The FDR/UPSTREAM Suite

- A single INNOVATION solution that leverages the unique strengths of IBM System z, zSeries, pSeries AIX, Windows, Novell, SUN SPARC and Intel x-86 servers to provide enterprise strength protection for databases and data on distributed storage.

- The FDR/UPSTREAM suite is a comprehensive business resiliency solution that provides data protection and business continuance for servers and databases every where in the enterprise.
The UPSTREAM Enterprise Suite

- FDR/UPSTREAM
- UPSTREAM/SOS
- FDR/UPSTREAM z/OS UNIX
- FDR/UPSTREAM Linux on System z
- UPSTREAM RESERVOIR
Choice of Storage Servers

- Reservoir
  - Windows
  - AIX
  - Linux (x86, Linux for pSeries & Linux on System z)
  - Solaris (Intel and SPARC)
- FDR/UPSTREAM
  - z/OS mainframe
  - Same client as the Reservoir
  - Tape compatible with the Reservoir
FDR/UPSTREAM Clients

- Windows XP
- Windows Vista
- Novell NetWare
- Novell OES2 Linux
- IBM AIX
- Sun Solaris
- Sun X86
- VMware

- HP-UX
- OS/2
- Tru64 UNIX
- X86 Linux
- Linux for pSeries
- Linux on System z
- z/OS UNIX
- Any storage system that can be NFS mounted can be backed up/restored
A z/OS server-based solution, for enterprise-wide, file level, backup/restore, archival, storage management and disaster recovery of distributed data.

Dual component system offering highly reliability and performance.

Employs existing z/OS tape management, scheduling, automation, and security systems

- TSO ISPF & JAVA GUI user interfaces
UPSTREAM Linux on System z

- SuSE and Red Hat Linux on System z in z/VM or LPAR
- A z/OS backup server-based solution
- Employs existing z/OS tape management, scheduling, automation, and security systems
  - Extensive database and file system support
  - Admin, User and z/OS Batch interfaces
  - De-duplication / data transfer reduction
  - Familiar z/OS operational procedures
  - Client support
  - Rescuer Bare-metal recovery
UPSTREAM Linux on System z

- Employs and supports HiperSockets
- On-Line Database Agents for Oracle, DB2, and Domino
- File System support
- Extensive file system features
  - Hard links, symbolic links, owners,
  - Reiser, ext2, ext3, GFS, XFS, NFS, MAPFS, GPFS, single file system support, etc
  - Support for user specified file systems
- Full-featured daemon
- UPSTREAM Rescuer
UPSTREAM System User Interfaces

JAVA GUI

TSO/ISPF

COMMAND ???
1 USTBATCH - Host Initiated Services
2 STATUS - Current Status Information
3 DEFINE - Define Control Files
4 CONFIGURE - Main Options
5 PROFILE - Client Profile Names
6 CPED - Operator Commands
7 REPORT - Report 1
8 REGISTRY - Near Registry
9 DUPLICATE - Duplicate File Audit
10 SCHEDULE - Command Scheduler
11 MANAGEMENT - Backup Management
12 FOCUSYI - FOCUSYI Options

USTID ??? UST - For multiple sets of UPSTREAM dialog profile variables ( UST PBD )
UPSTREAM Administration
Command / User Control

- JAVA GUI
  - Storage Manager Director
  - End-User Restore Interface
- TSO/ISPF
  - Interactive Control
  - Real Time Monitor
- Command Line/Character mode
- z/OS Batch
**z/OS BATCH Interface - USTBATCH**

- Initiate Backups, Restores, File Transfers, Run Functions, and *UPSTREAM commands*
- Can wait for process completion
- Can initiate multiple, concurrent operations
- Used as the interface to host based JOB scheduling systems (CA-7, OPCA, etc.)
UPSTREAM Data Management

- Individual client or global policy managed
- Backup data managed by existing external tape management systems (RMM, CA-1, etc.)
- Retention periods usually managed with GDGs with benefit that system maintains itself
- Can also use expiration dates
- Migrate Disk Backups to Tape
- Off-Site tape copy support - Vaulting
- Bi-Directional File Transfer
Scheduling Operations

Server Initiated

- z/OS with your EXISTING Job Scheduler such as CA7, Zeke, OPCA
  or
- UPSTREAM z/OS Integrated Scheduler

