



# Washington Systems Center - Storage

## Accelerate with IBM Storage:

- Part 1: TS7770 – A New Addition to the Family!
- Part 2: Copying Data Between Clusters and Grids



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## Accelerate with IBM Storage Webinars

### The Free IBM Storage Technical Webinar Series Continues in 2019...

*Washington Systems Center* – Storage experts cover a variety of technical topics.

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### 2019 Upcoming Webinars:

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**Register Here:** <https://ibm.webex.com/ibm/onstage/g.php?MTID=e6037edc31ba8c6d8e6e6670c39134d5d>



# **Part 1:** **TS7770 – A New Addition to the Family!**

## TS7770 (Hardware) and TS7700 R5.0 (Software) Overview

- **Announce Date:** October 22, 2019
- **General Availability Date:** November 22, 2019
- **TS7770 Hardware**
  - TS7770 Server 3957 Model VED
  - TS7770 3956 Cache Controller Model CSB & Cache Module Model XSB
  - TS7770 Tape Frame 3952 Model F06 (TS7760 uses this frame as well)
- **TS7700 R5.0 Software**
  - Required for TS7770 systems
    - Provides code and device drivers for new server and storage hardware
  - Can be installed on TS7760 (3957-VEC) systems as well
    - 32 GB memory upgrade (Feat Code 3466) still only required when cloud-attach function is added
  - New functions available in both TS7760 and TS7770 systems
    - Secure Data Transfer
    - DS8K Object Store
    - Expire Hold Times (up to 2,000 years) and Write Protect Exclusion Categories (up to 128) improvements



## TS7770 (Hardware) Product Preview

- **Product Preview to be delivered in 1H20**
  - 2nd Expansion frame
    - Delivering 3.9PB Disk Cache Per System
      - ❖ Over 19PB with 5:1 Compression
- **Customer Supplied 19” Rack**
  - (1) 3957-VED, (1) 3956-CSB, (1) 3956-XSB and (1) TSSC (TS3000 System Console) installed on-site by IBM SSRs (System Support Representatives, a.k.a. “CE’s”) in a standard rack
    - Preliminary design (subject to change) calls for 18U of rack space
  - Licensed usable disk capacity from 20 TB to 140 TB (in 20 TB increments)



## TS7770 – Super Computer Based Control

- **Built on the POWER9™ platform (TS7770: 3957-VED)**

- Two 10 core, 3.8GHz processors
- 64GB DDR4 Memory
- 16Gb FICON (up to 4 adapters, 2 ports per adapter, 512 paths per port)
- 1Gb Copper and 10Gb LW Grid Network (2 or 4 ports)
- 16Gb FC attachment to disk cache and tape drives (up to 16 ports)
- SSD or SAS for local storage in POWER9™
- Common DS8000 Power hardware, I/O bays and adapters
- Single phase power (30AMP), Three Phase 400V support via iRPQ
- Primary ethernet and FC adapters integrated into POWER9™ processor slots
- TSSC required on every TS7770 – sharing a single TSSC between multiple TS7770s (or other TS7700 systems) is not supported





## TS7770 – Next Gen Storage Built on Storwize V5030E

### • Larger Capacity

- 10TB 7.2K SAS Drives, RAID6 Distributed RAID Pools
- 157.9 TB formatted capacity per pair of drawers
- 789 TB formatted capacity base Frame
- 2.37 PB 1x Expansion Frame, 3.9PB 2x Expansion Frames\*
- Concurrent disk cache drawer expansion



### • Capacity On Demand

- First 200 TB of capacity purchased in 20 TB feature increments
- 201 TB+ purchased in 100 TB feature increments

### • Full AES256 Encryption

- Both Local and External Key Management supported
- SKLM KMIP with TLS 1.2 support (distributed SKLM instances only)
- Encryption must be enabled at time of purchase
  - **TS7770 systems do not support retroactive enablement** (*the TS7760 systems still do*)
  - A system can start with local key management and convert to external key management later
- Encryption / decryption is done in the cache controllers (versus the drives)
  - TS7770 systems use regular disk drives (*versus the self encrypting drives in a TS7760*)

\*2<sup>nd</sup> exp frame - PGA1 (1H20)

## TS7770 – Cache Capacity On Demand - Details

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- **How it works**

- First 200 TB of capacity purchased in 20 TB increments (Feature Code 5262). At least one 20TB minimum required
- 201 TB+ purchased in 100 TB increments (Feature Code 5263). First 10 20TB features are a pre-req before buying 100TB features
- Any physical drawers purchases must have corresponding one or more features to enable some portion of the last pair
- If not enough formatted capacity remains to enable a full 100TB feature, that feature can not be purchased without buying an additional pair of drawers
- All spindles of physical disk cache will be used, even if not all installed capacity is enabled

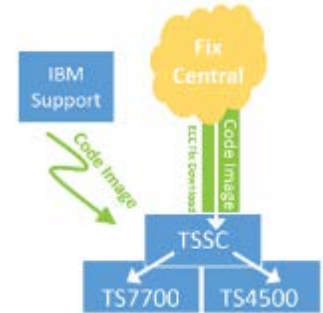




## TS7770 – Changes and Additions

### • Remote Code Load (RCL)

- IBM's strategic direction is to move to RCL for all Storage products
- Reduces costs and improves flexibility for both customers and IBM
- Customers must choose RCL option at time of TS7770 purchase
  - Feature Code 9904 – Use Remote Code Load
  - Feature Code 5904 – Use SSR On-site Code Load (RCL exception – additional charges apply)
- RCL is recommended, but not required, for new and existing TS7760 systems



### • Single-phase and three-phase support

- RPQ 8B3722 provides a three phase power distribution unit (PDU) for clients who need 400 volt support and RPQ 8B3723 provides a pair of 415 volt three phase WYE power cables



## TS7700 R5.0 – Secure Data Transfer

### • Secure Data Transfer Between Clusters in a Grid

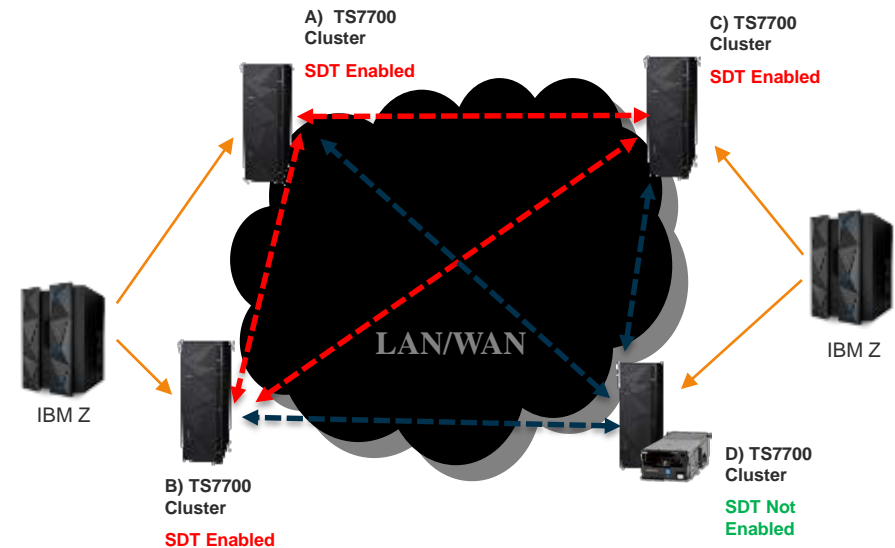
- All logical volume access including copies and remote reads and writes are encrypted in flight
- Priced function can be enabled concurrently at each location on TS7760 or TS7770
- Any two locations with enablement will begin communicating using encryption
- Clusters without enablement or down level can co-exist (non encrypted)

### • TLS 1.2 Support

- TLS 1.2 used to create a secure connection per logical volume
- Default or customer provided certificate supported
- AES128 or AES256 is utilized once the connection is created

### • High Performance

- Exploits the POWER9™ and POWER8® encryption instruction set
- Minimal performance and CPU overhead when enabled



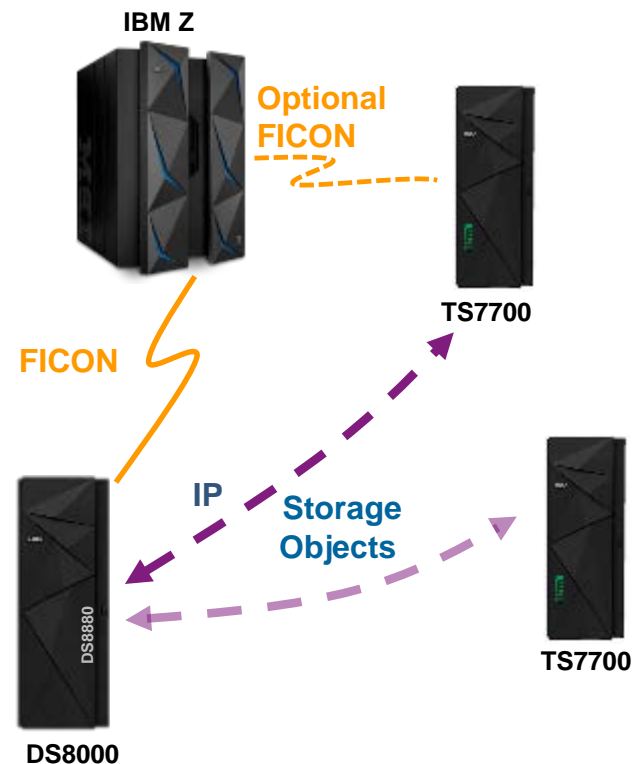
## TS7700 R5.0 – DS8000 Object Store

### • DFSMS initiated DS8000 object offload support

- Through DFSMS policy management, applications such as DFSMSHsm can request the DS8K offload datasets in the form of objects directly to the TS7700 instead of a traditional object store device (MLC instead of ML2)
- Optional, priced function on the TS7700 system(s)
- The DS8K can target two TS7700s providing a zero RPO of redundancy
- Offload occurs through the existing 1Gb or 10Gb TS7700 Grid network
- FICON created content and DS8K offload data can co-exist through the use of Logical Disk Cache Partitions within the TS7700
- Over 2x faster than DS8K offload to a standard on prem object store

