

Winchester Systems FlashDisk

Remote Replication

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Products Covered by this Document

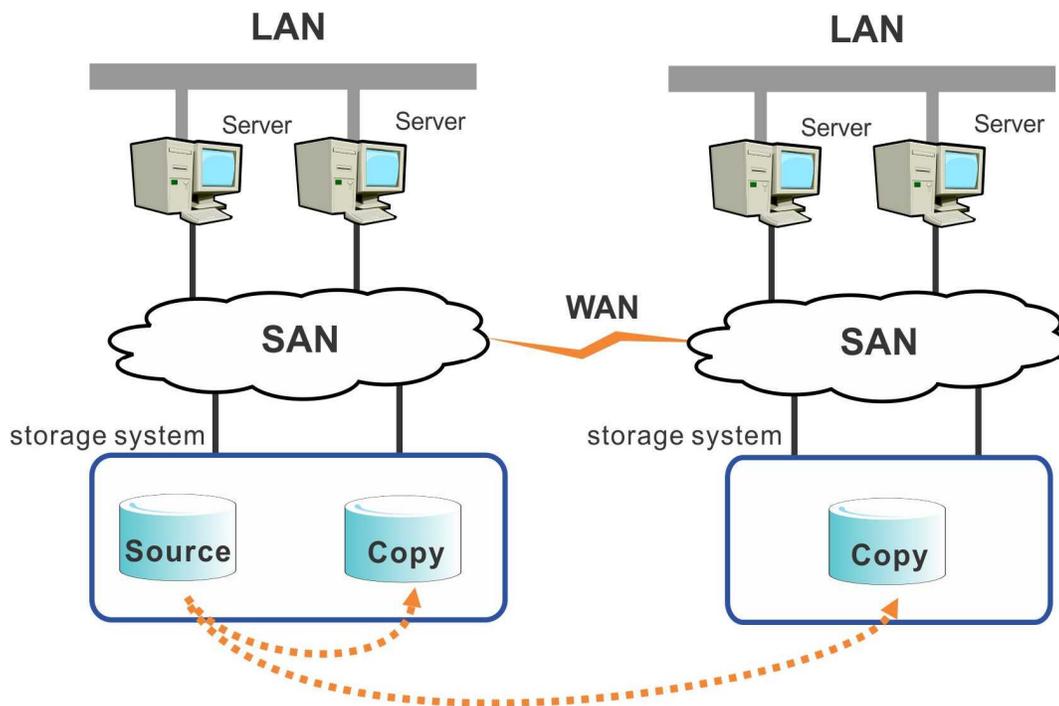
Winchester Systems FlashDisk FX Series Storage Subsystems

What is Remote Replication?

Remote replication capability allows users to create full data copies across storage systems, using synchronous or asynchronous mode. If the source data fails due to system malfunction or disaster, users can leverage a disk-based remote copy to restart services in a few minutes. If the source needs to resume its role, it can be quickly synced with the remote copy while adjusting only for differentials.

To further ensure the integrity of remote data, remote replication allows users to protect remote copies with snapshot technology. Granular snapshot images can help restore corrupt remote copies in seconds when the continuation of business services is a top priority.

Remote replication is available on FlashDisk FX Series Storage Subsystems.



Benefits of Remote Replication

Disaster recovery

When the primary site experiences an unexpected power outage or otherwise catastrophic failure such as a natural disaster, remote replication helps customers retain access to their data via a secondary site. FlashDisk provides synchronous and asynchronous remote replication. Therefore, customers can ensure their service data remains usable by backup to a remote storage system.

Remote Backup and Recovery

FlashDisk remote replication can support up to 16 source volumes, and each source volume can have four replication pairs. Scenarios may be one-to-one, one-to-many, many-to-one, and many-to-many. FlashDisk remote replication supports diverse customer requirements.

FlashDisk supports Fibre Channel or Ethernet remote replication. Customers can choose which interface suits their needs.

Development Platform

Remote replication allows more flexibility when developing storage features and applications, as it enables engineers to work on new projects without suspending normal storage operation. With remote replication, research and development occur on primary storage while normal services are routed to the secondary (remote) set temporarily. Once development is complete and the new features or applications are verified, services can seamlessly switch back to primary storage with the new features implemented.

Basic Remote Replication Concepts

Remote Replication Types

There are several replication types, including synchronous mirror, asynchronous mirror, volume copy, and snapshot. Synchronous mirror requires higher network bandwidth and is suitable for critical data. Asynchronous mirror is suitable for archived data. Volume copy is used for application development or tests. Remote replication with snapshot allows customers to “roll back” data to specific restore points.

Automatic Target Volume Mapping

If disasters occur, the FlashDisk simplifies the target volume mapping process.

