



| Lab Guide for Implementing Hitachi Universal Replicator Software on Open Systems

TSI0150

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NOTICE:

Notational conventions: 1KB stands for 1,024 bytes, 1MB for 1,024 kilobytes, 1GB for 1,024 megabytes, and 1TB for 1,024 gigabytes, as is consistent with IEC (International Electrotechnical Commission) standards for prefixes for binary and metric multiples.

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HDS Academy 1031

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Product Names mentioned in courseware:

Enterprise Storage Systems

- Hitachi Virtual Storage Platform
- Hitachi Universal Storage Platform® V
- Hitachi Universal Storage Platform VM
- Hitachi Universal Storage Platform
- Hitachi Network Storage Controller

Legacy Products:

- Hitachi Lightning 9900™ V Series enterprise storage systems
- Hitachi Lightning 9900™ Series enterprise storage systems

Modular Storage Systems

- Hitachi Adaptable Modular Storage
- Hitachi Workgroup Modular Storage
- Hitachi Adaptable Modular Storage 2000 Family

Legacy Products:

- Hitachi Thunder 9500™ Series modular storage systems
- Hitachi Thunder 9200V™ entry-level storage

Management Tools

- Hitachi Basic Operating System
- Hitachi Basic Operating System V
- Hitachi Resource Manager™ utility package
 - ♦ Module Volume Migration Software
 - ♦ LUN Manager/LUN Expansion
 - ♦ Network Data Management Protocol (NDMP) agents
 - ♦ Logical Unit Size Expansion (LUSE)
 - ♦ Cache Partition Manager feature
 - ♦ Cache Residency Manager feature
 - ♦ Storage Navigator program
 - ♦ Storage Navigator Modular program
 - ♦ Storage Navigator Modular 2 program

Replication Software

Remote Replication:

- Hitachi Universal Replicator
- Hitachi TrueCopy® Heterogeneous Remote Replication software bundle
- Hitachi TrueCopy Remote Replication software bundle (for modular systems)

- Hitachi TrueCopy Synchronous
- Hitachi TrueCopy Asynchronous
- Hitachi TrueCopy Extended Distance

In-System Replication:

- Hitachi ShadowImage® Heterogeneous Replication (for enterprise systems)
- Hitachi ShadowImage Replication (for modular systems)
- Hitachi Copy-on-Write Snapshot

Hitachi Command Suite

- Hitachi Chargeback
- Hitachi Device Manager
- Hitachi Dynamic Link Manager
- Hitachi Global Link Manager
- Hitachi Global Reporter
- Hitachi Path Provisioning
- Hitachi Protection Manager
- Hitachi QoS for File Servers
- Hitachi QoS for Oracle
- Hitachi Replication Monitor
- Hitachi Storage Services Manager
- Hitachi Tiered Storage Manager
- Hitachi Tuning Manager

Other Software

- Hitachi Backup and Recovery, powered by CommVault®
- Hitachi Backup Services Manager, powered by APTARE®
- Hitachi Business Continuity Manager
- Hitachi Command Control Interface (CCI)
- Hitachi Dynamic Provisioning
- Hitachi Storage Resource Management Solutions
- Hitachi Volume Migration
- Hi-Track® Monitor

Other Solutions and Terms

- Hitachi Content Platform
- Hitachi NAS Platform®
- Hitachi High-performance NAS Platform, powered by BlueArc®
- Hi-Star™ crossbar switch architecture
- Hitachi Universal Star Network™ V

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Lab Activity 1

Universal Replicator Operations

Objectives

Upon completion of the lab project, you will be able to do the following:

- Using Storage Navigator:
 - ♦ If necessary, install Universal Replicator license key files
 - ♦ Configure replication links,
 - ♦ Create journals and add journal volume to existing journals
 - ♦ Create and manage Universal Replicator pairs
 - ♦ Examine Universal Replicator data replication progress and the usage rates of hardware and software components using the Usage Monitor

Reference Material

In addition to the Student Guide, reference material is available. Consult with your instructor for access:

- *Storage Navigator User's Guide* for the assigned storage system
- *Universal Replicator User Guide* for the assigned storage system

Lab Format

This lab project contains numbered steps that guide you through the configuration of Universal Replicator software.

In some steps, screen shots are provided to help you understand what should happen.

The screen shots in the lab project may be slightly different from the actual command output due to differences between the system that you are working on and the system used to capture the screen shots. This will have no effect on the outcome of the lab activity.

Procedure

The class is divided into two lab groups. For minimum conflict between lab groups sharing storage systems:

- If both lab groups use Windows, cooperation between lab groups is required.
- One lab group using Windows and one using Solaris works fine, as well as both using Solaris.

Each lab group has access to the following hardware:

- A PC host connected to your assigned storage system.
- A Sun host connected to your assigned storage system.
- A Hitachi Virtual Storage Platform, Universal Storage Platform V or VM storage system.
- USP VM can be used only if there are additional Fibre Channel features installed.

Note: This is a complex environment. Each lab activity is accompanied by a diagram showing the required configuration for that lab.

You first define and operate a standalone Loopback HUR replication in Labs 1 and 2. In Lab 3, you add TrueCopy for a 3 Data Center Multi-target configuration. In Lab 4, you add the necessary links and create a 3DC Multi-target Delta Resync environment. In Lab 5, you convert the 3DC Delta Resync configuration to a 2DC MxN Consistency group environment and operate MxN pairs with CCI.

Part 1: Universal Replicator Configuration

Setup Instructions:

Host Access and LDEV mapping

The operations covered in these lab activities require that a Windows server and a Solaris server connect to each storage system. Since port usage depends on the storage platform assigned, the instructor will specify the ports to which your hosts are connected.

P-VOL and S-VOL LDEVs, Command Devices:

- **Suitable LDEVs** have been created and mapped to ports for your use. Check with your instructor for the specific LDEV and LUN numbers.
- The default Host Groups for the Cluster 1 and Cluster 2 ports of your choice have been set to the appropriate host mode. LUN Security is not enabled.
- 10 LDEVs from CU00 have been mapped to the Cluster 1 port of your choice. These will be used as P-VOLs.
- **A Command Device has also been mapped to the cluster 1 port to which your host is attached.**
- 10 LDEVs from CU03 beginning at LUN 000 and 10 LDEVs from CU02 beginning at LUN 0010 have been mapped to the Cluster 2 port of your choice. These will be used as S-VOLs.

Step 1: The Instructor has confirmed that the necessary Fibre Channel cables for the Links are in place on the assigned subsystems.

Step 2: The Instructor will provide a diagram for each lab group of the necessary replication link configuration with Ports Numbers, Port Attributes, and so forth. This may be a handout or be drawn on the whiteboard. Make sure you understand the proposed configuration before beginning.

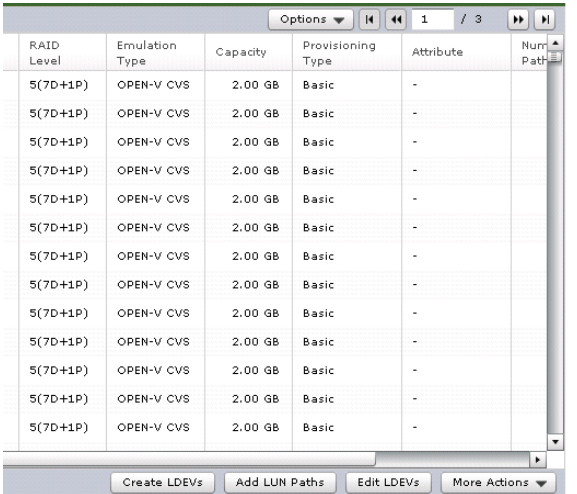
Important! If using VSPs, check with instructor to see if LDEVs have already been mapped to ports. If not, execute VSP LDEV Mapping procedure below. Otherwise, skip this section.

Use Remote Desktop Connection to connect to the Winserver assigned to your lab group. Launch Internet Explorer. Enter [http://\[IP address of your assigned VSP\]/](http://[IP address of your assigned VSP]/)

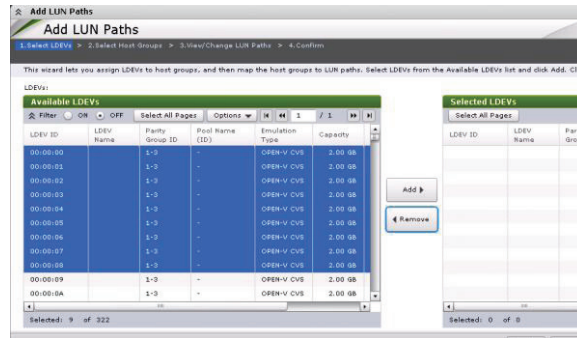
1. When SN login screen opens, login as *replicationuser*.
2. In Explorer Menu on left, select Logical Devices



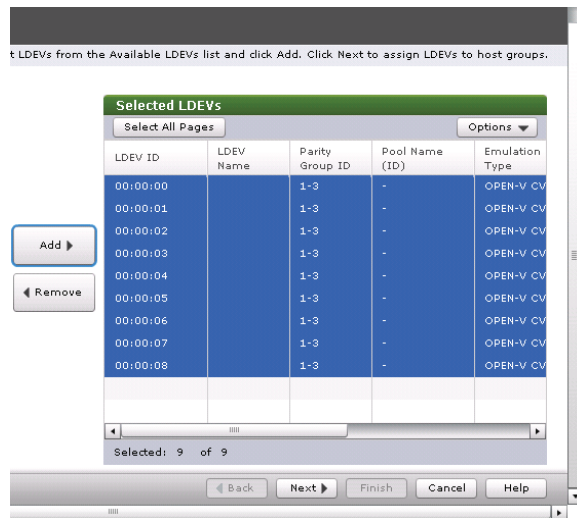
3. Click Add LUN Paths.



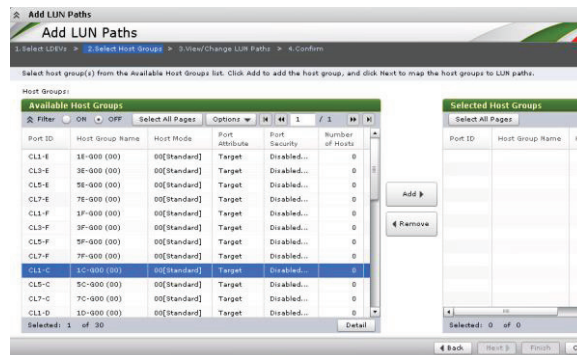
4. Select Devices to be mapped.



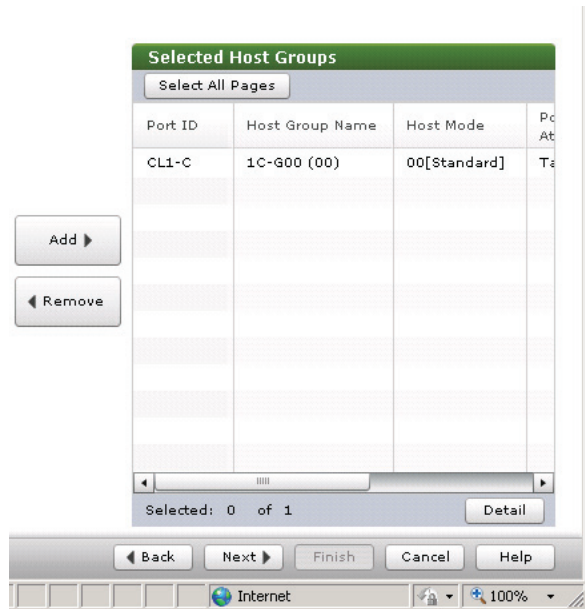
5. Click **Add**. Click **Next** at bottom of screen.



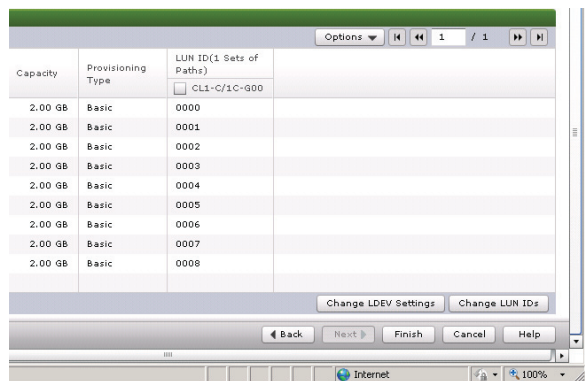
6. Select port from list. Click **Add**.



7. Click **Next** at bottom of screen.

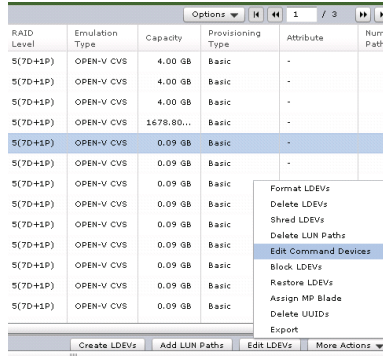


8. Confirm list of LDEVs to be added and click **Finish** at bottom of screen.

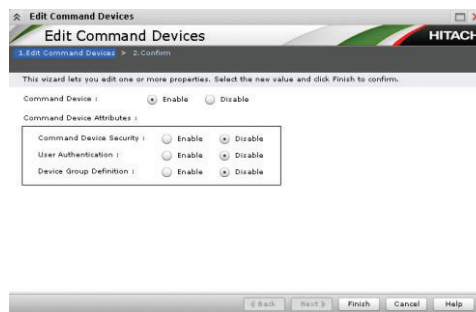


9. Return to main Storage Navigator browser window. Repeat steps beginning with Item 1 for the other port. Use the information in Part 1, Host Access and LDEV Mapping for guidance on LDEVs to choose.

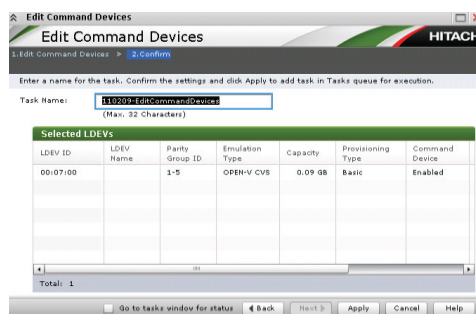
10. **Setting Command Device.** In Logical Devices selection scroll down to locate desired device. (.09 MB volumes are suitable). Scroll to lower right of screen and select **More Actions** menu. From popup menu, select **Edit Command Devices**.



11. Edit Command Devices panel opens. Select **Enable** and click **Finish**.



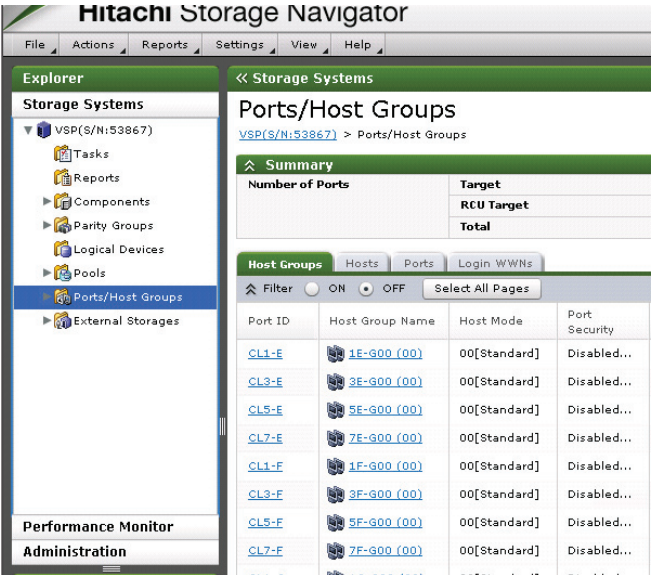
12. Confirm by clicking **Apply** at bottom of screen.