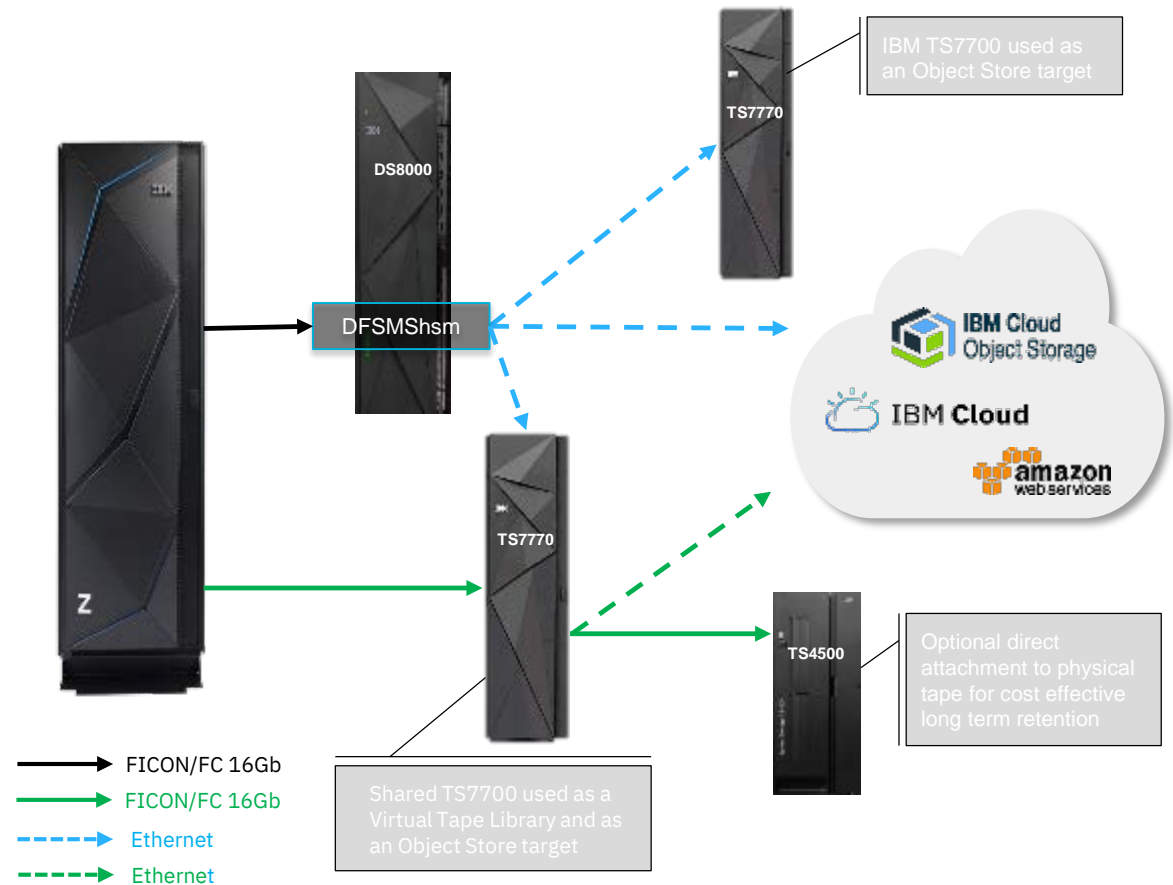
### • MIPs Reduction

- Up to 50% reduction in MIPs used by DFSMSHsm
- DFSMSHsm recycle processing can be eliminated
- Future use cases such as HSM Backup, DSS Full Volume Dump, DB2 Image Copies and others will be supported.



## TS7700 R5.0 – Transparent integration to hybrid cloud for IBM Z

- Transparent Cloud Tiering (TCT) enables hybrid cloud as an additional storage tier for data archiving, long term retention and data protection
- Efficiently moves data to the proper medium reducing costs while keeping the information available
- Does not require an additional server or gateway
- Provides up to 50% savings in mainframe CPU utilization when using TCT with DS8880/F to migrate large datasets



# TS7700 R5.0 – Enhanced Download System Summary on Web GUI

## • More information added to “Download System Summary” from Management Interface (MI)

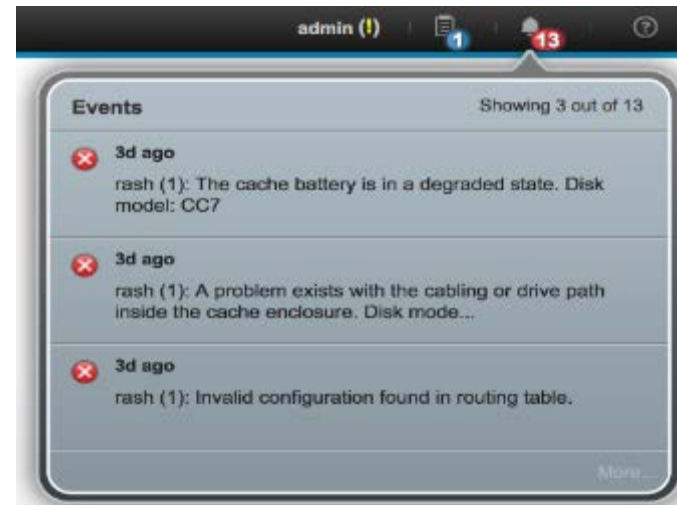
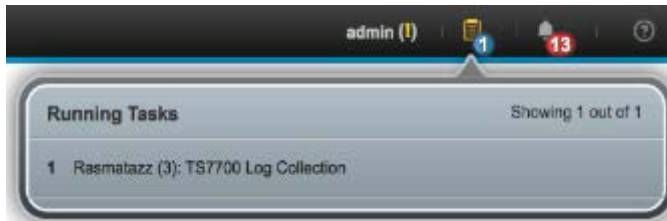
- List of all DDMs serial numbers from all cache strings
- VTD Execs installed on cluster
- Secure Data Transfer Information
  - Status – Enabled / Disabled
  - Protocol Used
  - Key Size
  - Current Security Certificate



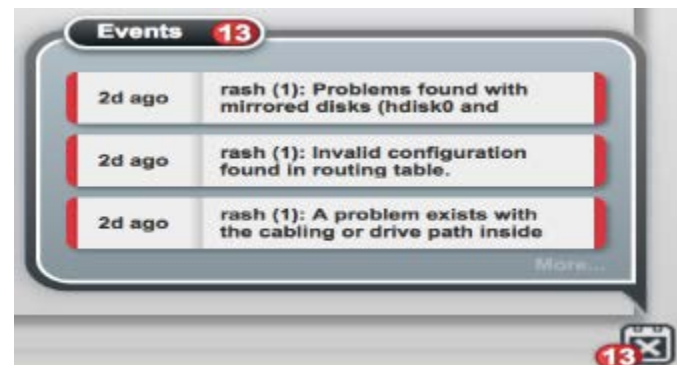
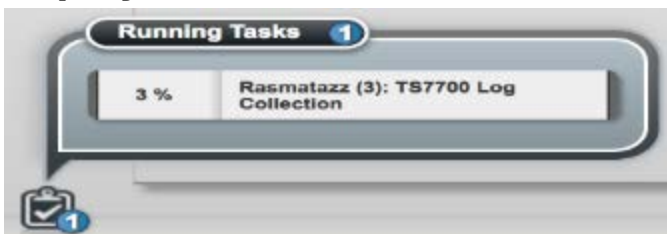
Cluster Summary		Secure Data Transfer	
Distributed Library Sequence Number		Protocol and Version	Disabled
Cluster Name	7700VTAP	Standard and Key Size	-
Family		Certificate	Alias: lwiks   Issued to: CN=www.ibm.com, OU=STG, O=IBM, L=Tucson, ST=AZ, C=US   Fingerprint: DD:BC:C7:7B:F7:C4:60:99:D7:61:74:36:7 4:D5:A0:69:80:A9:98:3A   Expiry: 2033- 06-01T15:46:05 UTC
Model	3957VEC	DDM Serial Numbers	
Microcode Level	8.50.0.130	String S0 ( Main Frame )	
Description	WSC TS7760	Enclosure E85	
Disk Encryption	AES256 Enabled local	Slot 01	ZA17WYLP0000R7443J87
Key Creation Date	-	Slot 02	ZA17WYV80000R745JYN0
Hardware Serial Number		Slot 03	ZA17WYZD0000R744Y5WX
Licensed Capacity	61.55 TB	Slot 04	ZA17WYPG0000R741JMAM
Total Physical Used	1.00 TB	Slot 05	ZA17WYK90000R7443MPZ
Licensed Throughput		Slot 06	ZA17ZQKT0000R745JZS5
Removal Threshold	3.00 TB	Slot 07	ZA17WYYQ0000R744Y5W5
String 0 WWID	600A098000AD8954000000059774EBF	Slot 08	ZA17ZQPF0000R744Z8K4
VTD_EXEC installed	-	Slot 09	ZA17WYVN0000R744XPX6
		Slot 10	ZA17WYBV0000R744Z2A1
		Slot 11	ZA17WYFQ0000R744JA04
		Slot 12	ZA17ZQBK0000R744Z52Y