Should the source volume fail, the target volume automatically maps to the host. Then, the host launches a script to execute specific activity if required. After the OS disk is rescanned, the application retries and is ready to work again.

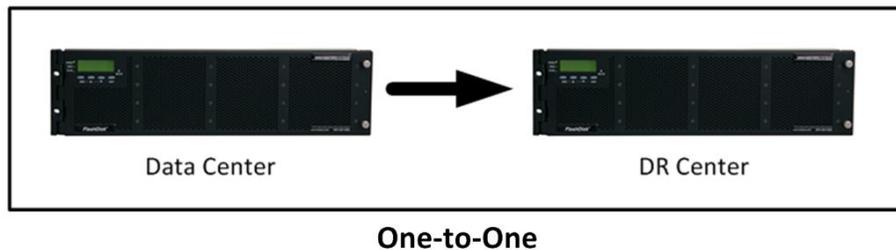


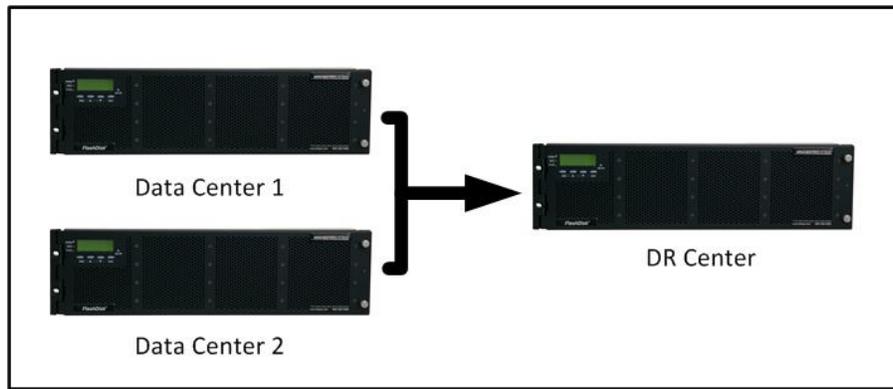
Schedule

FlashDisk remote replication provides a wide scheduling range. Customers can choose backup windows based on data importance. For critical data, we suggest customers choose synchronous mirror or asynchronous mirror with a five minute sync interval. For archived data, we suggest customers choose asynchronous mirror with a larger sync interval.

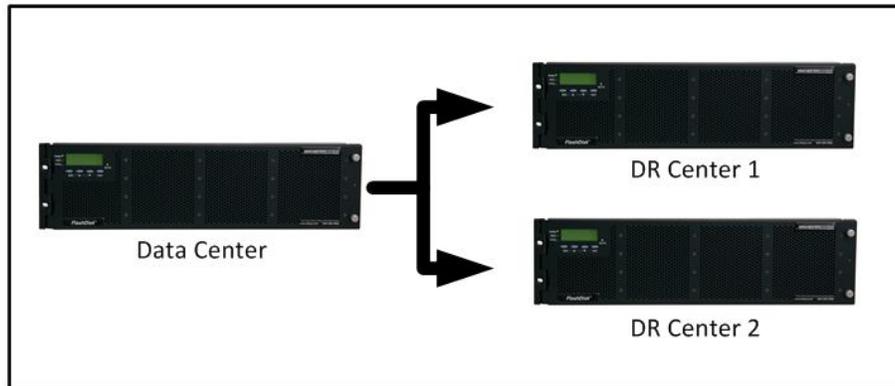
Remote Replication Specification	
Maximum number of source volumes in a system	16
Maximum number of replication pairs per source volume	4
Maximum number of replication pairs per system	64

With the remote replication specifications shown above, FlashDisk provides multiple usage scenarios like one-to-one, many-to-one, one-to-many, and many-to-many.