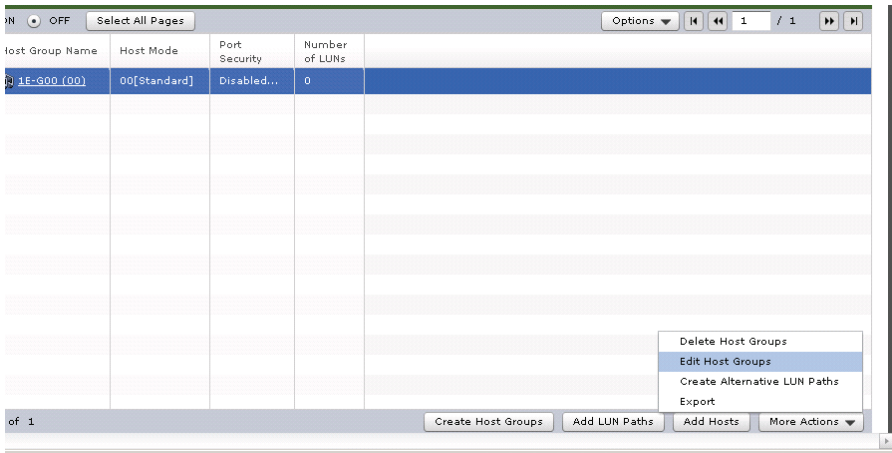
13. Now, repeat the LDEV Mapping Procedure at Step 1 above to map the command device to the port of your choice.

Next, change Host Mode on VSP:

1. On SN Browser window, select Explorer...Ports/Host Groups. Select a port.

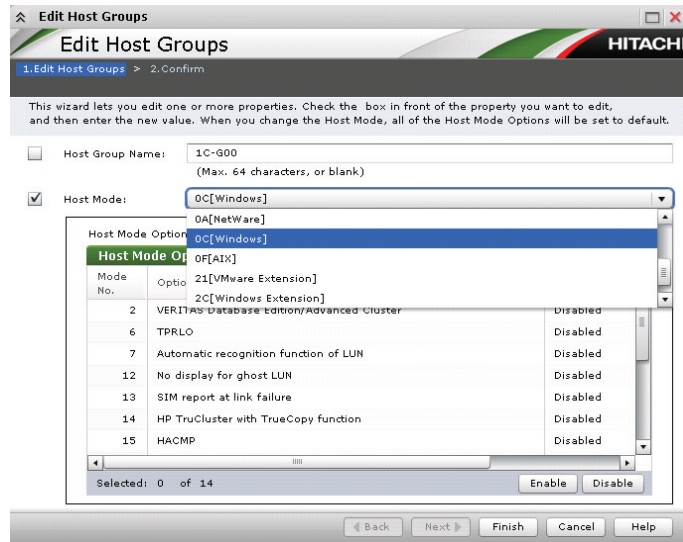


2. Then highlight the port and select **More Actions** menu at bottom right. Select **Edit Host Groups** from popup panel.

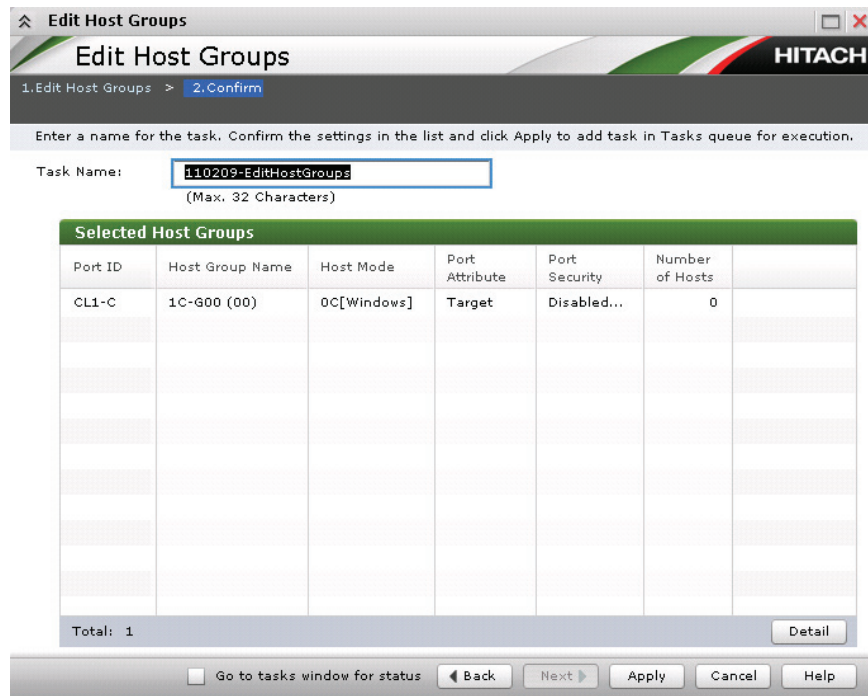


1.

3. Select Host Mode box, then select the desired mode from the dropdown list. Click **Finish** at bottom of screen.



4. Confirm, then click **Apply**.

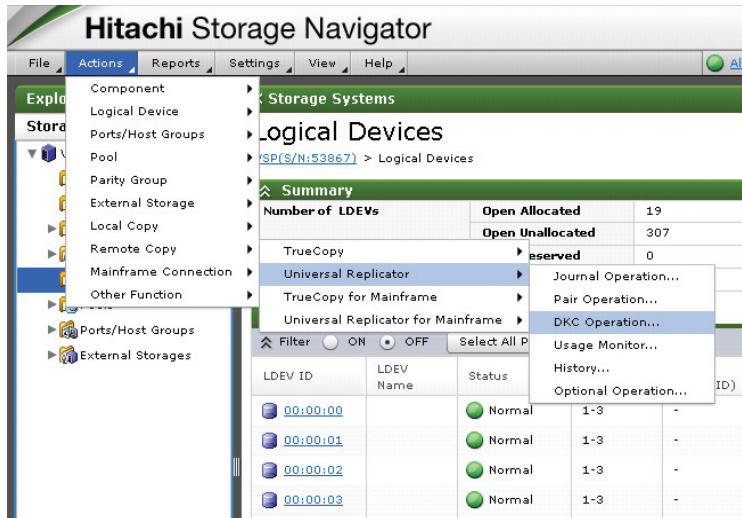


5. Repeat for other port. Return to main browser screen.

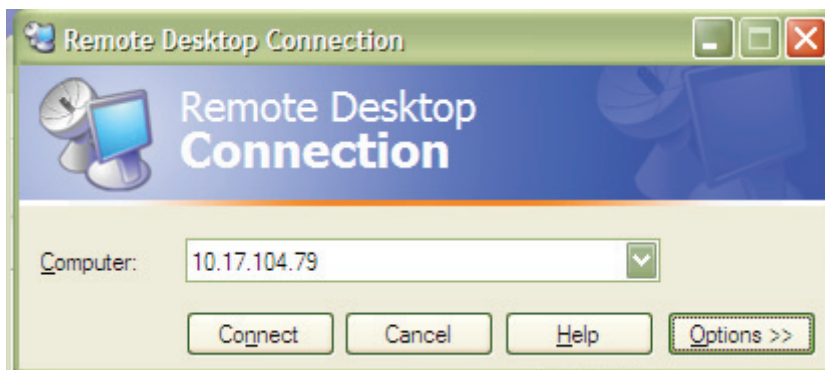
This completes the LUN mapping.

Part 2. Universal Replicator Operations

VSP: Launch Storage Navigator GUI



USP V — Use Remote Desktop to connect to the assigned storage system



Once connected using the password provided by the instructor, register your lab group, minimize the SVP screen, and then launch Internet Explorer. The Storage Device List screen will open. Select the link to the desired subsystem. Storage Navigator login and password are *root/root*.

Step 1: Make sure your connections are active. On the Storage Navigator main screen, click on the Information Option in the Menu, and then click on the **System** tab at the top of the System Equipment Information screen. See screen shot on next page for an example.

Step 2: Confirm Host access.

Step 3: Confirm status of ports

If the ports are highlighted, the ports are active (a cable is installed and connected at both ends). Please continue with the lab exercises. If the ports that were assigned to you are not highlighted, contact your instructor.

VSP

Port Location

Cluster 1

16MU (Fibre)											
1A	3A	1E	3E	9A	BA	1J	3J	1N	3N	9J	BJ
5A	7A	5E	7E	DA	FA	5J	7J	5N	7N	DJ	FJ
1B	3B	1F	3F	9B	BB	1K	3K	1P	3P	9K	BP
5B	7B	5F	7F	DB	FB	5K	7K	5P	7P	DK	FP
16LFC (Fibre)											
1C	3C	1G	3G	9C	BC	1L	3L	1Q	3Q	9L	BL
5C	7C	5G	7G	DC	FC	5L	7L	5Q	7Q	DL	FL
1D	3D	1H	3H	9D	BD	1M	3M	1R	3R	9M	BM
5D	7D	5H	7H	DD	FD	5M	7M	5R	7R	DM	FM

Cluster 2

16MU (Fibre)											
2A	4A	2E	4E	AA	CA	2J	4J	2N	4N	AJ	CJ
6A	8A	6E	8E	EA	GA	6J	8J	6N	8N	EJ	GJ
2B	4B	2F	4F	AB	CB	2K	4K	2P	4P	AK	CP
6B	8B	6F	8F	EB	GB	6K	8K	6P	8P	EK	GP
16LFC (Fibre)											
2C	4C	2G	4G	AC	CC	2L	4L	2Q	4Q	AL	CL
6C	8C	6G	8G	EC	GC	6L	8L	6Q	8Q	EL	GL
2D	4D	2H	4H	AD	CD	2M	4M	2R	4R	AM	CM
6D	8D	6H	8H	ED	GD	6M	8M	6R	8R	EM	GM

Legend: 1A Available and connected to the other device 1A Available, but not connected to the other device 1A Not equipped or not available

USP V or VM

Port Status

Cluster 1

16FS Fibre 8ch-4mp				16FS Fibre 8ch-4mp				8S Serial 4ch-4mp			
1A	3A	1E	3E	9A	BA	1J	3J	1N	3N	9J	BJ
5A	7A	5E	7E	DA	FA	5J	7J	5N	7N	DJ	FJ
1B	3B	1F	3F	9B	BB	1K	3K	1P	3P	9K	BP
5B	7B	5F	7F	DB	FB	5K	7K	5P	7P	DK	FP

Cluster 2

16FS Fibre 8ch-4mp				16FS Fibre 8ch-4mp				8S Serial 4ch-4mp			
2A	4A	2E	4E	AA	CA	2J	4J	2N	4N	AJ	CJ
6A	8A	6E	8E	EA	GA	6J	8J	6N	8N	EJ	GJ
2B	4B	2F	4F	AB	CB	2K	4K	2P	4P	AK	CP
6B	8B	6F	8F	EB	GB	6K	8K	6P	8P	EK	GP

Legend: 1A Available and connected to the other device 1A Available, but not connected to the other device 1A Not equipped or not available

Verify LUNs Are Visible to Host

Before you proceed, verify that the mapped devices including the command device are visible on the host. For Solaris, this may require editing the *sd.conf* file and rebooting the system, executing a reconfiguration reboot, or running the HBA utilities to automatically detect new LUNs.

Verifying Solaris LUNs and Command Device

On Solaris shell prompt, execute the format command and look for **-CM** in the output of the command.

Format command output

```
AVAILABLE DISK SELECTIONS:
 0. c0t0d0 <ST320420A cyl 39533 alt 2 hd 16 sec 63> 180802FF
    /pci@1f,0/pci@1,1/ide@3/dad@0,0
 1. clt1d3 <HITACHI-OPEN-3-SUN-2104 cyl 3336 alt 2 hd 15 sec 96>
    /pci@1f,0/pci@1/fibre-channel@2/sd@1,3
 2. clt1d4 <HITACHI-OPEN-3-SUN-2104 cyl 3336 alt 2 hd 15 sec 96>
    /pci@1f,0/pci@1/fibre-channel@2/sd@1,4
 3. clt1d5 <HITACHI-OPEN-3-SUN-2104 cyl 3336 alt 2 hd 15 sec 96>
    /pci@1f,0/pci@1/fibre-channel@2/sd@1,5
 4. clt1d10 <HITACHI-OPEN-3-CVS-CM-2104 cyl 48 alt 2 hd 15 sec 96>
    /pci@1f,0/pci@1/fibre-channel@2/sd@1,a
Specify disk (enter its number): 4
selecting clt1d10
[disk formatted]
Disk not labeled. Label it now? y
```

Caution: DO NOT create a file system on the **command device**, or do any I/O activity. This will render the command device unusable by the storage system. However, you will need to label the volume by selecting the device from the format command output.

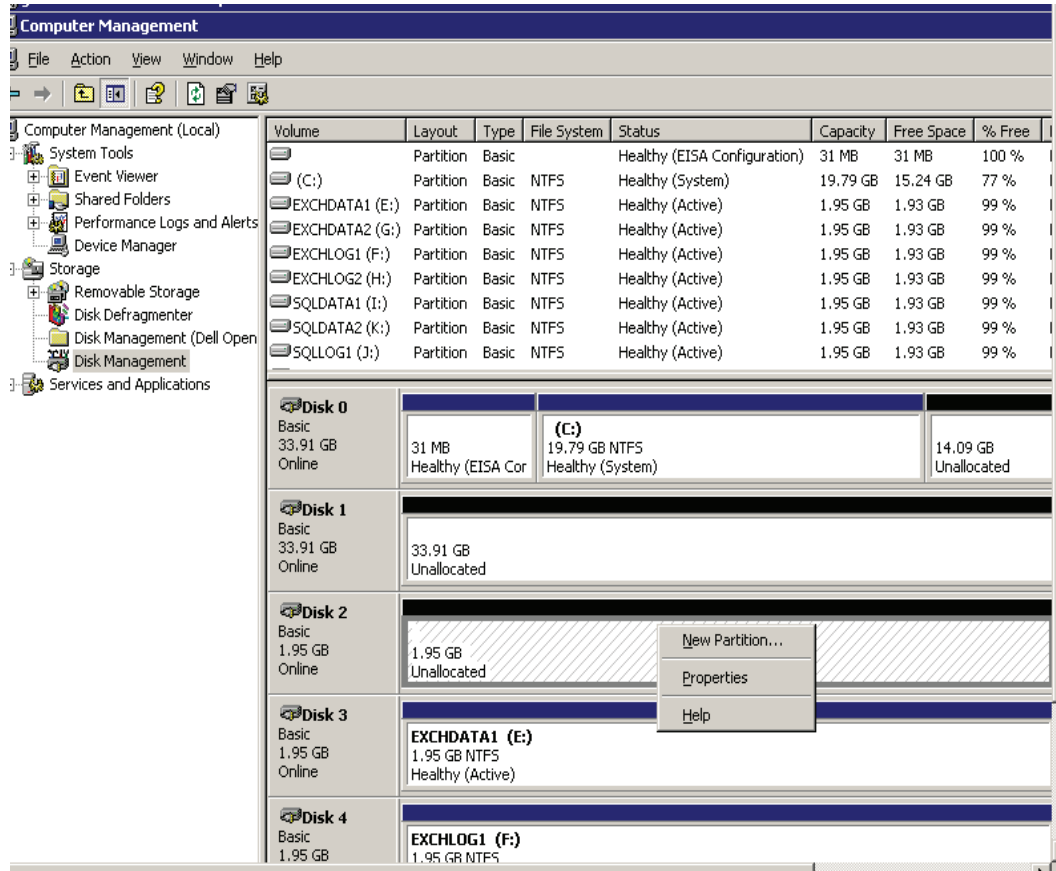
Verifying Windows LUNs and Command Device

Caution: Do not partition the **Command Device**. This will render the command device unusable by the storage system.

