The Evolution of Mainframe Data Storage: Expecting More from Virtual Tape
Session #25812

Dave Tolsma

Director, Systems Engineering

Luminex

Luminex At A Glance

Delivering mainframe data solutions worldwide for 25+ years

- Enabling mainframes to leverage distributed systems resources via native I/O channels

- Renowned for its industry-leading, enterprise-class mainframe virtual tape solutions

MISSION STATEMENT

Luminex serves as a <u>trusted advocate</u> helping *enterprise customers* **protect**, **manage**, and **leverage** corporate data assets by developing and delivering high quality, innovative technology solutions.

What is a Tape Drive?

- In historical mainframe vernacular, a tape drive has also been referred to as a …
  - "Transport"
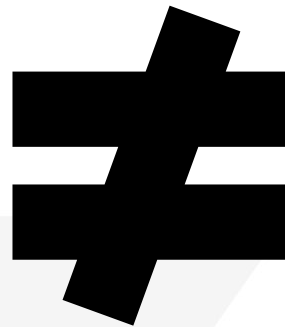- What does the word "Transport" evoke?
  - Movement?

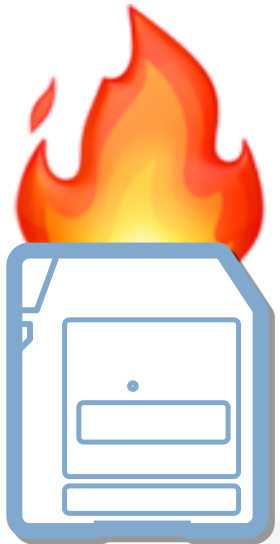All things being equal, it's always more efficient to <u>not</u> move data than it is to move data.

… So, why do we move data?

Because All Things Aren't Equal

Number of Copies

1 ≠ 2 or more

Because All Things Aren't Equal

Host Storage Economics
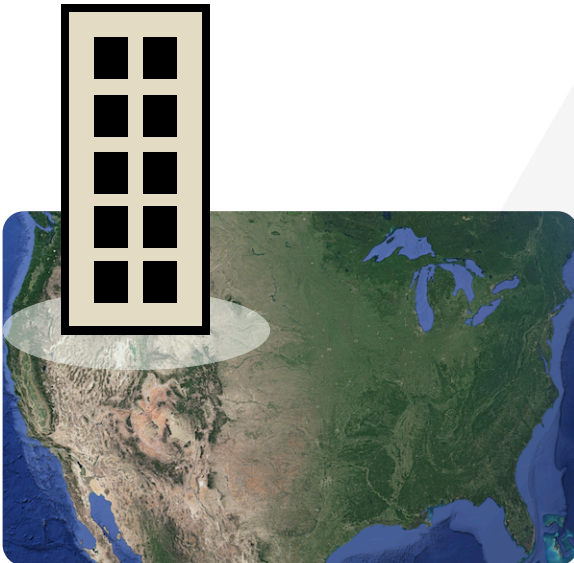
DASD $ ≠ "Tape" $

Because All Things Aren't Equal

Geography

Production Site ≠ DR Site
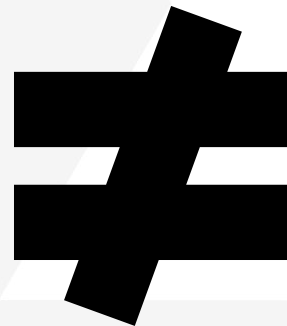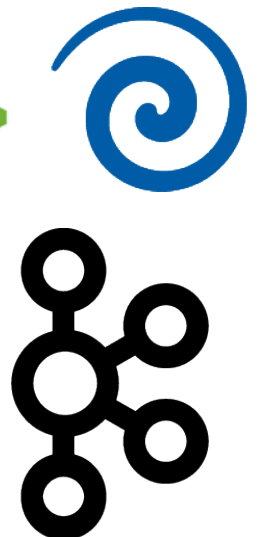
Because All Things Aren't Equal

Platform

z/OS ≠ Everything Else
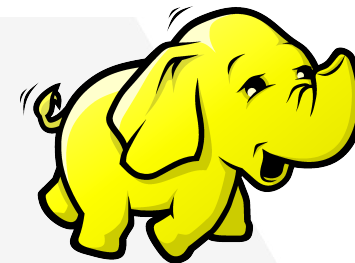
To Sum Up, We Move Data To:

- **Protect**
- **Manage**
- **Leverage**

Innovation and the Evolution of Tape

- Why innovate?