Client Initiated

- UPSTREAM Dispatcher Client Scheduler
  or
- Your EXISTING Client Scheduler
Data Reduction and De-duplication Technology Minimizes Data Transmission

Advanced Data Reduction Technology Operations Employ De-Dupe Technology to Reduce Backup Time

- Data Compression
- Logical Volume Full Merge Backup
- Logical File Granularity
- Incremental Backup Processing
- Duplicate File Recognition
- Segmented backup support
- Exclude/Include
- Auto Migrate inactive data
Operations can be performed from either the Director GUI or z/OS ISPF interfaces

- Backup/Restore/Inquiry
- Status Display
- File Transfers
- Run Remote Client Process
Full Merge Backup

“First Time Full”
Incremental #1
Incremental #2
Incremental #3
Incremental #4

“Full Merge” (Incremental and Directory Listing)

UPSTREAM Merge Process

New Merged Full Backup
Merge Backups—The Way To Go for Best Performance and Tape Utilization.

- A form of de-duplication:
  - Takes incremental and the prior full to provide a picture of the current client file system state now.
  - Creates real fulls without sending up all of the files.
- Improve backup performance
  - By not reading and transmitting all files for fulls or incremental.
- Maximize tape utilization
  - By piggybacking multiple backups onto a tape.
  - Avoid duplication of files between incremental and the full.
- Allows “highlighted back to full” and “highlighted back to oldest” inquires and restores.
  - Where incremental and fulls are combined into a full, up to date view of the system.
Rule #1 for Merge Backups

- Always use the same backup profile for the same data (typically a file server or database).
  - Don’t mix server data on the same profile.
- The merge requires that the same profile always relate to the same files.
  - For example: Profile PAT is my machine. Never mix my databases or BOB’s files with my profile.
Types of Merge Backups

- **First-time full**
  - A traditional full backup – read and write every file.
  - Use for the first backup of a server/instance.
    - Restartable throughout the backup process.
    - Support for DASD, Virtual or real tape.
    - If to tape, uses only one drive.
Types of Merge Backups

- Incremental Merge
  - Simply an incremental (changed file) backup.
  - Managed by the storage server in the same way as a non-merge backup.
  - Fully Restartable.
  - Support for DASD, Virtual or real tape.
  - If to tape, uses only one drive.
Types of Merge Backups

- **Full Merge**
  - Only transmits the changed files as an incremental plus a “picture of the disk”.
  - Server matches files backed up in prior backups by date, time and size.
  - The client sends any mismatched files.
  - Result: A tape or disk file with all of the files equivalent to a first-time full without all of the data movement from client to server.
  - De-duplicated: a file is only read and transmitted when it has changed. It may appear on multiple backups, but only read by the file server once for each change.
Merge Backups to Disk

- Each backup (full or incremental) is a single new disk file on the storage server.
- z/OS:
  - Can be either a flat file or a GDG.
  - Cleanup of expired backups is by catalog control/GDG or retention period management.
- Reservoir:
  - Cleanup of expired backups is by Reservoir profile policy.
    - Number of backups, number of fulls, expiration date, number of tape sets (backups).
  - If there is not enough space in the primary directory you can setup the profile definition to point to an alternate directory (spare tank).
Merge Backups to Tape

- Each backup can start a new tape OR
- The first incremental after a full starts a new tape and incrementals up to and including the full are appended to the tape.
  - Maximizes tape utilization
    - Multiple backups on a tape
    - Files on the incremental which are on the full are not recopied
    - (Reservoir) Profile sets allow multiple profiles on a single tape
Backup Types and Methods
Continued...

- Combinations
  - All tape–Incremental and full backups to tape
  - Fulls on tape, incrementals on DASD
  - Deferred backups to DASD, merged to tape.

- DASD Migration issues
  - Available space
  - Tape unit availability
  - Increase system throughput via concurrent operations
The original de-duplication technology
Duplicate File Support

Full, Incremental & Merge Backup

SystemA File 1
SystemB File 1
SystemC File 1
SystemD File 1
Duplicate File Support

- Database on storage server that contains files which are duplicates
- Client path name is not used
  - File name
  - Modification date
  - Size
- Preliminary host setup required
Segmented File Support
Block Level De-Duplication

- Based on the assumption that large files are usually updated in place or data is added at the end of the file, a new technology can aid in backup. As only relatively small portion(s) of the file change between backups, we can transmit only those changed segments… thereby introducing “file segmentation”.