## TS7700 R5.0 – Events & Task Alerts Moved to Banner Section (top)

### • R5.0 Displays



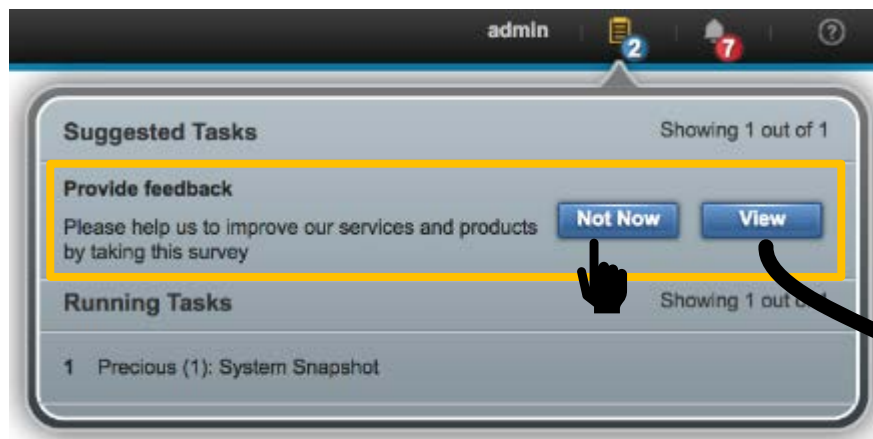
### • R4.x Displays



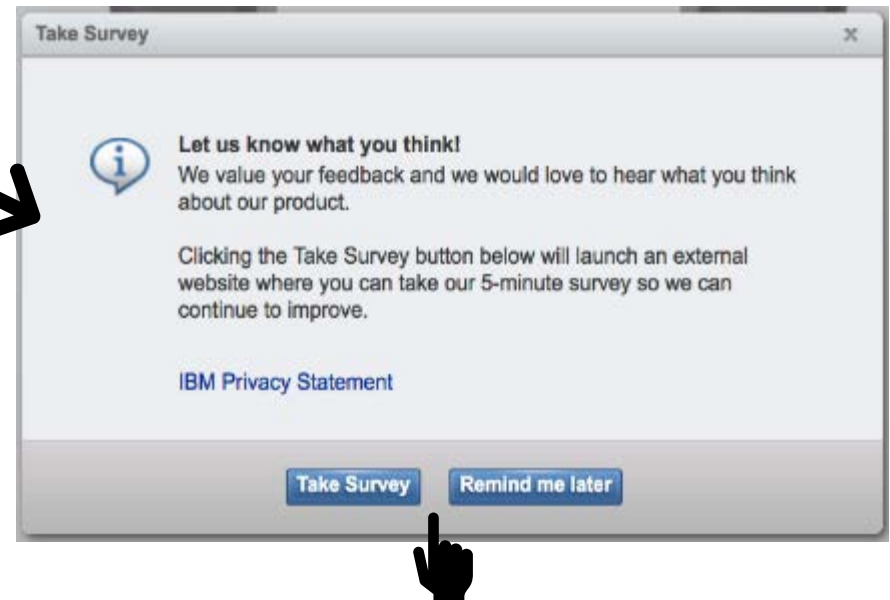


## TS7700 R5.0 – Satisfaction Survey

- This feature is an opportunity for customers to provide feedback by opening an external site from the TS7700 MI



- ✓ The Feedback request is presented 30 days after user logs in to the MI for the first time after new code is installed



- ✓ Dismissing the request will make the “Provide feedback” task **disappear for 30 days**

## TS7700 R5.0 – Password Reset From Login Page

- Any user can change his or her own expired password from Login page regardless their defined role in the target TS7700
- User has to enter expired password to be successfully authenticated before the MI asks user to change the password

IBM TS7700  
Storage Management (Rascal-3)

User name:

Password:

Login

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IBM TS7700  
Storage Management (Rascal-3)

New password:

Verify password:

Submit

Your login password has expired. Enter a new password.

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## TS7700 R5.0 – Default Password for admin User Marked as Expired

- In compliance with California law default user "admin" has to have its default password changed
- The first time admin logs in to the MI, the application will report the password as expired requesting an update



IBM TS7700  
Storage Management (Rascal-3)

User name:

Password:

Login

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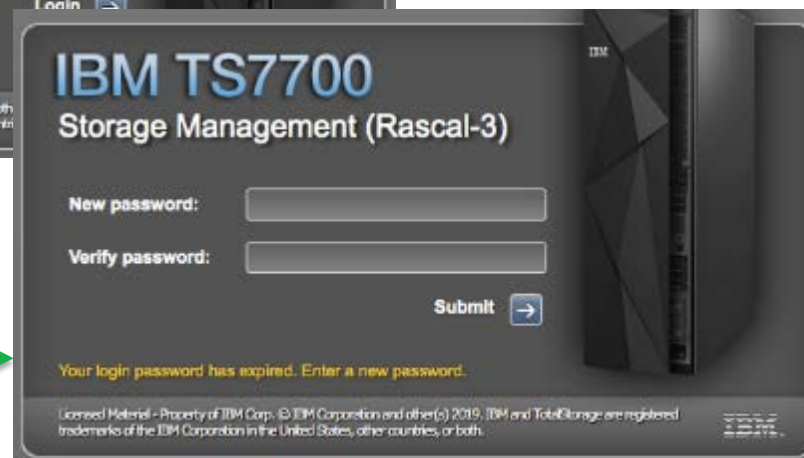


The password criteria has NOT changed!

New password must be 6 - 16 characters in length composed of alphanumeric characters.

**Password restrictions include:**

- At least 5 letters and 1 number must be used
- A number cannot be in the first or last position
- No spaces can be included
- The user name cannot be included



IBM TS7700  
Storage Management (Rascal-3)

New password:

Verify password:

Submit →

Your login password has expired. Enter a new password.

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# TS7700 R5.0 – 128 Write Protect Categories

- Allow up to 128 excluded categories from Write Protect Mode page
- Important for customers using the FlashCopy for D/R testing function in a Grid with many logical partitions
- All clusters on the Grid must be at 5.0 code level



**Reminder:** Use Backup & Restore pages to replicate WP categories from one cluster to another

Category Write Protect Properties:

Select	Category	Excluded from Write Protect	Description
<input type="radio"/>	0001	No	not include
<input type="radio"/>	0002	No	not include
<input type="radio"/>	0003	No	not include
<input type="radio"/>	0004	No	not include
<input type="radio"/>	0005	No	not include
<input type="radio"/>	0006	No	not include
<input type="radio"/>	0007	No	not include
<input type="radio"/>	0008	No	not include
<input type="radio"/>	0009	No	not include
<input type="radio"/>	0010	No	not include
<input type="radio"/>	0011	No	not include
<input type="radio"/>	0012	No	not include
<input type="radio"/>	0013	No	not include
<input type="radio"/>	0014	No	not include
<input type="radio"/>	0015	No	not include
<input type="radio"/>	0016	No	not include
<input type="radio"/>	0017	No	not include
<input type="radio"/>	0018	No	not include
<input type="radio"/>	0019	No	not include
<input type="radio"/>	0020	No	not include

Page 1 of 7 | Total: 128 | Filtered: 128 | Displayed: 20

**"Precious[1]" (#BA101): Backup Settings**

Backup Settings:

- Select All
- Feature Licenses
- Cluster Network Settings
- Roles & Permissions
- Copy Policy Override
- SNMP
- Write Protect Mode Categories

Download

---

**"Stanley[2]" (#BA102): Restore Settings**

Backup file:

Choose File | No file chosen

Show file

File:

Cluster: "Precious[1]" (#BA101)

Time of backup: Tuesday, October 15, 2019 5:47:38 PM UTC

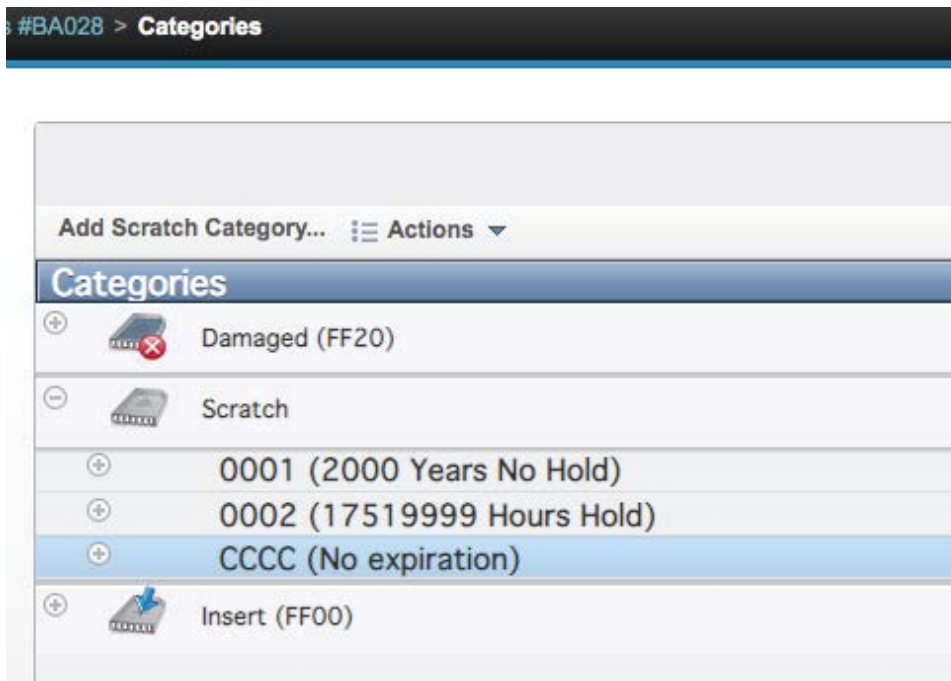
Restore Settings:

- Select All
- Write Protect Mode Categories

Restore

## TS7700 R5.0 – Expire Hold Time Up to 2000 Years

- Scratch categories support up to 2000 years for expire hold attribute (equals to 17,520,000 hours or 730,000 days)
- Previous releases 4.12 and 4.2 support 10 years as limit



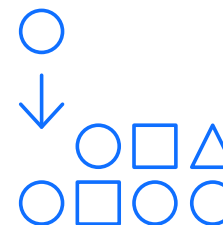
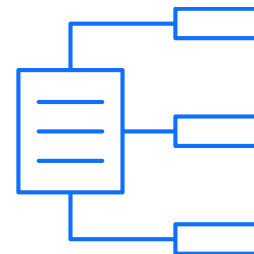
## TS7700 R5.0 – Enhanced Data Handling

- **Concurrent TS3500/TS4500 Maintenance**

- Physical tape library can now transition to a non-operational state with minimal impact to TS7700T operations. Premigration and recalls are suspended
- Premigration queue will be allowed to increase indefinitely during such an outage and will not introduce excessive throttling when the library becomes operational
- New function will support planned and unplanned outages of the TS3500/TS4500 library. Customer can initiate a “library pause” state through LI REQ

- **TS7760 Improved Key Management Security**

- TLS 1.2 Now Supported with TS7760 CSA SKLM attachment





## TS7700 R5.0 – LI(brary) REQ(uest) Command Changes

- Add SETTING2, ALERT, RSDOHIGH **keyword**
- Add SETTING2, ALERT, RSDOLOW **keyword**
- Add PVOL RELABEL **command** to mark a physical volume for re-labeling
- Add COPY, QUEUE **keyword**
- Add LVOL, COPY, CANCEL **command**
- Add SETTING2, CENCRYPT **keyword**
- Add copy job age to COPY, ACTIVITY **output**
- Add SETTING2, COPY, COPYRFSH/DEF, PAUSE/UNPAUSE **keyword**
- Add SETTING2, PHYSLIB, SLDPMPRI **keyword**
- Add SETTING2, PHYSLIB, MAINT **keyword**
- Add SETTING2, ALERT, CAGAHIGH/CAGALOW/CAGHIGH/CAGLOW **keyword**



## TS7700 R5.0 – LI(brary) REQ(uest) Command Changes (cont'd)

- Add CLDGHOST option (**keyword**) to COPYRFSH command
- Add MMOUNT option (**keyword**) to PARTRFSH command
- Add SETTING,EXISTDEL,AUTINTVL/AUTCOUNT **keyword**
- Add SERVICE **command**
- Add SETTING2,VOLINVT,LPAGRP **command**

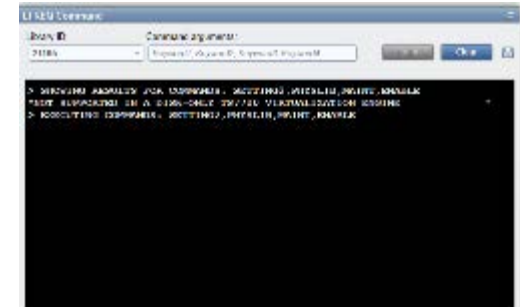


**IBM® TS7700 Series z/OS Host Command Line Request User's Guide Version 5.0**

White Paper will be released soon after R5.0 GA (November 22, 2019)

## TS7700 R5.0 – SETTING2,PHYSLIB,MAINT,DISABLE (or ENABLE)

- **Suspends (or resumes) all physical tape activity for maintenance**
  - Physical tape activities to be suspended are Premigration, Recall, Reclaim, Copy Export, Secure Data Erase, Read Only Recovery and Offsite Reclaim
  - If any of the physical tape activities listed above are already running, they will not be canceled
  - Use the **LIB REQ,distname,PDRIVE** command to monitor the status of the physical drive usage



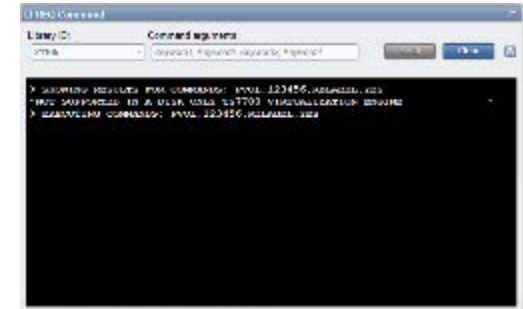
## TS7700 R5.0 – PVOL,zzzzzz,RELABEL,YES/NO

- **Makes it possible to write a new internal label to specified physical volume next time when it is written from the beginning of tape**

- **Note:** The command does not cause the TS7700 to immediately write a new internal label on a tape. Rather it allows the tape to receive a new label later when the cartridge is selected for use as a stacking tape

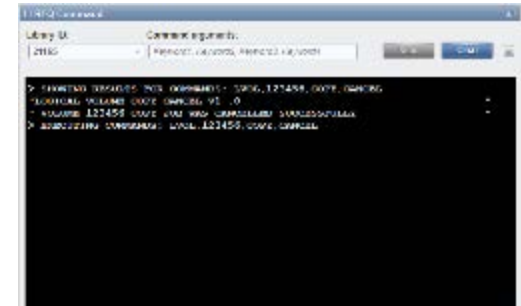
- **Usage example:**

- The physical tape is inserted into the physical library and is known to have an external label that is different than the internally written label
- Before the TS7700 selects the inserted physical tape for writing, the customer should issue a library request command to relabel this tape
- If the PVOL,zzzzzz,RELABEL,YES has not been entered before the tape is attempted to be used, the TS7700 will issue an error message about the tape and it will eject the tape from the physical tape library



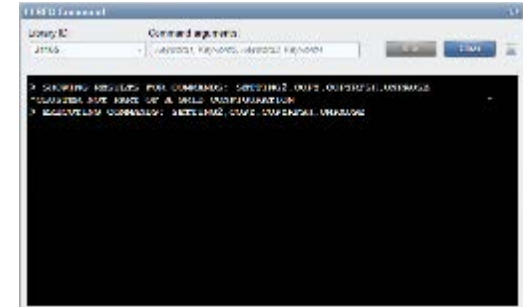
## TS7700 R5.0 – LVOL,zzzzzz,COPY,CANCEL

- **Cancels in-flight copy job for a specified volume and delay the job**
  - The command may be useful when:
    - Copy needs to be canceled immediately
    - Copy job get stuck in “in-flight” state and needs to be canceled
  - Best to think of this as a copy reset command as once the cancel is complete, the TS7700 will automatically retry the copy later



## TS7700 R5.0 – SETTING2,COPY,COPYRFSH/DEF,PAUSE/UNPAUSE

- **Pauses or resumes (unpauses) incoming COPYRFSH/Deferred Grid copies**
  - This command supports finer knob compared to GRIDCNTL command
    - LI REQ GRIDCNTL stops both incoming and outgoing Grid copies
  - Two (2) formats:
    - **SETTING2,COPY,COPYRFSH,PAUSE** (or UNPAUSE)
      - All incoming copy refresh operations are suspending. In-flight operations (tasks already copying data) are allowed to complete
    - **SETTING2,COPY,DEF,PAUSE** (or UNPAUSE)
      - DEF includes COPYRFSH, Immediate-Deferred / Sync-Deferred / Family-Deferred (i.e. except RUN copies). In-flight operations (tasks already copying data) are allowed to complete





## TS7700 R5.0 – TS7760 and TS7770 Support



### IBM TS7760

**Built on POWER8® Platform**

Two 10 core, 3.42GHz processors  
32GB DDR3 Memory (64GB option)  
**Up to 2.45PB of storage capacity**  
In 61TB increments

### Common Features

**DS8880 synergy**

Common pSeries hardware, IO bays and adapters

**Integrated power system**

30amp single phase power

**Exclusive features**

4x10GB optical LW Ethernet links for Grid Cloud replication  
16Gb FC attachment to disk cache and TS1100 tape drives

**R5 Code Exclusive**

Secure Data Transfer  
DS8000 Object Store

### IBM TS7770

**Built on POWER9™ Platform**

Two 10 core, 3.8GHz processors  
64GB DDR4 Memory / SSD option  
**UP to 3.9PB of storage capacity**  
Capacity on Demand  
Up to 200 TB, in 20 TB increments  
After 200 TB, in 100 TB increments



## TS7700: Enterprise Feature Evolution

<b>B16</b> - Industry First VTS (1997)
<b>B18</b> - Next Gen VTA
<b>P2P VTS</b> - First DR VTS
<b>B10/B20</b> - Next Gen VTS
<b>TS7700 R1.0 9/29/06</b>
2-way grid TS3500 Support 16 3592 J1A drives
<b>R1.1 1/25/07</b>
Autonomic Ownership Take over TS1120 Drive Support Larger Disk Cache SW 1Gb Fibre Grid replication 256 virtual devices
<b>R1.2 3/09/07</b>
First Tape drive AES256 encryption Broadband Call home
<b>R1.3 8/31/07</b>
3-way grid LI REQ Support Copy Export (standalone) 1M logical volumes Secure data erase ROR recovery

<b>R1.4 11/23/07</b>
Copy export (Grid)
<b>R1.5 12/05/08</b>
TS7720 Introduction (disk only)
LM Convergence Disk Cache refresh TS1130 Support TS3500 HD support
<b>R1.6 12/04/09</b>
4-wqy grid TS7720/TS7740 Hybrid Logical WORM Network Load Balancing Cluster Families
<b>R1.7 6/04/10</b>
Disk Cache Refresh Selective Write Protect Additional Memory FC 600MB Logical Volumes LDAP support

<b>TS7700 R2.0 6/3/11</b>
Power7 technology Server Swap support 2x10Gb LW optical Grid Ports 4x1Gb Grid Ports 6-way grid Scratch Allocation Assist TS1140 Support
<b>R2.1 12/19/11</b>
Synch Mode Copy Remote Mount iP link Failover Grid Merge Copy Export Merge Parallel Copies and Pre-Migration Copy Export Acceleration