To see the command device:

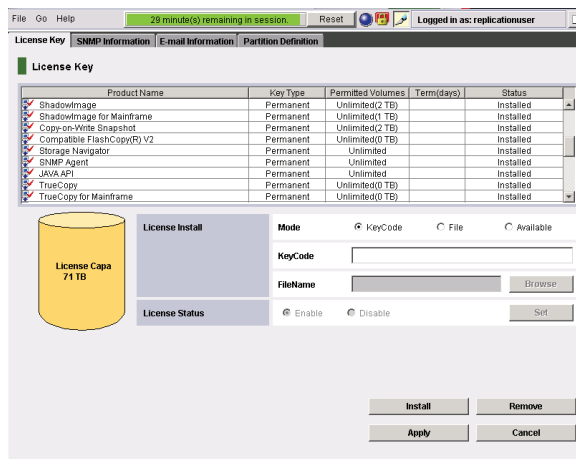
1. Open Disk Management by right-clicking on **My Computer**.
2. **Select Manage**
3. Right click on **Disk Management**
4. Select **Rescan disks**. By now, all newly mapped disks should appear on the right-hand pane. If not, reboot the server.
5. Right click on the **disk that has been designated as a command device**.
6. Optional: Write a Windows Signature on the Disk. Do NOT create a partition.

- Note that we will use the Command Device in later labs. No further action on the Command Device is required at this time.



Verify License Key Installation

Step 1: Verify the license keys are installed on the storage array. On Storage Navigator Go menu, select Environment Setting...License Key.



Step 2: Confirm that Universal Replicator, TrueCopy, and ShadowImage keys are installed. Also check that the **Disaster Recovery Extended** key is present.

Step 3: If the license keys are *not* installed, ask your instructor where the key files are located. Put Storage Navigator into MODIFY Mode by clicking the *PEN* icon at top right of the screen. After Modify Mode is set, select the **File Mode** in the License Key interface, then browse for the Key File. Select the file then click **Install** and **Apply**.

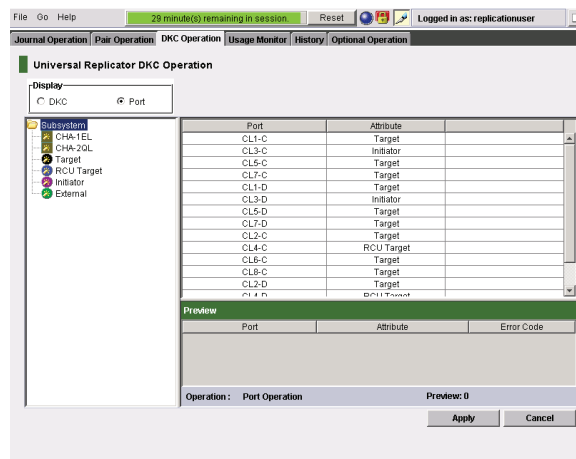
Set Replication Link Port Attributes

The next step to configure Universal Replicator software is to change the port settings to *Initiator* and *RCU Target*. Since Universal Replicator requires two links, you will need to change the attributes of four ports.

Step 1: From the Go Menu, select Universal Replicator menu option, and then select DKC Operations. *Note:* There are two versions of Universal Replicator, open systems and mainframe. Select the correct version.



Step 2: When the DKC Operation tab appears, click on the **Port** radio button on the left side of the interface. Using the port assignments given by the instructor, change the port attributes of the initiator and RCU Target ports.

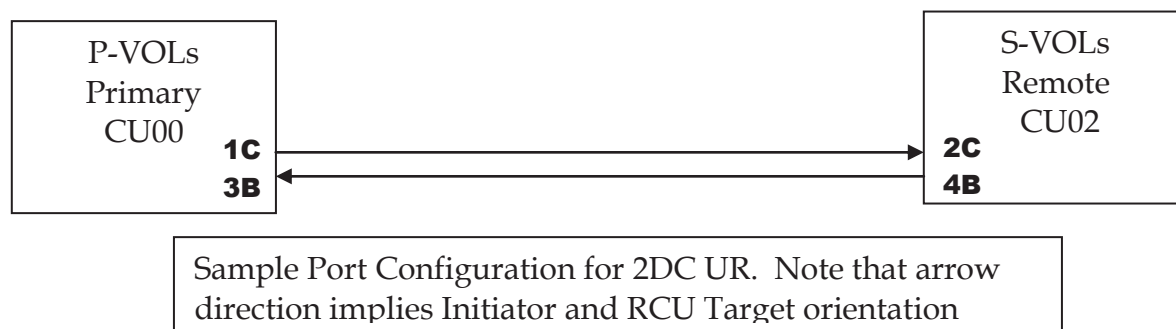


Step 3: First, select either Subsystem or the individual CHA card from the tree view.

Step 4: Within the table on the right hand side of the screen, right-click on the port you want to change.

Note: Changing port types may change two ports. Make sure the partner port is not being used by a host.

Step 5: Set Initiator and RCU Target attributes as specified in the configuration material provided by the instructor.

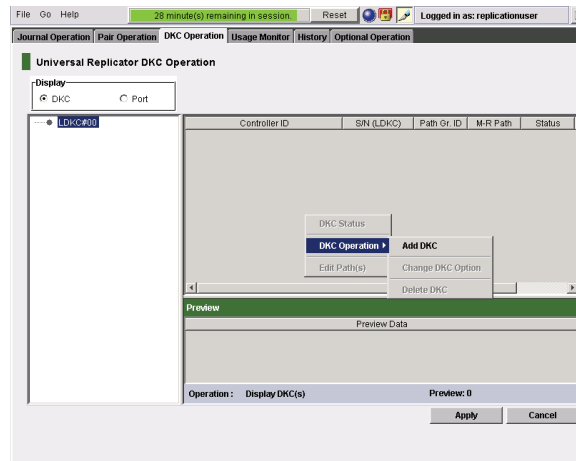


Add DKC

After the ports on your storage system have been configured for Universal Replicator, the next step is to add the Universal Replication remote storage system.

Note: Usually this procedure has to be done at **both** Primary and Remote Sites. However, in our case the procedure is required only at the primary site because we are defining our Universal Replicator in a loopback configuration.

Step 1: Select the DKC Operation tab, select the **DKC** radio button.

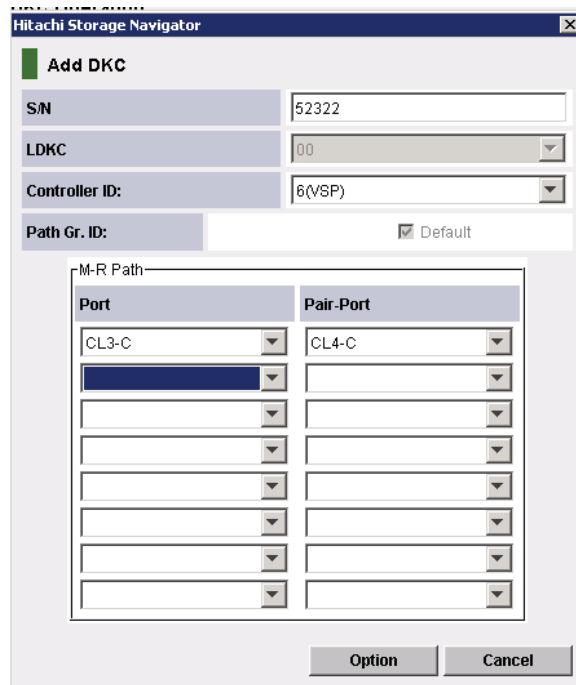


Step 2: Next, select LDKC #0 in the tree view at left, then right-click within the blank area to the right.

Step 3: Select **DKC Operations** from the popup box.

Step 4: Select **Add DKC**.

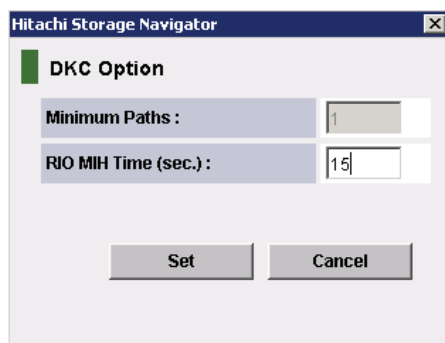
The next dialog box that appears will ask you to supply the information Universal Replicator needs to find the remote DKC and paths.



Step 5: Enter the **Serial Number** of the Remote DKC. *Note:* For the loopback configuration, this will be the serial number for your assigned storage system.

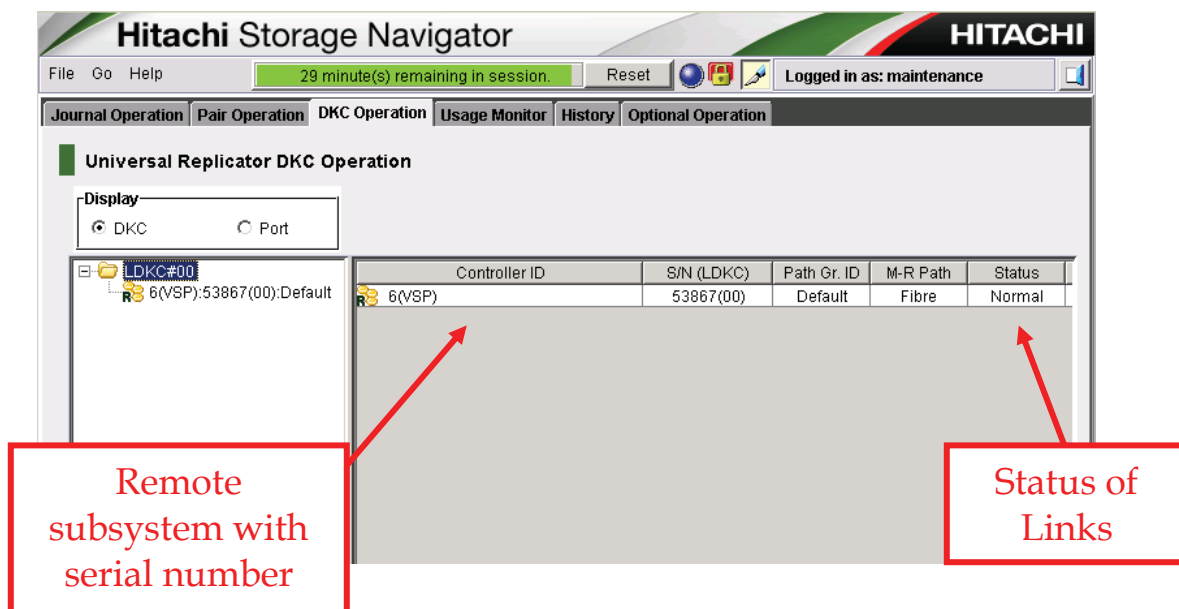
Step 6: Using the port assignments you have recorded earlier in this lab, select the master and remote ports which will be used by Universal Replicator. Make sure that Initiators are in the Port column and RCU Targets are in the Pair-Port column.

Step 7: Next, click on **Option**.



Step 8: Keep the default settings and click **Set**.

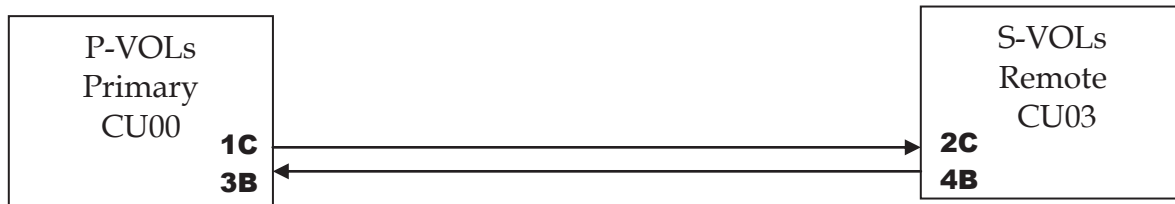
Step 9: When the main screen appears, click **Apply**. Status should be **Normal**



Step 10: If not, right-click the remote system and select DKC Status for more detail. Correct the problem using courseware for guidance. Confirm Normal Path Status before proceeding.

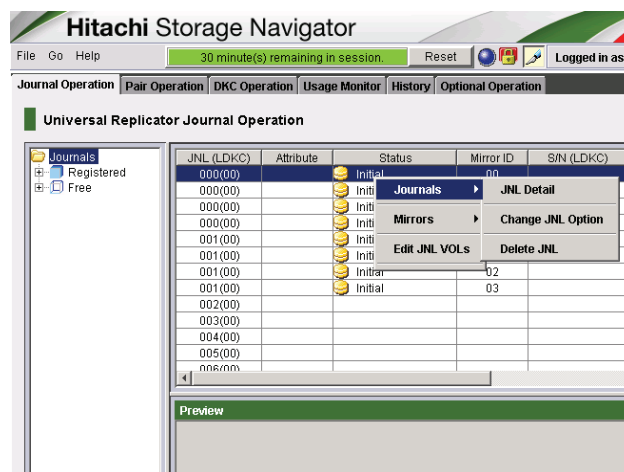
At this point you have created a configuration similar to the one shown below. Note that P-VOLs reside in CU00 and S-VOLs will reside in CU03. This is a loopback configuration, that is, both CUs are in the same system. We will add another system in a later lab activity and use CU02 at that time.

Note that your assigned port numbers may be different from those shown here.



Create Journal Groups

Step 1: Click on the **Journal Operation** tab. In this Lab Activity, you will create two Journal Groups. Use Journal Group IDs 00 and 01.



Step 2: Within the table that appears on the right-hand side, right-click on the desired JNL.

Step 3: When popup window appears, select **Edit JNL VOLs**.

A screen will appear asking you to select the LDEVs you want to include in your journal group.

Step 4: When the dialog box opens, select a Control Unit with 4GB or 8GB LDEVs. Note that only Open-V volumes are visible.

Step 5: Add TWO LDEVs. After selecting your choice, click **Set**.

Parity Group	LDKC:CU:LDEV	Capacity (GB)	Emulation	CLPR	Operation
1-2	00:01:07	8.00	OPEN-V	00:CLPR0	Add
1-2	00:01:08	8.00	OPEN-V	00:CLPR0	Add
1-2	00:01:09	8.00	OPEN-V	00:CLPR0	Add
1-2	00:01:0A	8.00	OPEN-V	00:CLPR0	Add

Parity Group	LDKC:CU:LDEV	Capacity (GB)	Emulation	CLPR	Operation
1-2	00:01:07	8.00	OPEN-V	00:CLPR0	Add
1-2	00:01:08	8.00	OPEN-V	00:CLPR0	Add
1-2	00:01:09	8.00	OPEN-V	00:CLPR0	Add
1-2	00:01:0A	8.00	OPEN-V	00:CLPR0	Add
1-2	00:01:0B	8.00	OPEN-V	00:CLPR0	Add

PG/CU change : ☐ PG ☐ PG(Ext) ☒ CU 01

2DC Cascade : ☐ Enable ☒ Disable

Journal : 000

Current : 0 (0.00 GB) Total : 4 (32.01 GB)

Set Cancel

Step 6: Locate the **Add** button near the center of the panel. Click **Add**, then **Set**

Note: Repeat steps 2 through 6 to create additional journal group 01.

Step 7: When groups are defined and the main screen appears, click **Apply**.

JNL (LDKC)	Attribute	Status	Mirror ID	SN (LDKC)	Pair JNL
000(00)		Initial	00		
000(00)		Initial	01		
000(00)		Initial	02		
000(00)		Initial	03		
001(00)		Initial	00		
001(00)		Initial	01		
001(00)		Initial	02		
001(00)		Initial	03		
002(00)					
003(00)					
004(00)					
005(00)					
006(00)					

Operation : Preview :

Apply Cancel

What status should be shown on the journal group you created? _____

You are now ready to start replicating data. You will complete this task in the next section.

