Enterprise Data Protection Considerations…
Consolidation, De-duplication and Migration of Tape Data Files

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August 10, 2011
Session Number 9339
Executive Solution

Everyone is moving to the Cloud…
Mainframe customers…

- Are moving to the cloud with Linux on Z and z114/z196 zEnterprise Hybrid Computing

Now is the time to slip past conventional constraints…

- Technology is available that can provide non-disruptive z/OS and Enterprise Distributed Data Protection, that scales capacity and performance for “Big Data”.
  - Direct z/OS FICON access to Distributed Data, High-Capacity Disk and Tape Storage Devices, Storage Virtualization, Hardware Replication and VTL appliances with De-duplication
What is the Cloud…
What does the Cloud bring with it?

- Cloud Computing is…
an effort to make distributed computing more like a
mainframe or put Public/Private Clouds on the mainframe.
- What challenges does it bring with it?
  - Economic Challenges
  - Multi-Platform Consolidation
  - Physical Storage Consolidation
  - …too much data & it’s difficult to adequately protect
- What does it need…a new way to provide…
  Multi-Platform Disaster Recovery & Distributed
  Data Protection.
Multi-Responsibilities

• Economic Challenge
  • Optimize Declining IT Budgets
  • Support Evolving Business Process
  • Safeguard the Data

• Multi-Platform Consolidation
  • Consolidate Platforms with Virtualization

• Physical Storage Consolidation
  • Larger Disk and Tape Volumes
  • Storage Virtualization
    • Hardware Replication
    • Virtual Tape Solutions
    • De-duplication
Multi-Platform Consolidation to System z/zEnterprise using Hybrid computing and mainframe infrastructure

z114 and z196 Ensemble with zBX

Linux on Z…UNIX on Z
z/OS Hypersockets…
AIX on Power…Linux on IBM X Series
Intra-ensemble Data Network (IEDN)…

All INNOVATION products support zEnterprise Systems

IBM Claims…14 New Z accounts: in 1Q 2011
50+ zBX units shipped; 300+ blades shipped as of 1Q
Mainframe Resources for z/OS & Distributed Data Protection

Using System z Backup Storage

- New High-Capacity Tape
  IBM TS1140 (4TB/295MBS) and ORACLE/STK T10K (5TB/240MBS).
- Physical Tape Library IBM TS3500 or ORACLE/STK SL8500.
- Virtual Tape Library IBM TS7700, ORACLE/STK VSM or EMC DLm.
- De-duplication Technology IBM TS7680 ProtecTIER or EMC DD890.
- EMC VMAX, HDS VSP, and IBM DS8800 disk.

Under the control of z/OS

- Auto-ops scheduling (CA-Scheduler, IBM TWS/OPC…)
- Tape management (CA1, RMM, TLMS…)
- Data access security (RACF, ACF2, Top Secret…)

[Image and logo]
INNOVATION is working closely with…
Enterprise Data Protection
CONSIDER…there are problems

• Consolidating to Linux on Z puts more data on the mainframe
  • …so you need a good solution to protect it
• Enterprise backup congests communication networks
  • …so take it off the communications network
• Backup takes too long
  • …so you need to reduce the disruption of backup
• There is too much data and it’s difficult to migrate to a VTS
  • …so you need to reduce amount of backup data storage
  • …so you need an easy to use tape to VTS migration tool

But there are solutions
Centralized Enterprise Data Protection using Mainframe Infrastructure Strengths

Enterprise Data Protection Solution Benefits

• z/OS controls backup data from OS server to z/OS tape
• Virtualization solves backup window problems
• Efficient tape drive and tape media utilization
• Centralizes scheduling, tracking and auditing
• Meet Disaster Recovery Restore Time Objectives

FDR/UPSTREAM, FDRSOS and FDR/UPSTREAM/SOS are examples of Centralized Enterprise Data Protection...
Volume Level Business Recovery Protection
File Level Enterprise Data Protection

FDRSOS and FDR/UPSTREAM – are examples

- Business Recovery and Enterprise File Level Data Protection for Linux on System z, AIX, Linux, UNIX and Windows storage
- Employing z/OS existing Tape Management, Security and Scheduling
- Command data, meta data and backup data can all travel on a TCP/IP connection or a FICON Channel connection
- On-line data base support for DB2/UDB, ORACLE, LOTUS Notes, SQL Server, MS Exchange, etc.
  - Virtualizes full volume backup with “Deferred Full Merge”
  - Provides “Outboard Data De-duplication”...
    Duplicate File Reduction, Duplicate Segment Reduction
Conventional Disk Storage Architectures