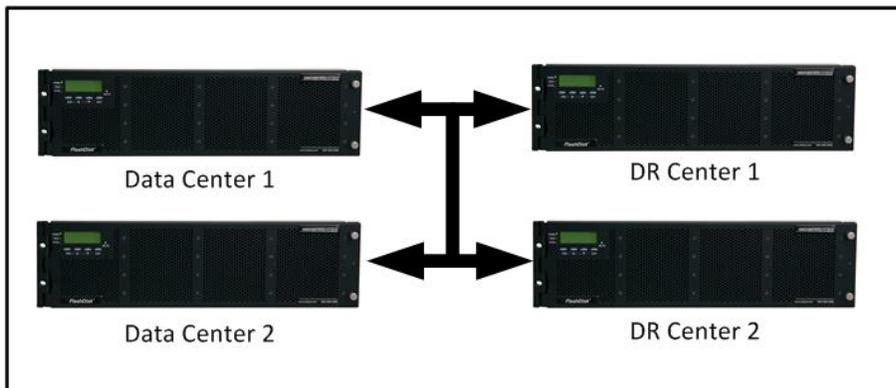




Many-to-One



One-to-Many



Many-to-Many

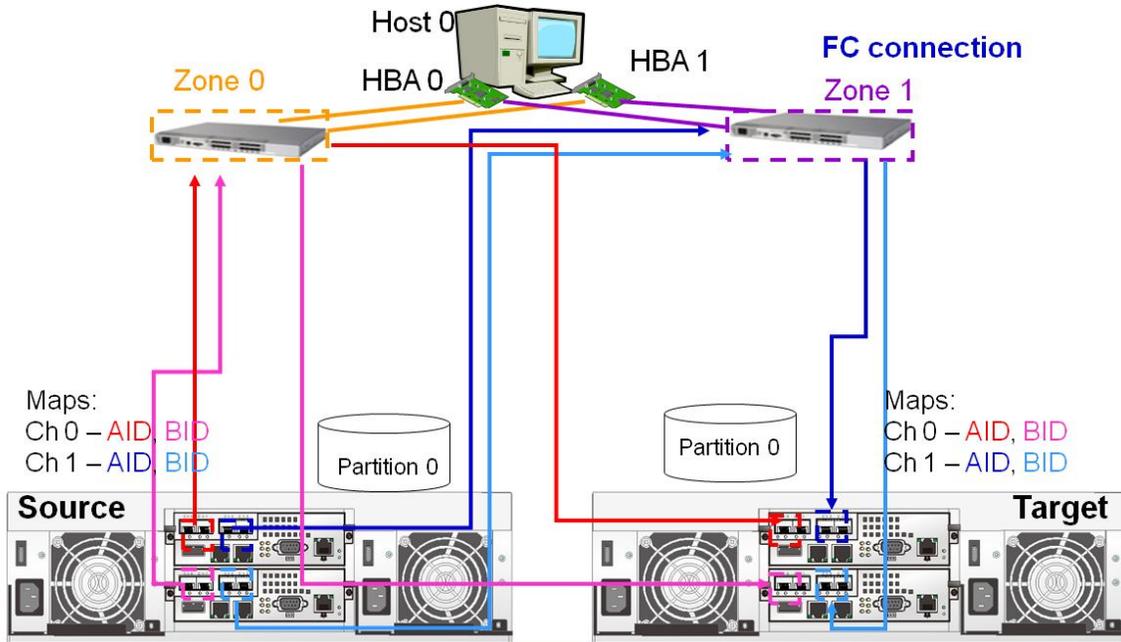
Detailed Event Messages

Customers can easily find network statistics from detailed event messages. These include transmission, latency, and packet loss data after creating remote replication pairs. With the help of detailed event messages, customers are able to check remote replication status and carry out appropriate actions according to event codes. Technical support can also address problems quickly using these event codes.

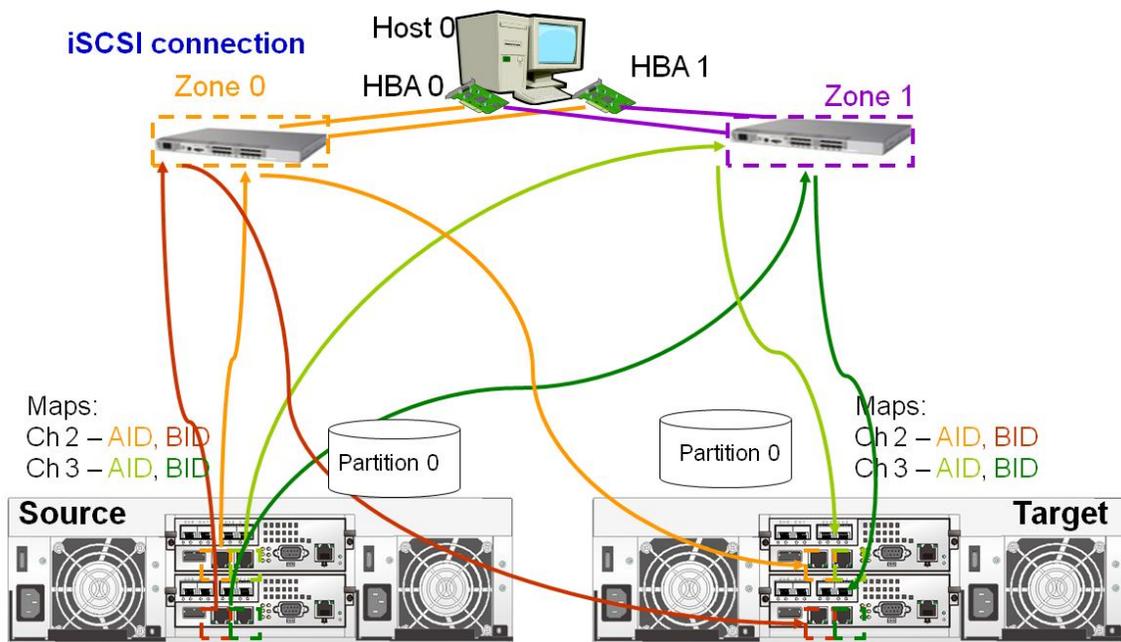
Index ▾	Severity ▾	Type ▾	Date/Time ▾	Events ▾	Code ▾
212			2014/01/17 12:43:58	12:43-12:43 Hour 1 transfer/latency/loss: 2.0Gbps/0ms/0.0% Hour 2: 0.0bps/0ms/0ms.0%	0x0212004E
211			2014/01/17 12:43:58	NAME:RemoteMirror 2 ID:33451FA34948FD4E Initial copy completed, transfer size: 10GB, rate: 262MB/s	0x0212003F
210			2014/01/17 12:43:19	NAME:RemoteMirror 2 ID:33451FA34948FD4E Initial copy started	0x0212003D
209			2014/01/17 12:43:16	NAME:RemoteMirror 2 ID:33451FA34948FD4E Pair created	0x02120015
208			2014/01/17 12:43:06	NAME:Volume ID:5F835213328F22B3 Pool status changed to online	0x02130008