Lab Project 1 — Part 1 Review Questions

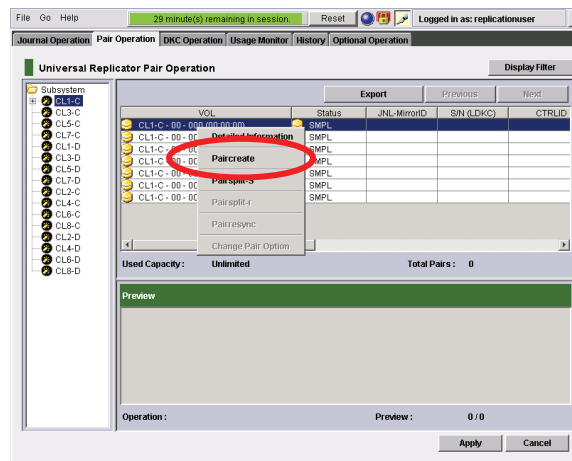
Configuring Universal Replicator

1. What is the first item that requires your attention when configuring Universal Replicator software?
2. What DKC information is necessary to set up replication links between storage systems?
3. Which port attributes are required for UR replication links?
4. What LDEV emulation types are available to journal volumes?
5. When journal volumes are successfully configured, what volume status is displayed in the Journal volume table?

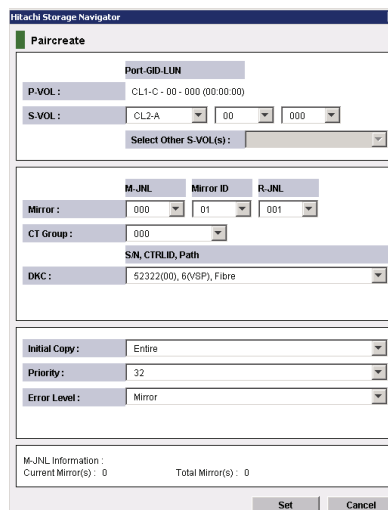
Part 2. Universal Replicator Operations with Storage Navigator

Create Pairs with Universal Replicator.

1. Click on the **Pair Operation** tab. When the tab opens, FC Ports are displayed on the left hand side of the screen. Select the Cluster 1 port from the list of ports. The volumes mapped to this port are your P-VOLs.
2. Referring to the Pair Operation screen capture, select the first LUN from the list of mapped volumes in the center of the screen. **Note:** Once it is selected, this volume acts as your production volume. Your secondary volume is selected from the LDEVs that are mapped to the Cluster 2 port.
3. Note the LDEV # _____



4. Right-click volume and select **Paircreate**. The Paircreate Panel opens.



5. Select an S-VOL mapped to CL2. Enter Host Group and LUN number.
6. Enter M-JNL ID, Mirror ID (1), and R-JNL ID.

CT Group field can be set if desired. As a best practice, set this to the same as the M-JNL Group number. Otherwise, this field is populated automatically by Universal Replicator. Note the CT Group ID here: _____

DKC Field contains all defined Remote DKCs. At this point only one is visible.

7. If desired, Initial Copy parameter can be set to **None**. Take defaults for the other parameters.
8. When all parameters have been entered, click **Set**. Click **Apply** to start the Initial Copy process.
9. Confirm PAIR status.

Create more Universal Replicator Pairs

Notes on additional pair creation:

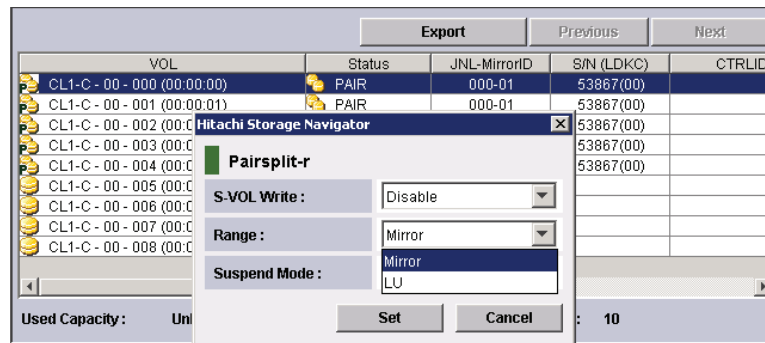
- Add to same journals and consistency group as the first Universal Replicator Volume pair.
- Use Pair Display command to show status of pairs. Note that the Refresh cycle time on this screen is faster than on the main Pair Operation screen.

- After you complete the entire process, confirm all Universal Replicator pairs are displayed in Storage Navigator.

Split Pairs

In this activity, you will see how Universal Replicator manages differential data when volumes are split.

1. To split the first volume, select the **Pair Operation** tab.
2. Select a volume pair within journal group 00.
3. Right-click on the volume pair you want to split.
4. From the menu, select **Pairsplit -r**.
5. When the dialog box appears, accept the defaults and click **Set**.



6. When the main window appears, click **Apply**. Confirm.

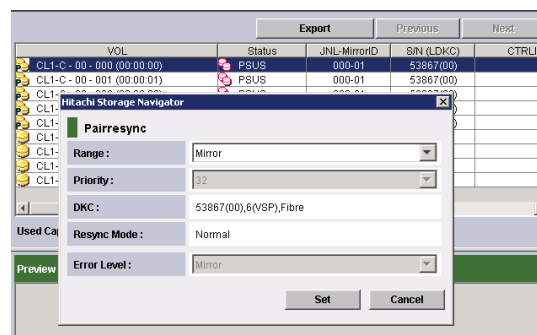
What is the new status? _____

Did the status of the other pairs in the group change? _____

Why? _____

Resynchronize Pairs

1. Right-click on one of the pairs within Journal Group 00
2. Select **Pairresync**.
3. When the dialog box opens, accept all defaults. Click **Set**.



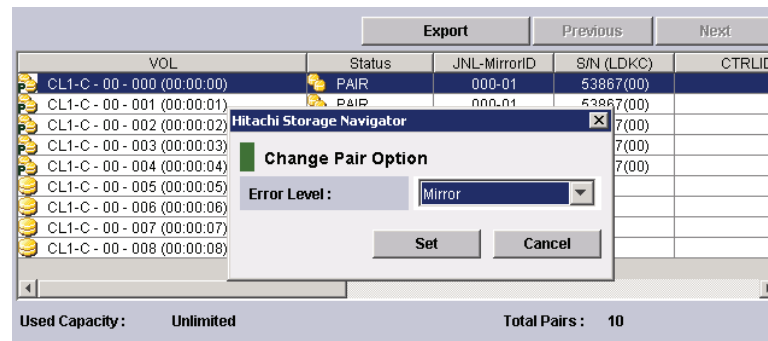
4. On the main window, click **Apply**.

When the process finishes, what is the volume pair status? _____

What about the other pairs in the group? _____

Change pair options

1. While in PAIR status, right-click a pair, select Change pair Option



2. Change Error level, click **Set**, then click **Apply**.
3. Use Detail function to confirm change.

Pairsplit Using S-VOL Enable

1. Issue **pairsplit** command to one of the pairs.
2. When the Pairsplit detail screen appears, change S-VOL Write to **Enable**.
3. Make sure Range is set to LU and click **Set**.
4. On the main window, click **Apply**.
5. Click OK on the next dialog box.

You now have one split pair and the others in PAIR status. The split S-VOL is write enabled.

Adding Journal Volumes to a Group

In this activity, you will look at the effects of manipulating journal volumes during various JNL Group status conditions.

Manipulating Journal Volume Size on Journal Group 00

1. Verify from Storage Navigator in the primary and secondary that you have pairs established in JNL Group 00. At least one is in PAIR status.
2. Make sure journal group 00 and 01 status is Active. Right click on the active master journal group (00), and select **Edit JNL Volumes**.
3. From the same CU you earlier used for the M-JNL volumes, select volumes to add to your Journal Group.
4. After you have selected your volumes, click **Add**.
5. Click **Set**.
6. When the main window appears, click **Apply**.

Were you successful? _____

Why or why not? _____

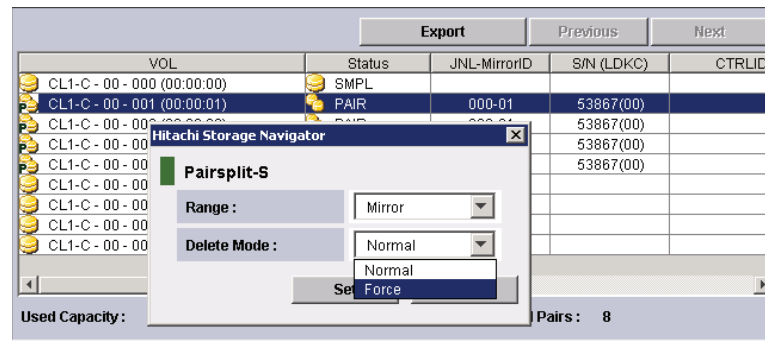
Now delete a Journal Volume. Select JNL Group 00 as before, then select the journal volume added in the previous step. **DELETE** it. Click **Set** and **Apply**.

Were you successful? _____

Why or why not? _____

Delete Pairs

1. If necessary, select the **Pair Operations** tab.
2. Right-click on a pair.
3. Select **Pairsplit-S**.



4. A dialog box will appear.
5. Change **Range** to LU.
6. Click **Set**.
7. Click **Apply**.
8. Observe the pair status. Note that only one pair deleted.
9. Delete the other pair or pairs.
10. Now return to Journal operations and delete one volume from Journal 00.

Were you successful? _____

This completes Lab Activity 1, Part 2.

To prepare for the next lab activity, ensure all pairs are deleted. Leave Journal, R-DKC, and Links in place.

Lab Project 1, Part 2 Review Questions

Universal Replicator Operations

1. Which UR Operation panel allows you to create pairs?
2. When you created additional pairs within the same journal group, how did the **paircreate** options panel signify an already used Consistency Group?
3. What is the difference between **pairsplit -r** and **pairsplit -S**?
4. When **pairsplit -r** is invoked and the S-VOL Write is marked as *Enabled*, what effect does that have on the UR S-VOL?
5. What happens when attempting to update the number of journal volumes while the UR pairs are not in SMPL or PSUS?

Lab Activity 2

Managing Universal Replicator with CCI

Lab Objective

Upon completion of the lab project, you will be able use Hitachi Universal Replicator software with CCI and Storage Navigator to manage pairs.

Reference Materials

In addition to the Student Guide, which contains the lab project, other Hitachi reference manuals may be needed. Your Instructor will assist if necessary.

- *Hitachi Universal Replicator User's Guide*
- Hitachi Command Control Interface (CCI) documentation

Lab Format

This lab project contains numbered steps that allow you to create valid CCI configuration files to be used for Universal Replicator CCI operations.

Note: The screen shots in the lab project may be slightly different from the actual command output due to microcode differences between the system that you are working on and the system used to capture the screen shots.

Part 1: CCI Installation and Configuration

Solaris — Install CCI Software

If using Solaris, use the **RMinstsh** and **RMuninst** scripts downloaded by the instructor to your Windows server to automatically install and uninstall the CCI software on your Solaris host.

On your Solaris server, check for a /Software/CCI directory. If this directory exists, open the directory and run the **RMinstsh** script directly. FTP from the windows server is not necessary.

If the /Software directory does not exist, then return to the Windows server, navigate to the C:\SOFTWARE directory, select CCI, then the latest version. Note the RMinstsh and RMuninst scripts. You must FTP the install scripts and the Solaris RMHORC file from your Windows server to the Solaris server. When the RMHORC file is in place, install CCI by running the **RMinstsh** script and following the prompts.

You may also follow the instructions in Step 9.1 of the readme file that comes with the version. Verify installation by locating the /HORCM directory.

Windows: Install CCI Software

Install CCI on all servers involved in CCI operations. On the Winserver assigned to your lab group, navigate to the C:\SOFTWARE directory, select CCI, then the latest version, or follow the instructor's direction.

- Run **setup.exe** and follow the instructions on screen to complete the installation. Verify installation by checking the C:\HORCM\etc directory for CCI commands.

Setup Instructions

Use the configuration defined in the previous lab activity for your CCI lab. A sample diagram is shown below.



Note: In the previous lab, you set up the physical replication links and defined the RCU. Revisit the procedure in Lab Activity 1 if necessary.

CCI Checklist

1. Set up the command device, if it was not done in Lab Activity 1.
2. Using courseware for guidance, create the horcm configuration files.
3. Perform necessary housekeeping functions
4. Start the instances.
5. Issue CCI software commands

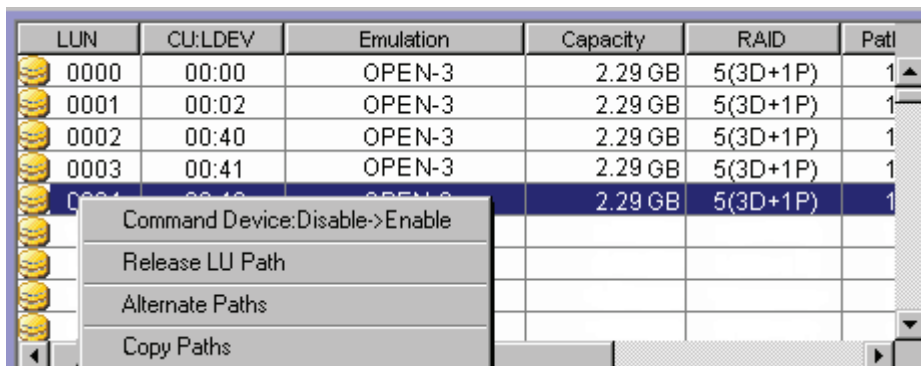
1. Command Device: If the command device is already set up, skip this step.

Note: If you are assigned a USPV and the command device is not already defined and mapped, you need to perform the following operations.

1. Find a suitable custom volume (46MB if available) using **Virtual LVI/LUN (VLL)**. If one does not exist, create it from any available free space.
2. Map this custom volume to the port to which your P-VOLs are already mapped as the last available LUN number.

Write the LUN# here: _____

3. Right-click on your new LUN in the **LU Path Table** in the right top corner of the screen
4. Select Command Device: **Disable->Enable**.



LUN	CU:LDEV	Emulation	Capacity	RAID	Patl
0000	00:00	OPEN-3	2.29 GB	5(3D+1P)	1
0001	00:02	OPEN-3	2.29 GB	5(3D+1P)	1
0002	00:40	OPEN-3	2.29 GB	5(3D+1P)	1
0003	00:41	OPEN-3	2.29 GB	5(3D+1P)	1
0004	00:42	OPEN-3	2.29 GB	5(3D+1P)	1

Context Menu:

- Command Device:Disable->Enable
- Release LU Path
- Alternate Paths
- Copy Paths

Command Device recognition

Refer to section in Lab Activity One on verifying LUNs and Command Devices to confirm that the host can recognize the command device.

2. Set up the horcm Configuration Files: LDEV Parameter

You need to determine the following for this lab:

Primary server IP address or host name: _____

Secondary server IP address or host name: _____

Use a text editor (dependent on host OS) to remove commented lines from sample **horcm.conf** file. Or you may create new horcm0.conf and horcm1.conf files containing the parameters specified below. Create at least three pairs.

