



Keys to enhance the performance & availability of IBM TCT Solutions

Brian Larsen
Broadcom, Dir. Partner Business Development

Eddie Lin
IBM, Senior Technical Staff Member with IBM Systems Storage

IBM TechU Session #: s203367

Oct 26-28th, 2020 | Virtual World





Agenda

Cyber Resiliency

Protecting Your Data with IBM Solutions

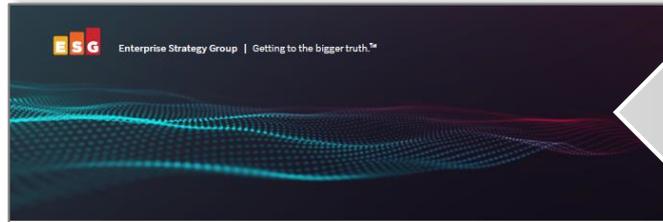
Transparent Cloud Tiering Solution Overview

TCT - Network & Distance Impact
Considerations

Practical - Real World Discussion

Introducing **CYBER RESILIENCY SOLUTIONS** for IBM Z

*This presentation is based on
the findings from these two
papers.*



ESG WHITE PAPER

Enhancing End-to-end Cyber Resilience in IBM Z Environments with IBM Storage and Networking Solutions

By Jack Poller, ESG Senior Analyst
August 2020

[Maximizing Performance and
Security of the IBM Z Replication
Solutions](#)

[Enhancing End-to-end Cyber
Resilience in IBM Z
Environments with IBM Storage
and Networking Solutions](#)



Technical Validation

Maximizing Performance and Security of IBM Z Replication Solutions

Leveraging IBM Storage with Transparent Cloud Tiering and IBM
b-type Networking for Mainframe Backup

By Alex Arcilla, Validation Analyst
September 2020

Cyber Resiliency – Why is it important?

Enterprise Strategy Group - Observations

- **Sixty-four percent** of organizations say IT is more complex compared with two years ago. (ESG Note 1)
- **85% of respondents** said network security has become more difficult than it was two years ago (ESG Note 2)

Three key challenges for IT environments include:

- **Data security**—organizations can ensure data is not compromised by securing data within the compute and storage platforms and in flight across the network.
- **Data replication**—organizations need to select methods of data replication to ensure they meet their business continuity and recovery requirements.
- **Data recovery**—continuity of business operations requires organizations to quickly recover their production environment from good copies of data.

¹ Source: ESG Master Survey Results, [2020 Technology Spending Intentions Survey](#), January 2020.

² Source: ESG Master Survey Results, [Network Security Trends](#), March 2020.



IT is more complex compared with two years ago.



Network security is more difficult compared with two years ago.



Enterprise Strategy Group

Cyber resilient networks include features to provide:

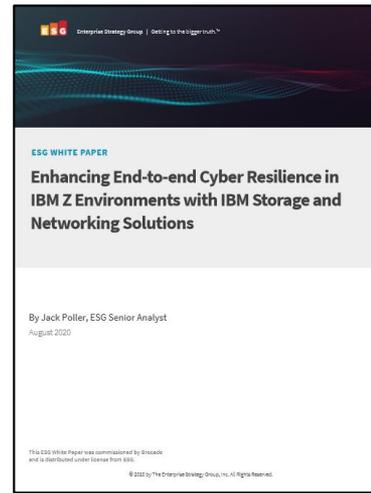
- Encryption in flight & at rest
- High Availability
- Data Immutability
- Data transfer automation and management

ESG: Enhancing End-to-end Cyber Resilience in IBM Z Environments with IBM Storage and Networking Solutions

<https://www.ibm.com/downloads/cas/LMAKJPQG>

ESG white paper: Maximizing Performance and Security of IBM Replication Solutions

<https://www.ibm.com/downloads/cas/AEPGKPMW>



Encryption in flight and at rest

—that protects the business by making data unreadable and unusable when data is exposed or exfiltrated.

High availability

—which ensures that data, the lifeblood of the business, can be used when networking components fail or are compromised.

Data immutability

—write-once-read-many-times (WORM) and tape air gaps protect data from logical corruption, both from malicious attacks such as ransomware and from inadvertent mishaps.

Data transfer automation and management

—that transparently enables the use of various cloud resources and IP networks, enabling multiple redundant data copies for disaster recovery.

Cyber Resiliency

IBM functional capabilities
to become
Cyber Resilient

Z15 & DS8900F
Fibre Channel End
Point Security for **full
end-to-end
encryption** coupled
with **Safe-guarded
Copy** to ensure
known good copies
for recovery needs

High availability and
disaster recovery
with nearly **zero
seconds failover**
using Metro/Global
Mirroring and across
the TS7700 8-way
grid solutions



DS8000 and TS7700
support Transparent
Cloud Tiering for
**Point in Time Data
Backups and full
encryption** of “data
in flight” and “data at
rest” while saving
IBM z CPU MIPS

Get **security
notifications** for
potential ransomware
attacks using
advanced detection
solutions*

*IBM zSecure, QRadar,
Spectrum Protect



Protecting Your Data with IBM Solutions

Putting it all together to create a Cyber Resilient infrastructure:

- Z15
- DS8K
- TS77xx
- b-type SAN & Extension

IBM Z + IBM Storage

Integrated by design



IBM DS8900F

All-flash enterprise storage for production environments with mission-critical requirements