- Segmented file support, a form of block level de-duplication, helps reduce and manage growing amount of data to be backed up and stored.

- Normal Setup per backup job
  - Define the minimum file size to invoke segmented file checking
    - default is 1GB
  - Define the segments size for UPSTREAM to break file into pieces
    - default is 1MB
Segmented File Support
Data De-dup

- During backup UPSTREAM will cut the file into pieces of the specified size (segment size), and back them up as separate files.
- The “Signature” of every backed up segment is kept in a “Digest” on the client system.
- During subsequent incremental backups the signature for every segment read is compared with the stored ones, and UPSTREAM backs up only segments with a changed signature.
- During full merge backups unchanged segments from prior fulls are combined with the incremental segments, and the most current full set of segments gets copied to create the new file on the full backup.
- The result can be a dramatic Reduction in the amount of data sent and stored.
UPSTREAM Recovery Tools

UPSTREAM Rescuer

- Fast reliable data files and system databases restore
  - Linux on System z – SUN - X86 Linux- AIX
- NDS
- Active Directory
- System State
- Windows XP Automated System Recovery
Off-Site Vaulting

Powerful utility for offsite tapes

- Creates secondary tape copy for DR to be stored in an offsite vault
- For on-site recovery if primary backups are damaged or unusable
- Can also be used for backups requiring long-term retention
Business Continuance and Data Protection Software

FDR/UPSTREAM

and

UPSTREAM Reservoir

Data Protection & Business Continuance for Business Resiliency for Enterprise Storage
Enterprise Data Protection

FDRERASE for z/OS and FDRERASE/OPEN

Protect Sensitive Data
Prevent Identity Theft
Meet Regulatory Requirements
FDRERASE for z/OS and FDRERASE/OPEN deny access to disk data leaving your control…

Protect Sensitive Data
Prevent Identity Theft

• Meet Regulatory Requirements
   By removing your data from disks...
   • When decommissioning or selling disks
   • When leaving a disaster site
   • When reusing disks within your organization

• **FDRERASE z/OS erases CKD-format disks from a z/OS system.**
  • Fast, secure erase of z/OS disks
    • Runs under z/OS
    • Erases mainframe disks

• **FDRERASE/OPEN supports erasure: Fibre, SCSI, ATA, IDE Disks, SAS, USB and hard drives on laptops.**
  • Fast, secure erase of open system disks
  • Runs on Intel and compatible systems Runs under Sun Solaris x86
  (provided by INNOVATION) Erases open system disks
FDRERASE …
Compliant, Secure and Fast Data Erasure

- National Security, Personal Privacy Protection Legislation and Privileged Corporate Financial Information are just a few of the obligations to consider when disposing & repurposing disk.
- FDRERASE (for z/OS and /OPEN), is the only US Government EAL2++ Certified Data Protection Solution for erasing mainframe and open systems disk storage is also the most efficient solution…available today to meet data security obligations when disposing & repurposing disk.
- …a fast, easy to use, Sensitive Data Protection Solution for erasing mainframe and open system disk that complies with all US DOD and Australian DSD directives, US Federal, State and international government guidelines for personal identity protection i.e. FISMA, GLBA, HIPAA, SOX and the European Data Protection Directive as well as commercial governance standards like PCIDSS.
- Compliant: FDRERASE complies with current US government, Department of Defense (DoD) and international guidelines for erasing computer disks prior to disposal or reuse.
- Secure: FDRERASE provides advancing levels of security with all erase techniques making data unreadable to conventional z/OS disk access.
- Fast: FDRERASE erases data and allows users to balance the level of security they want for specific data against the time it takes to erase that data.
SECURE: All levels of FDRERASE for z/OS erasure...make data unreadable

- FDRERASE for z/OS provides advancing levels of secure data erasure allowing you to strike a balance between the sensitivity (need for security) and the cost of security (elapsed time); as well as a verify to confirm an erasure.
  - ERASE
  - SECUREERASE
  - VERIFY (Confirm Erase)

- All FDRERASE erase levels make data unreadable to conventional z/OS (MVS and z/OS) disk access.
SECURE: All levels of FDRERASE for z/OS erasure...make data unreadable