Sample horcm0.conf file - using HORCM_LDEV

```
HORCM_MON
#ip_address service      poll(10ms)  timeout(10ms)
172.16.0.46 horcm0      1000        3000

HORCM_CMD
#dev_name Solaris        Windows
/dev/rdisk/c1t1d10s2    \\.\CMD-80006

HORCM_LDEV
#dev_group dev_name      Serial# CU:LDEV  MU#
Urgrp      dev01         80006   00:00      1
Urgrp      dev02         80006   00:01      1
Urgrp      dev03         80006   00:02      1

HORCM_INST
#dev_group ip_address  service
Urgrp      172.16.0.46  horcm1
```

Sample horcm1.conf file

```
HORCM_MON
#ip_address service      poll(10ms)  timeout(10ms)
172.16.0.46 horcm1      1000        3000

HORCM_CMD
#dev_name Solaris        Windows
/dev/rdisk/c1t1d10s2    \\.\CMD-80006

HORCM_LDEV
#dev_group dev_name      Serial# CU:LDEV  MU#
Urgrp      dev01         80006   03:00      1
Urgrp      dev02         80006   03:01      1
Urgrp      dev03         80006   03:02      1

HORCM_INST
#dev_group ip address  service
```

Save Files to proper directory:

1. If using Solaris, save configuration files to /etc.
2. If using Windows, save to the highest level Windows folder.

3. Set up the Operating System Environment

Services File

Solaris:

Use vi or the text editor to open the `/etc/services` file. Scroll to the end of the file. Add service entries. Examples are shown below.

```
horcm0 11000/udp
```

```
horcm1 11001/udp
```

Windows:

Use Notepad to edit `C:\Windows\system32\drivers\etc\services`.

Example entries:

```
horcm0 11000/udp
```

```
horcm1 11001/udp Note: Hit Enter key at end of last line!
```

TIP: Set command window width to 120 before starting. This will prevent line wrapping and make it easier to read the output of the `pairedisplay` command.

Environment Parameters:

CCI Command line usage: Instance numbers and other environment parameters can now be specified in the command line using the `-ITC` or `-IH` parameters for TrueCopy / Universal Replicator.

Example: Environment parameter for UR, Primary Instance 0 is `-IH0`. This has to be coded in all commands relating to the UR pairs defined in `horcm0.conf`.

4. Start the Instances — Solaris

On the primary site, change to the `/HORCM/usr` directory.

Enter:

```
horcmstart.sh 0 1
```

This starts the horcm0 and horcm1 instances.

If you do not get a successful start, troubleshoot the error. Start with the log files specified in the error message.

5. Start the Instances — Windows

1. Open the command prompt on the primary site.
2. Change directories to `\HORCM\etc` and enter:
 - ♦ `horcmstart 0 1`

This starts the instances.

Note: If you do not get a successful start, you can troubleshoot the error, by using:
`C:\HORCM\Log0\curlog\`

Ensure Log files are closed before issuing another horcmstart command. Otherwise an error will occur.

Part 2. Issue CCI Commands

In this section, all commands will be executed on the primary server.

The paircreate and pairdisplay Commands

1. **BEST PRACTICE:** When both instances start successfully, use a `pairdisplay` command on the groups. Verify the devices and the copy direction. This will confirm you have the correct devices defined in the configuration files and will confirm the copy direction.
2. `pairdisplay -g [group name] -IH0`

```
C:\Documents and Settings\Administrator.GSS-2K3-2>pairdisplay -g HURGRP01
Group  PairVol<L/R> <Port#,TID, LU>,Seq#,LDEV#.P/S,Status,Fence,Seq#,P-LDEV# M
HURGRP01      FS13<L>      <CL4-C , 7, 27>10075      85.SMPL  ---- -,-----
HURGRP01      FS13<R>      <CL6-C , 6, 9>10075      84.SMPL  ---- -,-----
```

3. `pairdisplay -g [group name] -I0 -fxce`

What differences in commands did you notice?

- If the devices are correct and the proper copy direction is defined, check that primary and secondary volumes are in SMPL status. Now you can issue the command to create the group. Specify the fence level, CT ID, copy direction, environment parameters, and journal IDs. For example:

```
paircreate -g [group] -f async 00 -vl -jp [M-JNL]-js [R-JNL] -IH0
```

This launches the Base Journal (Initial Copy) process for the group. Note CTG ID 00 in the fence parameter.

- Now display the pair. Enter:

```
pairstatus -g [group]-fcx -IH0
```

- Observe that volumes are now in COPY status. Continue checking until PAIR status occurs.
- Now open Universal Replicator in Storage Navigator and check the status of the volume pair.

What did you notice? _____

- From CCI, issue **pairstatus -g [group]-fxe -IH0**
- Note the differences between the pairstatus output using the -fxe parameter and the output using the -fcx parameter. What did you notice?

- Now issue **pairstatus -g [group]-fdcx. -IH0** Note the differences.
- To check the status of the journal after the pair has been created:

```
raidvchkscan -v jnl [M-JNL] -fx -IH0
```

You should find an output similar to this:

```
C:\Documents and Settings\Administrator.GSS-2K3-2>raidvchkscan -v jnl 0
JID MU CTG JNLS AP U(<%) Q-Marker Q-CNT D-SZ(BLK) Seq# Num LDEV#
000 0 0 PJNN 2 0 - - 828920 10075 9 263
001 0 0 SJNN 2 0 - - 1392626 10075 15 264
002 - - SMPL - - - - 77312 10075 1 265
003 - - SMPL - - - - 77312 10075 1 266
```

Journal Status Codes:

- ♦ SMPL: No pairs defined in the Journal Groups
- ♦ P(S)JNN: P(S)Vol Journal Normal Normal
- ♦ P(S)JNS: P(S)Vol Journal Normal Suspend (-nocsus option, Delta Resync)
- ♦ P(S)JSN: P(S)Vol Journal Suspend Normal
- ♦ P(S)JNF: P(S)Vol Journal Normal Full (JNL Threshold exceeded, PFUL)
- ♦ P(S)JSF: P(S)Vol Journal Suspend Full (PFUS)
- ♦ P(S)JSE: P(S)Vol Journal Suspend Error (including link failure)
- ♦ P(S)JES: P(S)Vol Journal Error suspend (-nocsus option, Delta Resync)

Pairsplit Command – Split UR Pairs

1. When you have created your Universal Replicator pair, try to split the pairs. To split Universal Replicator pairs, type this command:

```
pairsplit -g [group] -r -IH0
```

Issue the proper **pairedisplay** command. What are the new P-VOL and S-VOL status conditions?

P-VOL - _____

S-VOL - _____

2. Again, check the status of Journal Volumes with **raidvchkscan**. You should see an output like this:

```
C:\Documents and Settings\Administrator.GSS-2K3-2>raidvchkscan -v jnl 0
JID MU CTG JNLS AP U(<%) Q-Marker Q-CNT D-SZ<BLK> Seq# Num LDEV#
000 0 0 PJSN 2 0 - - 828920 10075 9 263
001 0 0 SJSN 2 0 - - 1392626 10075 15 264
002 - - SMPL - - - - 77312 10075 1 265
003 - - SMPL - - - - 77312 10075 1 266
```

What is the significance of these new status conditions?

Pairresync Command – Resynchronize UR Pairs

1. After the P-VOL and S-VOL have been split, issue the command:

```
pairresync -g [group] -IH0
```

2. Next, issue the proper **pairedisplay** command to check the status.

What is the new status of the group? _____

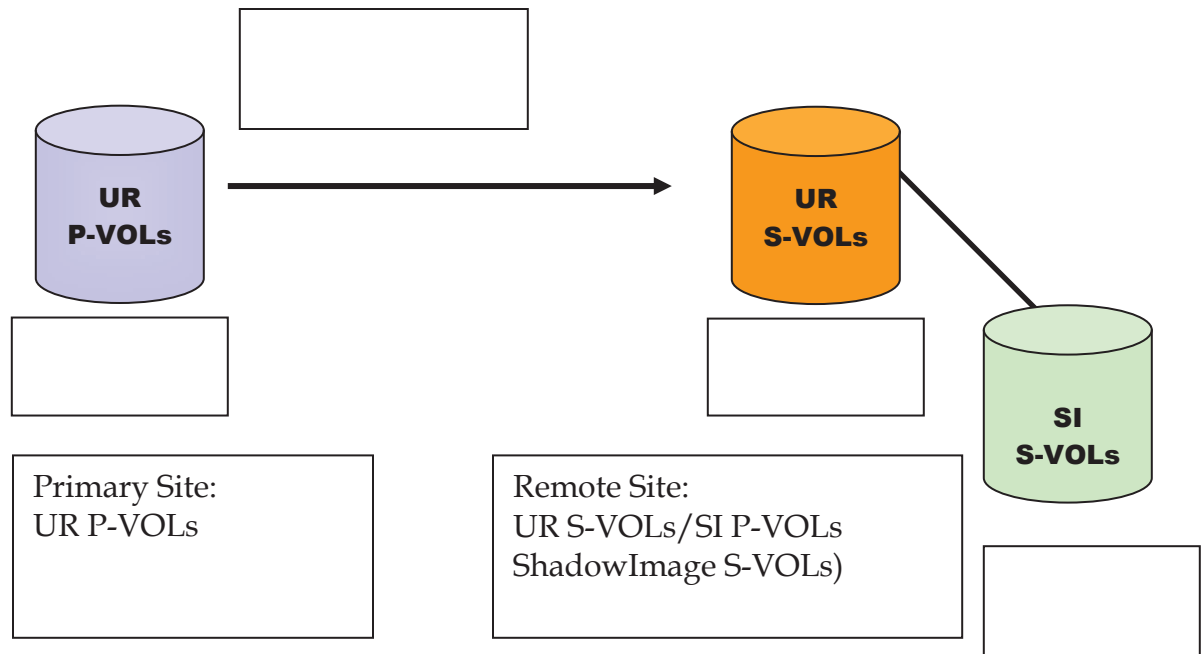
3. Run **raidvchkscan -v jnl 0 -IH0** to check the status of the journal.

Notice that the status is the same as in the end of paircreate and pairedisplay.

Note: If you set up a repeated copy of data to the P-VOL and keep refreshing the **raidvchkscan** display, you can watch as CCI monitors the state of the journal. Suspend and resync to see the state of the Journal group change. In particular, the Q-CNT column starts to increase inside the primary journal volume and gradually decrease as replication progresses.

Combining UR and ShadowImage CCI Operations

Note: Create two new configuration files (horcm10.conf and horcm11.conf) for ShadowImage pair. Note that the SI P-VOLS will be the UR S-VOLs. Adapt the configuration files HORCM0 and HORCM1 as necessary. Select the ShadowImage S-VOLS from CU 03.



Create CCI Environment for Universal Replicator and ShadowImage

Edit the horcm Files

Save horcm0.conf as horcm10.conf. Edit the horcm10.conf file and horcm11.conf files as necessary. These files will manage the ShadowImage pairs. Ensure that the ShadowImage P-VOLS are the same LDEVs as the Universal Replicator S-VOLS.

Start instances 10 and 11

Issue CCI Software Commands

With this configuration, you can now perform both Universal Replicator, as well as ShadowImage operations.

For ShadowImage operations make sure to include the ShadowImage environment variable M or SI in the command.

Once all instances start successfully, use a **pairedisplay** command on the primary server to view the volumes by group name, and view the status.

Sample commands:

```
pairedisplay -g urgrp -fxce -IH0  
pairedisplay -g siggrp -fxce -SI10
```

Create a corresponding ShadowImage consistency group. Review the CCI Module in the Student Guide if necessary to refresh your knowledge of SI consistency group creation.

```
#paircreate -g siggrp -vl -m grp 10 -SI10
```

Why use **-m grp 10** parameter? _____

Use pairedisplay commands to confirm that the UR S-VOLs belong to UR and ShadowImage consistency groups simultaneously, thus achieving our goal. You may also validate this by using **Storage Navigator**.

```
#pairedisplay -g siggrp -fxce -SI10  
#pairedisplay -g urgrp -fxce -ITC0
```

Consistency Group Operations:

Edit the configuration files to include more UR and ShadowImage volumes and create more pairs in their respective consistency groups.

1. Issue **pairsplit** command to UR group. This forces UR to send all updates to S-VOLs, giving consistent data on S-VOLs. Confirm with **pairedisplay**.
2. Issue proper **pairsplit** command to split the ShadowImage group. Confirm.

Note that you have now performed a ShadowImage At-Time Split, producing multi-volume consistent data on the ShadowImage secondary volumes.

3. Leaving ShadowImage pairs in split status, resync the UR pairs. Note that the ShadowImage S-VOLs protect your remote data while UR resynchronizes. Now the ShadowImage S-VOLs can be mounted and used for backup, disaster recovery testing, and so forth.

Pair Delete Command — Delete all pairs

1. The last task is to delete the pair(s). Issue the command:

```
pairsplit -S -g [group] -ISI10
```

```
pairsplit -S -g [group] -IH0
```

2. Issue **pairedisplay** commands as necessary to confirm all pairs are deleted

What is the status of the pairs? _____

3. Check the status of the journal. Enter the command:

```
raidvchkscan -IH0 -v jnl 0
```

What is the status of the journal group? _____

This completes Lab Activity 2.

To prepare for the next lab activity, ensure all pairs are deleted. Leave Journals in place.

Lab Project Review Questions

Managing Universal Replicator with CCI

1. True or False. Before you create UR pairs, you must create journal volumes via Storage Navigator.
2. What environment variables are in UR commands for Instance 0?
3. How many **horcm** instances did you need?
4. What parameter is used to display Initial Copy progress?
5. If Journal volume status reads *PJSN*, what does that signify?

Lab Activity 3

Universal Replicator

3DC

Objectives

Upon completion of the lab project, you will be able to do the following:

- Describe the differences between 3DC Multi-Target and 3DC Cascade configurations.
- Configure TrueCopy Synchronous (TC) and Hitachi Universal Replicator (UR) for 3DC Multi-Target operations using Storage Navigator.
- Execute 3DC pair operations with CCI.

This exercise shows you how UR can work in conjunction with TrueCopy Synchronous to implement a 3-data center replication solution.

The Instructor will connect the necessary Fibre Channel cables and give you the port IDs to use as Initiator and RCU Target. Configure the two systems as shown below.

Note that you will be using two storage systems rather than three systems for our 3DC Configuration. Study the diagrams below. Note that the arrows indicate direction of data flow; i.e., Initiator to RCU Target.

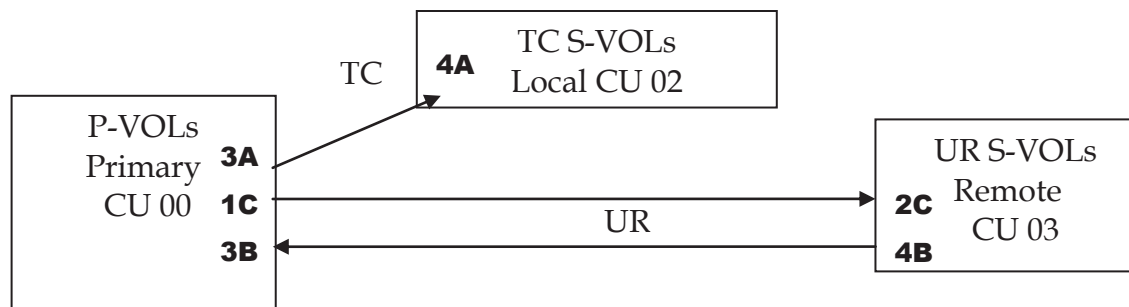


Fig 1. 3DC Multi-Target Configuration

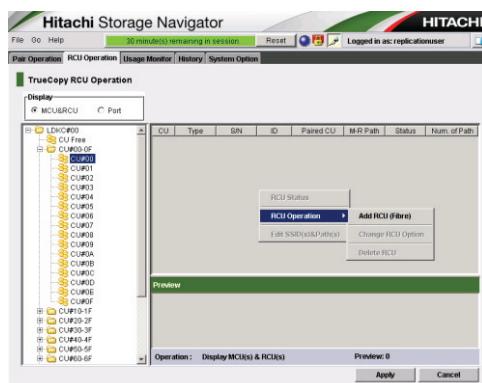
Multi-Target Lab Overview

- Use Storage Navigator to set TrueCopy Initiator and RCU Target ports.
- Define the TrueCopy RCU. To ensure the RCU definition is correct, create one TrueCopy Pair using a previously mapped LUN in MCU as the P-VOL and a previously created LUN in RCU as the S-VOL.
- Initiate 3DC Pair Operation by using CCI. Create TrueCopy pairs with CTG ID. Then create Multi-Target UR pairs. Note that the UR P-VOL is also the TrueCopy P-VOL.