IBM TS7770

High-Performance Virtual Tape Library for Modern Data Protection

#1

enterprise storage solutions for mainframe environments

9 of the top 10

largest public banks in the world
rely on IBM Storage

More than 25

advanced capabilities integrated
by design

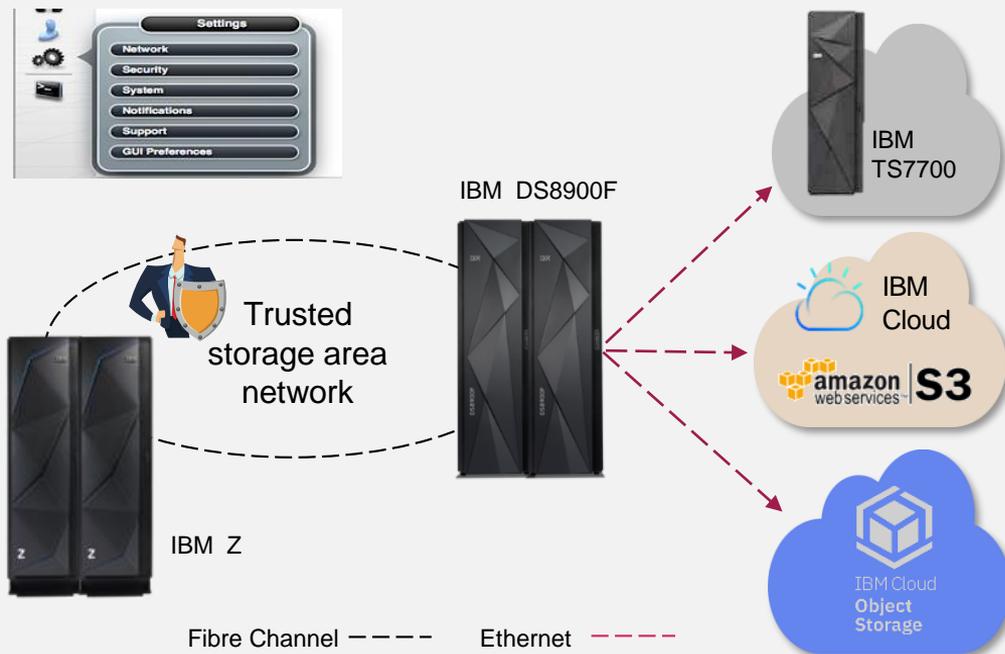
Encryption Everywhere

Z15 and DS8900
Fibre Channel End Point Security

100% data encryption, at-rest in-flight and when it is moved to the cloud

AES-256
bit GCM* encryption

Zero
performance impact



Fiber Channel Endpoint Security

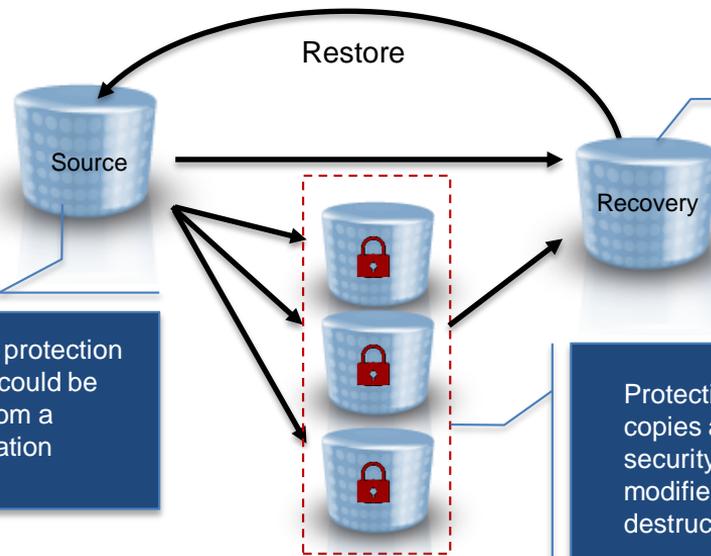
Ensures customer data is accessed only by trusted servers and storage devices within and across datacenters without application, operating system, or file system changes and without consuming host CPU cycles

- Enabled automatically between host and storage endpoints that are 'security-capable'
- Each established link must 'prove' its identity as a trusted component
- Trusted connections are identified; visible to both OS and HMC
- Policy can be established to enforce that only trusted connections can be made
- Integrated and automated key management



Logical corruption protection copies

Logical corruption protection (LCP) are secure, point-in-time copies of production data that can later be used for identification, repair, or replacement of production data that has been compromised by either cyber or internal attack or corrupted by system failures or human error.



Recovery devices are used to logically restore back data to the production environment or to investigate a problem and determine what the recovery action is

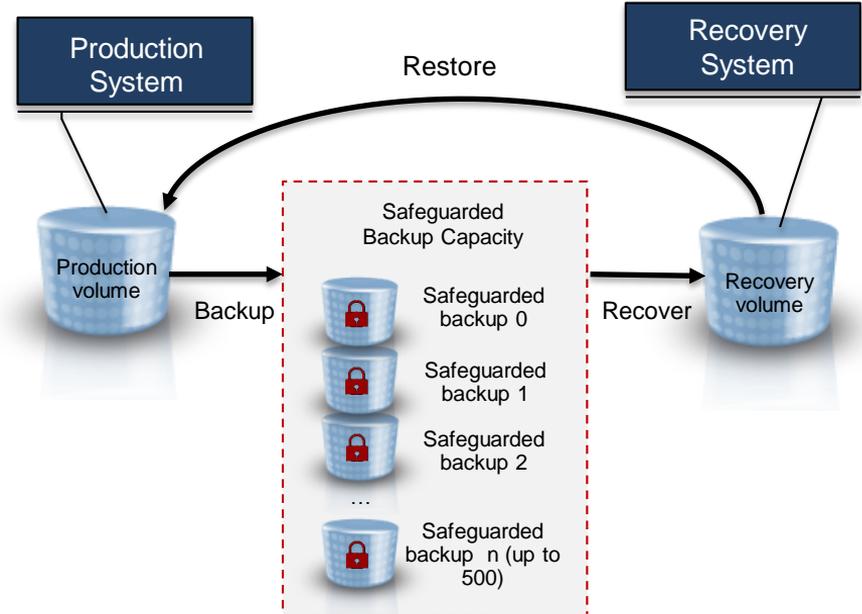
Source devices are where the protection copies are taken from. These could be production devices or taken from a HA/DR copy using data replication

Protection devices provide one or more logical protection copies and are not accessible by any system. Additional security measures aim to protect these from being modified or deleted due to user errors, malicious destruction or ransomware attacks

Safeguarded Copy for logical corruption protection

- Safeguarded Copy provides functionality to create up to 500 recovery points per production volume
- The Safeguarded Backups are stored in a storage space that is called Safeguarded Backup Capacity (SGBC)
- The Safeguarded Backups are hidden and non-addressable by a host
- The data can only be used after a Safeguarded Backup is recovered to a separate recovery volume.
- Recovery volumes can be accessed using a recovery system and used to restore production data.

IBM DS8900F Safeguarded Copy prevents sensitive point in time copies of data from being modified or deleted due to user errors, malicious destruction or ransomware attacks



IBM DS8900F - The fastest, most reliable and secure storage system for IBM Z



Cloud Native

Accelerate tasks associated with developing, deploying, and maintaining cloud-native applications with Red Hat OpenShift* and IBM Cloud Paks



Encryption Everywhere

100% data protection wherever it resides by extending z15 pervasive encryption



Cyber Resilience

Continue delivering your business outcomes protecting your data despite user errors or ransomware attacks

Flexible Storage

Flexible racked and rack mounted configurations for IBM DS8900F for all business sizes and needs



* through OpenShift flex volume driver support

IBM TS7770 Virtual Tape + IBM Z + DS8900F

Secure and reliable critical data storage

Flexible Storage



New! Enterprise capabilities available for midrange organizations with flexible deployments across client-supplied in 19" racks*.

Cloud native experience



Seamless hybrid multicloud integration with Transparent Cloud Tiering for long-term data retention with the server-less direct data transfer from TS7770 to a cloud.

Encryption everywhere



Secure data transfer provides 100% encryption of all grid data, at rest, in the cloud and in-flight over Ethernet.

Cyber Resilience



True Air Gap protection between data and online hackers, logical WORM protection, high availability and disaster recovery with nearly zero seconds failover across up to 8 grid systems.

IBM Storage Portfolio requires a Network Discussion



32 Gb/s



All-Flash and Hybrid Systems



Entry / Mid-Range



Mid-Range



High-End Enterprise



Heterogeneous Enterprise

Enterprise Storage

DS8900F

TS7770



32 Gb/s



High-End Z Enterprise

IBM b-type Gen 6 Storage Networking supports 32 Gb/s, NVMe, FICON, and Extension

FICON Extension Solutions



32Gb Ext Blade (SX-6)