Usage Cases

In this chapter we introduce usage related to remote replication scenarios. As described before, remote replication is the process of **copying data** to a device at a **remote location** for **data protection, migration, and disaster recovery** purposes in different vertical markets such as healthcare, government, and IT.



Fibre Channel topology



iSCSI topology

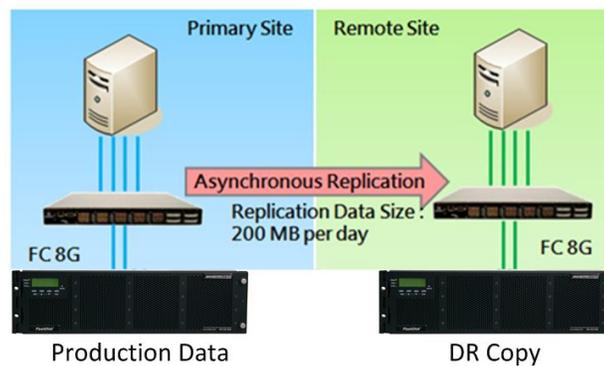
Usage Case 1: Healthcare

Patient personal data such as blood pressure and age is crucial to treatment at a hospital. Our customers want to ensure patient data is safe and available. Hence, they choose Winchester Systems as their trusted partner to guarantee data integrity.

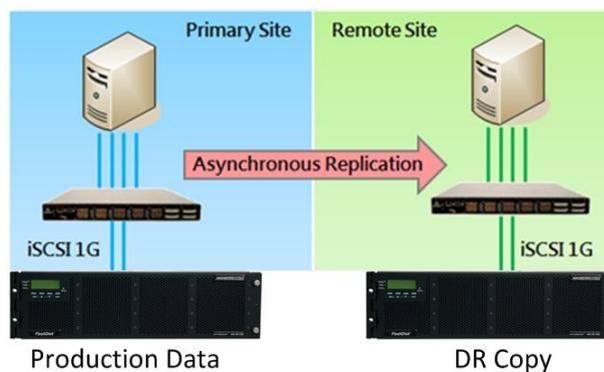
Case highlights:

- Support local and remote replication
- Provide network diagnosis
- Provide remote replication in FC SAN and IP SAN
- Ability to support remote replication in Windows Server 2012 environments

Usage case 1-1 and 1-2 illustrate the topology of FlashDisk remote replication as implemented in a customer environment.



Usage case 1-1



Usage case 1-2

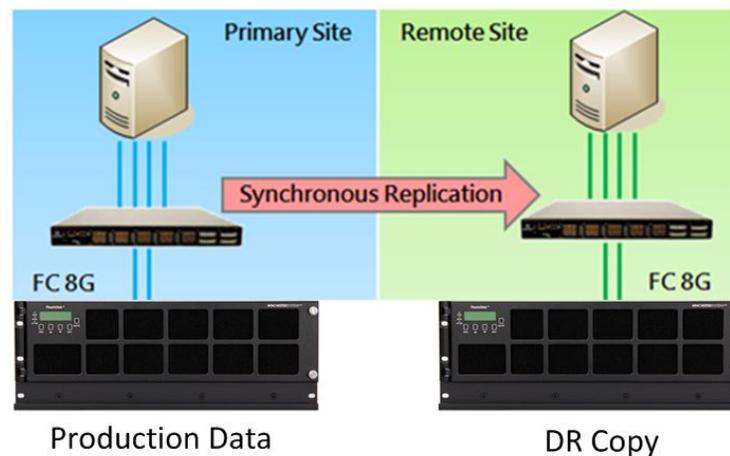
Usage Case 2: Government

The personal data of citizens is stored at different government agencies which want to ensure data integrity and accessibility. After reviewing various options, they choose Winchester Systems to partner with.