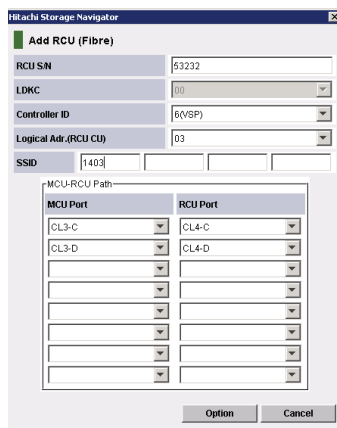
Step 1. TrueCopy Configuration

1. You will use the partner lab team's storage system for your *Local (or Intermediate) System*, containing the TrueCopy RCU.
Note the Serial Number here: _____
2. Each lab team will communicate with their partner team as necessary to prevent interference.
3. TrueCopy uses the same OPEN-V LDEVs for **P-VOLs** that have already been used for **Universal Replicator P-VOLs**. TrueCopy S-VOLs are drawn from the available CU02 LDEVs mapped to Cluster 2 host port of the *LOCAL* system (RCU).
4. Note the LUN numbers, Host Group Numbers, and Port numbers here:
CU00 (TC P-VOLs, UR P-VOLs) _____
CU02 (TC S-VOLs in the partner storage system RCU) _____
CU03 (UR S-VOLs) _____

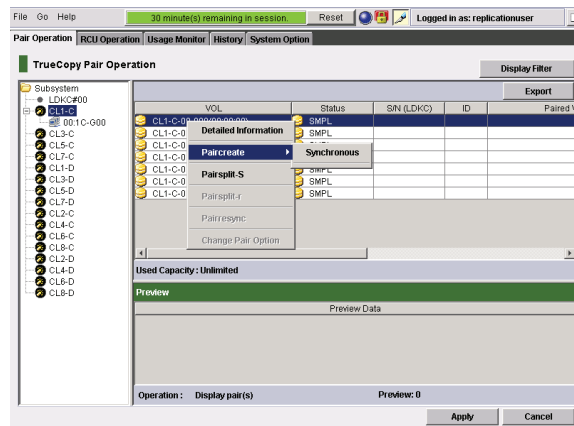
5. Use Storage Navigator **TrueCopy RCU Operations Panel, Port selection** to set TrueCopy **Initiator Ports and RCU Target Ports**. Examples are:
 - ♦ Primary system - CL3-A Initiator
 - ♦ Local System - CL4-A RCU Target
6. In the Primary System, use Storage Navigator **TrueCopy RCU Operations MCU/RCU selection** to define the TrueCopy RCU. Select CU 00, and then float the cursor in the open area to the right. Right-click and select RCU Operation>ADD RCU. (See following screen shots).
7. **Note:** DO NOT use CU Free. The expected configuration requires CU00 as the MCU and CU02 as the RCU. CU Free will assign CU00 to CU00.



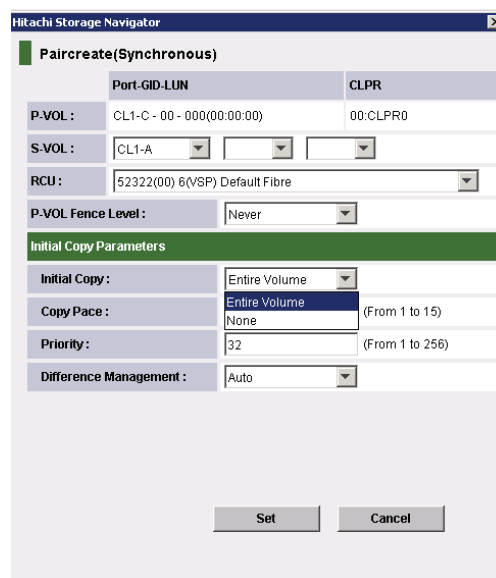
6. Consult your configuration document for the Serial Number and SSID. Note the S/N and SSID here: _____.
7. Note that TrueCopy associates the RCU to a specific Logical Control Unit. Complete the RCU Definition by entering the necessary information in the **Add RCU (Fibre)** popup panel. Use CU 02 for the Logical Address (RCU CU).
8. Remember that the Initiator port is specified as the MCU port. The RCU Target port is entered in the RCU Port column.
9. Complete RCU Definition by clicking **Option**. Take the defaults and click **Set**.



10. Inspect the Preset List to make sure the RCU Definition is correct then click on **Apply**. When Apply completes, check the RCU Status. It should be NORMAL. If RCU Status is any condition other than Normal, recheck all inputs and re-define the RCU if necessary.
11. Once RCU Status is Normal, you have completed the RCU Definition process. Now it is time to test our configuration by creating a pair.
12. On the **MCU**, select the **Pair Operations Tab**. The Pair Operations screen opens. In the Tree View on the left, select the port where you mapped your P-VOLs. The LDEV List then appears in the list area to the right of the Tree View.

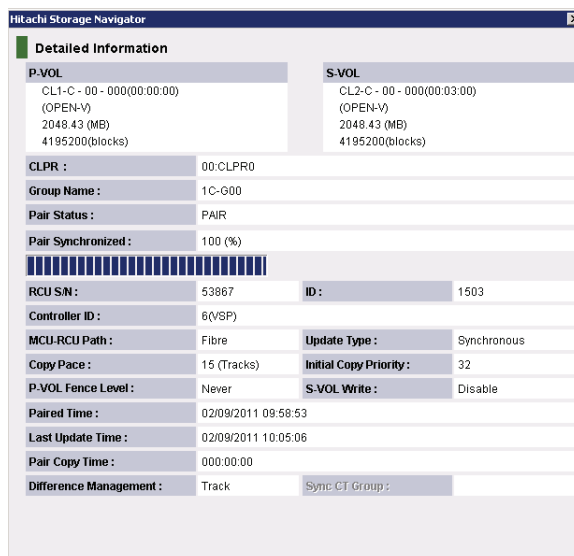


13. Select an available LDEV in CU 00 (right-click on the LDEV entry) and select **Paircreate...Synchronous**. (Asynchronous pairs are not supported in 3DC).



14. The Paircreate (Synchronous) pop-up window appears. Enter the necessary information:

- ♦ S-VOL: **Port, Host Group Number, LUN Number**. Refer to your notes above for the Host Group Number and LUN number of the S-VOL.
 - ♦ RCU: Only one RCU is defined therefore, you do not need to select it.
 - ♦ P-VOL Fence Level: Set to Never or Data (Data is recommended for 3DC operations).
 - ♦ Initial Copy: Use **None**, if desired.
 - ♦ Take defaults for other parameters.
15. Click **Set**, then check **Preset List** for correct entry. If correct, click **Apply**.
 16. Initial Copy will commence. Check progress by right-clicking the Pair entry and selecting **Pairedisplay**. See screen shot on next page for guidance.
 17. Periodically Refresh the Pairedisplay screen. When Initial Copy completes, check the box labeled **Refresh the Pair Operations Panel after...**, then close the Pairedisplay screen.



18. Check **Status** after the Pair Operations screen refreshes. Status should be **PAIR**.
19. **Your configuration is confirmed. DELETE** the TrueCopy pair (Pairsplit - S) in preparation for establishment of the 3DC environment with CCI.

Step 2: Prepare Universal Replicator Journal to Use for CCI 3DC Pair Operations

1. Select the Storage Navigator Universal Replicator feature.
2. If you did not use MU Number 1 when creating UR pairs in the previous lab, then split and delete any Universal Replicator pairs.
3. The Journals were created in earlier labs. Use these as is and no changes are necessary.

Step 3: Create and Edit Necessary CCI Configuration Files

Note: You must create new horcm.conf configuration files. As a best practice, modify the horcm.conf files that were created in the previous CCI lab. Use the 'standard' convention for naming CCI instances; i.e. even-numbered instances manage P-VOLs and odd-numbered instances manage S-VOLs.

Using the courseware for guidance, create and edit horcm.conf files.

1. UR P-VOLs: Check **horcm0.conf**, ensure MU # 1 is specified for each entry.
2. UR S-VOLs: Check **horcm1.conf**, ensure MU # 1 is specified for each entry.
3. Create and edit **horcm2.conf** file. Add the TrueCopy P-VOLs (same LDEVs as used in horcm0.conf, with different group and device names). Use MU# 0 (or leave blank) for each entry.
4. **Important:** In the appropriate server connected to the *LOCAL* system (the partner storage system), create and edit **horcm3.conf**. Use the devices in LCU02 as the TrueCopy S-VOLs. Use MU# 0 for each entry. Ensure that **HORCM_MON** and **HORCM_INST** parameters are coded correctly. Use courseware for guidance, if necessary.
5. *Note:* The easiest way to create horcm2.conf and horcm3.conf is to copy horcm0.conf and edit as necessary.

Question 1: Which HORCM configuration files manage our primary volumes?

Question 2: Do the S-VOLs added have to be the same size as the P-VOLs?

Complete CCI housekeeping

1. Edit Services files on **all hosts** to include new instance numbers. Make sure to include ALL instances in every Services file, even those that run on another host.
2. Stop and restart all Instances to incorporate configuration file changes.
3. Note that Instance 3 has to be started on the server attached to the system containing your TrueCopy S-VOLs.
4. If Instances start correctly, begin Pair Operations. If not, troubleshoot the configuration files. Use the log files generated in the HORCM directory. Also, check for hidden characters, spaces at the ends of lines, and so forth.

Step 4: Perform CCI Pair Operations

1. If desired, perform the necessary steps on the servers to allow host access and copy data to the UR P-VOLs.
2. Issue `pairedisplay` command to check UR volume status.

```
pairedisplay -g [UR group] -IH0 -fxce
```

If you specified MU number 1 for the UR pairs created in the previous CCI lab, you do NOT have to delete the UR pairs before creating the TC pairs.

Issue **pairedisplay** command to check that all TC volumes are in **SMPL** state. Do not forget that your TrueCopy P-VOLs are managed by Instance 2. Use the appropriate environment parameter. If not, delete the pairs with **pairsplit -S**. Now issue **paircreate** command for the **TrueCopy** pairs. Code the CTG ID so that TC Sync Consistency Group 02 is created.

```
paircreate -g[TCgrp] -fg never 02 -v1 -IH2
```

Note: You MUST use a fence level of 'never', 'data', or 'status' to designate a TrueCopy Sync pair.

Question 2: Is the `-v1` parameter necessary? _____

What does it mean? _____

3. Monitor with **pairedisplay** command. Wait for status to change to **PAIR**.

```
pairedisplay -g[TC group] -fxce -ITC2
```
4. After TC pair is in PAIR status, split the TC pair. Check with **pairedisplay** command. Resynchronize the TC pair.

5. Create UR pairs if they do not exist:

paircreate -g [UR group] -f async 00 -vl -IH0 -jp [M-JNL] -js [R-JNL] -IH0

Note that we used CTG ID 00. This avoids interference with the TC Consistency Group created earlier.

Question 3: What does the -f option specify?

Answer: _____

6. Monitor with **pairedisplay** command.
7. When pair status changes to **PAIR**, you have successfully created a Three Data Center Multitarget Replication. You are using TrueCopy and UR together to replicate the same P-VOL to S-VOLs in different locations.
8. Check the journals.

raidvchkscan-v jnl [M-JNL ID] -IH0

Journal Volume Status must be **PJNN**, **SJNN** (Primary Journal Normal, Secondary Journal Normal).

9. Issue **pairsplit** to the UR pair.

pairsplit -g [UR group] -r -IH0

10. Monitor with **pairedisplay** command.
11. Issue **pairsplit** to the TrueCopy pair. Check status.

What environment parameter will you use to issue commands to the TrueCopy pair? _____

12. Resynchronize the UR pair. Check status
13. Now resynchronize the TrueCopy pair.
14. You have performed 3DC Multitarget pair operations.

This completes the 3DC Universal Replicator Lab

Answers to embedded questions:

1. Which HORCM configuration files will manage our P-VOLs?

A: horcm0.conf for UR and horcm2.conf for TC.

2. Does the S-VOL added here have to be the same size as the P-VOL?

A: Yes. It must be the same emulation and the same size.

3. Is the -vl parameter necessary?

A: -vl or -vr must always be coded.

What does it do?

A: The -vl option specifies the data flow direction and assumes the host which issues the command possesses the primary volume (local host). If -vr is coded by mistake, copy direction is reversed.

4. What does the -f option specify?

A: -f specifies the fence level. ASYNC is the default for UR pairs in 3DC. NEVER is the default for the TrueCopy pairs.

3DC Lab Review Questions

1. Can Hitachi Universal Replicator be **cascaded** from TrueCopy Asynchronous?
2. Can TrueCopy Synchronous be **cascaded** from Hitachi Universal Replicator?
3. True or False. The logical paths set up for UR are also compatible with TrueCopy synchronous.
4. True or False: TrueCopy Links and RCU Definitions are associated to Logical Control Units.
5. True or False: UR Links and RCU Definitions are associated to systems.

Lab Activity 4

Universal Replicator

Delta Resync

Operations

Objectives

Upon completion of the lab project, you will be able to do the following:

- Perform the steps necessary to configure and operate a 3DC Multi-target Delta Resynchronization.

Lab Format

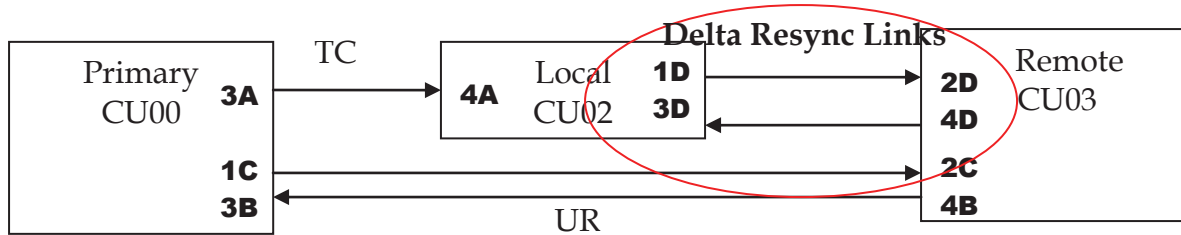
Note that you will be building on the configuration created in earlier Lab Activities. Ensure that all procedures in previous labs have been accomplished.

The screen shots in the lab project may be slightly different from the actual command output due to microcode differences between the system that you are working on and the system used to capture the screen shots.

3DC Multi-Target Delta Resync Lab Summary:

1. Using Storage Navigator, define Port Attributes for the UR links from the LOCAL CU to the Remote CU (Delta Resync Links in the diagram below.)
2. Add a UR Remote DKC definition to BOTH storage systems.
3. Create Journal 02 in the LOCAL Site (to be used for the Delta Resync pairs).
4. Using CCI, define the configuration files to be used for Delta Resync. Use the TrueCopy S-VOLs in the LOCAL Site (CU02) as your Delta Resync P-VOLs, paired with the existing UR S-VOLs in the Remote Site (CU03). Thus, HUR Delta Resync pairing takes place between the LOCAL site and the REMOTE site.
5. Using CCI or Storage Navigator, check that TrueCopy and Multi-target UR pairs are established. These MUST be established before the Delta Resync copy group is created.
6. Using Storage Navigator or CCI, create the Delta Resync pairs.
7. Ensure HOLD status for the pairs.
8. Using CCI, prepare the 3DC replication for Delta Resync by issuing **pairsplit -RS** to TC S-VOLs, then split the primary UR pairs.
9. Using Storage Navigator, execute the Delta Resync operation to change the Delta Resync pair status from HOLD to PAIR.