SAN42B-R

32 Gb/s



SAN64B-6



SAN256B-6



SAN512B-6

GEN6
FIBRE CHANNEL



32/64 Gb/s



SAN64B-7



SAN256B-7



SAN512B-7

GEN7
FIBRE CHANNEL

64 Gb/s Ready



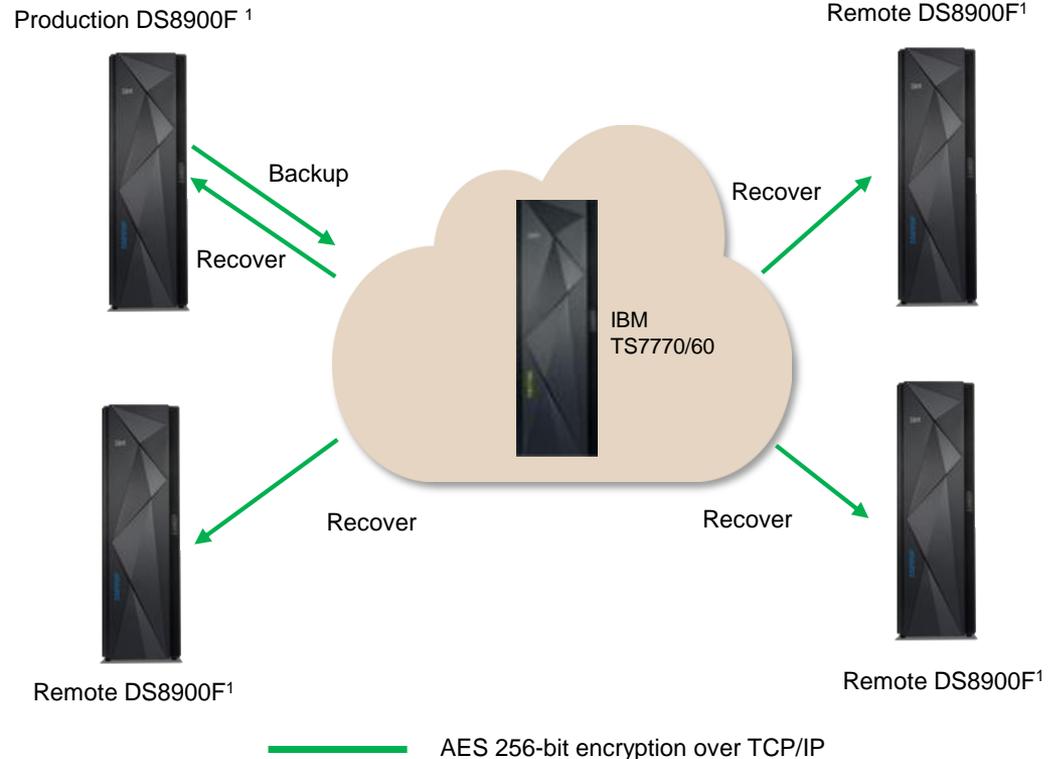
Transparent Cloud Tiering Solution Overview

Pairing IBM z15 with DS8900
and TS7700 help resolve your
Cyber Resiliency challenges

Extend your cyber resiliency strategy with offline backups to the hybrid multicloud

Use Transparent Cloud Tiering to create point-in time copies of data to the cloud, where copies can be restored to any system

- **Protect your data** by making use of the immutability capabilities, provided by the cloud repository
- **Take advantage of the benefits** provided by Transparent Cloud Tiering:
 - **50%** savings in IBM Z CPU utilization
 - No additional server or gateway required
 - No impact in IOPS performance
 - In-flight encryption with AES 256-bit

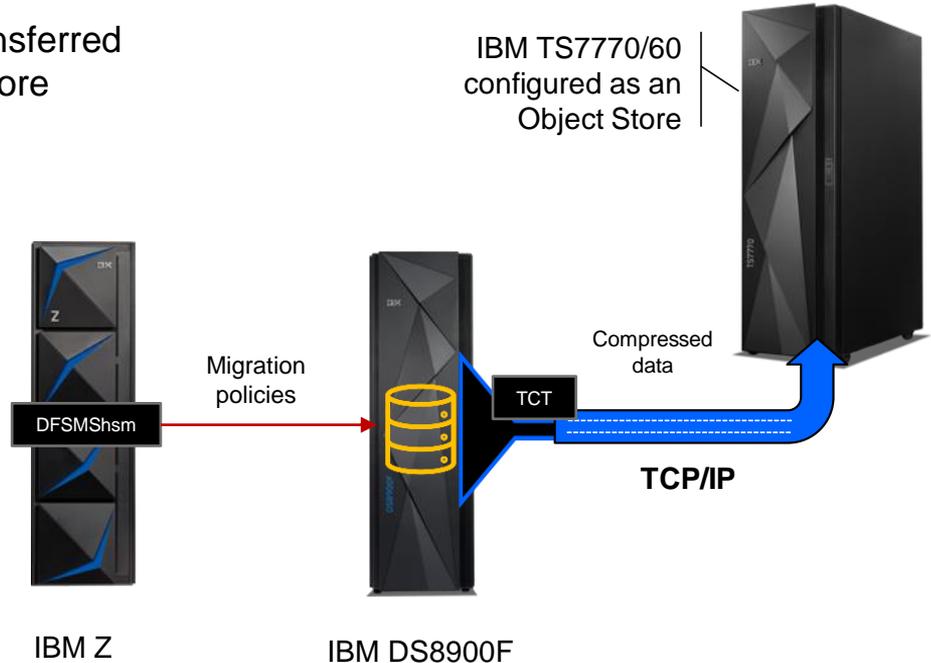


¹ The capability applies for models DS8900F and DS8880F

IBM DS8900F compression support for Transparent Cloud Tiering with IBM TS7700 as an Object Store

Compress data within the DS8900F prior to being transferred over TCP/IP to a TS7700¹ configured as an Object Store

- **Store 3x more data²** in the same physical space:
 - Reduce CAPEX up to **55%**
 - Reduce OPEX over 3-year period by up to **44%**
- **Improve performance** by cutting the time to store the same amount of data by **60%**
- **Reduce bandwidth** requirements with no impact in IOPS performance
- **Automated maximization of system resources** by avoiding compression if data is already compressed or encrypted by IBM Z

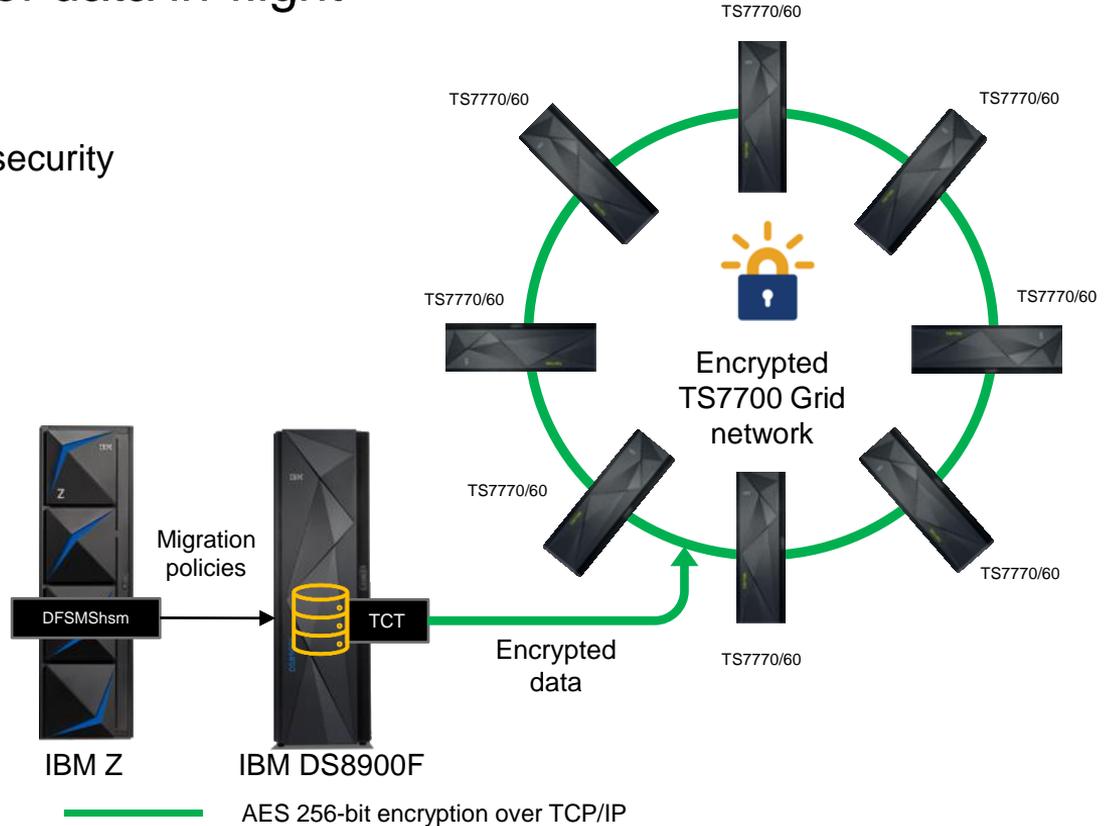


IBM DS8900F and TS7700

Enhancements on encryption of data in-flight

Secure data transfer offers next-level cybersecurity with SP 800-131A-compliant encryption.