- Every innovation in tape over the last 20 years has been about enhancing one or more of these themes:
  - Protect
  - Manage
  - Leverage

- Some examples…

Examples of Past Tape Innovations

- **Protect**
  - Tape encryption

- **Manage**
  - Disk cache to backend physical tape helped manage capacity use on media

- **Leverage**
  - Replication enhanced "where" you can use the data "geographically"

Luminex's Mission Statement

Luminex serves as a <u>trusted advocate</u>
helping *enterprise customers*
protect, **manage**, and **leverage**
corporate data assets
by developing and delivering
high quality, <u>innovative</u> technology solutions.

Luminex Innovations

- **Protect**
  - SecureTransfer: Turn off Port 21
  - CloudTAPE: Versioning support

- **Manage**
  - MVThsm: Offhost HSM Recycle
  - Multitenant Management

- **Leverage**
  - MDI: Mainframe Data Integration family

SecureTransfer: Turn Off Port 21 (FTP)
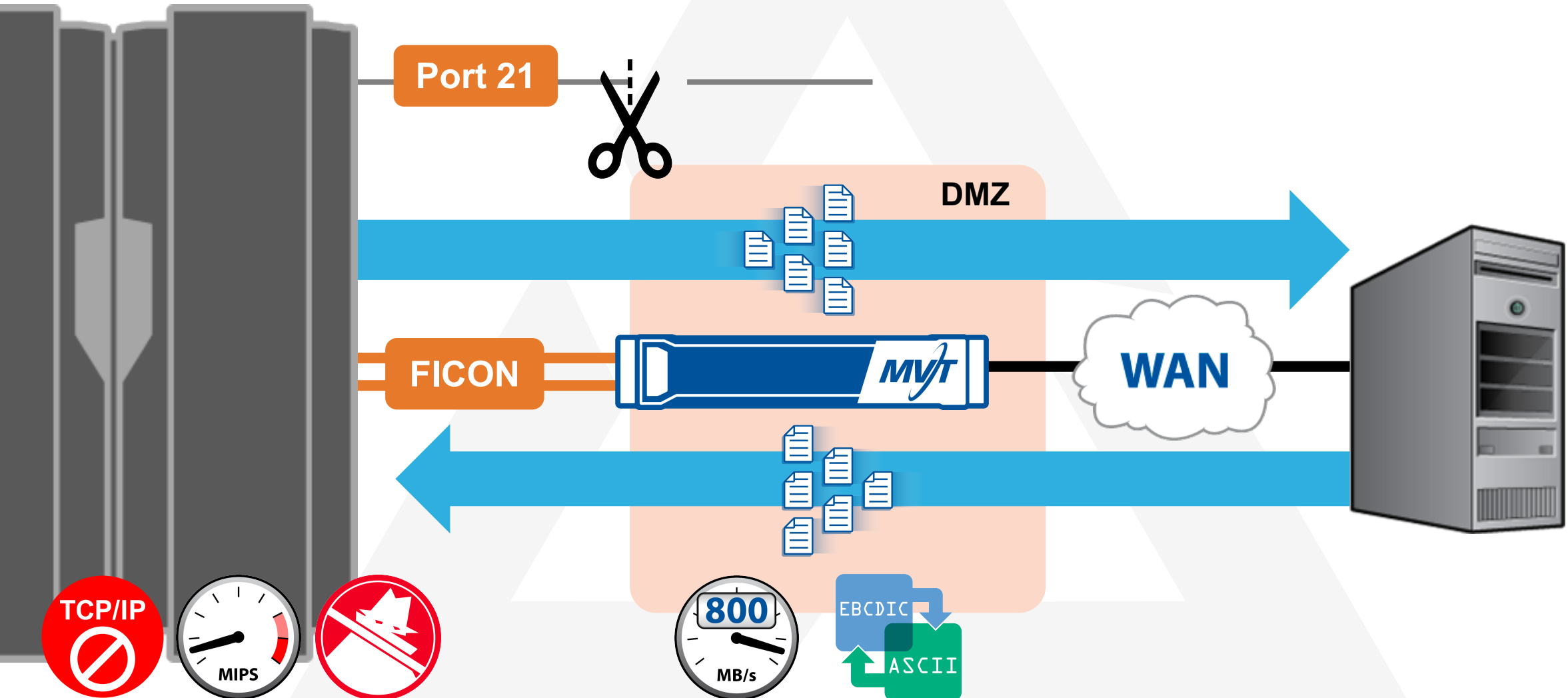
SecureTransfer: Using FICON as a Secure Data Path

"If you replace mainframe FTP with a channel/**FICON** based solution, you can mitigate FTP security issues a great deal, if not remove them completely. This is the real benefit of a solution such as MDI SecureTransfer."