Be sure you understand the 3DC Multi-target Delta Resync Diagram before beginning the lab procedure. Note that you will be adding another set of links from the Local Site (represented by CU02 in the second storage array) to the Remote Site (represented by CU03 in the first storage array.)



Delta Resync Diagram: The Local Site is the MCU for the Delta pairs.

Storage Navigator Setup: Define Port Attributes in preparation for Delta Resync Operations

- Establish Remote Desktop connection to assigned LOCAL system.
- Launch Storage Navigator and load Universal Replicator. Go to DKC Operations.
- Select Port radio button and set port attributes for the Forward Link. Use ports specified in your configuration document.

In Local Site, Add DKC definition for Delta Resync

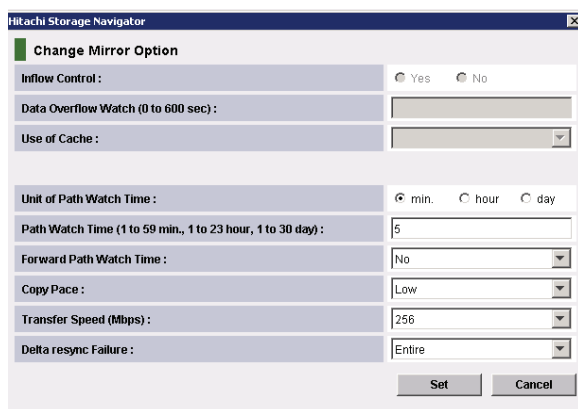
- Right-click in the List area and select ADD DKC. Create a DKC, using the ports designated as the Delta Resync forward link in the diagram above. Use the screen shots in Lab Activity for guidance if necessary.

In Remote Site, Add DKC definition for Delta Resync

- Switch to Remote Site. Go to Universal Replicator DKC Operations.
- Select Port radio button and set port attributes for the Reverse Link as shown in the Delta Resync Diagram above.
- When Initiator and RCU Targets are set, switch to DKC.
- Ignore the existing entry.
- Right-click in List area and select ADD DKC. Create a DKC, using the serial number of the LOCAL storage system and the ports designated as the Delta Resync reverse link. Refer to the screen shots lab Activity 1 for guidance.

Create Delta Resync Journal Group

1. Switch to LOCAL site. Select Universal Replicator...Journal Operations tab. Select Journal ID 02. Edit JNL VOLs and select LDEVs from the same CU that the other Journals came from. This will be the Journal Group for the Delta Resync UR P-VOLs. Refer to courseware and previous labs for guidance if necessary.
2. Open the Change Mirror Options panel (Journal Options panel if using USPV). Make the proper setting for the Delta Resync Failure option. Note the Journal Group number: _____.



The screenshot shows the 'Hitachi Storage Navigator' window with the 'Change Mirror Option' dialog box open. The dialog box contains the following settings:

Option	Value
Inflow Control :	☒ Yes ☐ No
Data Overflow Watch (0 to 600 sec) :	
Use of Cache :	
Unit of Path Watch Time :	☒ min. ☐ hour ☐ day
Path Watch Time (1 to 59 min., 1 to 23 hour, 1 to 30 day) :	5
Forward Path Watch Time :	No
Copy Pace :	Low
Transfer Speed (Mbps) :	256
Delta resync Failure :	Entire

At the bottom right of the dialog box are 'Set' and 'Cancel' buttons.

Important! Note that you do not create another Journal Group in the Remote Site. Use the existing R-JNL Group already created for the primary UR pairs.

Build horcm.conf files for Delta Resync pairs

1. Using CCI, define the configuration files to be used for Delta Resync. Use the TrueCopy S-VOLs in the LOCAL Site as your Delta Resync P-VOLs, paired with the existing UR S-VOLs in the Remote Site. Thus, HUR Delta Resync pairing takes place between the LOCAL site and the REMOTE site.
2. Create horcm4.conf and horcm5.conf for the Delta Resync pairs.
3. horcm4.conf defines the Delta Resync P-VOLs and are the same LDEVs currently used for TrueCopy S-VOLs in horcm3.conf. The group names and device names are different.
4. horcm5.conf contains the Delta Resync S-VOLs and are the same LDEVs currently used for the primary UR S-VOLs in horcm1.conf. The group names and device names must match those in horcm4.conf.
5. Perform necessary housekeeping (edit services files in both servers). Start horcm instances 4 and 5 on the proper hosts. Note that horcm instance 4 runs on the LOCAL host (partner lab team's server) while instance 5 runs on the REMOTE host (same as Primary).

Step 5: Create Delta Resync pairs. Confirm HOLD status

1. Using CCI or Storage Navigator, check that TrueCopy and Multi-target UR pairs are established. These MUST be established and in PAIR status before the Delta Resync pairs can be created.
2. You can use either Storage Navigator or CCI to create the Delta Resync pairs.
3. If you wish to use Storage Navigator, go to UR in the Local storage system. Select Pair Operations. Select a P-VOL. Right-click and select **paircreate**.
4. If you wish to use CCI, go directly to Step 5.

Hitachi Storage Navigator

Paircreate

Port-GID-LUN

P-VOL : CL1-C - 00 - 000 (00:00:00)

S-VOL : CL2-C 00 000

Select Other S-VOL(s) : Increment

M-JNL Mirror ID R-JNL

Mirror : 000 01 001

CT Group : 000

S/N, CTRLID, Path

DKC : 53867(00), 6(VSP), Fibre

Initial Copy : Entire

Priority : Entire

Error Level : MIRROR

M-JNL Information :
Current Mirror(s) : 0 Total Mirror(s) : 0

Set Cancel

Paircreate

Port-G-ID-LUN

P-VOL : CL7-F - 00 - 000 (33:A0)

S-VOL : CL1-A 00 000

Select Other S-VOL(s) :

M-JNL Mirror ID R-JNL

Mirror : 00 00 01

CT Group : 00

DKC S/N, CTRLID, Path

DKC : 11111, 04, Fibre

Initial Copy : Entire

Priority : 32

Error Level : Group

M-JNL Information :
Current Mirror(s) : 0 Total Mirror(s) : 0

Set Cancel

5. **Optional:** Use CCI **paircreate** command to create Delta Resync pair.

Example of the **paircreate** issued at the LOCAL site:

```
paircreate -g deltagrp -vl -nocsus -f async 04 -IH4 -jp 02 -js 01
```

Note that you used CTG ID 04 to avoid interference with the primary UR and TrueCopy CTGIDs.

6. Ensure HOLD status for the pairs, either by checking pair status display in UR Pair Operations or use CCI **pairedisplay** command. Use the correct environment parameter.

Execute Delta Resync Operation

1. Prepare the 3DC replication for Delta Resync. Using Storage Navigator or CCI, split the primary Universal Replicator pairs.

```
pairsplit -g urgrp -r -IH0
```

2. Confirm Primary UR pairs are in PSUS status, either with CCI or Storage Navigator.

```
pairedisplay -g urgrp -IH0 -fxce
```

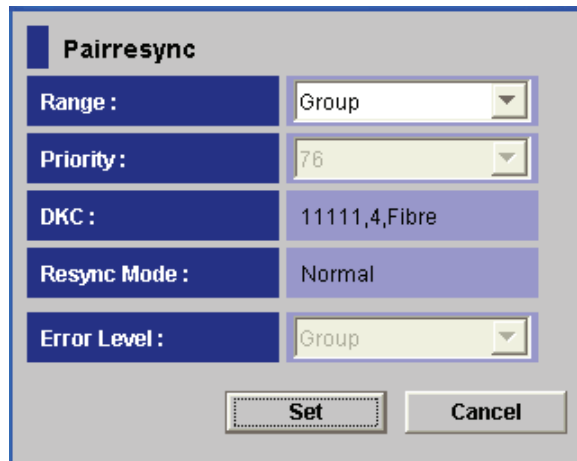
3. Using CCI, fail the TC pairs over to the LOCAL site. On Local site issue:

```
pairsplit -RS -g tcgrp -IH3
```

4. Confirm TC S-VOL shows SSWS pair status with CCI **pairedisplay** command.

```
pairedisplay -g tcgrp -IH3 -fxce
```

5. Use host I/O (file copy or IOMETER) to copy data to the TrueCopy S-VOL in SSWS status. While the data is changing, execute **Delta Resync**.
6. Using Storage Navigator at the LOCAL Site, execute the **pairresync** operation to change the Delta Resync pair status from HOLD to PAIR. Note that the Resync Mode will display DELTA.



The image shows a 'Pairresync' dialog box with a blue title bar. It contains five configuration rows, each with a label on the left and a value on the right. The labels are 'Range:', 'Priority:', 'DKC:', 'Resync Mode:', and 'Error Level:'. The values are 'Group', '76', '11111,4,Fibre', 'Normal', and 'Group' respectively. At the bottom right, there are two buttons: 'Set' and 'Cancel'.

Label	Value
Range :	Group
Priority :	76
DKC :	11111,4,Fibre
Resync Mode :	Normal
Error Level :	Group

Buttons: Set, Cancel

Confirm Delta Resync

Confirm pair status change with either Storage Navigator or CCI. If successful, Delta Resync status is PAIR and the primary Universal Replicator status is PSUS or HOLD.

If the Delta Resync is unsuccessful, a full volume copy should commence automatically, as you set the Delta option to Entire during the paircreate process.

The occurrence of a full-volume copy does not necessarily indicate a problem with Delta Resync, as this is the expected behavior if no changed data is present on the TrueCopy S-VOL at the time of the resync operation.

If desired, split the Delta resync pairs and resync the primary UR replication. The Delta Resync status changes back to HOLD. The primary UR pairs will change back to PAIR status.

Cleanup: **IMPORTANT!** Before leaving this Lab, please delete ALL pairs, including the TC pairs.

You will use the same volumes and some of the same links in the next lab activity, but you need to define them in a different manner.

Lab Project 4 Review Questions

1. Why do we select 'ENTIRE' as the Delta Resync Failure Option on the Change JNL Option Panel?
2. Is there a CCI command to issue the Delta Resync operation?
3. Why do you have to select an unused Consistency Group ID for the Delta Resync paircreate operation?
4. Does a full-volume Delta Resync necessarily indicate a problem?

Lab Activity 5

Universal Replicator MxN Consistency Group Operations

Objectives

Upon completion of the lab project, you will be able to perform the steps necessary to configure and operate a Universal Replicator MxN Consistency Group in a 2DC UR environment.

Lab Format

You will restructure the 3DC configuration for this lab. Before you do this, ensure that all ALL pairs have been deleted.

This lab project contains numbered steps that guide you through the configuration of Universal Replicator software.

In some steps, the *Standard Output* created by executing the command or function will be included as a screen shot to help you understand what should happen.

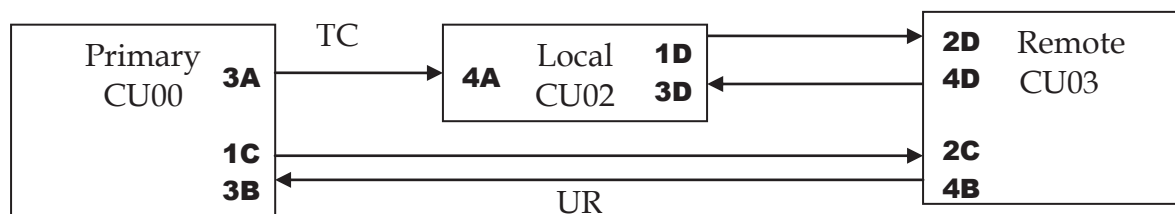
The screen shots in the lab project may be slightly different from the actual command output due to microcode differences between the system that you are working on and the system used to capture the screen shots.

MxN Consistency Group Lab Summary:

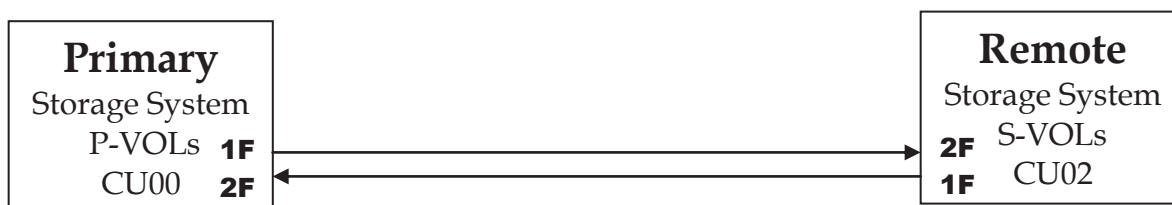
- Change the configuration to support MxN Consistency Groups
- Using Storage Navigator, create necessary Journal Groups
- Create (or modify) CCI configuration files to define an MxN Consistency Group.
- Issue the CCI commands to manage pairs in the MxN Consistency groups.

Part 1. Restructure the configuration

The ending configuration after the last lab looked like this:



- Using either CCI commands or Storage Navigator, ensure the TrueCopy pairs have been deleted.
- Using either CCI commands or Storage Navigator, ensure all UR pairs have been deleted. This includes Delta Resync pairs also.
- Using Storage Navigator in both MCU and RCU, delete all TrueCopy RCU definitions. This converts the 3DC configuration back to 2DC.
- Using Storage Navigator, delete all Journal Groups and all R-DKC definitions on both storage systems. Reset all port attributes to Target.
- Using Storage Navigator, refer to the diagram below and create a 2DC UR configuration. Use the ports specified in Lab Activity 4, Delta Resync, for the replication paths. When complete, your configuration should be similar to this:



- Note that we are NOT using the loopback configuration defined in lab Activity 1. While the P-VOLs will be the same volumes we used in Lab Activity 1, the S-VOLs will be the former TrueCopy S-VOLs in the partner storage system (LCU 02). Now we will use them as UR S-VOLs.
- Use courseware for guidance when defining the R-DKCs. Note that you will define an **R-DKC with one link** in each storage system. This will establish the necessary bidirectional configuration for UR.
- Using Storage Navigator, create two journals in each storage system. If lab teams are sharing storage systems, cooperate with each other to attain desired Journal Group configuration. For example, Lab Group A would set up 00 and 02 as M-JNL groups for their replication, then create Journal Groups 11 and 13 for the other lab group R-JNLs. Lab Group B would create JNL groups 10 and 12 for their M-JNLs, and 01 and 03 for Lab Group A to use as R-JNLs.

When complete, this config would look like this.

	Lab Group A	Lab Group B
Storage System 1	M-JNL 00, 02	R-JNL 11,13
Storage System 2	R-JNK 01,03	M-JNL 10,12

- This scheme preserves the even-odd convention recommended for horcm instance numbers. If desired, you can match up the M-JNL IDs with the R-JNL IDs. That is; 00 to 00, 01 to 01. That works equally well.
- The necessary configuration steps are complete. You are ready to create the CCI configuration files.

Part 2. CCI Configuration for MxN operations with multiple Journal Groups

Create CCI horcm.conf files for the MxN Consistency Groups. Two files are required. You have already created files up through horcm5, so use horcm6.conf and horcm7.conf. (If sharing hosts with another lab group, specify unique instance numbers).