- **ERASE**
  - Overwrites tracks with binary zeros
    - Or user specified pattern
  - Meets NIST guideline for “clearing” all but the most sensitive or highly classified data
  - Appropriate when selling off or scrapping disks and leaving an unsecured D/R site
- **SECUREERASE**
  - The most secure level of data erasure
  - Overwrites tracks *multiple times*
    - Randomly generates patterns
    - Minimum of three erase passes
    - Uses alternating complements of previous pass pattern
  - Meets NIST guideline for “purging” your *most sensitive* data
- **VERIFY**
  - Many standards require independent confirmation of an erasure by a second user
    - VERIFY enables a user to confirm that the physical tracks of a z/OS DASD volume have indeed been overwritten sufficiently that no residual information remains.
    - Samples a percentage of a volume by default, but can verify an entire volume if needed.
FDRERASE for z/OS runs at hardware speed
Minimizing Contention for the Best Possible Performance

- FDRERASE for z/OS can concurrently erase up to 64 disks

FDRERASE for z/OS automatically selects logical volumes from different physical disk raid ranks to minimize contention and sustain the best possible performance.
EASY to USE:

- FDRERASE for z/OS set up is very simple:

  ```plaintext
  //FDRERASE EXEC PGM=FDRERASE,REGION=0M
  //STEPLIB DD DISP=SHR,DSN=fdrerase.loadlib
  //SYSPRINT DD SYSOUT=*  
  //FDRSUMM DD SYSOUT=* 
  //SYSIN DD *  
  ERASE TYPE=FULL 
  MOUNT ERASEUNIT=(07C*,07D*,07E*,07F*)
  ```

Note:
1. The unit address has to be offline.
2. Only use one mount command for all volumes per physical storage frame.
3. ERASE overwrites each track once with binary zeros.
Simple JCL

- This job does a SECUREERASE on 6 specific disks:

```plaintext
//FDRERASE EXEC PGM=FDRERASE,REGION=0M
//STEPLIB DD DISP=SHR,DSN=fdrerase.loadlib
//SYSPRINT DD SYSOUT=*  
//FDRSUMM DD SYSOUT=*  
//SYSIN DD *
SECUREERASE TYPE=FULL
  MOUNT ERASEUNIT=(07C5,07D2,07D3,07DA,07E5,07F4)
```

- This job does a SECUREERASE on 6 specific disks. SECUREERASE overwrites each track 3 times with randomly generated values. The first pass is randomly generated, the second pass is the complement of the first pass, and the third pass is again randomly generated.
This output from a SECUREERASE shows the 3 passes on the disk and the data pattern used in each pass.

The messages about “hardening” show that FDRERASE ensures that the data is actually written to the disk (is not just in cache) before continuing with the next pass.
### Device Summary Output

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDR122</td>
<td>Operation Statistics for 3390 Volume</td>
<td>21C3</td>
</tr>
<tr>
<td>FDR122</td>
<td>Cylinders on Volume</td>
<td>3,339</td>
</tr>
<tr>
<td>FDR122</td>
<td>Datasets Processed</td>
<td>0</td>
</tr>
<tr>
<td>FDR122</td>
<td>Bytes Read from DASD</td>
<td>0</td>
</tr>
<tr>
<td>FDR122</td>
<td>DASD Tracks Erased</td>
<td>150,255</td>
</tr>
<tr>
<td>FDR122</td>
<td>Number of Erase Passes</td>
<td>3</td>
</tr>
<tr>
<td>FDR122</td>
<td>DASD EXCPS</td>
<td>10,038</td>
</tr>
<tr>
<td>FDR122</td>
<td>Target DASD EXCPS</td>
<td>0</td>
</tr>
<tr>
<td>FDR122</td>
<td>CPU Time (Seconds)</td>
<td>3.635</td>
</tr>
<tr>
<td>FDR122</td>
<td>Elapsed Time (Minutes)</td>
<td>3.1</td>
</tr>
<tr>
<td>FDR122</td>
<td>Erase Time</td>
<td>3.1</td>
</tr>
<tr>
<td>FDR999</td>
<td>FDR Successfully Completed</td>
<td></td>
</tr>
</tbody>
</table>

- Each FDRERASE output ends with this summary of the device and the operation run on it.