Mark Wilson
Technical Director
RSM Partners

www.rsmpartners.com

SecureTransfer
Benchmark Testing: 30 MB File

SHARE
EDUCATE ▸ NETWORK ▸ INFLUENCE

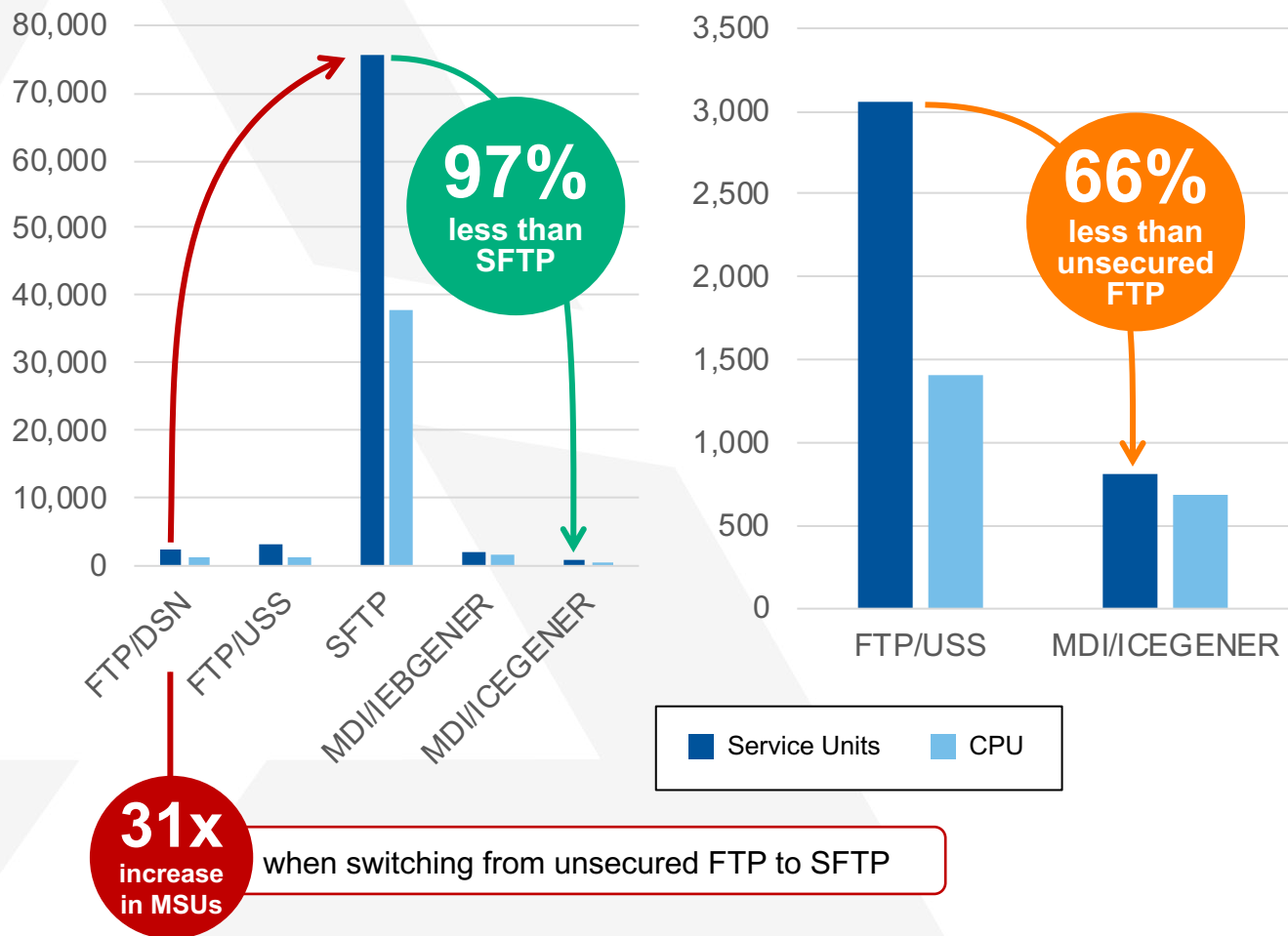| Method	Job	Program	Elapsed	Service Units	CPU
FTP from DSN	BNCHMRK1	FTP	0:00:15.32	2403	1280
(Clear Text)			**0:00:15.32**	**2403**	**1280**
FTP from USS	BNCHMRK2	FTP	0:00:13.96	3060	1409
(Clear Text)			**0:00:13.96**	**3060**	**1409**
SFTP	BNCHMRK3	login	0:00:00.10	150	135
(Encrypted)	BNCHMRK3	tty	0:00:00.02	140	119
	BNCHMRK3	sftp	0:00:00.14	340	317
	BNCHMRK3	ssh	0:00:06.27	68463	34493
	BNCHMRK3	sftp	0:00:08.41	6106	2363
	BNCHMRK3	SH	0:00:08.47	213	163
	BNCHMRK3	BPXBATCH	0:00:08.77	129	107
			0:00:32.18	**75541**	**37697**
MDI/IEBGENER	BNCHMRK4	IEBGENER	0:00:03.24	2010	1407
	BNCHMRK4	LUMXPROC	0:00:09.34	156	134
			0:00:12.58	**2166**	**1541**
MDI/ICEGENER	BNCHMRK5	ICEGENER	0:00:00.79	667	550
	BNCHMRK5	LUMXPROC	0:00:09.19	151	131
			0:00:09.98	**818**	**681**