- **Extend encryption** from the DS8900F to **all** the TS7700¹ systems in a grid.
- **Encryption made easy** without the need to configure key groups, key managers and other configurable items
- **Save an average** of \$21,300 USD in CAPEX and OPEX



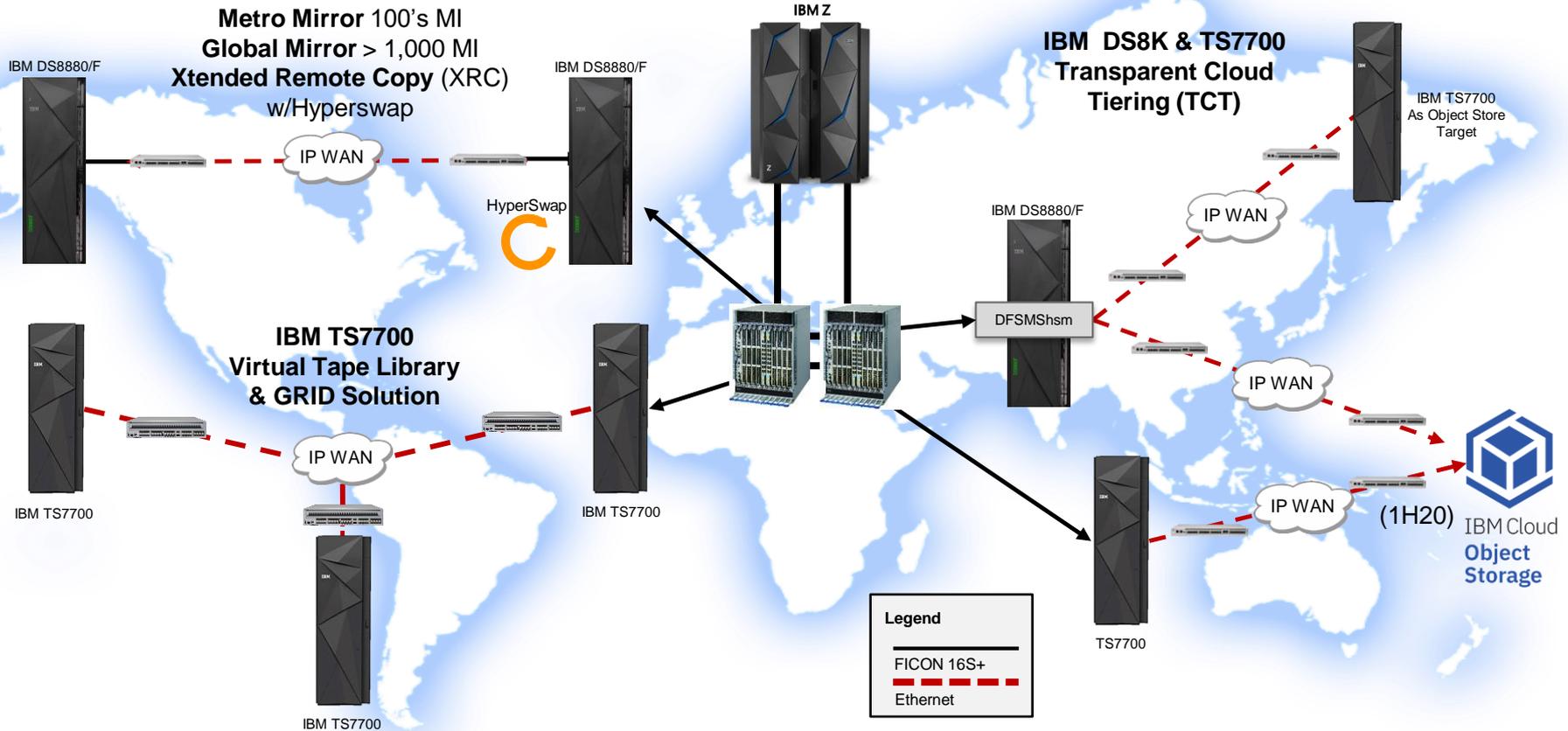
¹ TS7770 Secure data transfer feature code must be installed on target TS7700, TS7760 can provide encryption if it has R5.0 code applied.



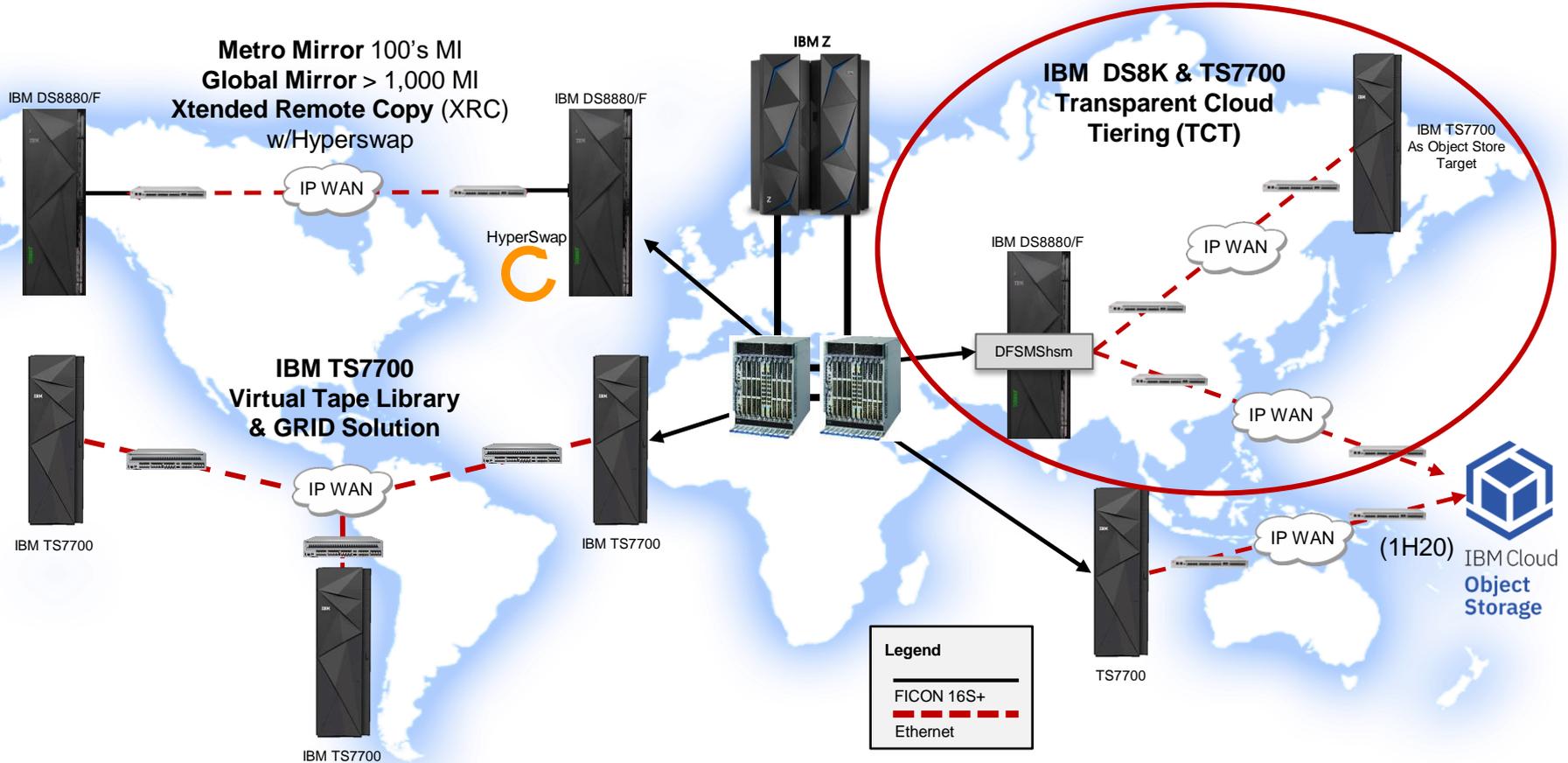
TCT - Network & Distance Impact Considerations