- Note that although this is a 3390-3 which contains 50,085 tracks, the “DASD TRACKS ERASED” shows 3 times that, because SECUREERASE did 3 passes on each track.
FDRERASE/OPEN Architecture

(1) FDRERASE/OPEN Application
(2) Solaris 10 X-86 OS
(3) Write Once CD-ROM Compact Disc
(4) USB Flash drive
(5) FDRERASE/OPEN Key

(5) FDRERASE/OPEN supports erasure:
Fibre, SCSI, ATA, IDE Disks, SAS, USB sticks
and hard drives on laptops.
FDRERASE/OPEN “Key”

- The FDRERASE/OPEN product CD image, for security purposes, is customized to the serial number of an associated key…called the “FDRERASE/OPEN key”.
  - FDRERASE/OPEN requires both the CD and the USB key to run.
  - The USB key is also used to store parameters and history information.

- Innovation will provide the USB key or you can use your own by providing its serial number when ordering.
FDRERASE/OPEN...
Main Operation Window
FDRERASE/OPEN...
Options Dialog
FDRERASE/OPEN...
OPERATION Confirmations to Proceed

The following disk(s) are already erased and will be skipped:

- c3t50050763030B0447d2p0
- c3t50050763030B0447d6p0
- c3t50050763030B0447d10p0
- c3t50050763030B0447d14p0
- c3t50050763030B0447d18p0

You can erase any disks that have already been erased by enabling the settings under Options.

All data will be lost on the following disk(s):

- c3t50050763030B0447d2p0
- c3t50050763030B0447d6p0
- c3t50050763030B0447d10p0
- c3t50050763030B0447d14p0
- c3t50050763030B0447d18p0

Click OK to Erase
FDRERA/OPEN...

OPERATION Confirmations to Proceed
FDRERASE/OPEN...
OPERATION Completion
### Cumulative History File Report

<table>
<thead>
<tr>
<th>Device Address</th>
<th>Storage System Make Model and Serial Number</th>
<th>Elapse Time</th>
<th>MB/Sec Function</th>
<th>Completion on Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:37:55 15:22:46</td>
<td>IBM 2107900 75764211120</td>
<td>00:15:08 36 Erase</td>
<td>Ended</td>
<td></td>
</tr>
<tr>
<td>15:39:31 15:38:52</td>
<td>EMC SYMMETRIX 8924A000a</td>
<td>00:00:38 56 Erase</td>
<td>Canceled</td>
<td></td>
</tr>
<tr>
<td>15:40:40 15:39:57</td>
<td>EMC SYMMETRIX 8924A000a</td>
<td>00:00:43 50 Erase</td>
<td>Canceled</td>
<td></td>
</tr>
<tr>
<td>15:44:43 15:43:06</td>
<td>IBM 2107900 75764211122</td>
<td>00:15:09 36 Erase</td>
<td>Ended</td>
<td></td>
</tr>
<tr>
<td>15:45:01 15:43:06</td>
<td>IBM 2107900 75764211112</td>
<td>00:15:09 36 Erase</td>
<td>Ended</td>
<td></td>
</tr>
<tr>
<td>15:45:01 15:43:06</td>
<td>IBM 2107900 75764211112</td>
<td>00:15:09 36 Erase</td>
<td>Ended</td>
<td></td>
</tr>
<tr>
<td>15:45:07 15:43:06</td>
<td>IBM 2107900 75764211112</td>
<td>00:15:09 36 Erase</td>
<td>Ended</td>
<td></td>
</tr>
<tr>
<td>15:46:03 15:46:03</td>
<td>IBM 2107900 75764211112</td>
<td>00:15:09 36 Erase</td>
<td>Ended</td>
<td></td>
</tr>
<tr>
<td>15:53:16 15:53:13</td>
<td>HITACHI OPEN-3-CVS 045159DE038E</td>
<td>00:00:02 114 Erase</td>
<td>Ended</td>
<td></td>
</tr>
<tr>
<td>15:53:37 15:53:37</td>
<td>HITACHI OPEN-3-CVS 045159DE038E</td>
<td>00:00:02 114 Erase</td>
<td>Ended</td>
<td></td>
</tr>
<tr>
<td>15:54:29 15:54:29</td>
<td>HITACHI OPEN-3-CVS 045159DE038E</td>
<td>00:00:02 114 Erase</td>
<td>Ended</td>
<td></td>
</tr>
<tr>
<td>15:56:14 15:56:05</td>
<td>HITACHI OPEN-3-CVS 045159DE038E</td>
<td>00:00:02 114 Erase</td>
<td>Ended</td>
<td></td>
</tr>
</tbody>
</table>
INNOVATION Solutions… Enterprise Data Protection
Business Continuity and Storage Resource Management
Improve Business Resiliency