTREAM can also utilize these high-speed links for its data transmission.
- For users looking to backup S/390 Linux data, FDR/UPSTREAM is also positioned to utilize **Hipersocket** connections (if available and configured on your CPU).
- FDR/UPSTREAM also supports **APPC** (Advanced Program-to-Program Communications) for most platforms to transmit data over SNA communication links. APPC, being peer-to-peer, provides higher speed and more flexibility over the old LU 2 screen-based approach used by many micro-to-mainframe vendors.

As well as using the fastest possible network links, FDR/UPSTREAM also reduces to a *minimum* the amount of data that has to be transmitted:

- It provides standard **Incremental Backup** services; by checking the PC archive bit, only the changed files are transmitted to the OS/390 host—drastically reducing the time required to take daily backups. (Note: In UNIX systems, where no archive bit is maintained, UPSTREAM uses its own “local incremental database” to record the files it has backed up, and thus determine which files are to be included in the next incremental backup).
- The unique ‘**Merge Backup**’ Facility reduces the elapsed time of weekly full backups by utilizing already existing mainframe backups of files which have not changed.
- The Merge Backup Facility also includes **Duplicate File Support**, which avoids backing up files that are duplicated across multiple servers or workstations, saving on transmission time during the backups and also reducing host storage requirements. A single copy of each duplicated file can be stored in a repository at the OS/390 host.
- Backup times can be further reduced by the optional **Compression** of backup data, prior to its transmission to the OS/390 host. Multiple levels of data compression are available, all performed on the client prior to transmitting the data, ensuring high-speed transmissions even on slower links.
- A ‘**Physical Disk Backup**’ Facility is provided, which is a high-speed, byte-by-byte backup of a physical hard disk. There are several performance-related advantages to this type of backup. Firstly, since the disk heads move across the disk sequentially, there is no head or rotational delays, which can often significantly reduce performance. Also, in a complete disaster, FDR/UPSTREAM has a number of techniques which allow a physical disk backup to be used for high-speed Operating System restores, often from a single floppy disk onto a “bare metal” system. Finally, a number of database vendors store their data directly onto physical disks using their own labeling schemes. In these situations, a physical disk backup is the only way to backup this data.

*Note: Users of EMC's Symmetrix DASD Subsystem can take advantage of **FDRSOS** and **FDR/UPSTREAM/SOS**, which are two separately priced products from Innovation. They work in conjunction with the EMC Symmetrix to provide high-speed backups of Open System volumes in the Symmetrix, across an ESCON channel connection. For more information, see the “FDRSOS and FDR/UPSTREAM/SOS” Concepts & Facilities Guide.*

PART ONE

GENERAL OVERVIEW

Flexible, Fast Restores

FDR/UPSTREAM offers great flexibility on restore operations. Individual files, groups of files, directories, drives and even whole servers can be restored. In addition, FDR/UPSTREAM offers several useful features at restore time:

- **LOCAL BACKUP.**

This is a technique whereby some or all of the FDR/UPSTREAM backup data is stored locally (i.e. on a SCSI/FIBRE-attached disk drive accessible by the Open System server or workstation being backed up) as well as being transmitted to the OS/390 host. In environments where slow WAN or LAN links are used, this can drastically reduce restore times. If the files to be restored are still held on the Local Backup disk, FDR/UPSTREAM can restore them without having to transmit data across the network connection.

- **TAPE VAULTING**

FDR/UPSTREAM allows you to create secondary “vault” copies of some/all your backups, which can be placed offsite for safe storage. Should a disaster strike and you lose the primary copies of your backups, a simple process enables the vault copies to be used for subsequent restores.

- **SAR (Stand-Alone Restore)**

SAR (Stand-Alone Restore) is a powerful feature of FDR/UPSTREAM where you can use a Windows machine with a SCSI attached tape drive to perform disaster recovery restores without UPSTREAM/MVS. Some of SAR’s features include:

- Restores in locations where you do not have mainframe access.
- Restore of backups from any system supported by UPSTREAM, including UNIX systems.
- File-by-file or physical disk restores.
- Support of virtually all SCSI tape drives. No tape driver is required.
- Browser-based interface allows remote administration.
- No tape preparation required. Request the restore from your UPSTREAM client, insert your host tape and your restore begins immediately.
- Support of all UPSTREAM/MVS tapes generated, including vault tapes.
- Tape drive-speed restores. For a Windows PC there is no network overhead.
- Multi-tasking. If you have multiple tape drives you can run multiple simultaneous restores.