Benchmarks performed on z13 Model 2965-N10 using SMF Type 30 records

MDI/ICEGENER System Resources Savings

97% less than SFTP

66% less than unsecured FTP

31x increase in MSUs — when switching from unsecured FTP to SFTP
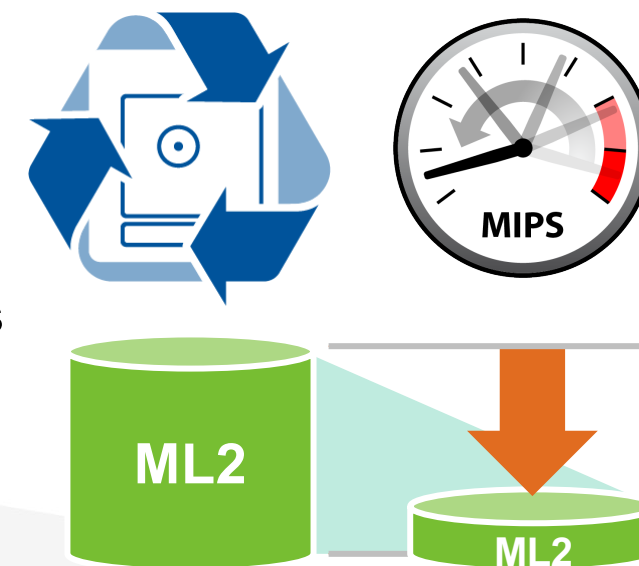
Service Units ■   CPU ■

CloudTAPE with Versioning Support

- Using Cloud/object storage as a virtual tape storage target
  - These systems frequently offer versioning functionality
  - Luminex MVT supports version tracking/reporting
- Virtual Tape Air Gap
  - Data is stored as immutable objects in an object storage, rather than a mounted filesystem
  - Typical Ransomware that takes over mounted filesystems via encryption cannot "mount" an object storage or modify the objects
  - Cloud providers can also support multi-region replication for further data protection
  - Data availability is guaranteed by SLAs, e.g AWS S3 offers **99.999999999** availability.