<b>TS7700 R3.0 Dec 2012</b>
Disk Cache Refresh Disk Cache AES 256 Encryption Unified GUI 4Million Logical Volumes Native LDAP Limited IPv6 support
<b>R3.1 Dec 2013</b>
1PB TS7720 8x8Gb FICON Support (2.5GB/s) 512 paths per port Flash Copy for DR Testing Time Delayed Replication
<b>R3.2 Dec 2014</b>
Tape Attached TS7720 (TS7720T) 25GB Volume Support 496 UCB/Devices RACF LDAP Support
<b>R3.3 Sept 2015</b>
TS1150 Support 100PB TS7720T External key management for Disk Grid to Grid Migration

<b>TS7700 R4.0 June 2016</b>
TS7760 introduction Consolidated Model Power8 Technology TS4500 Support Disk cache Reresh 1.3PB TS7760 Dynamic Disk Pools 4x10Gb Grid replication
<b>TS7700 R4.1 Feb 2017</b>
7/8-way Grids Library Request command for grid status
<b>TS7700 R4.1 May 2017</b>
8 TB drives
<b>TS7700 R4.1.2 March 2018</b>
16 Gb FICON – 4 TB/s) Enhanced Compression
<b>TS7700 R4.2 Sept 2018</b>
TS7760C TCT Support

<b>TS7700 R5.0 Nov 2019</b>
TS7770/T/C VED CSB/XSB Disk Cache Secure Data Transfer DS8K Object Offload 128 WP Exclusion Category 2000 Year Expire Hold

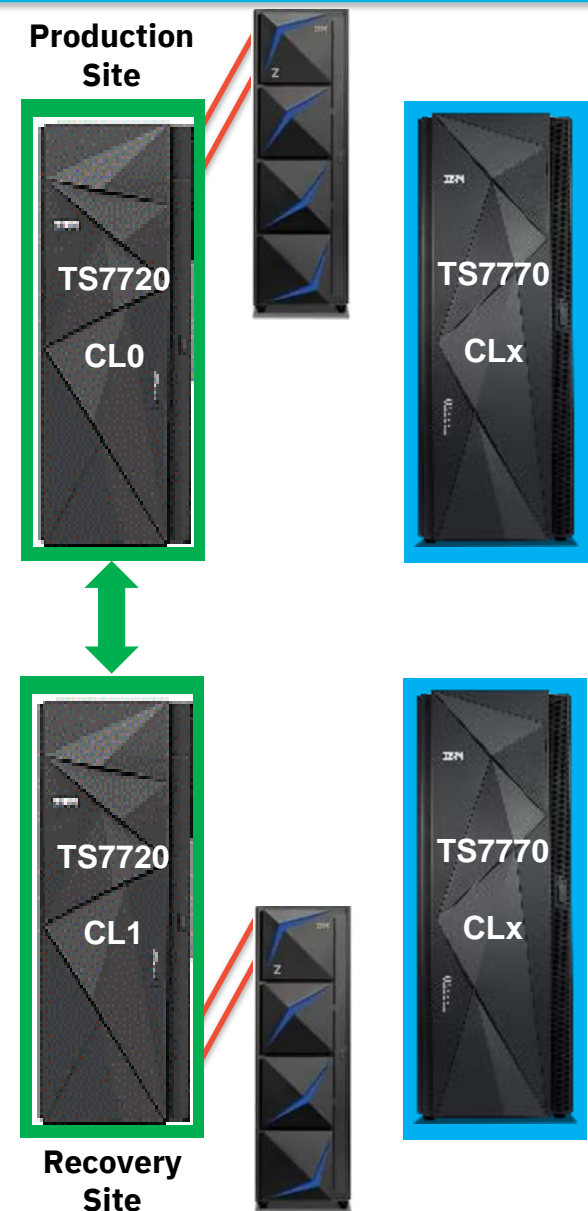


## **Part 2:**

# **TS7700 – Copying Data Between Clusters and Grids**

## TS7700 – Example Used Throughout This Section

- **A common scenario will be used throughout this section to help explain the options available to copy or move data between TS7700 clusters and Grids**
  - The term TS7700 is used generically – each cluster can be a TS7720/20T, a TS7740, a TS7760/60C/60T, or a TS7770/70C/70T
- **In this example, two (2) existing TS7720 clusters need to be replaced with two (2) new TS7770 clusters**
  - The two (2) TS7720 clusters are members of an existing Grid
  - Two (new) TS7770 clusters have been acquired to replace the TS7720 clusters
  - The data contained on the virtual volumes in the existing Grid must be moved or copied to the new clusters while maintaining full production and disaster recovery capabilities

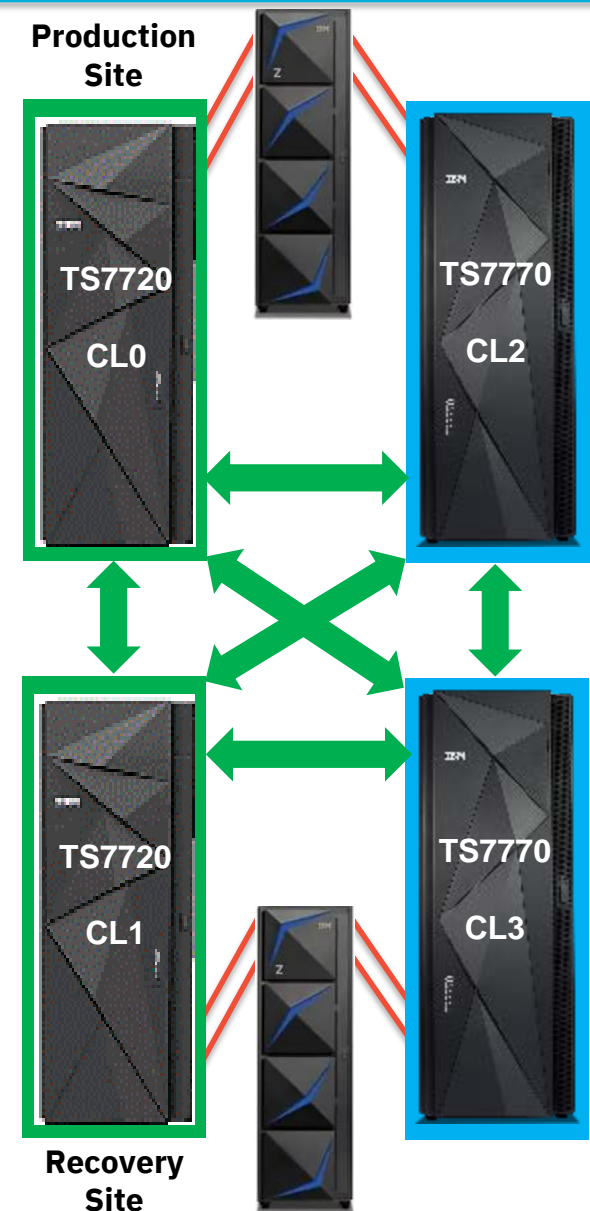


## **Part 2 – Option A: Using TS7700 Grid Functions or Elapsed Time**

## Option A1 – Join New TS7770 Clusters to Grid and Wait for Existing Private Volumes to Expire (i.e. a “Natural” Move)

### • Overview

- Join two (2) new TS7760 clusters to existing Grid
  - Update Copy Consistency Policies (CCPs) in all four (4) clusters to only keep data in clusters 2 and 3 (CL2 and CL3 – TS7770 systems). Mark CL2 and CL3 as the preferred clusters for scratch mounts
  - Define CL2 and CL3 to the appropriate hosts
  - **Wait for all of the existing private volumes in CL0 and CL1 to expire**
  - Remove CL0 and CL1 from the Grid
- **Note: It is quite rare for this option to be completely practical as most Grids contain private volumes with expiration dates that are months or years away**
- A few Grids only contain private volumes with expiration dates of 120 days (or less)

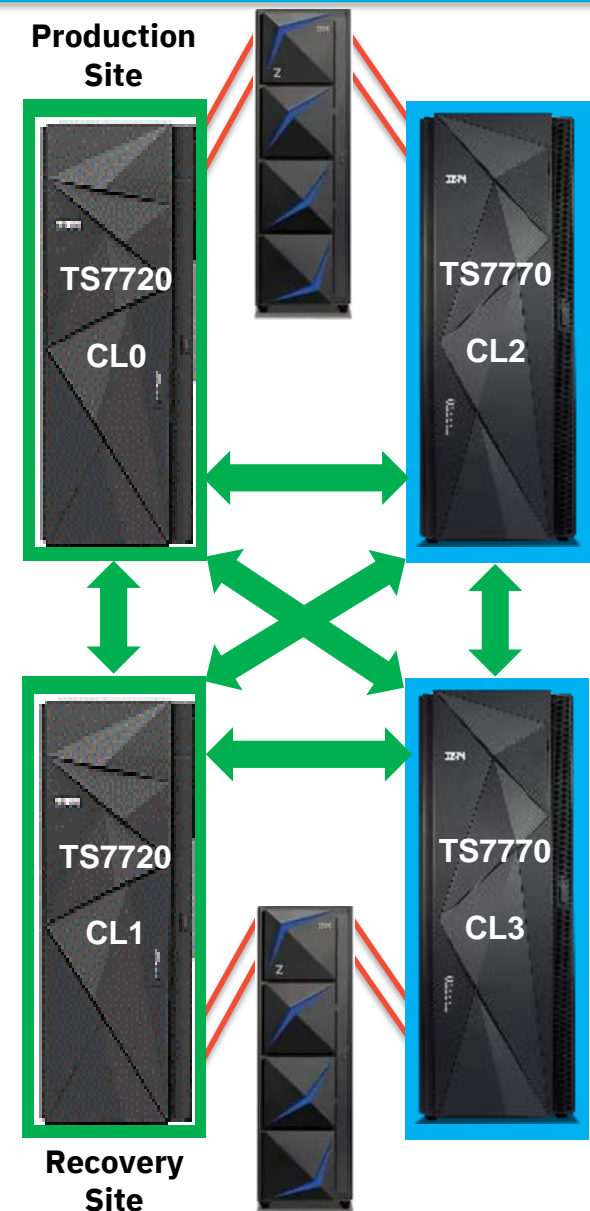




## Option A2 – Join New TS7770 Clusters to Grid and Use the IBM PRESTAGE Tool to Open All Existing Private Volumes in CL0 & CL1