Case highlights:

- Support local and remote replication
- Provide network diagnosis
- Support synchronous remote replication
- Provide remote replication in FC SAN

Usage case 2 illustrates the topology of FlashDisk remote replication implemented in the customer environment.



Usage case 2

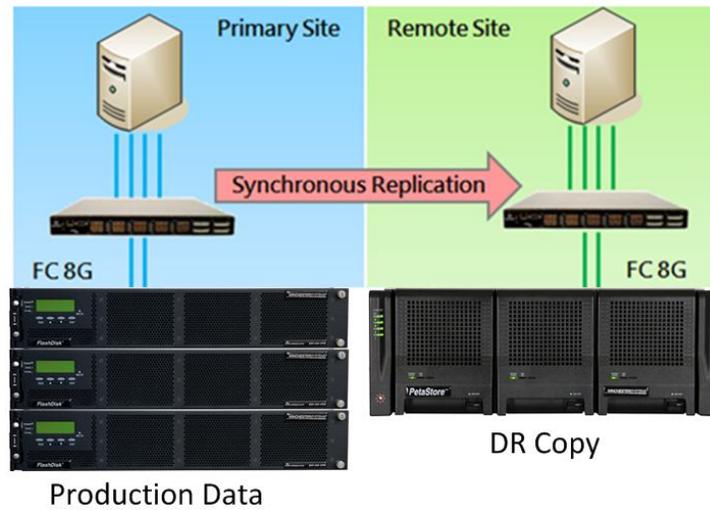
Usage case 3: IT

Data is absolutely critical at IT companies. Should services be disrupted, companies stand to suffer large losses, which cannot be tolerated. IT companies choose FlashDisk remote replication as their solution.

Case highlights:

- Support local and remote replication
- Provide network diagnosis
- Support synchronous remote replication
- Provide remote replication in FC SAN

Usage case 3 illustrates the topology of FlashDisk remote replication implemented in the customer environment.



Usage case 3

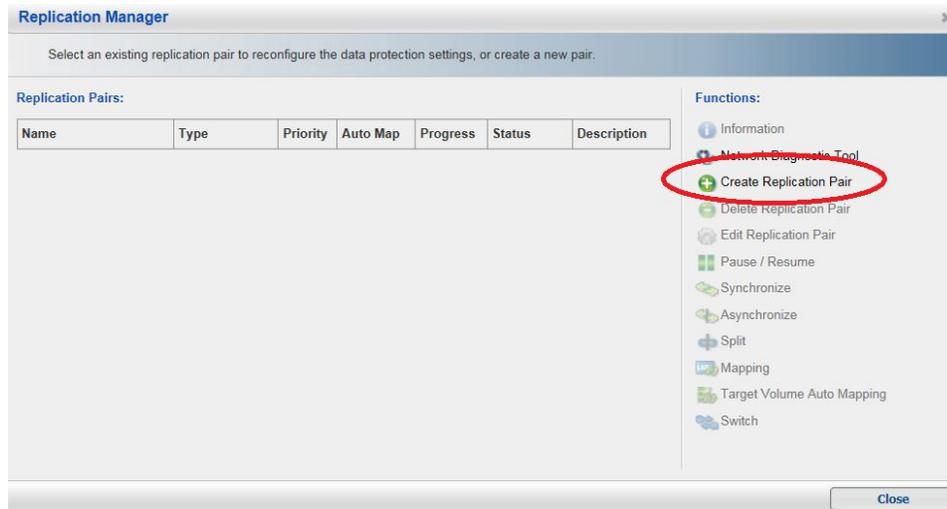
Remote Replication Operation

This section quickly explains how to use and check remote replication operations and what incremental disaster recovery is.

Step 1: Connect to two systems and select Replication Manager.