HORCM_MON				
#ip_address	service	poll(10ms)	timeout(10ms)	
10.17.105.4	horcm6	1000	3000	
HORCM_CMD				
#dev_name	dev_name	dev_name		
\\.\CMD-10145				
HORCM_LDEV				
#dev_group	dev_name	Serial#	CU:LDEV(LDEV#)	MU#
mxngrp	pair1	10145:00	00:00	1
mxngrp	pair2	10145:02	00:01	1
HORCM_INST				
#dev_group	ip_address	service		
mxngrp	10.17.105.5	horcm7		
HORCM_CTQM				
#dev_group	Interval	mode		
mxngrp	300			

HORCM_MON				
#ip_address	service	poll(10ms)	timeout(10ms)	
10.17.105.5	horcm7	1000	3000	
HORCM_CMD				
#dev_name	dev_name	dev_name		
\\.\CMD-10156				
HORCM_LDEV				
#dev_group	dev_name	Serial#	CU:LDEV(LDEV#)	MU#
mxngrp	pair1	10156:01	02:00	1
mxngrp	pair2	10156:03	02:01	1
HORCM_INST				
#dev_group	ip_address	service		
mxngrp	10.17.105.4	horcm6		
HORCM_CTQM				
#dev_group	Interval	Mode		
mxngrp	300			

Sample horcm.conf files for MxN Consistency Group with Journal IDs specified in the HORCM_LDEV parameter. This allows simultaneous creation of pairs in multiple Journal Groups.

1. Edit files appropriately and save in proper directory.
2. Edit appropriate Services file and add instances.
3. Start instances in appropriate hosts.
4. Issue **pairedisplay** command:
pairedisplay -g mxngrp -IH6 -fxce
5. All volumes must be SMPL.
6. Issue **paircreate** command with proper parameters. If you are using the horcm files with journal IDs in the HORCM_LDEV parameter, there is no need to specify Journal IDs in the **paircreate** command.

The example creates consistency group 00 containing one pair each from two different sets of journal groups as specified in the horcm configuration files.

paircreate -g mxngrp -f async 00 -vl -IH6

7. Issue **pairedisplay** to note status of volumes and percent synchronized.

pairedisplay -g mxngrp -IH6 -fxce

8. When PAIR status is attained, issue **pairedisplay** commands with **-v jnl**, **-v jnlt**, and **-v ctg** parameters. Your courseware explains differences in the outputs for the three parameters.

pairedisplay -g mxngrp -IH6 -fxe -v jnl

JID	MU	CTG	JNLS	AP	U(%)	Q-Marker	Q-CNT	D-SZ (BLK)	Seq#	Num	LDEV#	CTQM
000	1	0	PJNN	1	0	00001852	2128	16258303	10145	2	100	-
001	1	0	SJNN	1	6	00000fff	2011	16258303	10156	2	100	00000011
002	1	0	PJNN	1	0	000017e9	1002	16258303	10145	2	102	-
003	1	0	SJNN	1	0	000015ff	190	16258303	10156	2	102	00000017

pairedisplay -g mxngrp -IH6 -fxe -v jnlt

JID	MU	CTG	JNLS	AP	U(%)	Q-Marker	Q-CNT	D-SZ (BLK)	Seq#	DOW	PBW	APW	CTQM
000	1	0	PJNN	1	0	00001e2e	1935	16258303	10145	60	300	40	-
001	1	0	SJNN	1	5	0000169f	1815	16258303	10156	60	300	40	00000017
002	1	0	PJNN	1	0	00001dc5	1935	16258303	10145	60	300	40	-
003	1	0	SJNN	1	5	00001636	1725	16258303	10156	60	300	40	00000017

pairedisplay -g mxngrp -IH6 -fxe -v ctg

CTG	P/S	Status	AP	U(%)	Q-Marker	QM-Cnt	SF(%)	Seq#	IFC	OT/s	CT/m	RT/m
000	P-VOL	PAIR	1	0	00002004	0	50	10145	ON	60	-	-
000	S-VOL	PAIR	1	0	00002004	-	70	10156	-	-	-	-
000	P-VOL	PAIR	1	0	00002004	0	50	10145	ON	60	-	-
000	S-VOL	PAIR	1	0	00002004	-	70	10156	-	-	-	-

9. Issue normal **pairsplit** command with proper parameters.

pairsplit -r -g mxngrp -IH6

10. Issue **pairdisplay** to confirm pair status change.

pairdisplay -g mxngrp -IH6 -fxe

11. Issue **pairresync** with proper parameters.

pairresync -g mxngrp -IH6

12. Issue **pairdisplay** to confirm status change:

pairdisplay -g mxngrp -IH6 -fxe

```
Group PairVol (L/R) Port#, TID, LU) , Seq#, LDEV#. P/S, Status, Fence, %, P-LDEV# M CTG JID
mxngrp pair1 (L) (CL1-A-0,1,0) 10145 0. P-VOL COPY ASYNC , 99 200 - 0 0
mxngrp pair1 (R) (CL1-A-0,1,0) 10156 200. S-VOL COPY ASYNC ,----- 0 - 0 1
mxngrp pair2 (L) (CL1-A-0,1,1) 10145 1. P-VOL COPY ASYNC , 99 201 - 0 2
mxngrp pair2 (R) (CL1-A-0, 1,1) 10156 201. S-VOL COPY ASYNC ,----- 1 - 0 3
```

13. Note Copy status. This indicates R-DKC is waiting for changed tracks.

14. Issue **pairdisplay** again. Status must be PAIR.

Part 3. Condition S-VOLs for host access in the event of primary host failure.

1. Shift to secondary host, where the secondary instance is running. Issue **pairdisplay** command. Note that the L (local) volumes are now the S-VOLs.

pairdisplay -g mxngrp -IH7 -fxe

```
Group PairVol (L/R) Port#, TID, LU) , Seq#, LDEV#. P/S, Status, Fence, %, P-LDEV# M CTG JID
mxngrp pair1 (L) (CL1-A-0,1,0) 10156 200. S-VOL PAIR ASYNC , 99 0 - 0 1
mxngrp pair1 (R) (CL1-A-0,1,0) 10145 0 . P-VOL PAIR ASYNC ,----- 200 - 0 0
mxngrp pair2 (L) (CL1-A-0,1,1) 10156 201. S-VOL PAIR ASYNC , 99 1 - 0 3
mxngrp pair2 (R) (CL1-A-0, 1,1) 10145 1. P-VOL PAIR ASYNC ,----- 201 - 0 2
```

2. Issue **pairsplit -RS** command:

pairsplit -RS -g mxngrp -IH7

- Issue **pairedisplay** command. Note SSWS status for S-VOLs, and that P-VOLs remain in PSUS status. S-VOLs allow unlimited host access.

pairedisplay -g mxngrp -IH7 -fxc

```
Group PairVol(L/R) (Port#,TID,LU),Seq#, LDEV#. P/S, Status, Fence, %,P-LDEV# M CTG JID
mxngrp pair1(L) (CL1-A-0, 1, 0) 10156 200.S-VOL SSWS ASYNC, 100 0 - 0 1
mxngrp pair1(R) (CL1-A-0, 1, 0) 10145 0 .P-VOL PSUS ASYNC, 100 200 W 0 0
mxngrp pair2(L) (CL1-A-0, 1, 1) 10156 201.S-VOL SSWS ASYNC, 100 1 - 0 3
mxngrp pair2(R) (CL1-A-0, 1, 1) 10145 1. P-VOL PSUS ASYNC, 100 201 W 0 2
```

- At this point, the replication can be reversed (S-VOLs become P-VOLs) if desired.
- Issue **pairresync -swaps** command to change S-VOLs to P-Vols:

pairresync -swaps -g mxngrp -IH7

- Issue **pairedisplay** command to confirm change in copy direction.
- To switch back to normal copy direction, issue **pairsplit -RS** and **pairresync -swaps** on new S-VOLs. (CU 00 in original primary site)
- Now issue **pairsplit -RS** again, on S-VOLs (now back to CU 02 in Secondary site)
- Confirm SSWS status. then issue **pairsplit** with **-RB** parameter. Confirm S-VOLs change to PSUS status with **pairedisplay** command.

pairedisplay -g mxngrp -IH7 -fxe

```
Group PairVol(L/R) (Port#, TID, LU),Seq#,LDEV#.P/S, Status, Fence, Seq#, P-LDEV# M CTG JID
mxngrp pair1(L) (CL1-A-0, 1, 0) 10156 200.S-VOL PSUS ASYNC, 100 0 - 0 1
mxngrp pair1(R) (CL1-A-0, 1, 0) 10145 0 .P-VOL PSUS ASYNC, 100 200 W 0 0
mxngrp pair2(L) (CL1-A-0, 1, 1) 10156 201.S-VOL PSUS ASYNC, 100 1 - 0 3
mxngrp pair2(R) (CL1-A-0, 1, 1) 10145 1. P-VOL PSUS ASYNC, 100 201 W 0 2
```

Resync pairs from Primary Site

- Return to primary site. Issue **pairedisplay** to confirm status.
- Issue **pairresync** command:

pairresync -g mxngrp -IH6

3. Issue **pairdisplay** to confirm that normal resync occurs:

pairdisplay -g mxngrp -IH6 -fxe

4. Confirm status changes to PAIR.
5. You have now completed two failovers (one to Secondary site, and one back to Primary site. You then set the S-VOLs into SSWS status, then converted to normal split status, then resynced with the normal copy direction.
6. In preparation for the second part of the lab, delete all pairs:

pairsplit -S -g mxngrp -IH6

7. Issue **pairdisplay** to confirm.

Group	PairVol(L/R)	(Port#, TID, LU)	Seq#	LDEV#	P/S	Status	Fence	%	P-LDEV#	M	CTG	JID
mxngrp	pair1(L)	(CL1-A-0, 1, 0)	10145	0	SMPL	----	-----	,	-----	-	-	-
mxngrp	pair1(R)	(CL1-A-0, 1, 0)	10156	0	SMPL	----	-----	,	-----	-	-	-
mxngrp	pair2(L)	(CL1-A-0, 1, 1)	10145	1	SMPL	----	-----	,	-----	-	-	-
mxngrp	pair2(R)	(CL1-A-0, 1, 1)	10156	1	SMPL	----	-----	,	-----	-	-	-

Part 4. MxN Consistency Group operations with multiple CCI groups

Edit horcm configuration files

1. Edit your primary configuration file as follows. Note that you do not include the Journal Group IDs in the LDEV parameter.

HORCM_LDEV

#dev_group	dev_name	Serial#	CU:LDEV(LDEV#)	MU#
grp1	pair1	10145	00:00	1
grp2	pair2	10145	00:01	1

HORCM_INST

#dev_group	ip_address	service
grp1	10.17.105.5	horcm7
grp2	10.17.105.5	horcm7

HORCM_CTQM

#dev_group	Interval	mode
grp1	300	
grp2	300	

2. Edit your secondary configuration file appropriately. Keep in mind your secondary instance is running on another host.
3. Stop and restart both instances.
4. Issue **pairdisplay** commands for both groups. Do not forget to include the environment parameter. Refer to previous **pairdisplay** commands for guidance. Pair status for both groups should be SMPL.
5. Issue **paircreate** command for grp1. You must specify the journal Group IDs in the command. Do not forget to code a CTG ID in the **-fence** parameter.

```
paircreate -g grp1 -f async 00 -vl -IH6 -jp 6 -js 7
```

6. Issue **pairdisplay** to confirm Initial Copy for grp1.
7. Issue **paircreate** command for grp2. Use the same Consistency Group ID you coded in the previous **paircreate** command.
8. Issue **pairdisplay** command to confirm grp2 is in COPY status.

9. When both pairs reach PAIR status, display both groups. Note that the Consistency Group ID is the same, indicating you successfully incorporated multiple CCI groups using different Journal Groups into one Consistency Group

```
C:\HORCM\etc>pairstatus -g grp1 -IH6 -fxe
Group  PairVol (L/R) (Port#,TID, LU),Seq#,LDEV#.P/S,Status,Fence, Seq#,P-LDEV# M CTG JID
grp1   pair1(L)      (CL1-A-0, 1, 0)10145 0. P-VOL PAIR ASYNC, 10156 200 - 0 0
grp1   pair1(R)      (CL1-A-0, 1, 0)10156 200.S-VOL PAIR ASYNC ,----- 0 - 0 2

C:\HORCM\etc>pairstatus -g grp2 -IH6 -fxe
Group  PairVol (L/R) (Port#,TID, LU),Seq#,LDEV#.P/S,Status,Fence,Seq#, P-LDEV# M CTG JID
grp2   pair2(L)      (CL1-A-0, 1, 1)10145 1. P-VOL PAIR ASYNC , 10156 201 - 0 1
grp2   pair2(R)      (CL1-A-0, 1, 1)10156 201.S-VOL PAIR ASYNC , ----- 1 - 0 3
```

10. Suspend each group. Can you suspend both with one command? _____ Why or why not?
11. Other pair operations are the same as previously accomplished. If time permits, execute the same series of operations on the new configuration (split, resync, etc.)
12. When satisfied with the lab, delete all pairs.

This completes the lab activity.

Appendix: Review

Lab Project 1 Review Questions

Configuring Universal Replicator

1. What is the first item that requires your attention when configuring Universal Replicator software?
A: Set Port Attributes.
2. What DKC information is necessary to set up Universal Replicator logical pathing between storage systems?
A: Serial number, Controller ID, Initiator and RCU Target port IDs
3. What LDEV emulation types are usable for journal volumes?
A: Open V only
4. When journal volumes are successfully configured, what Journal Group Status is displayed in the Journal volume table?
A: Initial.

Universal Replicator Operations

1. Which Operation panel of UR allows you to create pairs ?
A: Pair Operations panel
2. When you created additional pairs within the same journal group, how did the paircreate options panel signify an already used journal group?
A: An asterisk is appended to the Consistency Group number.

3. What is the difference between pairsplit -r and pairsplit -S?
A: pairsplit -r splits a pair, while pairsplit -S deletes a pair.
4. When pairsplit -r is invoked and the S-VOL Write is marked as "Enabled," what effect does that have on the UR S-VOL?
A: Host I/O can write data on the S-VOL.
5. What happens when attempting to update the number of journal volumes while the UR pairs are not in SMPL or PSUS?
A: Journal Volumes can be added to an ACTIVE group. Journal cannot be deleted from a group unless all pairs in the group are split (PSUS) or deleted (SMPL).

Lab Project 2 Review Questions

Universal Replicator CCI

1. True or False. Before you create UR pairs, you must create journal groups via Storage Navigator.
A: True
2. What environment variable should be set in the CCI commands?
A: -IH0
3. What parameter is used to display Initial Copy progress?
A: Pairedisplay with -fxce parameter
4. If Journal volume status reads, "PJSN" what does that signify?
A: Primary Journal Suspend Normal

Lab Project 3 Review Questions

1. Can Hitachi Universal Replicator be **cascaded** from TrueCopy Asynchronous?
A: No.
2. Can TrueCopy synchronous be **cascaded** from Hitachi Universal Replicator?
A: No

3. True or False. The logical path setup for UR is also compatible with TrueCopy synchronous.

A: False. TrueCopy and UR cannot share links.

4. True or False: TrueCopy Links and RCU Definitions are associated to Logical Control Units.

A: True

5. UR Links and RCU Definitions are associated to systems.

A: True

Lab Project 4 Review Questions

1. Why do you select 'ENTIRE' as the Delta Resync Failure Option on the Change JNL Option Panel?

A: So that a full-volume copy is completed in the event of a Journal Resync failure. If you select 'None', then you need to delete then re-create the Delta pairs.

2. Is there a CCI command to issue the Delta Resync operation?

A: No. The Delta Resync operation can only be done from Storage Navigator.

3. Why do you have to select an unused Consistency Group ID for the Delta Resync paircreate operation?

A: The Consistency Group ID must be unique to the particular Journal Group association.

4. Does a full-volume Delta Resync necessarily indicate a problem?

A: No. This is expected if there are no Journal Updates on the TrueCopy S-VOLs when Delta Resync is initiated.