### • Overview

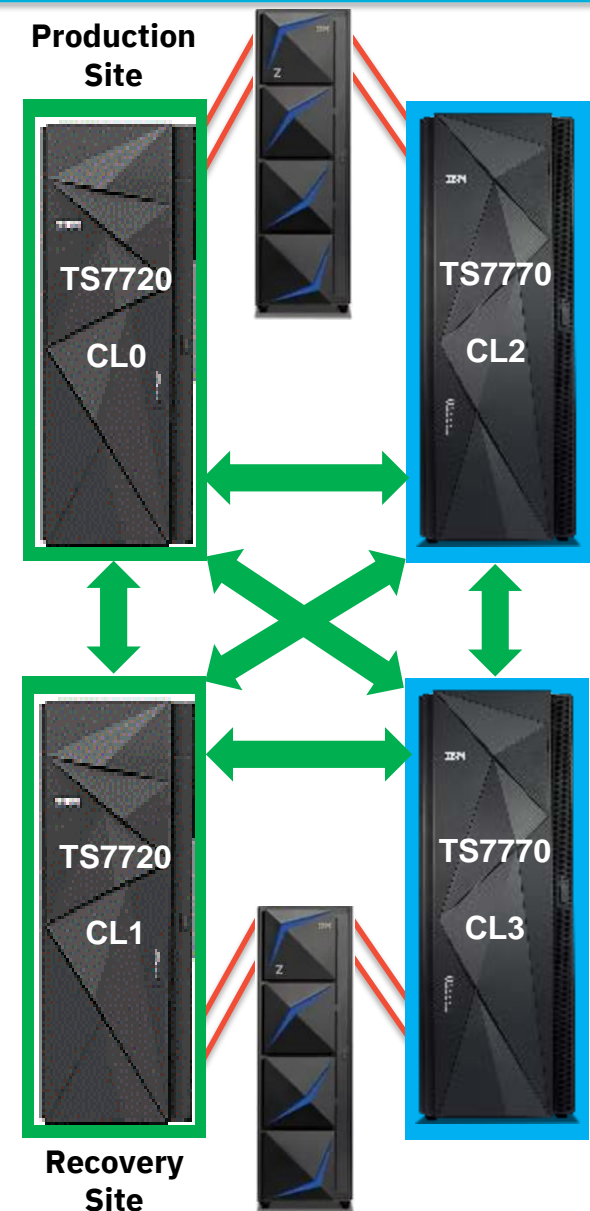
- Join two (2) new TS7760 clusters to existing Grid
  - Update Copy Consistency Policies (CCPs) in all four (4) clusters to only keep data in clusters 2 and 3 (CL2 and CL3 – TS7770 systems). Mark CL2 and CL3 as the preferred clusters for scratch mounts
  - Define CL2 and CL3 to the appropriate hosts
  - **Use the IBM PRESTAGE tool (included in the IBM TAPETOOL package) to open all existing private volumes in CL0 and CL1. As each volume is closed, the Grid will recognize that it has to adjust where the copy of each volume is being kept**
  - Remove CL0 and CL1 from the Grid
- **Note:** The PRESTAGE utility pre-dates the COPY REFRESH function. **COPY REFRESH is a better option. PRESTAGE still works but it is no longer recommended**



## Option A3 – Join New TS7770 Clusters to Grid and Manually Enter COPYRFRSH Cmds for All Existing Private Volumes in CL0 & CL1

### • Overview

- Join two (2) new TS7760 clusters to existing Grid
  - Update Copy Consistency Policies (CCPs) in all four (4) clusters to only keep data in clusters 2 and 3 (CL2 and CL3 – TS7770 systems). Mark CL2 and CL3 as the preferred clusters for scratch mounts
  - Define CL2 and CL3 to the appropriate hosts
  - **Identify all of the private volumes in CL0 and CL1. Manually (or build an automation script to) enter a `LIBRARY REQUEST,distname,COPYRFRSH,volser` command for each private volume. The `COPY REFRESH` command will cause the Grid to recognize that it has to adjust where the copy or copies of each volume is being kept**
  - Remove CL0 and CL1 from the Grid
- **Note:** The “Cache Contents” or “Volume Status” reports from the Bulk Volume Information Retrieval (BVIR) feature can be used to identify the private volumes

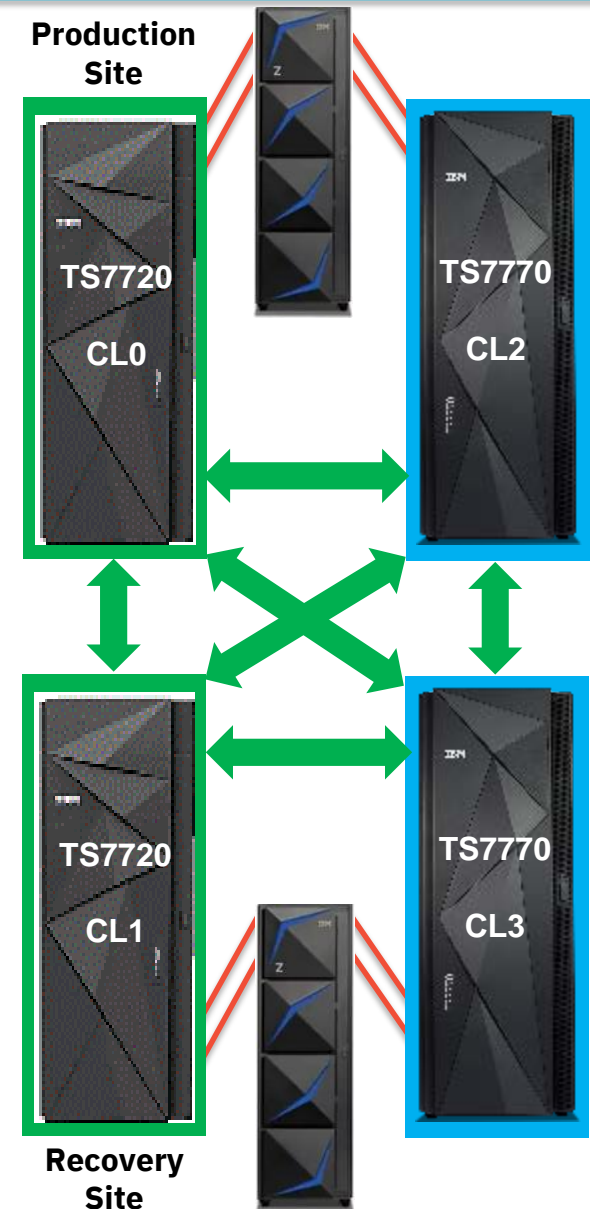




## Option A4 – Join New TS7770 Clusters to Grid and Use the COPYRFSH Tool for All Existing Private Volumes in CL0 & CL1

### • Overview

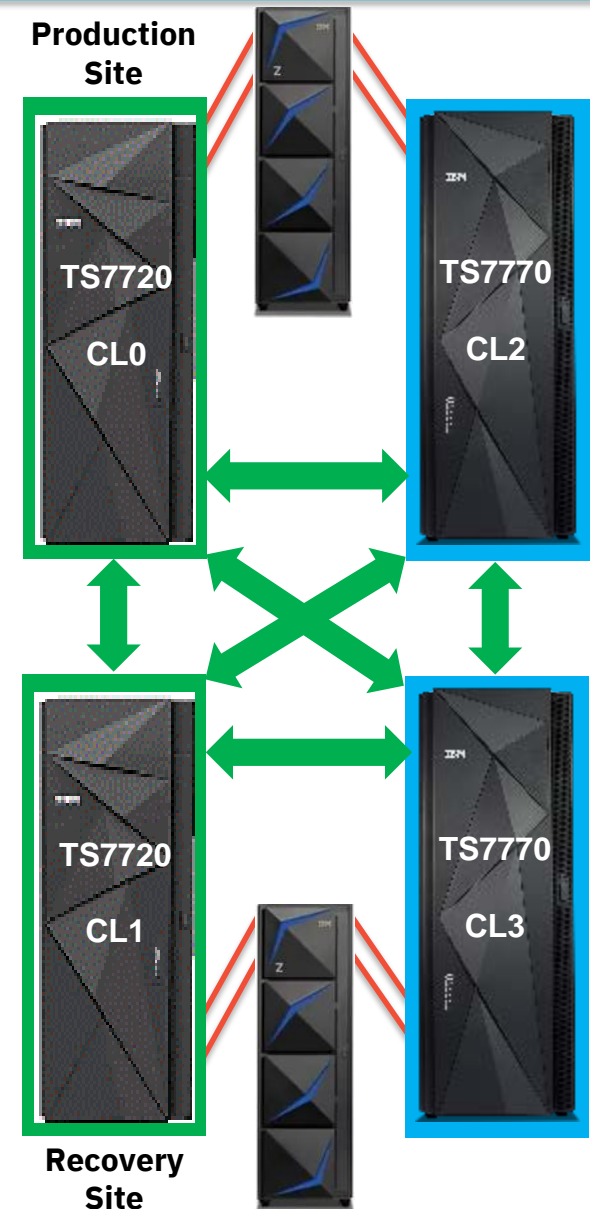
- Join two (2) new TS7760 clusters to existing Grid
  - Update Copy Consistency Policies (CCPs) in all four (4) clusters to only keep data in clusters 2 and 3 (CL2 and CL3 – TS7770 systems). Mark CL2 and CL3 as the preferred clusters for scratch mounts
  - Define CL2 and CL3 to the appropriate hosts
  - Use the **IBM COPYRFSH tool (included in the IBM TAPETOOL package)** to automate the issuing of **LI REQ COPYRFSH** commands for all existing private volumes in **CL0** and **CL1**. As each **COPYRFSH** command is processed, the **Grid** will recognize that it has to adjust where the copy(ies) of each volume is/are being kept
  - Remove CL0 and CL1 from the Grid
- **Note:** The COPYRFSH tool uses data from the Bulk Volume Information Retrieval (BVIR) feature to identify the private volumes