MVThsm: Off-Host HSM Recycle

- Optimize HSM ML2 tape capacity off-host
  - No FICON I/O, done entirely within the tape system itself
  - Reduces expired data set space usage by 99.9%
- VOLSER and block IDs remain the same
  - No need to update the HSM Control Data Set
    - The **most CPU-intensive aspect** of the HSM Recycle process
- Performance continues to improve
  - Tapes get smaller with each cycle
    - Faster cloning process
    - Smaller tapes replicate faster
- Effectively reduces tape storage capacity requirements
  - Reduced reliance on mainframe resources = more frequent optimization = less total capacity required
  - Existing users can delay storage upgrades
  - New users can move existing tape workloads into a smaller capacity/lower cost tape system

MVThsm: Process

1 Luminex program gathers invalid data set info from CDS

MVThsm

2 Report sent to MVT

Invalid Data Report
- DSNs
- Block IDs

3 MVT locks and internally reads original tape (no FICON I/O)

ABC123

4 New tape is written

ABC123

- **Valid** data set block ranges written as **16k blocks**
- **Invalid** data set block ranges written as **16 byte blocks**
- Same VOLSER
- Same Block IDs
- No need to update CDS
- Each cycle reduces size of future reads/writes, further **improving performance over time**

5 Original tape is deleted

MVThsm: Tape Layout Before and After

VOLSER ABC123: 1,000,000 blocks @ **16 KB** each = **16 GB**

BEFORE RECYCLE

| DSN1 | DSN2 | DSN3 | DSN4 | ••• | DSN*n* |

50,000 blocks @ **16 KB** each
= **800 MB**

100,000 blocks @ **16 KB** each
= **1,600 MB**

VOLSER ABC123: 1,000,000 blocks @ **16 KB** or **16 byte** block sizes = **13.6 GB**

AFTER RECYCLE

| DSN2 | DSN4 | ••• | DSN*n* |

DSN1
50,000 blocks @ **16 bytes** each
= **0.8 MB**

DSN3
100,000 blocks @ **16 bytes** each
= **1.6 MB**
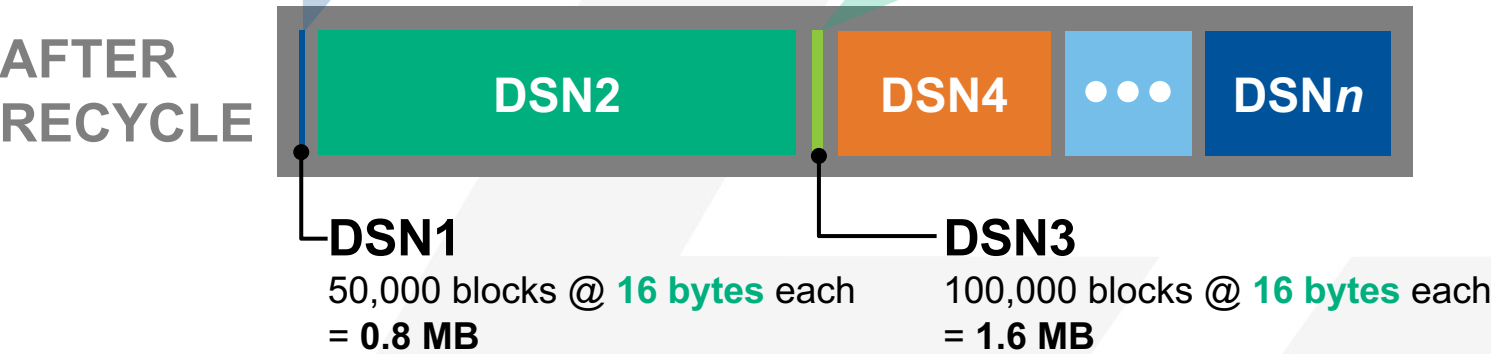
```
850,000*16 KB    = 13.6   GB
150,000*16 bytes =  0.0024 GB
_____
Total            = 13.6024 GB
```

- Same VOLSER
- Same Block IDs

Multitenant Management: Manage Disparate Storage Pools Independently

- Separate **Global** and **Storage Pool Level** views
- Storage Pool administrator can only see information for Storage Pools and devices assigned to them
- Global administrator can see all information for all Storage Pools
- Global administrator can assign capacity "quotas" for individual Storage Pools
  - These quotas are reported and alerted on but are not strictly enforced
  - E.g. a tenant can use 120% of their quota as long as there is enough backend storage

Multitenant Management
Storage Pool Level View: Restricts Display to Assigned Storage Pool

- Status Monitor for Associated Devices
- Replication Monitor
- Replication Audit Logs
- View Scratch Pools
- View/Search Volumes
- Capacity Information

- Compression Rates
- Load/Unload Tape
- VOLSER methods
- DR Methods
- Inventory Audit
- Admin Settings