Leveraging IBM b-type SAN
Extension Platforms for Data
Transport

IBM z, DS8K & TS77xx – BC/DR Using b-Type Extension



IBM z, DS8K & TS77xx – BC/DR Using b-Type Extension



ESG Technical Validation

TCT - Distance Testing (Write)

Test Overview

- **TCT Migration (Write) Testing with Distance/Latency**
 - 20G non-compressed Data File used for test purposed
 - Performance measured in time to complete transfer
 - *Distance between sites varied from 0 to 5000 miles*
 - No packet loss injected

ESG Results

- All write jobs using IPEX with TCT remained consistent at 6 minutes per job
- Without IPEX being used, job times grew to 14.2 minutes and 120 minutes for 500 miles and 5000 miles respectively

ESG Observations

- Based on our testing, ESG found that *the combination of IBM TCT and IPEX helps the IBM solution to achieve low job completion times* for both reads and writes as distance increased.

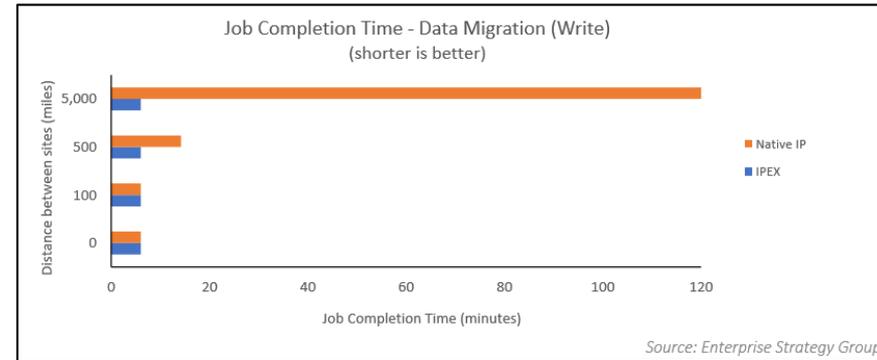
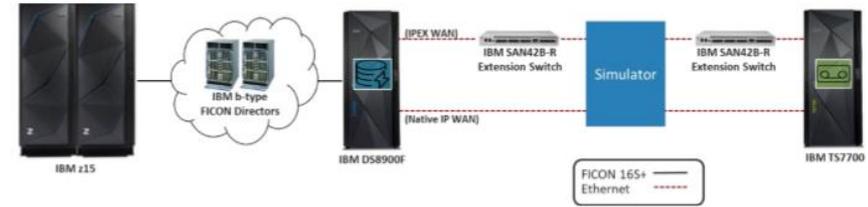


Table 1. Job Completion Times for Data Migration with Increasing Distance – IPEX versus Native IP

Distance between Sites (miles)	Job Completion Time with IPEX (min)	Job Completion Time with Native IP (min)
0	6	6
100	6	6
500	6	14.2
5,000	6	120

Source: Enterprise Strategy Group

ESG Technical Validation

TCT - Distance Testing (Read)

Test Overview

- **TCT Recall (Read) Testing with Distance/Latency**
 - 20G non-compressed Data File used for test purposed
 - Performance measured in time to complete transfer
 - *Distance between sites varied from 0 to 5000 miles*
 - No packet loss injected

ESG Results

- Data recall (read) jobs were consistent with and without IPEX up to 500 miles
- Testing at long distance (i.e. 5000 miles) showed a significant increase in job time without IPEX on the IP WAN

ESG Observations

- Coupled with an IPEX enabled WAN that maintains consistent throughput over network links, *the IBM solution can help in delivering fast and consistent reads and writes for backup and recovery purposes.*

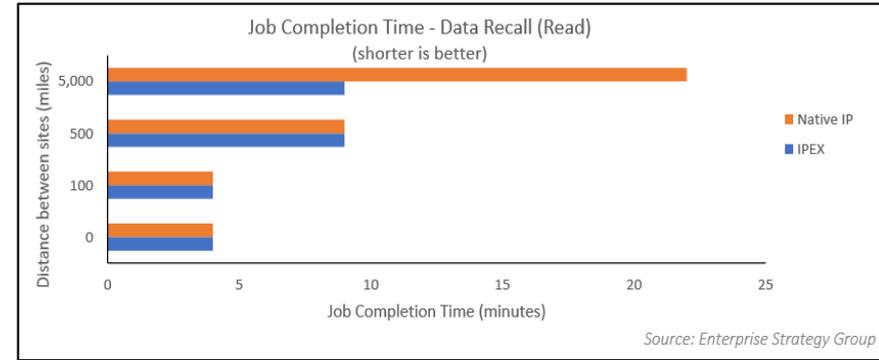
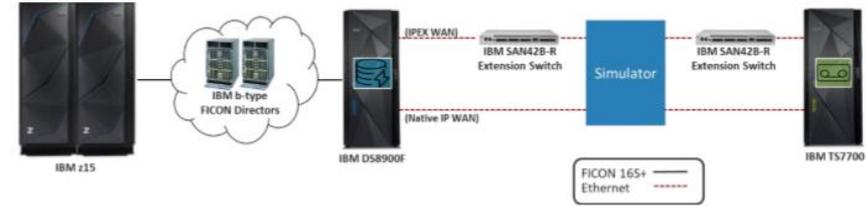


Table 2. Job Completion Times for Data Recall with Increasing Distance – IPEX versus Native IP

Distance between Sites (miles)	Job Completion Time with IPEX (min)	Job Completion Time with Native IP (min)
0	4	4
100	4	4
500	9	9
5,000	9	22

Source: Enterprise Strategy Group

ESG Technical Validation

TCT – Packet Loss Test (Write)

Test Overview

- **TCT Migration (Write) Testing with Packet Loss**
 - 7.6G non-compressed Data File used for test purposed
 - Performance measured in time to complete transfer
 - Distance remained consistent at 100 miles between sites
 - *Packet loss varied from 0.00% to 0.03%*

ESG Results

- Job completion times for writes over the native IP WAN without IPEX increased as packet loss reached 0.03%, from 0.52 minutes to 120 minutes.
- Job completion times using IPEX remained relatively consistent throughout the testing

ESG Observations

- ESG’s review of the test results showed that organizations using this IBM solution for backup and restore operations, in *combination with IBM TCT and IPEX, can achieve high and consistent performance in light of network packet loss up to 0.03%.*