PART ONE

GENERAL OVERVIEW

Intelligent, Safe, Easy-To-Use...

FDR/UPSTREAM provides a safe, reliable and easy-to-use platform for all your Open System backups and restores.

- Through the use of a mainframe integrated scheduler, or via your own mainframe job scheduling system, you can configure FDR/UPSTREAM to run at any combination of times (daily, weekly, monthly, etc.) UPSTREAM is very flexible and can also be scheduled from a client scheduler, such as CRON, Windows NT scheduler or a 3rd party scheduling product.
- A System Administrator can set up an FDR/UPSTREAM backup system in a matter of minutes. The screens are familiar and simple to use, allowing an easy selection of files, directories, drives or whole servers.
- Backup and restore operations can be transparent and automated, with nothing to maintain on a day-to-day basis.
- During a backup, FDR/UPSTREAM can detect files that are unavailable due to LAN data sharing issues, and retry those files at a later stage. Failed backups or restores (e.g. due to communications line failure, host unavailability, etc.), can be restarted at the point of failure.
- FDR/UPSTREAM records the location of all its backups. It will remember on which tape (or disk) volume they are stored, completely eliminating the need to keep manual records. FDR/UPSTREAM can automatically restore files back to a specific date, intelligently combining restores from its full and incremental backups.
- FDR/UPSTREAM maintains logs that record details of the files backed up or restored, together with any communications problems, skipped files, transmission statistics, and every other significant event of the operation. This ensures that both the client LAN or UNIX Administrator *and* the mainframe Administrator can monitor, control, and verify every aspect of the operation. FDR/UPSTREAM also generates a summary log (with one line of information for every operation performed) to provide instant reporting. Finally, FDR/UPSTREAM's history feature also keeps online records of all operations, which can be queried either interactively or by a batch reporting program.

And There's More...

Aside from the primary operations of Backup and Restore, FDR/UPSTREAM also offers a range of other useful Storage Management features for Open Systems data. A brief summary of those features is included here, but for full details please see the main product manuals.

Data Migration

As free disk space on workstations and LAN servers becomes critically low, FDR/UPSTREAM can detect and then backup and delete any files that have not been used for a period of time. From a management perspective, a detailed report can be executed to provide a list of the migrated files and the UPSTREAM inquiry facilities allow ad-hoc interrogation of these files and restore initiation. Just like a file that was backed up, the migrated files can be restored at any time. Files migrated from a Novell server can be automatically recalled when a user accesses them, as UPSTREAM leaves a stub file in its place, providing true mainframe-like Storage Management facilities.

PART ONE

GENERAL OVERVIEW

File Transfer

The File Transfer facility of FDR/UPSTREAM allows 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 FDR/UPSTREAM a powerful tool for interchanging data between different computer systems. For example, this function can be used for transmitting the UPSTREAM client log to the OS/390 storage administrator

Software Distribution & Data Sharing

FDR/UPSTREAM's fast, secure and unattended nature makes it ideal for software distribution. Since restores can be automated, PC users can backup their critical applications nightly, and at the same time retrieve new software and data updates. Also, when data is stored in a location common to all users, other users can easily retrieve it (subject to security constraints). Since FDR/UPSTREAM is so fast and easy to use, many data sharing requirements are easily solved.

The Rescuer

The Rescuer is a powerful addition to the FDR/UPSTREAM storage management system, offering a complete backup and restore solution with disaster recovery for SuSE S/390 Linux and Sun Solaris. The Rescuer is a stand-alone system recovery facility which allows administrators to completely restore a system from data that is saved in FDR/UPSTREAM *without* separate system backups. The Rescuer provides this essential system recovery supplement because it is completely integrated into FDR/UPSTREAM.

Summary

As you have seen, FDR/UPSTREAM offers a full range of Storage Management facilities for Open Systems data, equivalent to the type of features that have been available for OS/390 storage for many years. Now, at last, Storage Administrators have the capability to manage their Open Systems storage with the same high level of control, performance and ease-of-use as their OS/390 or z/OS data.