## Option A5 – Join New TS7770 Clusters to Grid and Use TS7700 Migration Services for All Existing Private Volumes in CL0 & CL1

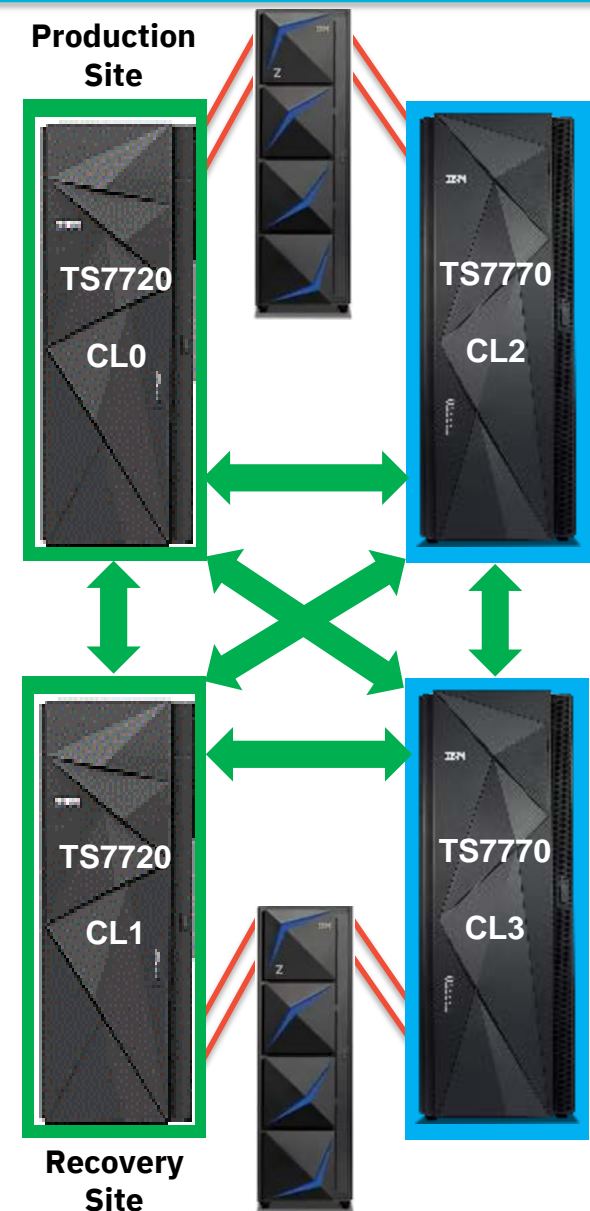
### • Overview

- Join two (2) new TS7760 clusters to existing Grid
  - Update Copy Consistency Policies (CCPs) in all four (4) clusters to only keep data in clusters 2 and 3 (CL2 and CL3 – TS7770 systems). Mark CL2 and CL3 as the preferred clusters for scratch mounts
  - Define CL2 and CL3 to the appropriate hosts
  - **Use the priced TS7700 Migration Services offering from the IBM Lab Services team. Using software and scripts temporarily installed on one of the clusters in the Grid, the LBS team will automate the initiation of the copy tasks needed. No host actions or commands are required. Commands and reports are available to monitor the data copy process**
  - Remove CL0 and CL1 from the Grid when GGM complete
- **Note (1):** This IBM Lab Services offering was previously called “Migrations Made Easy”
- **Note (2):** This Services offering is usually done using the remote support functions of a TS7700. For sites where remote access is not allowed, alternative arrangements can be made



## Option A – About Volume Copies in Clusters with an “E” Status

- **The TS7700 Grid function does not “move” volumes between clusters, it “copies” them**
  - As each volume is opened/closed or Copy Refresh’ed, the Grid will adjust where the volume copies are located by making copies in the “to” clusters. The original copies in the “from” clusters are not immediately removed, but they will be flagged as having an “E” (for “Exists”) status
  - These “E” status volumes can be thought of as “Extra” volume copies
  - The default is for these “E” status volumes to remain in the cluster until the virtual volume is scratched and the Delete Expire Time value is reached.
  
- **An automatic “E” status volume removal (EXISTDEL) process can be enabled and configured using these commands (on each of the “old” clusters):**
  - **LI REQ,distname,SETTING,EXISTDEL,CRITERIA,ALL** (default: STALE)
  - **LI REQ,distname,SETTING,EXISTDEL,WHEN,AUTO** (default: ATCLOSE)
  - **LI REQ,distname,SETTING,EXISTDEL,AUTINTVL,8** (default: 24)
  - **LI REQ,distname,SETTING,EXISTDEL,AUTCOUNT,1000** (default: 100)
  - These settings will cause a cluster to automatically remove up to 3,000 volumes with an “E” status each day



## **Part 2 – Option B: Copying Data Between Grids**

## Option B1 – Use New TS7770 Clusters to Create a Separate Grid and Use (z/OS) Host Copy Operations to Move Data Between Clusters

### • Overview

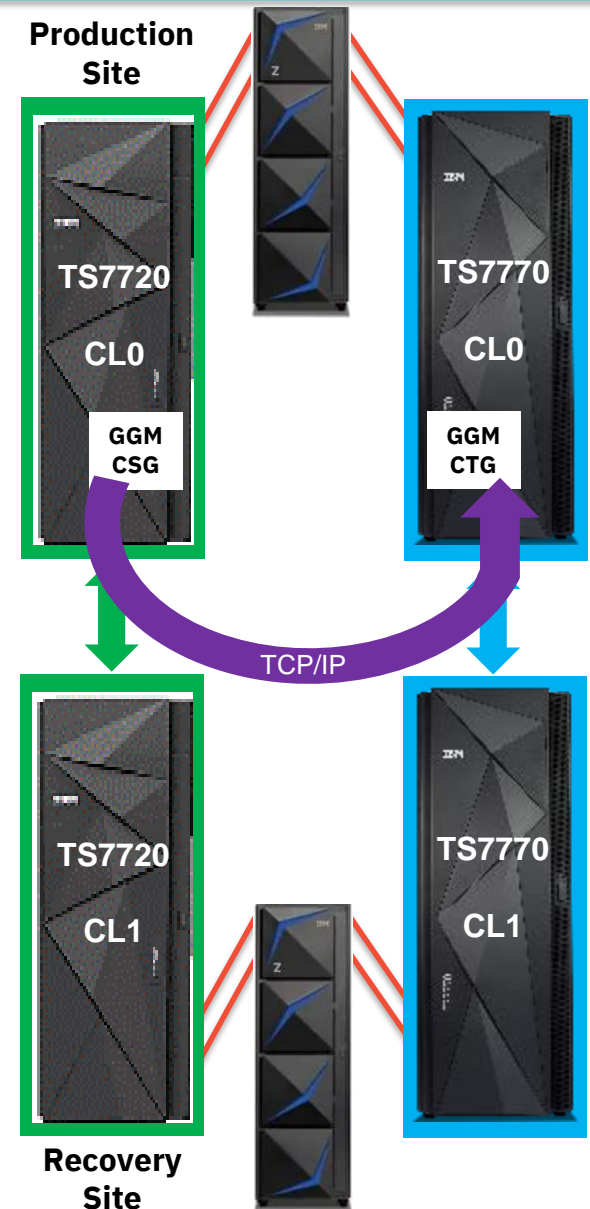
- Use two (2) new TS7760 clusters to create a completely separate new Grid
- Define new Grid and clusters to the appropriate hosts
- Direct all scratch mounts to the new Grid
- **Move (drain) all of the existing private data from the existing Grid/clusters using (z/OS) host copy operations. The use of a tape copy tool is recommended. These are several of the available options:**
  - CA Copycat (Broadcom)
  - Rocket Tape/Copy (Rocket Software)
  - TelTape for z/OS (Cartagena Software)
  - Zela (Software Engineering of America)
  - FATSCOPY (INNOVATION Data Processing)
- System or user catalogs, tape management system(s), and tape configuration data bases will need to be updated as well
- After all data has been moved, shutdown the original Grid and remove the hardware and host definitions



# Option B2 – Use New TS7770 Clusters to Create a Separate Grid and Use the Grid-to-Grid Migration (GGM) Option from IBM Lab Services

## • Overview

- Use two (2) new TS7760 clusters to create a completely separate new Grid
- Define new Grid and clusters to the appropriate hosts
- Direct all scratch mounts to the new Grid
- **Use the GGM priced offering from the IBM Lab Services (LBS) team**
  - Establish network infrastructure to allow the CSG and CTG clusters to communicate with each other
  - IBM SSR installs code on CSG, enables GGM on both clusters, and tests the GGM function (with LBS team assistance)
  - Customer or LBS team uses GGM to copy private volumes from CSG to CTG
    - System or user catalogs, tape management system(s), and tape configuration data bases will need to be updated as well
  - IBM SSR disables the GGM function on both the CSG and CTG
- After all data has been moved, shutdown the original Grid and remove the hardware and host definitions