**Distributed System Disk Storage**
- **Open System Storage**
  - Storage System Logical Device (i.e. Open System Physical Disk)
  - Open System Disk
  - Volume Groups

**z/OS Disk Storage**
- **z/OS System View**
  - DS8000 / VMAX Logical Device (i.e. System z Physical Disk)
  - CKD DASD volume addressed by an z/OS UCB

**IBM zDDB and EMC zSOS Multiplatform Disk Storage Architecture**
- **Open View**
- **DS8000 / VMAX View**
- **z/OS View**
  - Same DS8000 / VMAX Logical Device has two addresses
  - addressed by a FCP address
  - addressed by an z/OS UCB
IBM z/DDB and EMC zSOS
Multi-platform Access...Benefits

- Backup and recover large amounts of open systems data in less time with no negative impact on corporate networks.
- Production is not constrained by a shrinking backup window.
- Maximize uptime by avoiding costly customized integration.
- Protect your current mainframe hardware and software investments by using existing mainframe resources to protect Linux on Z and distributed enterprise storage.
- Extend mainframe security and automated operations to non-disruptive distributed data protection.
How FDRSOS® Works…Off-Network Business Recovery/Resiliency Solution

Data Travels Off Network
FDR/UPSTREAM®…
Enterprise Distributed Data Backup

Backup Data travels on the Corporate Network

Note:
2 to 5 days of incremental backups on disk

Note:
Weekly full volume merge backup on tape
UPSTREAM for Linux on System z®
Off-network File Level Backup with Virtual Hipersockets

Enterprise Storage
with Linux on System z
FBA DATA

System z10 BC

TCP/IP Hipersockets

FDR/UPSTREAM for Linux on System z
Off-network Hipersockets

Commands and Data

FICON SAN

FICON

FICON

Data Travels Off Network
Backup Data travels on the Intraensemble Data Network (IEDN)
FDR/UPSTREAM/SOS® – Off-Network File Level Enterprise Data Protection

- IBM z/DDB and EMC zSOS Multi-Platform access extends FDR/UPSTREAM file level protection.
- Off-Network File Level Enterprise Data Protection for AIX, Linux, UNIX, Windows and Linux on System z.
- Control data travels on the TCP/IP connection.
- All backup data travels on FICON channels. Extends UPSTREAM File Transfer Facility with off-network capability.

FDR/UPSTREAM/SOS Data Flow, File Incremental Backups
FDR/UPSTREAM/SOS® Off-Network File Level Enterprise Data Protection

Data Travels Off Network
Consider…

z/OS and Enterprise Business Continuance

- Backups are taking longer and longer.
- Larger disk volumes handle growth but require more time.
- Non-disruptive backup requires special DR procedures.
- Platform unique solutions make for costly integration.
- Business resiliency requires “rapid restore”.
- You need to reduce amount of backup data to store.

THESE ARE PAIN POINTS!
Consider...Virtualizing Backup with Data Replication for an Instant Point-in-Time copy

- No more problems meeting your backup window!
  - Take backups and copy data sets without long interruptions
  - Minimize CICS and WebSphere disruptions
  - Eliminate unacceptable recovery time
- Complications...create complexity
  - Hardware replication produces exact duplicates
  - z/OS is not tolerant of online duplicates
    - Recovery Procedures require special renaming or “Conditioning”
  - There are multiple replication technologies from different vendors
Ways to Reduce Complexity… of non-disruptive z/OS backup

Make something…
- Simple…provide a common interface
- Flexible…offer Volume and Data Set (Extent) granularity
- Fast…let hardware do a quick copy to offline volumes or online data sets
- Non-Disruptive…Backup the offline target
- Reliable…Allocation, Catalog, Space Management all under program control

FDRINSTANT is a software solution that does these things…
All FDR Products Support…
All z/OS Storage Virtualization features