PART TWO

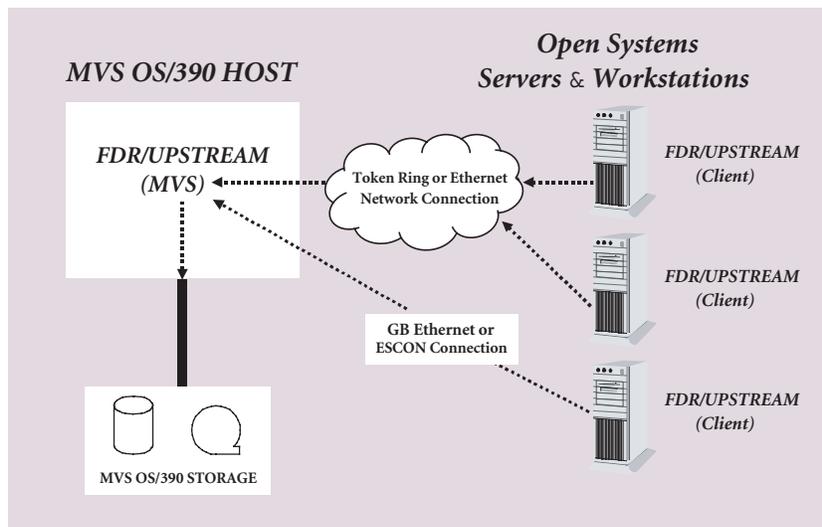
TECHNICAL DESCRIPTION

Introduction

PART ONE of this Guide provided a general overview of the main features of FDR/UPSTREAM. In this second part of the Guide, we are now going to look in more detail at how FDR/UPSTREAM operates. We'll also be taking a closer look at some of the features described in the overview.

How It Works

The following diagram summarizes a standard FDR/UPSTREAM system:



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

- **FDR/UPSTREAM REPOSITORY (MVS)**

This component resides on the OS/390 or z/OS host. It runs as a standard MVS started task with multiple sub-tasks and is responsible for the storage and retention of backups. It is also where the main configuration control files 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.

- **FDR/UPSTREAM (CLIENT)**

This component resides on the Open System server or workstation 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.

During backup and restore, data is transferred between the two components across one or more connections. As described in PART ONE, FDR/UPSTREAM offers several choices for this connection, including TCP/IP (or APPC) and high-speed links such as GB Ethernet, or Escon channel connections via Netfinity, Polaris (or other) Adapters.

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TECHNICAL DESCRIPTION

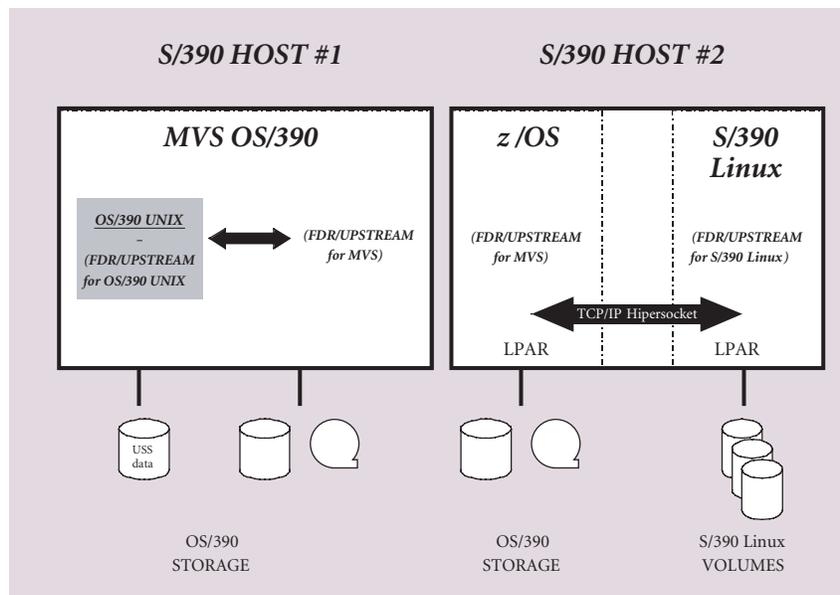
FDR/UPSTREAM for S/390 Linux and IBM/USS

Corporations today are looking to leverage the strengths of the S/390 Enterprise Server, for uses such as e-business applications and Web serving. With this in mind, FDR/UPSTREAM's support for UNIX systems has been extended to include **S/390 Linux** and **IBM OS/390 UNIX** (commonly known as **UNIX System Services**, or **IBM/USS**).

This support encompasses most of the facilities available for other UNIX platforms. For S/390 Linux and OS/390 UNIX, this includes a full-featured daemon, together with a choice of command line, client character mode and Director user interfaces. The full range of FDR/UPSTREAM's standard Storage Management features is available under both platforms.

The following diagram shows how FDR/UPSTREAM operates in conjunction with **OS/390 UNIX** (which runs within an MVS OS/390 or z/OS LPAR) and **S/390 Linux** (which operates as a separate LPAR on the S/390 host).