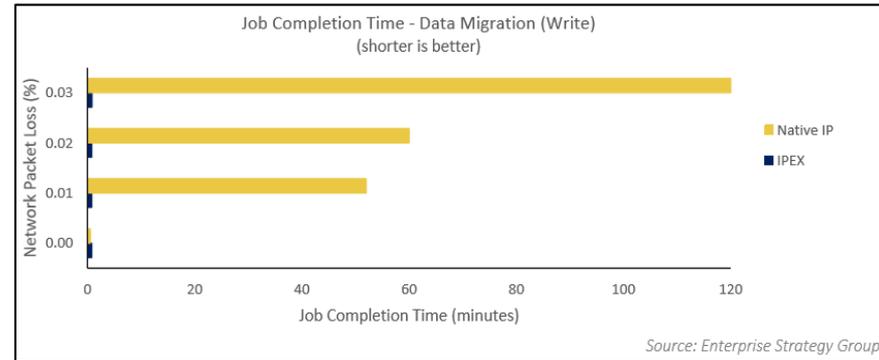
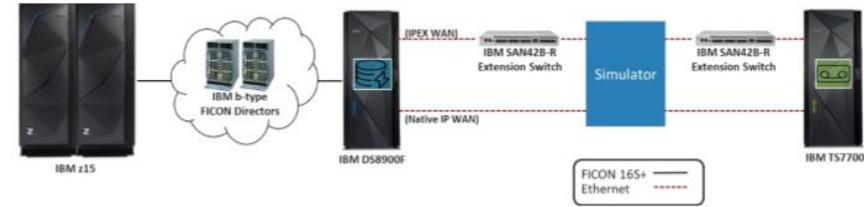


Table 3. Job Completion Times for Data Migration with Increasing Packet Loss – IPEX versus Native IP

Network Packet Loss (%)	Job Completion Time with IPEX (min)	Job Completion Time with Native IP (min)
0.00	0.78	0.52
0.01	0.78	52
0.02	0.78	60
0.03	0.83	120

Source: Enterprise Strategy Group

ESG Technical Validation

TCT – Packet Loss Test (Read)

Test Overview

- **TCT Recall (Read) Testing with Packet Loss**
 - 7.6G non-compressed Data File used for test purposed
 - Performance measured in time to complete transfer
 - Distance remained consistent at 100 miles between sites
 - *Packet loss varied from 0.00% to 0.03%*

ESG Results

- Job completion times increase “slightly” using IPEX WAN
- Job completion times for reads over Native IP WAN increased by 95% when comparing completion times from 0.00% packet loss to 0.03% packet loss

ESG Observations

- While *IBM TCT works to reduce MIPS* spent on moving data between locations, *IPEX maintains consistent throughput of data traveling between locations.*

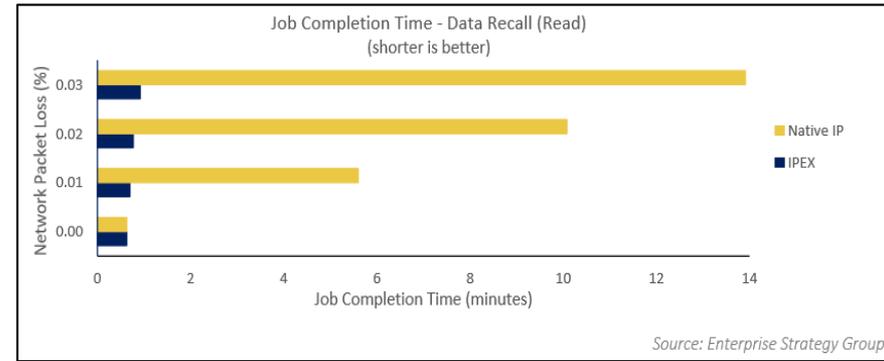
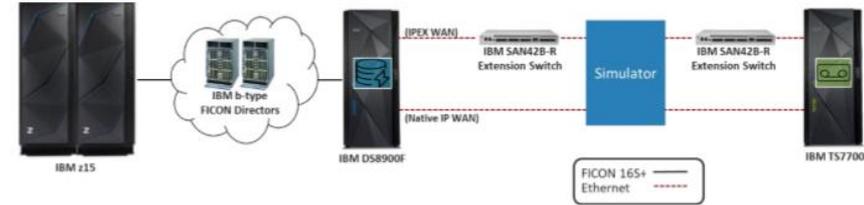


Table 4. Job Completion Times for Data Recall with Increasing Packet Loss – IPEX versus Native IP

Network Packet Loss (%)	Job Completion Time with IPEX (min)	Job Completion Time with Native IP (min)
0.00	0.63	0.63
0.01	0.70	5.60
0.02	0.77	10.08
0.03	0.92	13.91

Source: Enterprise Strategy Group

IBM Solution Reference

IBM TS77xx Support Statement

IBM SSIC

- Select:
 - Storage Family: IBM System Storage Virtualization Engine for Tape
 - Storage Model: TS7700
 - Storage Version: TS7700 R5.0 (8.50.0.134)
 - Adapter: IBM FC0409
 - SAN or Networking: Brocade x6-8
 - <click> Submit
 - Select Show for: IBM z/OS 2.4
 - In Search Details: SAN or Networking <click on url in notes>

TS7700 FAQ with Details:

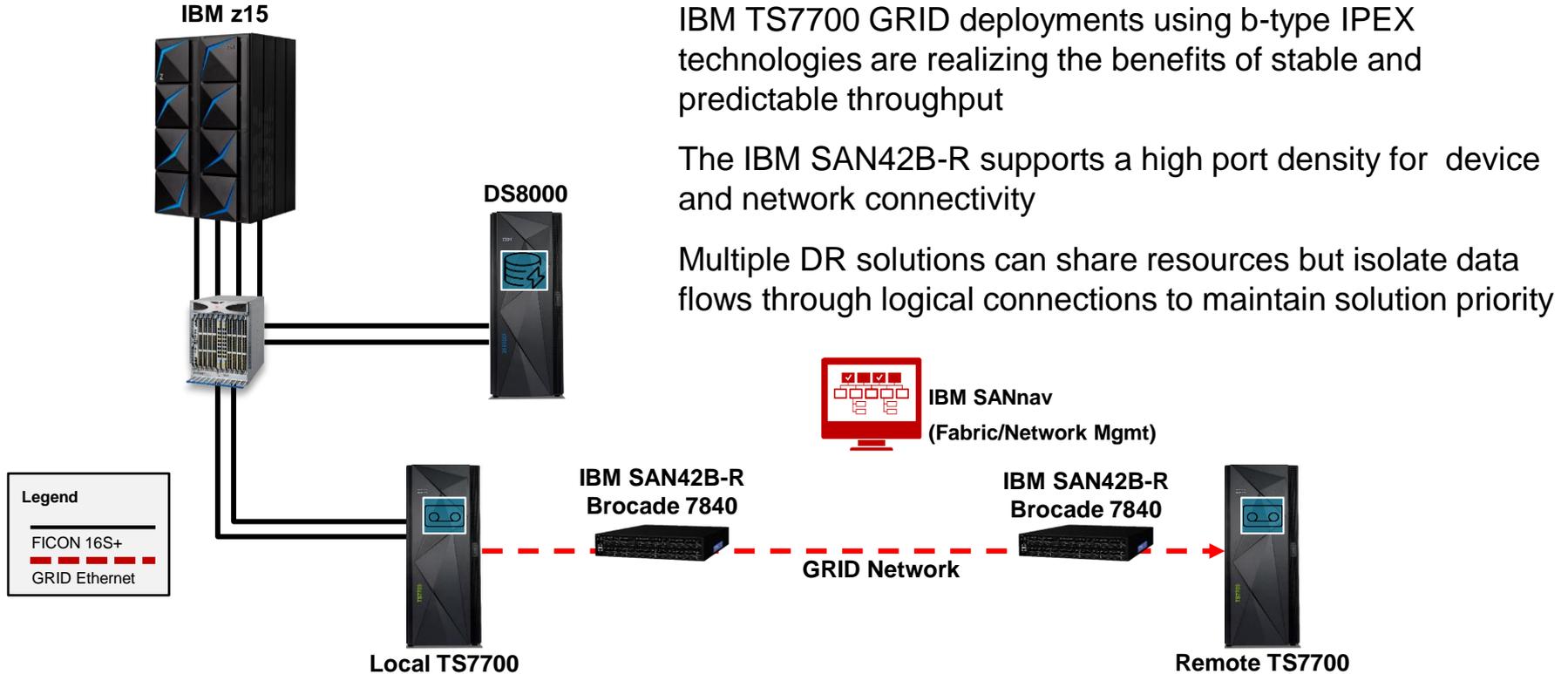
- Direct url:
 - <http://www-03.ibm.com/support/techdocs/atmastr.nsf/WebIndex/FQ116133>
- See Notes: Item #5
 - RPQ should be submitted for Brocade platforms not listed in Note #5

