Achieving Continuous Availability for Mainframe Tape with Synchronous Tape Matrix

SHARE Pittsburgh 2014
Luminex Lunch & Learn

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Discussion Topics

- Innovations in mainframe tape
- What have these innovations affected?
- The next evolutionary steps
- Use cases
  - Customer experience
  - Example configurations
- What’s the next innovation?
Innovations in Mainframe Tape

- Physical tape
  - Better recording technologies (3480, 3490, 3590)
- Robotics (automated tape loading)
  - Dual robotic arms
  - Higher slot counts
- Virtual tape (disk cache with physical tape back store)
  - Replication of disk cache
- Encryption
- Tapeless (no physical tape)
  - Deduplication
  - GRID
  - Synchronous replication
  - Cloud storage
### What Have These Innovations Affected?

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Synchronous Tape Matrix (STM)

- Continuous Availability
  - Resilient architecture instantly and automatically adjusts to multiple failures without interruption
  - Data is always available for I/O
  - No downtime from failover or restore processes
- No idle components to buy
  - All components contribute to day-to-day operations, not just during failure events
- Easy to implement
  - No host scripts or policies required
- Scalable
  - No limitations for throughput, capacity or degrees of redundancy
- Modular design ensures investment protection
- Supports dissimilar storage systems and compression/deduplication technologies
Simplified STM Configuration with $n$-Sites

<table>
<thead>
<tr>
<th>Layer</th>
<th>Site 1</th>
<th>Site 2</th>
<th>Site $n$</th>
</tr>
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<td>Compute Layer</td>
<td><img src="image" alt="Server" /></td>
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<tr>
<td>Connectivity Layer</td>
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<tr>
<td>Control Unit Layer</td>
<td><img src="image" alt="Controller" /></td>
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<tr>
<td>Virtual Tape Storage Layer</td>
<td><img src="image" alt="Tape Drive" /></td>
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Operational STM Configuration with Multiple Failures Across Layers and Sites

- **Site 1**
  - Compute Layer
  - Connectivity Layer
  - Control Unit Layer
  - Virtual Tape Storage Layer

- **Site 2**
  - Compute Layer
  - Connectivity Layer
  - Control Unit Layer
  - Virtual Tape Storage Layer

- **Site n**
  - Compute Layer
  - Connectivity Layer
  - Control Unit Layer
  - Virtual Tape Storage Layer

Symbols: 
- Red X: Failure
- Black Line: Connection
Customer Experience:
Major U.S. Healthcare Provider

Andrew Graham
Production Control Manager
Initial Mainframe Environment

Production Site

Mainframe

STK Virtual Tape

STK (Oracle) Tape Silo

For VTS Back Store

Tape Silo

Shipping Tape Media

Disaster Recovery Site

Mainframe

9840 Tape Drives

2 Pallets

Shipping Tape Media

Offsite Storage

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Goals And Objectives for Initial Mainframe Environment

- Address physical tape capacity limitations
- Improve performance
- Achieve uninterrupted service
- Completely tapeless environment
- Maintain “Belt and Suspenders” approach (3 copies of data)
Intermediate Mainframe Environment

Production Site
- Mainframe
- Luminex Channel Gateways
- Deduplication Storage (local replication copy)
- Local Replication

Disaster Recovery Site
- Mainframe
- Luminex Channel Gateways
- Remote Replication
- Remote Replication
- Deduplication Storage (remote replication copy)
Intermediate Benefits and Achievements

- Eliminated physical tape
  - No longer shipping 2 pallets of tapes
  - Eliminated offsite storage of tapes
- All tape data available at DR site, not just a subset of critical data
- Expanded capacity
- Improved performance (initially)
  - 5x reduction in time to restore DASD farm at DR site
  - 20 hours down to 4 hours (1000 volumes)
  - Significant improvement in production run times
Goals And Objectives for Intermediate Mainframe Environment

- Address virtual tape capacity limitations
  - Tape data continued to grow
- Improve performance
  - Deduplication system “read” performance degraded over time
- Local replication still required an outage in the event of a disaster
  - Manually taking storage offline and putting copy online
- Manually managing 3 copies of data
- Managing multiple replication streams was a challenge with existing deduplication storage systems
Current Mainframe Environment

Production Site

- Mainframe
- Luminex CGXs in STM Configuration
- Mirrored Virtual Tape Writes with Continuous Availability
- HDS HUS Storage

Disaster Recovery Site

- Mainframe
- Luminex CGXs
- Mirrored Virtual Tape Writes with Continuous Availability
- HDS HUS Storage

Luminex Replication with Monitoring

End-to-End Encryption

WAN
Current Benefits and Achievements

- Automatic management of multiple replication paths and copies
- Increased overall capacity
- Improved security by implementing CGSafe encryption
- Simplified DR testing with Push Button DR
- GUI-based monitoring of replication queues (RepMon)
- Improved performance (again)
  - 8-9x reduction in time for DASD restore over physical tape
  - Nearly 2x reduction over deduplicated virtual tape
  - Improved mainframe I/O performance and workload management
- Continuous availability for local data (STM)
- Potential storage outages can be automatically managed
Use Cases
STM Configuration Examples
Active-DR Host, Active-Active Local Storage with DR