Because the **S/390 Linux** and **OS/390 UNIX** systems are *resident* on the S/390 host, the data transfer between the Client and MVS UPSTREAM software components differs from the "standard" (i.e. network-based) operations described on page 9.



As you can see with the **OS/390 UNIX** system running on S/390 Host #1, data can be transferred directly between the two FDR/UPSTREAM components (via TCP/IP) without going across a network connection.

And in the case of **S/390 Linux**, running on S/390 Host #2, the data is routed between LPARs across an Open Systems Adaptor (OSA), which realizes that the recipient (i.e. MVS) is in the same box and routes the data straight there. This is often called 'bouncing' the data off the OSA. Data transfer between the two FDR/UPSTREAM components can also be achieved utilizing a feature called "TCP/IP Hipersockets", that is available for the z/OS operating system (version 1.2 and above), to add function for S390/Linux.

With Hipersockets, the TCP/IP data can be routed directly between partitions in an S/390 machine, *without* going to the OSA and bouncing off. The utilization of Hipersockets is transparent to callers like FDR/UPSTREAM, which just do their normal TCP/IP calls. However, because the data transfer does not involve the OSA, it is significantly faster than a bounce.

PART TWO

TECHNICAL DESCRIPTION

FDR/UPSTREAM Backups —The Merge Process

As you would expect of a feature-rich, high-performance backup system, FDR/UPSTREAM 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, FDR/UPSTREAM goes one step further by providing an intelligent and highly efficient *merge* process within its backups.

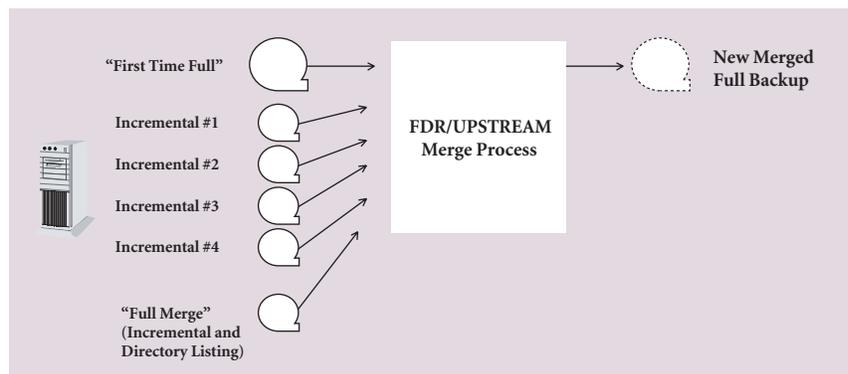
The merge technique still requires a *First-Time Baseline Full* backup to be taken of all the files belonging to the entity being backed up, which may be a single directory, server drive, or perhaps a complete workstation. Depending on the amount of data to be processed, this full backup may take some time to complete, but **FDR/UPSTREAM's** utilization of high-speed network links 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, FDR/UPSTREAM then runs daily *Incremental* backups to secure all of the changed files for that day, optionally turning off the archive bits for PC backups as it goes. This process is standard for most Incremental Backup systems, but where FDR/UPSTREAM 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, or missing the benefits of a full backup, 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, FDR/UPSTREAM retrieves a copy of each one from the backups it already has stored at the S/390 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, FDR/UPSTREAM 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. The benefits and results of the merge are very apparent when time is critical...and especially at restore time.

FDR/UPSTREAM not only transmits the backup data at extremely high speeds, but it also ensures that only the files that really need to be transmitted are sent to the host!

PART TWO

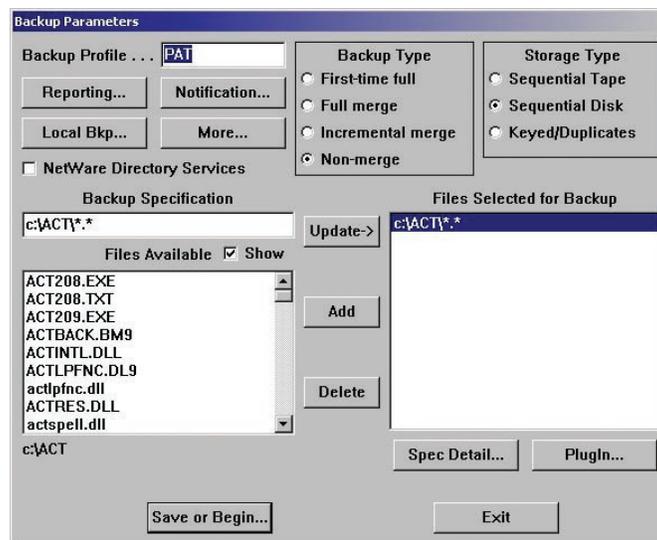
TECHNICAL DESCRIPTION

Defining (& Manually Initiating) FDR/UPSTREAM Backups

As described below, various options are available for defining (and manually initiating) FDR/UPSTREAM backups, and you can choose the option that best suits your own specific requirements. Please note, however, that the “Automation & Control” section later on in this Guide discusses the options for automating the initiation of FDR/UPSTREAM backups.