The screenshot shows the IBM TechDocs website interface. The main heading is "What are the supported FICON Director and Channel Extender Configurations for the TS7700? Frequently Asked Question". The document ID is FQ116133. The author is Trinidad Armando Rangel Ruiz and Jose de Jesus Cortes R. The document is from IBM Systems, dated 03/19/2020. The product(s) covered are # 3956; # 3957; TS7700. The FAQ text is: "FAQ: What are the supported FICON Director and Channel Extender Configurations for the TS7700?". The answer states that the table below is the matrix of FICON directors and switches supported with the TS7700. The table lists supported configurations: Support is for use between the host and the TS7700; 1 level of cascading (2 directors) is supported; 2 level of cascading is supported just with Brocade G620 switch model; No intermix of vendors; Maximum distance supported is 100km (62 miles) for all vendors/models (3000 miles for FICON accelerators - see notes below table); Switches must be set to Auto-Negotiate; Contact vendors to determine which products are appropriate for use with channel extenders.

- Notes:**
1. "FTA" refers to FICON Tape Accelerator feature.
 2. Support for below switches are provided based on qualification for IBM z Systems and FPC channels:
Brocade 8510-4
Brocade 8510-8
Brocade 6510
 3. EOL documents can be found here:
Brocade: <https://www.broadcom.com/support/fibre-channel-networking/eol>
 4. Brocade multihop configuration limited to the following: IBM brocade FICON Qualification Letter (<https://www-01.ibm.com/servers/resourceLink/svc03100.nsf?OpenDatabase>) and the IBM FICON multihop whitepaper (<https://www03.ibm.com/support/techdocs/atmastr.nsf/WebIndex/WP102704>)
 5. DS8K Object Store support of FOS 8.2.1c support for Brocade 7840 (IBM 2498-R42) only supported for 5.0 due to IBM DS8000 Team testing, limited to the following: IBM TS7760/TS7770 with R5.0, IBM DS8880 with R8.5.41 (8.5SP4.1) and IBM DS8900 with R9.0.

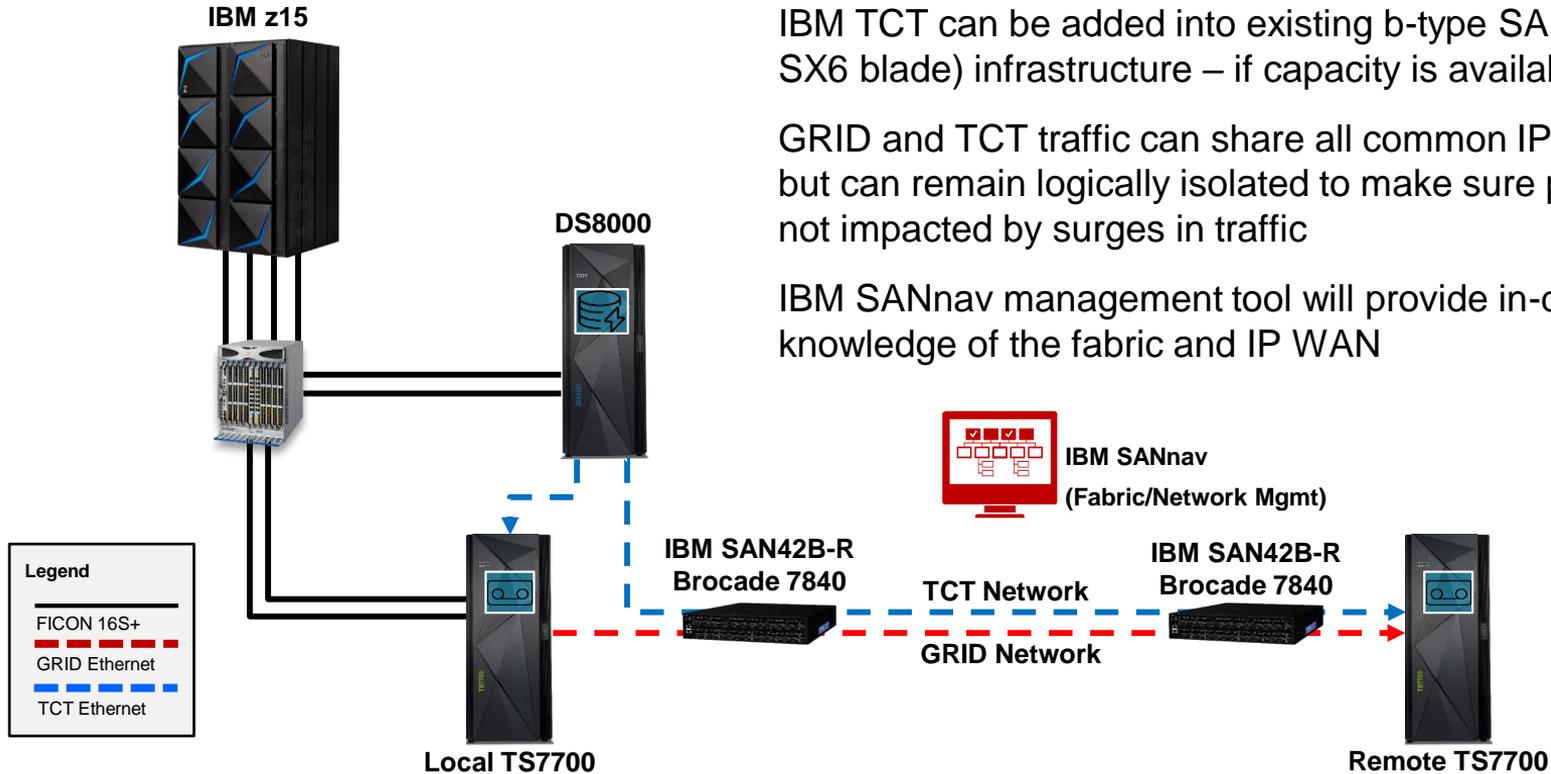
IBM GRID & TCT for DR - Using Same Infrastructure

Leverage IPEX Value for Both Solutions



IBM GRID & TCT for DR - Using Same Infrastructure

Leverage IPEX Value for Both Solutions



IBM TCT can be added into existing b-type SAN42B-R (and/or SX6 blade) infrastructure – if capacity is available

GRID and TCT traffic can share all common IP WAN capacity but can remain logically isolated to make sure priority flows are not impacted by surges in traffic

IBM SANnav management tool will provide in-depth knowledge of the fabric and IP WAN

Brocade & Partner Supported BC/DR Solutions

BC/DR Remote Solutions	IBM b-type SX6 Blade	IBM SAN42B-R 7840 Switch	IBM SAN18B-6 7810 Switch
IBM Metro Mirroring (FCIP Only)	Yes	Yes	Yes
IBM Global Mirroring (FCIP Only)	Yes	Yes	Yes
IBM GDPS/XRC (FICON Emulation Extension)	Yes	Yes	No
IBM Tape Extension – MF (FICON Emulation - FCIP)	Yes	Yes	No
IBM TS77xx GRID (IPEX)	Yes	Yes	No
IBM TCT – DS8K to TS7K/COS (IPEX)	Yes	Yes	No
IBM TCT – DS8K to COS (IPEX)	Yes	Yes	Yes
IBM TCT – TS7K to COS (IPEX)	Under Consideration	Under Consideration	Under Consideration



Practical – Real World Discussion

Thank you!