**GGM** = Grid-to-Grid Migration  
**CSG** = Copy Source Grid  
**CTG** = Copy Target Grid

## **Part 2 – Option C: Use Frame Replacement Process (a.k.a. a “Frame Roll”)**



# Option C1 – Use the TS7700 Frame Replacement Process – This is Often Unofficially Called a “Frame Roll”

Before

## • Overview

- A “frame roll” is only possible when both the existing and new TS7700 clusters will be connected to back-end physical tape libraries
  - Existing Clusters: TS7720T, TS7740, TS7760T or TS7770T
  - New Clusters: TS7760T or TS7770T
- The FICON, Ethernet, and fibre channel connections, along with library names and IDs and UCB addresses, are reused (new cables or definitions are usually not required)
- **Customer: Move (drain) all of the existing private data out of Copy Pool 0 (CP0 or resident) into CP1-7. No data can be in CP0 during the frame roll process**
- **IBM SSRs: Perform frame roll steps (est. 6 to 12 hours)**
  - Pre-migrate all data from CP1-7 to physical tape
  - Backup internal data bases of existing cluster to DVDs
  - Shut down existing cluster, disconnect cables, and remove
  - Install new cluster, reconnect cables and power up cluster
  - Restore internal data bases from the previous backup
  - Bring new cluster online to the Grid and host systems
  - If needed, repeat process on additional clusters

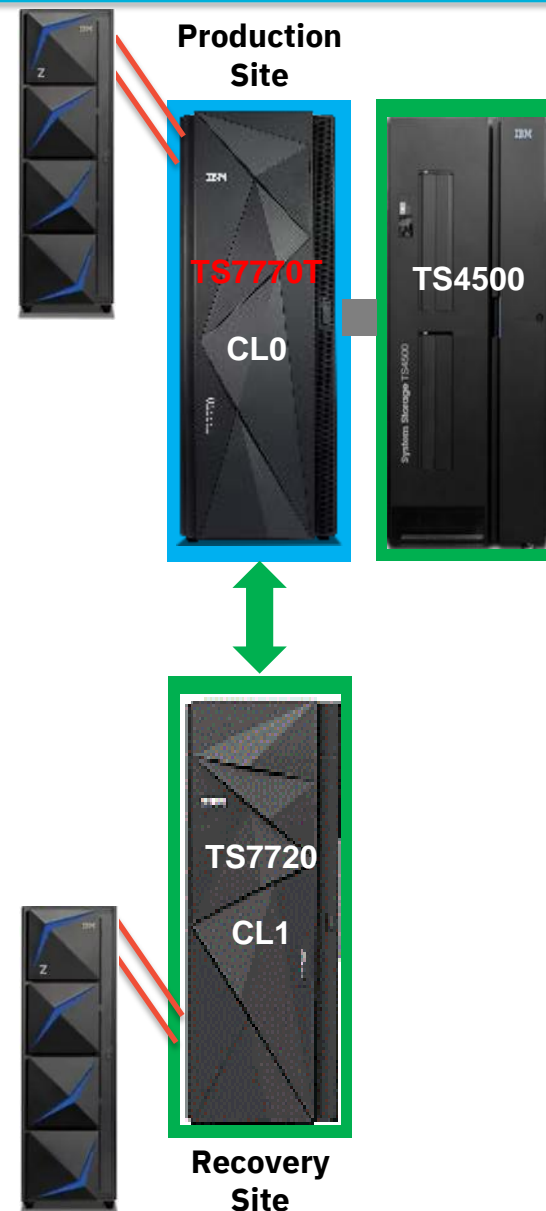


# Option C1 – Use the TS7700 Frame Replacement Process – This is Often Unofficially Called a “Frame Roll”

After

## • Overview

- A “frame roll” is only possible when both the existing and new TS7700 clusters will be connected to back-end physical tape libraries
- Existing Clusters: TS7720T, TS7740, TS7760T or TS7770T
- New Clusters: TS7760T or TS7770T
- The FICON, Ethernet, and fibre channel connections, along with library names and IDs and UCB addresses, are reused (new cables or definitions are usually not required)
- **Customer: Move (drain) all of the existing private data out of Copy Pool 0 (CP0 or resident) into CP1-7. No data can be in CP0 during the frame roll process**
- **IBM SSRs: Perform frame roll steps (est. 6 to 12 hours)**
  - Pre-migrate all data from CP1-7 to physical tape
  - Backup internal data bases of existing cluster to DVDs
  - Shut down existing cluster, disconnect cables, and remove
  - Install new cluster, reconnect cables and power up cluster
  - Restore internal data bases from the previous backup
  - Bring new cluster online to the Grid and host systems
  - If needed, repeat process on additional clusters



## **Part 2 – Option D: Use a Combination of Options A, B and C**

## Option D1 – Use a Combination of Migration Options A, B and C

### • Overview

- TS7700 Grids are often made of different type clusters (disk-only, tape-attach or cloud-attach) and clusters with different availability requirements
- A cluster at a recovery site can sometimes be unavailable for longer periods than clusters at the production site
- Thus, it is sometime necessary to use a combination of migration options (e.g. copy refresh, host copy, and frame rolls)
- **The TS7700 Grid example used in Option C1 started with a TS7720T at the production site and a TS7700 at the recovery site**
  - The TS7720T can be replaced using the frame roll process
  - The TS7720 does not have a connected physical tape library and thus, the frame roll process is not applicable on this cluster
  - For this case, the best choice will usually be to utilize the Copy Refresh process to move data from the existing TS7720 to a new TS7770 at the recovery site
    - One could delay the start of the Copy Refresh process several weeks or months to minimize the number of volumes needing to be handled. This is similar to the “natural move” process described in Option A1
    - The impact on production processing will be minimized



## Session Summary #1 – TS7770 Hardware & TS7700 R5.0 Software

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- **General Availability Date:** **November 22, 2019**
  
- **TS7770 Hardware**
  - TS7770 Server 3957 Model VED (POWER9™-based)
  - TS7770 3956 Cache Controller Model CSB & Cache Module Model XSB (New capacity licensing)
  - TS7770 Tape Frame 3952 Model F06 (TS7760 uses this frame as well)
  
- **TS7700 R5.0 Software**
  - Required for TS7770 systems
  - Can be installed on TS7760 (3957-VEC) systems as well
  - New functions available in both TS7760 and TS7770 functions
    - Secure Data Transfer
    - DS8K Object Store
    - Expire Hold Times (up to 2,000 years) and Write Protect Exclusion Categories (up to 128) improvements

## Session Summary #2 – Moving Data Between Clusters and Grids

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- **Option A – Using TS7700 Grid Functions or Elapsed Time**
  - Let time expire on existing private volumes (“natural move”)
  - Use PRESTAGE tool (from IBM TAPETOOL package) – no longer recommended
  - Manual entry of COPYRFSH commands – only viable for small numbers of volumes
  - Automated entry of COPYRFSH commands – customer developed programs or scripts
  - Priced IBM Lab Services (LBS) offering for TS7700 Migration Services
- **Option B – Using (z/OS) Host Copy Process or Grid-to-Grid Migration (GGM)**
  - Tape volume copy tools can make the use of host copies a viable option
  - Priced IBM Lab Services (LBS) offering for Grid-to-Grid Migration (GGM)
- **Option C – Cluster Replacement Using Frame Roll Process**
  - Only works when both existing and new cluster are attached to and use a physical tape library
- **Option D – A “Hybrid” Combination of Options A, B and C**

## Useful TS7700 Reference Documents

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- **(Knowledge Center) IBM TS7700 – Customer Documentation (R5.0 Updates Now Available)**  
[https://www.ibm.com/support/knowledgecenter/en/STFS69/landing/welcome\\_002.htm](https://www.ibm.com/support/knowledgecenter/en/STFS69/landing/welcome_002.htm)
- **(Redbook) IBM TS7700 Release 5.0 Guide (Coming Soon – Draft Expected in mid-December)**  
See [http://www.redbooks.ibm.com/redbooks.nsf/searchsite?SearchView=&query=ts77\\*&SearchWV=true](http://www.redbooks.ibm.com/redbooks.nsf/searchsite?SearchView=&query=ts77*&SearchWV=true) for all TS7700-related Redbooks
- **(Redbook) IBM TS7700 Release 4.2 Guide (SG24-8366-02)**  
<http://www.redbooks.ibm.com/abstracts/sg248366.html?Open>
- **(Redpaper) IBM TS7760 R4.2 Cloud Storage Tier Guide (REDP-5514-00)**  
<http://www.redbooks.ibm.com/abstracts/redp5514.html?Open>
- **(White Paper) IBM TS7700 Series DS8000 Object Store Users Guide V1.0 (NEW – Now Available)**  
<http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP102800>
- **(White Paper) IBM TS7700 Encryption Support V2.0 (NEW – Now Available)**  
<http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101000>
- **(Additional White Papers – Will be Published Soon)**  
See [http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebAllDocs2?Search&Query=\[HTMLDocumentName=WM\\*\]+AND+\(ts77\\*\)&Start=1&Count=100&SearchOrder=4&DateSearch=1&SearchMax=10000](http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebAllDocs2?Search&Query=[HTMLDocumentName=WM*]+AND+(ts77*)&Start=1&Count=100&SearchOrder=4&DateSearch=1&SearchMax=10000) for a list of the TS7700-related White Papers (Can access the White Paper site by using the term “IBM techdocs” in your favorite search engine)
- **(White Paper) IBM TS7700 Notification Messages v5.0.pdf**
- **(White Paper) IBM TS7700 Series Grid Resiliency Improvements User's Guide V1.1.pdf**
- **(White Paper) IBM TS7700 Library Request Command V5.0.pdf**



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