Option 1: Using the “Local” Client GUI panels for Windows

The FDR/UPSTREAM (Client) component includes a set of GUI panels that can be used to create, store and manually initiate the Full Merge and Incremental backup tasks. It is beyond the scope of this document to show the panels in detail, or to fully describe the creation and retention of backups. However, here is the main panel used for creating a backup:



The **Backup Profile** identifies the particular device, server or drives to be backed up. A drive or directory, identified by the Backup Specification (see below), should 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 media (tape or dasd) is specified via the **Storage Type** box.

The backup specification can be saved and/or manually initiated with the **Save or Begin...** button.

The selection of the actual 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. Additional features, like Reporting, Event Notification and more 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 (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.

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TECHNICAL DESCRIPTION

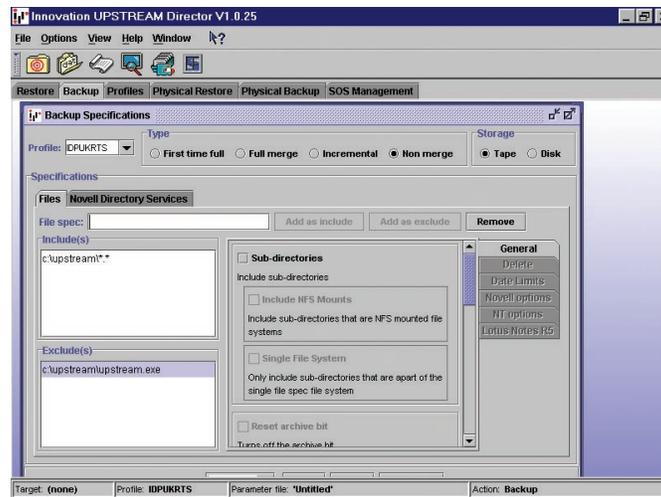
Option 2: Using the UPSTREAM “Director” Panels

The FDR/UPSTREAM **Director** can also be used to create and manually initiate FDR/UPSTREAM backups and restores (or manually restart pending backups/restores). It provides system-wide distributed control and operation, via a Windows Explorer-like interface. It operates by performing inter-process communications between the Client and MVS components, and can create, initiate and monitor UPSTREAM functions locally, or on another Client.

Taking advantage of the cross-platform nature of Java, the Director runs on many of the current platforms supported by FDR/UPSTREAM including:

- All UNIX systems (with X-Server support)
- Microsoft Windows NT, Windows Server 2003, 2000, XP, ME, 98
- Novell file server Java consoles or the Novell X-Client.

The Director can also run in a web browser (such a Microsoft’s Internet Explorer or Netscape Navigator) when served from a file server, or your existing web server. This avoids having to do a CD install/setup and provides ubiquitous web access to the Director and therefore your UPSTREAM backup system. Here is an example of the Director panel that can be used to define a backup task:



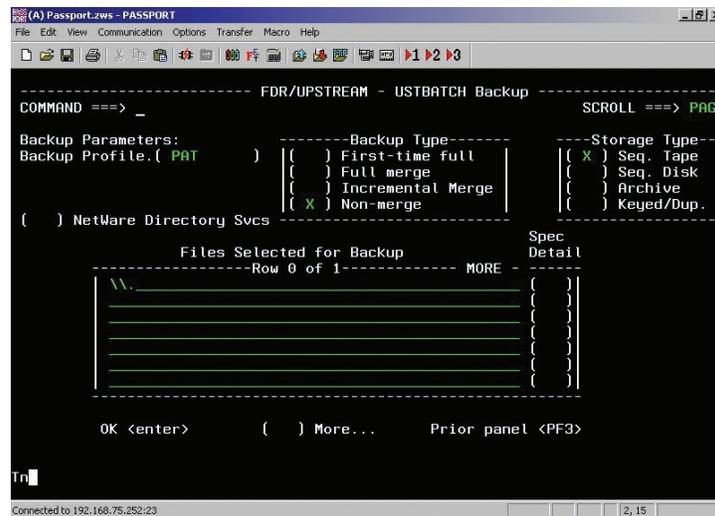
The capabilities of the **Director** stretch far beyond just a simple replacement for the local Client GUI panels. More examples of the facilities provided by the Director can be seen in “FDR/UPSTREAM Restores” and “Automation and Control” later.