IBM TechU **Session #:** s203367

Brian Larsen

Director, Partner Business Development

Brian.Larsen@Broadcom.com

+1-612-590-4166

Broadcom.com

Eddie Lin

Senior Technical Staff Member with IBM Systems
Storage

edlin@us.ibm.com

+1-520-404-8707

ibm.com

**Please complete the
session evaluation!**

Additional Resources

ESG Papers

- [Enhancing End-to-end Cyber Resilience in IBM Z Environments with IBM Storage and Networking Solutions](#)
- [Maximizing Performance and Security of the IBM Z Replication Solutions](#)
- [Solve Cyber Resilience Challenges with Storage Solutions](#)

Webpages

- [IBM b-type Storage Networking Solutions](#)
- [Broadcom FICON Resource Page](#)
- [Broadcom Fibre Channel SAN Solutions](#)

Other Resources

- [Unlock the Full Value of Mainframe Technology with Brocade Switched-FICON Architecture](#)
- [Introduction to FICON and Extension Solutions](#)
- [FICON Web-based Training Modules](#)
- [FICON Dynamic Routing \(FIDR\): Technology and Performance Implications](#)

Notices and disclaimers

© 2020 International Business Machines Corporation. No part of this document may be reproduced or transmitted in any form without written permission from IBM.

U.S. Government Users Restricted Rights — use, duplication or disclosure restricted by GSA ADP Schedule Contract with IBM.

Information in these presentations (including information relating to products that have not yet been announced by IBM) has been reviewed for accuracy as of the date of initial publication and could include unintentional technical or typographical errors. IBM shall have no responsibility to update this information. **This document is distributed “as is” without any warranty, either express or implied. In no event, shall IBM be liable for any damage arising from the use of this information, including but not limited to, loss of data, business interruption, loss of profit or loss of opportunity.** IBM products and services are warranted per the terms and conditions of the agreements under which they are provided.

IBM products are manufactured from new parts or new and used parts. In some cases, a product may not be new and may have been previously installed. Regardless, our warranty terms apply.”

Any statements regarding IBM's future direction, intent or product plans are subject to change or withdrawal without notice.

- Performance data contained herein was generally obtained in a controlled, isolated environments. Customer examples are presented as illustrations of how those
- customers have used IBM products and the results they may have achieved. Actual performance, cost, savings or other results in other operating environments may vary.
- References in this document to IBM products, programs, or services does not imply that IBM intends to make such products, programs or services available in all countries in which IBM operates or does business.
- Workshops, sessions and associated materials may have been prepared by independent session speakers, and do not necessarily reflect the views of IBM. All materials and discussions are provided for informational purposes only, and are neither intended to, nor shall constitute legal or other guidance or advice to any individual participant or their specific situation.
- It is the customer’s responsibility to insure its own compliance with legal requirements and to obtain advice of competent legal counsel as to the identification and interpretation of any relevant laws and regulatory requirements that may affect the customer’s business and any actions the customer may need to take to comply with such laws. IBM does not provide legal advice or represent or warrant that its services or products will ensure that the customer follows any law.

Notices and disclaimers

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products about this publication and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products. IBM does not warrant the quality of any third-party products, or the ability of any such third-party products to interoperate with IBM's products. **IBM expressly disclaims all warranties, expressed or implied, including but not limited to, the implied warranties of merchantability and fitness for a purpose.**

The provision of the information contained herein is not intended to, and does not, grant any right or license under any IBM patents, copyrights, trademarks or other intellectual property right.

IBM, the IBM logo, ibm.com and [names of other referenced IBM products and services used in the presentation] are trademarks of International Business Machines Corporation, registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the Web at "Copyright and trademark information" at: www.ibm.com/legal/copytrade.shtml

IBM

IBM b-type Storage Extension

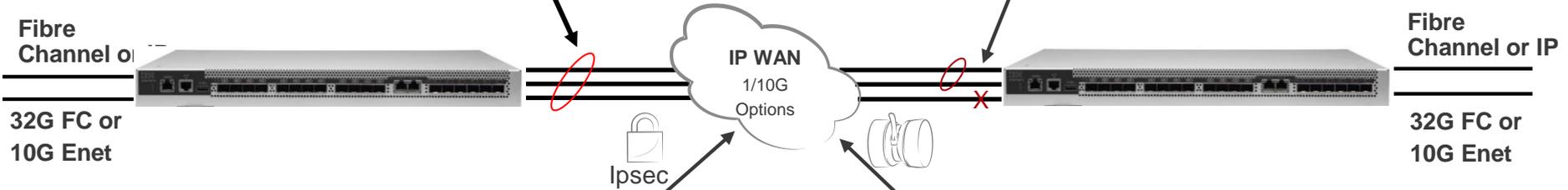
Consistent Performance, Stability, Scale, Self Healing & Visibility

- Bandwidth Load Balancing

- All WAN circuits are a single logical element
 - Add network capacity as needed

- Transparent Failover

- Traffic is shared across the logical elements available
 - No single point of network failure and all transmissions will self heal with no impact to application



- Secure Data Transmission

- Encrypt all Data Across the WAN
 - Ipsec deployed on WAN circuits

- Data Compression

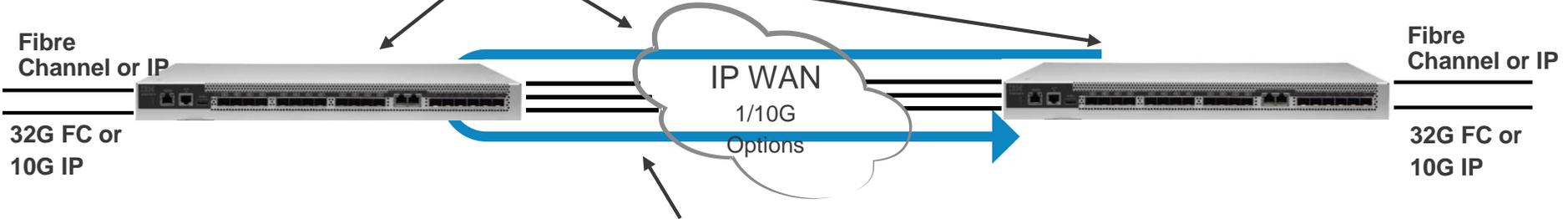
- Maximize the network efficiency
 - Compression of data reduces costs of network
 - 4:1 compression opens up 1/4 the b/w needed

IBM b-type Storage Extension

Consistent Performance, Stability, Scale, Self Healing & Visibility

- Network Insights

- **Advanced analytics help look into the network**
 - Monitor your SLA's & QoS
 - Improve time to problem resolution



- Network Validation Testing

- **Know your network will support production**
 - Test and verify network SLA's & what you are paying for
 - Built-in Traffic Generator Tests Network
 - Verify ASIC, Optics, Cables, Patch panel



Additional Information

Summary

- Cyber Resiliency needs to be part of the IT planning process
- Protecting your data against Ransomware and cyber attacks is a real threat
- Three Key Elements To Address:
 - Data Protection
 - Data Replication
 - Data Recovery
- IBM Solutions provides the most advanced capabilities to secure your data through
 - Fibre Channel End Point Protection
 - Encryption of Data in Flight and at Rest
 - Data replication through mirroring and Transparent Cloud Tiering schemes
- Distance and Network Packet Loss will impact overall replication performance
 - Leveraging IBM b-type Extension platforms provide stability and maximum throughput at virtually any distance