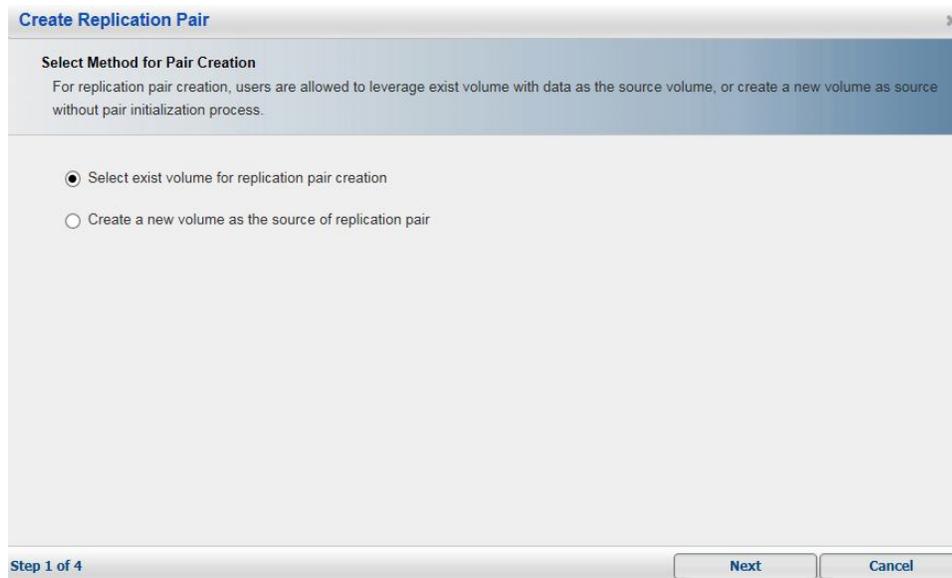


Step 2: create a replication pair.



Step 3: select method for pair creation

- if creating a new source volume, select “Create a new volume as the source of replication pair”
- if an existing source volume is used, choose “Select existing volume for replication pair creation”



Step 4: select your source device and source partition.

Create Replication Pair

Select Source Volume/Partition
Select the device where the source volume is located, and then assign the volume to the replication source.

Source Device: **FX3U16R1**

Partition Name	Logical Volume	Status	Total Capacity
Partition 1	Logical Volume 1	The volume has been mounted.	50 GB
Partition 2	Logical Volume 1	The volume has been mounted.	60 GB
Partition 3	Logical Volume 1	The volume has been mounted.	70 GB

Step 2 of 4 Previous Next Cancel

Step 5: select your remote device and logical volume on that remote device.

Create Replication Pair

Select Target Pool/Logical Volume
Select the device where the target Pool/Logical Volume is located, and then assign the Pool/Logical Volume to the replication target.

Target Device: **FX2U24R2**

Logical Volume	Logical Drive Amount	Status	Total Capacity
Partition 1	Logical Volume 1	The volume has been mounted.	50 GB

Step 3 of 4 Previous Next Cancel

Step 6: select the replication mode and parameters desired.

Create Replication Pair

Configure Replication Pair
Configure the replication parameters including the mode, priority, and type.

Replication Pair Name: **VolumeMirror 1**

Volume Mirror

Operation Priority: **Normal**

Volume Mirror Type: Synchronous Mirror Asynchronous Mirror

Remote Timeout Threshold: **30 Seconds**

Volume Copy

Schedule

Schedule Name: **New Schedule 1**

Operation Priority: **Normal**

Remote Timeout Threshold: **30 Seconds**

Step 7: select Diagnose Network to check the connection status between the source device and target device before creating the replication pair and observe the results.

Network Diagnostic

Diagnostic Result
The following result shows the bandwidth of all channels from the source device to the target device.

Source Device: Name: , ID: 80054, IP: 127.0.0.1
Target Device: Name: , ID: 8000D, IP: 10.10.10.1
Number of Diagnostic Packet: 100

Source	Link	Target	Connected	Received	Time	Rate	Xfer	Lost	Latency
SlotA/CH:0	Up	SlotA/CH:0	OK	100/100	8.466ms	738.24MB/s	--	--	--
		SlotA/CH:1	OK	100/100	8.462ms	738.59MB/s	--	--	--
SlotA/CH:1	Up	SlotA/CH:1	OK	100/100	8.602ms	726.57MB/s	--	--	--
		SlotA/CH:0	OK	100/100	8.599ms	726.82MB/s	--	--	--
SlotA/CH:2	Down	--	--	--	--	--	--	--	--
SlotA/CH:3	Down	--	--	--	--	--	--	--	--

Auto Refresh (10 seconds)

Step 3 / 3

Export Log Refresh Close

Step 8: select ok to create the replication pair.

Step 9: check remote replication task progress.

Progress

Creating the partition ...