PART TWO

TECHNICAL DESCRIPTION

Option 3: Using the MVS ISPF Panels

FDR/UPSTREAM backups can also be created and manually initiated from the OS/90 or z/OS host, using a similar set of panels under ISPF. The backup specifications are saved as JCL, which can then be submitted as a standard MVS batch job, and optionally through the MVS job scheduler—see “Automation and Control” later.



Option 4: Using a combination of Options 1, 2 and 3

In any environment, it is likely that a *combination* of the services outlined in Options 1, 2 and 3 would be used. For example, daily/weekly scheduled production backups would probably be host-initiated, while ad-hoc backups would be started through either the Director, the Client GUI panels, or the MVS ISPF panels.

PART TWO

TECHNICAL DESCRIPTION

Backup File Management

We have already described the various mechanisms that can be employed to transmit backup data from the Open System server/workstation across to the OS/390 or z/OS 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 **FDR/UPSTREAM** utilizes various facilities available under the host operating system:

- 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 FDR/UPSTREAM 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 FDR/UPSTREAM backup files can be controlled by the MVS Security system (e.g. RACF, ACF/2, Top-Secret).

FDR/UPSTREAM 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. Vaulting tapes can also be used for long-term archival of data. For example, if (for legal reasons) you need to retain tapes for 7 years, you might consider making a vault tape rather than keeping the backup online and catalogued. You will still have access to the data, but without keeping the entries in the UPSTREAM database.
- 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) but which must be later 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 no 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.

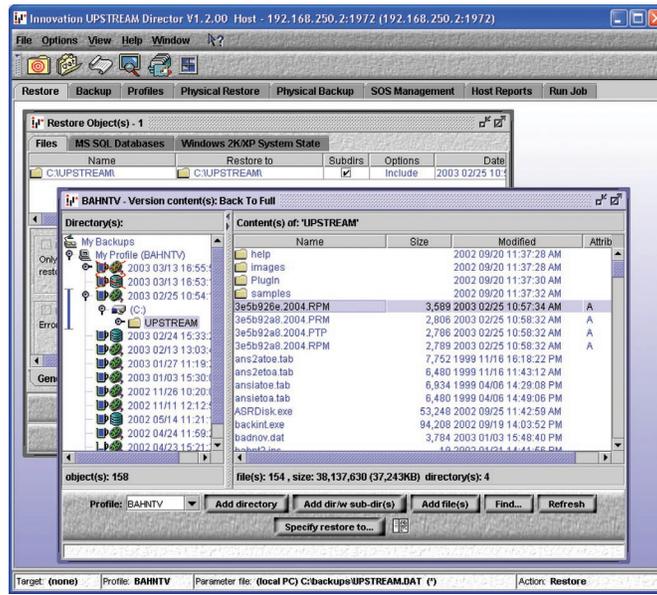
All of the above features combine to ensure the secure management of FDR/UPSTREAM backups. It is vital that these backups are created and stored safely at the OS/390 host with the minimum of resources and that they are retained for the required duration, readily available if/when a restore is requested.

PART TWO

TECHNICAL DESCRIPTION

FDR/UPSTREAM Restores

The restore capabilities of FDR/UPSTREAM are powerful, extremely flexible, and designed to meet any eventuality. As previously explained, individual files, groups of files, directories and even whole volumes can be restored from FDR/UPSTREAM backups.



Using either the Client panels, the Director GUI interface (shown here) or the ISPF panels, FDR/UPSTREAM 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 that are currently being managed by FDR/UPSTREAM, even across multiple Full backups.

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.