Multitenant Management
Global View: Display Extended to All Storage Pools

- All of the Storage Pool Level view functionality
- See all of the **storage pools** configured on the system
- **Execute operational commands**, such as restarting the MVT
- See **historical and real-time global performance statistics,** such as I/O or network rates
- Generate and download **support logs**
- View and modify **alert settings**
  - This does not imply that alert thresholds cannot be distinct among tenants, only that the management of alerts is done by the Global administrator

MDI: Mainframe Data Integration
From Virtual Tape… *to Virtually Anywhere*

SHARE
EDUCATE ▸ NETWORK ▸ INFLUENCE

VIRTUAL TAPE

DATA INTEGRATION

Source

Controller
- Compression
- Encryption
- Replication
- Push Button Disaster Recovery
- Tape Migration & Conversion
- Cloud Connectivity

Target

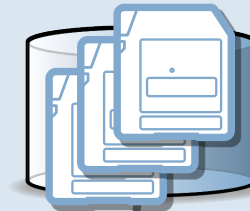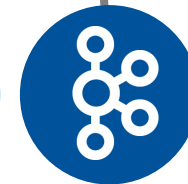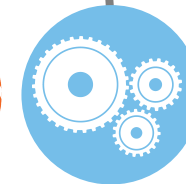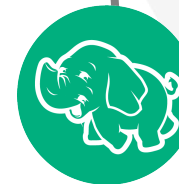Internal SAS, Fibre Channel, 1 or 10 GbE

FICON

FICON

1 or 10 GbE

- Data Movement
- Communications
- Translation / Conversion

- Data Integration Control Software
- Listener

Source / Target

Controller

Source / Target

MDI is a Data Transfer & Co-Processing Platform

Mainframe FICON

MVT or Dedicated MDI Platform

Data Sharing Targets/Sources

FICON

MDI

10 GbE

TCP/IP

MIPS

EBCDIC / ASCII

GB/s

MDI BigData Transfer

webHDFS

MDI XPDS

NFS

MDI SecureTransfer

SFTP

MDI SLP

SAS, MXG

MDI zKonnect

Kafka
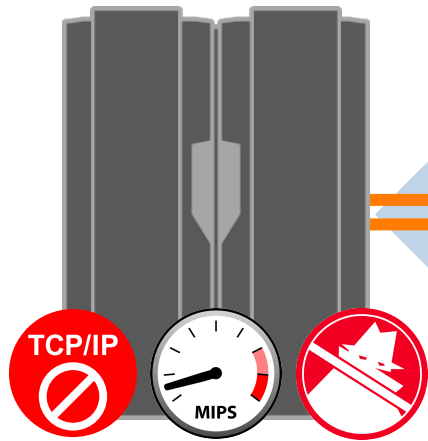
- Secure
- High speed
- Efficient, redundant I/O channels

- Profile-based architecture for extending processing & interface capabilities
- High speed, scalable transfer rates
- SAF integration & protocol-based encryption
- Bi-directional movement and communication for multi-platform workflows and co-processing
  - Including data translation from EBCDIC to ASCII and between character sets
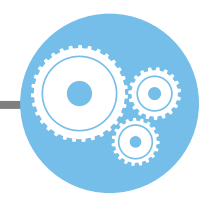
How MDI is Used

SAMPLE USE CASES

MDI BigData Transfer

webHDFS

AZURE DATA LAKE

Insurance Provider
Data aggregated into an Azure Data Lake with data from distributed systems, then used for risk analysis by actuaries

MDI XPDS

NFS

apache Ignite

Financial Services
DB2 dumped into Apache Ignite, transformed/ sorted off-host, then imported back into DB2 on the mainframe

MDI SecureTransfer

SFTP

Bank
Files securely, efficiently and simply shared with business partners via off-host encryption, compression and data movement over SFTP

MDI SLP

SAS, MXG

Transportation & Logistics Company
SMF data sent to MDI co-processor, reports generated with MXG off-host, then copies are sent back to mainframe ISPF and to Capacity Planning team via email

MDI zKonnect

Kafka

Transaction Processor
Credit card transactions sent to Kafka for near-real time fraud detection and alert processing

The Evolution of Mainframe Data Storage: Expecting More from Virtual Tape

Dave Tolsma

Director, Systems Engineering

Luminex