- IBM DS8700 / DS8800
  - FlashCopy, Space Efficient FlashCopy, Incremental FlashCopy, FRR (Fast Recovery Restore)
- EMC VMAX
  - TimeFinder CLONE/SNAP
  - Compatible Native FlashCopy (CN/FC)
  - TimeFinder SNAP to virtual volumes
- HDS USP-V
  - ShadowImage
  - FlashCopy
“Persistent / On Demand” FV replication (fully provisioned target volumes)

Split a persistent “mirror “relationship to create a (FV) PIT copy.
- EMC TF/Mirror – Hitachi ShadowImage – IBM Persistent FC
Dynamically create a full volume PIT copy on demand.
- EMC TF/Clone – EMC/HDS/IBM FlashCopy – ShadowImage – Quick Split
Enhancements for Faster Full Volume Replication

FDR, ABR full volume and ABR incremental backup enhancements

- Creates an On-demand relationship in advance
  - TimeFinder/Clone (Full Volume operations) – Pre Snap, Activate, Post Snap
  - IBM Persistent FC (FV) – Supports FRR Restore

Diagram:
- z9 Host
- Disk Storage System
  - (z/OS) "Source"
  - (Offline) Standard Volume
- Online z/OS I/O
- Offline z/OS I/O
- On Demand Replication in advance to any standard volume
- Differential, Pre-SNAP, Quick Split, Persistent FC
Enhancements for Faster Consistent Multi-volume Replication…

ABRInstant…
Creates multiple disk copies at a single point-in-time in parallel.

- Multiple volume point-in-time full volume replication – Consistent FlashCopy, Consistent ShadowImage, TF/Mirror CONSPLIT and TF/Clone CONSNA
- Full-volume and incremental backup from offline “Consistent” (PIT) copies.
Thin Provisioning

Using Less Capacity Means

Fewer Drives, Less Power, More GREEN

Puts any standard volume into a “copy on first write” (COFW) relationship with a “space efficient” virtual device backed by a pool of physical volumes, i.e. only copies data tracks that are updated.

- IBM Space Efficient FlashCopy [FC/SE] (FV)
- EMC TF/SNAP (FV)
Considerations for Virtualized Storage (Full vs Thin Provisioning)

**Full Provisioning (Traditional)**

**Usage Suggestions**

- When a full physical copy of data on disk is needed (for example to protect against hardware failures)
- Longer-term copies – FlashCopy/SNAP to be retained for more than 24 hours, as a backup or archive
- Copies of data with heavy update activity >20%
- Whenever performance is more important than economy

**Thin Provisioning (Virtualized Storage)**

**Usage Suggestions**

- When a backup on tape or a full remote copy is available as the primary means of data protection
- Short-term copies – FlashCopy/SNAP to be kept for less than 24 hours for consistency testing or Data Mining
- Copies of data with light update activity <20%
- When a choice based on economy will not put the business at risk
“On Demand” Data Set Replication

Creates a data set (extent level) copy dynamically on demand. Copying or moving multiple data sets in parallel.

- EMC TF/Clone Data Set Snap Operations (DS)
- EMC/HDS/IBM FlashCopy (DS)
Virtualize FDRINSTANT Data Set Operations for Performance

• Objective
  • Improve the performance of four jobs that run concurrently to copy ~350 data sets, >111 million tracks.

• Solution
  • Employ FDRINSTANT Copy using parallel sub-tasks to perform 20 concurrent copy operations. (MAXTASKS=5).

• Results
  • Copy complete in <8 min (the longest of four concurrent jobs.)
FDRMOVE using hardware replication consolidates…
25,000 DB2 Files to New Large Volumes in <8 minutes

- **Objective**
  - Consolidate 25,000 DB2 files to new larger volumes
- **Task**
  - Allocate ~ Catalog ~ Delete ~ 25,602 DB2 files
  - Copy (~ 1.4 million tracks)
- **Challenge**
  - Relocate the DB2 files with minimal impact
- **Solution**
  - Employ FDRMOVE with FDRINSTANT technology
- **Results**
  - Less than 8 minutes to consolidate 25,602 DB2 files to new larger volumes. FDRMOVE relocating data sets at the rate of 3,200/minute (i.e. moving data at about 150 MB/sec)
Benefits...with FDRINSTANT
Virtualizing Backup, Copy and Move...