PART TWO

TECHNICAL DESCRIPTION

Disaster Recovery

In the event of a disaster where complete servers/workstations are to be restored, FDR/UPSTREAM offers several facilities for the re-construction and restoration of the data:

- It can use the powerful combination of the weekly Full-Merge backups, together with the daily Incrementals to provide a complete “Back-to-Full” recovery. The start point of the recovery process can be controlled so that the data can be restored back to a given point in time. If *Physical* Disk Backups have been taken (see PART ONE), they can be used to recover the Operating System, as well as the user data.
- FDR/UPSTREAM also includes its own specially formulated procedures for the complete recovery of servers and/or workstations, including Windows XP/2000, Novell Netware and OS/2, often requiring just a basic pre-installation of the base Operating System.
- The “UPSTREAM Rescuer” facility, mentioned in the General Overview in PART ONE of this guide.
- Finally, in situations where you do not have mainframe access (or your WAN/LAN links are slow), the SAR (Stand-Alone Restore) feature of FDR/UPSTREAM can utilize a Windows NT SCSI attached tape drive to perform disaster recovery restores without requiring the MVS component to be up-and-running. SAR supports all of the backups created by FDR/UPSTREAM, including duplicate tapes created by the USTVAULT (vaulting) facility.

Automation and Control

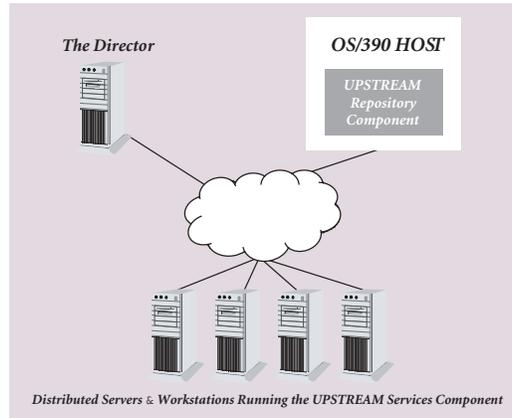
The performance and flexibility of FDR/UPSTREAM are complemented by a range of options, allowing for both the automation and a complete control of the backup and restore processes. We have already seen how FDR/UPSTREAM backups and restores can be initiated via the Client and Director GUI panels, as well ISPF panels provided with the MVS component. Although these facilities are all useful for *manually* initiating and testing FDR/UPSTREAM, a more *automated* method is generally needed for regular daily production backups, and the following options are possible:

- 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 FDR/UPSTREAM’s own MVS scheduler.
- Automatic initiation from the ***Client***. This would be done via the Open System’s own scheduling facilities, such as CRON or the Windows NT Scheduler (if available) or through the scheduling feature provided with the Client component of FDR/UPSTREAM.

PART TWO

TECHNICAL DESCRIPTION

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



While the Director panels may be used to manually initiate ad-hoc backups and restores, they can also be used to monitor the progress of such tasks, either run locally or (as shown in the diagram above) on another client servers or workstations.

Although the initiation of daily production backups may have been done with the OS/390 host, the monitoring and control of those backups (and perhaps the ad-hoc initiation of restores) can be done via the Director panels.

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.

The screenshot shows the 'UPSTREAM Status' window. It includes a table of active tasks and a 'UPSTREAM Status Monitor' graph.

| ID | Profile | IP Addr/ LU Name | User | Operation | Elapsed | CPU Secs | File | Bytes | Byte/sec |
|------|-----------|------------------|----------|-----------|----------|----------|------|--------|----------|
| 0142 | MONITOR | 192.168.150.49 | MONITOR | MONITOR | 00:07:54 | 0.0 | 0 | 0K | 0 |
| 0002 | LISTSCHED | LISTSCHED | SCHED001 | SCHEDULE | 04:34:42 | 0.0 | 6 | 0K | 0 |
| 0145 | PAT | 192.168.150.49 | | BACKUP | 00:00:13 | 0.1 | 17 | 5,789K | 438,877 |

The 'UPSTREAM Status Monitor' graph shows 'Monitor Graph - Characters per second' with a peak of 515,193 and a minimum of 479,324. The progress bar indicates 'Percent complete: 3%' and 'Bytes transmitted: 12KB of 373,073KB'.

Notification Via E-mail

To further assist with automation and control, UPSTREAM also has the capability of sending E-mail and SNMP Trap notifications. By configuring your backups and restores to send notifications of specific events, you can add another valuable layer of automation to your data management tasks.

PART TWO

TECHNICAL DESCRIPTION

Reporting

The ability to produce high quality reports (in both summary and/or detailed format) is an *essential* requirement of any good DASD Management System. In this Guide, we have already seen some examples of the powerful and flexible reporting capabilities of FDR/UPSTREAM:

- On page 16, we saw the easy-to-navigate restore panels, which can list some or all of the backups currently being tracked by FDR/UPSTREAM, thus facilitating the restore of an individual file, a group of files, a directory, or even a whole server.
- On page 18, we saw an example of the Director status panels, which can track and report on the progress of FDR/UPSTREAM activities that are running elsewhere within the system.
- And on page 7 we learned that the operational messages detailing the events of all FDR/UPSTREAM backups and restores can be recorded in sequential log files at both ends of the operation (i.e. at the host *and* on the server/workstation). These logs can be viewed by anyone wishing to obtain information about the activity and/or outcome of a particular FDR/UPSTREAM operation.