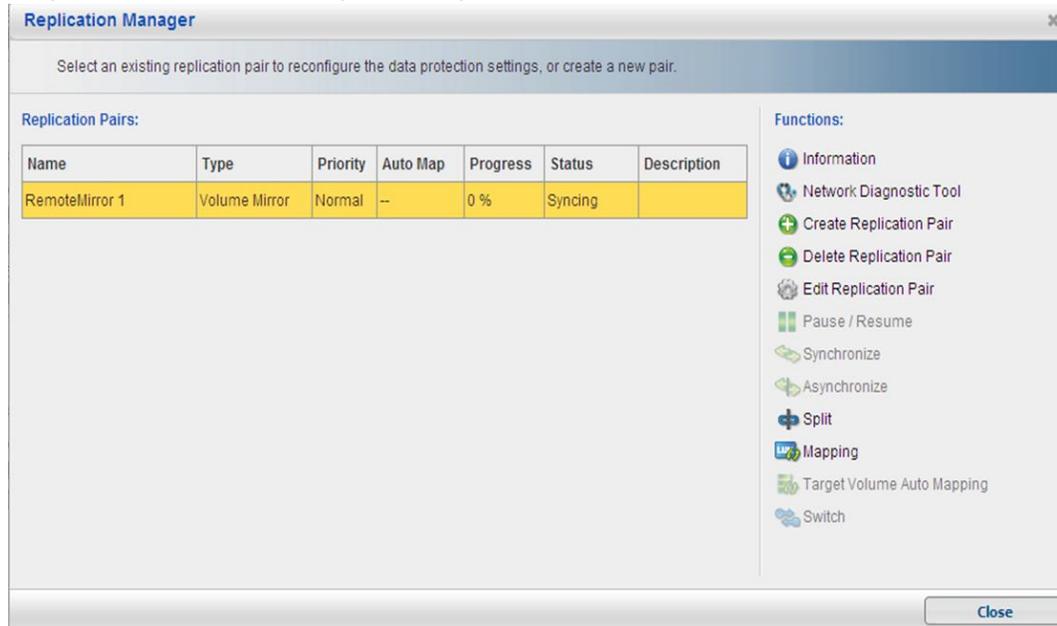
10% completed

Information

Volume Copy/ Volume Mirror Creation Complete.

Close

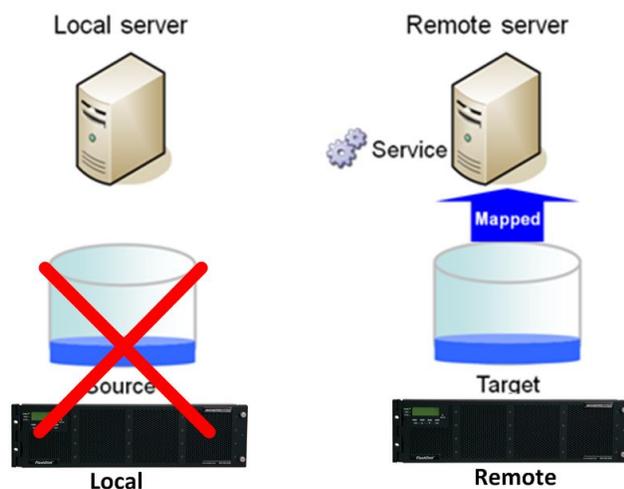
Step 10: check remote replication pair status.



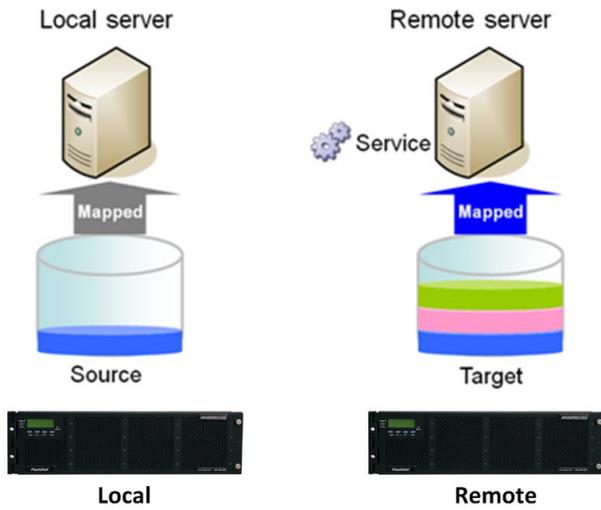
Incremental Disaster Recovery

Incremental backups are often desirable as they consume minimum storage space and are quicker to perform than differential backups. The purpose of an incremental backup is to preserve and protect data by creating copies that are based on the differences in that data and thus minimize the amount of time needed to perform the backup. With incremental backups, successive copies of the data contain only that portion that has changed since the preceding backup copy was made.

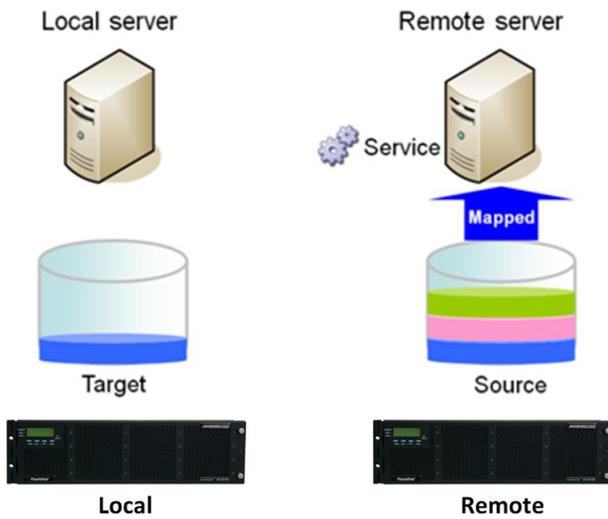
Step 1: Map the target to the host, so that the service can continue after the local is in a failed condition.