Production Site
- Production Mainframe
- Local Mirrored Storage

DR Site
- DR Mainframe (optional)
- Virtual Tape

Asynchronous Replication
WAN
STM Configuration Examples
Active-Standby Host, Active-Active Storage

Production Site

- Production Mainframe
- Mirrored Writes
- Virtual Tape

Standby Site

- Standby Mainframe
- Virtual Tape

Mirrored Writes
STM Configuration Examples
Active-Active Host/Storage

Production Site A

Production Mainframe

Virtual Tape

Mirrored Writes

Production Mainframe

Virtual Tape

Production Site B
STM Configuration Examples
Active-Active-DR Host/Storage

Production Site A
- Production Mainframe
- Virtual Tape
- Mirrored Writes
- DR Mainframe (optional)

Production Site B
- Production Mainframe
- Virtual Tape

DR or Bunker Site
- Asynchronous Replication
- Virtual Tape
RepMon: Replication Monitor

Provides **real-time status monitoring and logging** of virtual tape data writes and replication to a remote disaster recovery site at the VOLSER level

- Identifies Write and Replication Status of Mainframe Tape VOLSERs
- Identifies if virtual tape data at DR is still consistent with the primary datacenter
- Provides visual and audit capabilities to confirm when backups reach DR
Push Button DR Testing  
Replication During Normal Operations

Site A

1 Primary

Tape Data

Replication to Secondary Site or DR Site

2 Secondary

Tape Data

Site B
Push Button DR Testing
Replication During DR Testing

Site A

1 Primary
Tape Data

Replication to Secondary Site or DR Site continues uninterrupted

Secondary 2
Tape Data

Site B

DR Test Data

Read/Write Testing

Prepares DR environment for read/write testing; original Tape Data remains untouched

Start DR

Start DR

Push Button DR
Push Button DR Testing
After DR Testing is Completed

Site A

Tape Data

Primary

1

Secondary

2

Replication to Secondary Site or DR Site continues uninterrupted

Site B

Tape Data

DR Test Data is purged

 Optionally, DR Test Data can be automatically replicated back to Site A for auditing purposes

Stop DR

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Tape Migration Services and Software

- Luminex offers Tape Migration Services to migrate to STM
  - Elegantly designed to work with TMACS to move tape data without touching the tape catalogs
  - Current VOLSER #s and all historical information are retained in the new environment as well
  - Supports all existing tape library and virtual tape environments for z/OS
- TMACS (Tape Monitoring and Allocation Control Software) is optional host-based software to automate device allocation steering for complex environments
For current Luminex virtual tape environments

- Luminex offers Media Migration to non-disruptively migrate to the new storage target.
- Entirely off-host, no mainframe MIPS required.
- Current VOLSER #s and all historical information are retained in the new environment (no changes to tape catalogs).
- Volumes will acquire the characteristics of the new configuration.
More Options… A Better Fit Makes A Better Solution

OPTIONAL FEATURES

- **RepMon**: Monitor replication at the VOLSER level
- **CGSafe**: Encryption and key management
- **LTMon**: Integrated, centralized management from the mainframe console
- **Push Button DR**: with non-disruptive DR testing
- **Synchronous Tape Matrix**: Continuous Availability
- **CloudTAPE**: Cloud-based tape vaulting solution for mainframes

STORAGE OPTIONS

- **CGX**: Core product with up to 8Gb FICON, SMEs & hundreds of customers going tapeless
- **Internal Storage**
- **Enterprise storage options**
- **Modular storage options**
- **Compression**: at the control unit level
- **Deduplication**: DataStream Intelligence further reduces bandwidth & storage requirements

Other features:

- **Replication**: at the control unit or storage level
- **RepMon**: Monitor replication at the VOLSER level
- **CGSafe**: Encryption and key management
- **LTMon**: Integrated, centralized management from the mainframe console
- **Push Button DR**: with non-disruptive DR testing
- **Synchronous Tape Matrix**: Continuous Availability
- **RepMon**: Monitor replication at the VOLSER level
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What does the mainframe do today that you never thought possible?

What do you want the mainframe to do in the future?
What does the mainframe do today that you never thought possible?

What do you want the mainframe to do in the future?
Luminex’s Heritage of Innovation

1st to enable tape encryption solutions for mainframe physical tape

1st to enable deduplication storage for mainframe virtual tape
- Using Luminex DataStream Intelligence

1st to enable DASD and tape data consistency through unified replication

1st to provide 8Gb FICON for mainframe virtual tape

1st & Only virtual tape vendor to directly provide tape migration services without third-party contracting

1st vendor to enable cloud storage for mainframe tape

1st to deliver wire-speed FICON performance with CGX product release

1st to provide truly scalable continuous availability with Luminex Synchronous Tape Matrix

What’s Next?
Achieving Continuous Availability for Mainframe Tape with Synchronous Tape Matrix

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