• Maximum uptime avoiding costly customized integration projects
  • Proven technology that requires no changes for disaster recovery
• Freedom from the constrains of a constantly shrinking backup window
  • Non-disruptive backup solution for very large amounts of data
  • No negative impact on production schedules
  • Supports continuous business operation for Systems z mainframe data
• Protection for the investment in existing Systems z mainframe resources
  • Tape library management software, tape silos, VTL, tape drives and staff
  • Extend z/OS security to non-disruptive mainframe data protection
  • Extend z/OS auto-ops to non-disruptive mainframe data protection
Storage Resource Optimization
De-duplication is a natural complement to z/OS mainframe and Multi-Platform z/OS Distributed Data protection…

- Media generating headlines vs. analysts setting expectations
- z/OS backup already offers sophisticated data reduction…
  - Incremental Backup – Merge Backup – Last Tape Stacking
- De-duplication works…and dedupe appliances do more…
FDR, FDRABR, FDRSOS, UPSTREAM and RESERVOIR…all benefit.

- INNOVATION is working with EMC/Bus-Tech/Data Domain, IBM & Luminex to insure you the best results…
- Customers report…“Adding a de-duplication backstore to a mainframe VTL Solution is a no brainer”.
Efficiency Testing...
Shadow z/OS and Distributed Data Backup

50 z/OS volumes w/130GB (3390-1, 3, 9 and 27)
- z/OS IPL packs, System & ISV executables, JCL, Source, Listings, sysdump, FTP server, application work, DB2 systems & databases, BookManager and product softcopy manuals.
- ABR daily incr (7% changing) & weekly fulls.

50 distributed servers w/2 TB of data
- Windows Servers, Solaris on x86, SuSE, & RedHat Linux on x86 and on System z.
- UPSTREAM daily incr (4% changing) & a weekly full merge backup.
De-duplication by itself...
Leveraging compression...

further reduces
UPSTREAM backstore to...10.5 to 1

further reduces
FDR backstore to...25 to 1
Understanding Reduction Ratio and % Saved...

- 10 to 1 data reduction is a backstore savings of 90%
- Greater than 10 to 1 can be only be a bit more...
- How much is a 20 to 1 reduction?

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<th>Ratio to 1</th>
<th>Saved</th>
<th>Stored</th>
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<td>98%</td>
<td>2%</td>
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<td>25</td>
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<td>4%</td>
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<tr>
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<tr>
<td>12</td>
<td>92%</td>
<td>8%</td>
</tr>
<tr>
<td>10</td>
<td>90%</td>
<td>10%</td>
</tr>
</tbody>
</table>
How much can de-duplication reduce the …UPSTREAM backstore?

UPSTREAM
% of Original Space Requirement Used

Use as little as 10% of the amount of storage they now need to store the same amount of UPSTREAM backup data in its conventional form

Reducing UPSTREAM backstore 90%
How much can de-duplication reduce the …FDR backstore?

Use as little as 4% or 5% of the amount of storage they now need to store the same amount of ABR backup data in its conventional form.
What does 20 to 1 mean in practical terms?

Results will vary but the addition of a de-duplication backstore to a mainframe Virtual Tape Solution is for certain a “no brainer”…
How do you automate consolidating physical and virtual tape system?

Bring balance to tape conversion and stacking with...FATSCOPY™ FATS/ERASE...

The ONLY Tape Migration and Stacking Tools you will ever need!
Summary

- INNOVATION Data Processing leverages the latest technological innovations to virtualize, simplify and green all of its enterprise business resiliency solutions...

- INNOVATION Data Processing is a single source for enterprise business resiliency solutions addressing z/OS, Linux on System z, Linux on Power, Linux on x86, Novell NetWare/OES2, UNIX, Windows, Client/Server, SAN and direct attach storage providing:
  - High-Performance Data Protection
  - Enterprise Data Protection
  - Non-disruptive Business Continuance
  - Storage Resource Optimization
  - Privacy Information Protection
Storage “Virtualization” makes for a…
“Smarter…Planet…Business and…Data Center

Take away…
Mainframe Linux and z/OS users…Seize the opportunity
- Shake off the conventional data protection constraints
- Meet Consolidation, Virtualization, and Cloud objectives
- Choose INNOVATION business resiliency solutions
- In conjunction with z platform advances, distributed enterprise storage cross-platform access, hardware replication and high capacity mainframe VTL deduplication.