In PART ONE, we also briefly mentioned that the FDR/UPSTREAM MVS component maintains an online *history log*. This log, which keeps a record of all operations performed by FDR/UPSTREAM, can be queried by a special batch reporting program called USTRPORT.

The ease-of-use of USTRPORT is illustrated by the following example job, which reports on FDR/UPSTREAM activity within the last 2 days:

```
//USTRPORT EXEC PGM=USTRPORT,REGION=4M
//SYSPRINT DD SYSOUT=*
//USTCATLG DD DISP=SHR,DSN=the.upstream.history.log.file
//SYSIN DD *

TITLE LINE='RECENT UPSTREAM ACTIVITY'
SELECT DAYS<3
PRINT RPTYPE=HISTORY
```

The report produced by the above job would look something like this:

| RECENT UPSTREAM ACTIVITY | | | | | | | | | | | | | | | | |
|--------------------------|-------------------|-------|----------|--------|-------|-----------|--------|----------|----------|--------|---------|---------|-------|-------|-------|--------|
| Profile / | Start Date/Time | Flags | CondCode | Elapse | CPU | Operation | No. of | No. of | Merged | Merged | Migrate | Tracks/ | | | | |
| | | | Sys | User | Mins. | Seconds | Luname | UserId | Name | Type | Files | Bytes | Files | Bytes | Files | #Tapes |
| SERVER1 | | | | | | | | | | | | | | | | |
| | 10/10/01 15:55:23 | 70 80 | | | 0 | 0.1 | 0.297 | LU3AS018 | BACKUP | | 0 | 0 | 0 | 0 | 0 | 2D |
| | 10/10/01 18:57:08 | 00 00 | | | 0 | 0.1 | 0.039 | LU3AS018 | INQUIREV | | 1 | 0 | 0 | 0 | 0 | 0 |
| | 11/10/01 15:57:48 | 70 80 | | | 0 | 0.6 | 0.635 | LU3AS018 | BACKUP | | 23 | 1,184K | 0 | 0 | 0 | 29D |
| | 11/10/01 20:58:34 | 00 00 | | | 0 | 0.1 | 0.037 | LU3AS018 | INQUIREV | | 1 | 0 | 0 | 0 | 0 | 0 |
| | 11/10/01 22:02:32 | 00 00 | | | 0 | 0.1 | 0.055 | LU3AS018 | INQUIREV | | 23 | 0 | 0 | 0 | 0 | 0 |
| SERVER2 | | | | | | | | | | | | | | | | |
| | 10/10/01 09:32:48 | 70 80 | | | 0 | 0.1 | 0.287 | LU4AS035 | BACKUP | | 2 | 593 | 0 | 0 | 0 | 2D |
| | 10/10/01 09:32:54 | 00 00 | | | 0 | 0.1 | 0.038 | LU4AS035 | INQUIREV | | 1 | 0 | 0 | 0 | 0 | 0 |

As you can see, several operations (backups and inquiries) have been run against SERVER1 and SERVER2 in the last 2 days. In the case of the backup that ran against SERVER1 on 11/10/01, we can see that 23 files were backed up. The backup ran for 0.6 minutes and used 0.635 of CPU time. The resultant MVS backup file required 29 tracks of MVS DASD space.

FDR/UPSTREAM

Aside from reporting on general backup/restore operations, USTRPORT can also be used to create reports detailing:

- The options set within the FDR/UPSTREAM configuration dataset.
- Information about the MVS backup datasets currently being held by FDR/UPSTREAM.
- Information about secondary copies of backups created by the USTVAULT utility.

Summary

FDR/UPSTREAM provides all the facilities required for fast and efficient backups of Open Systems data to the OS/390 host.

- The backup (and restore) processes can be fully automated. Generating reports, as well as event notification can also be automated.
- The FDR/UPSTREAM 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 use of high-speed connections, combined with incremental backup and merge process, allow for regular (i.e. *daily*) incremental backups of very large Open Systems servers and workstations allowing both Logical Volume restores and File-Level Restores.
- FDR/UPSTREAM 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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C O N C E P T S & F A C I L I T I E S G U I D E