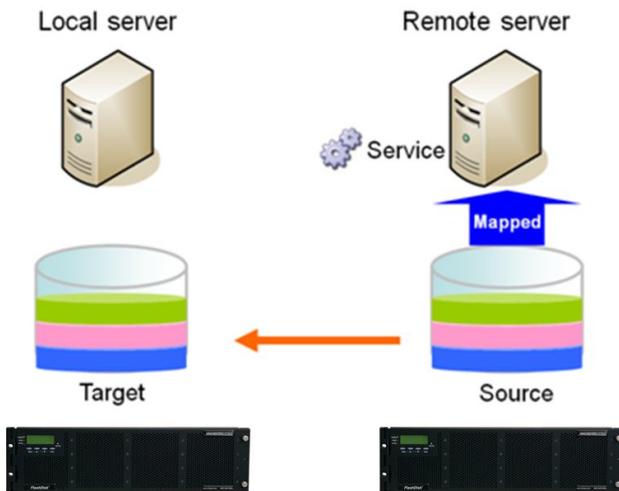
Step 2: Unmap source when local infrastructure has been recovered.



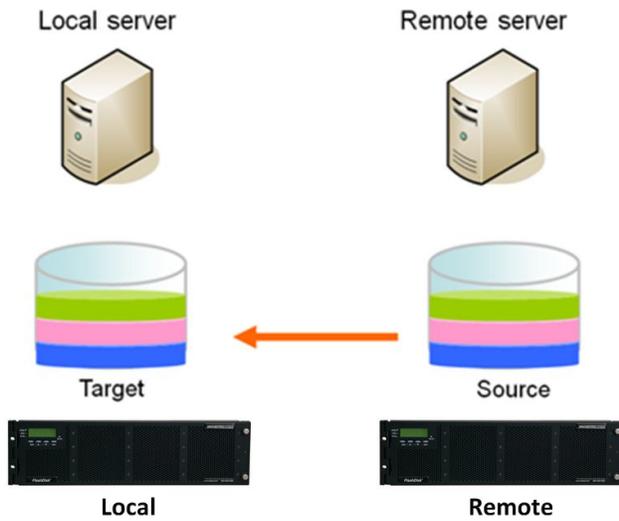
Step 3: Switch source and target roles.



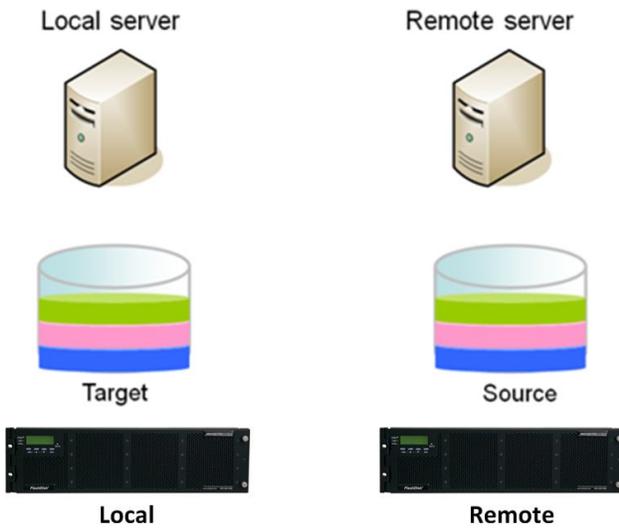
Step 4: Sync from remote to local.



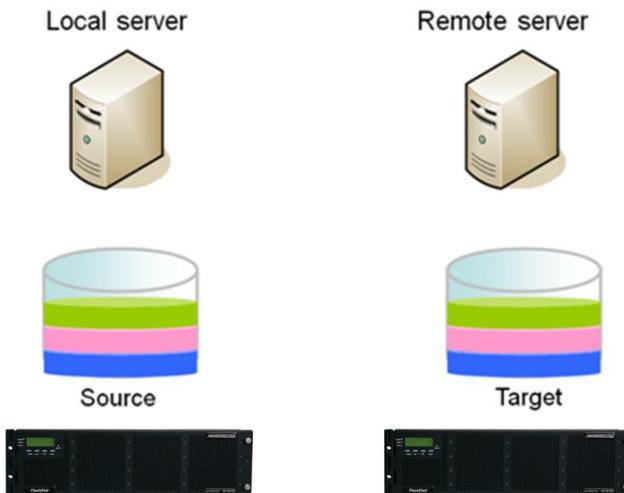
Step 5: Stop service and unmap remote source.



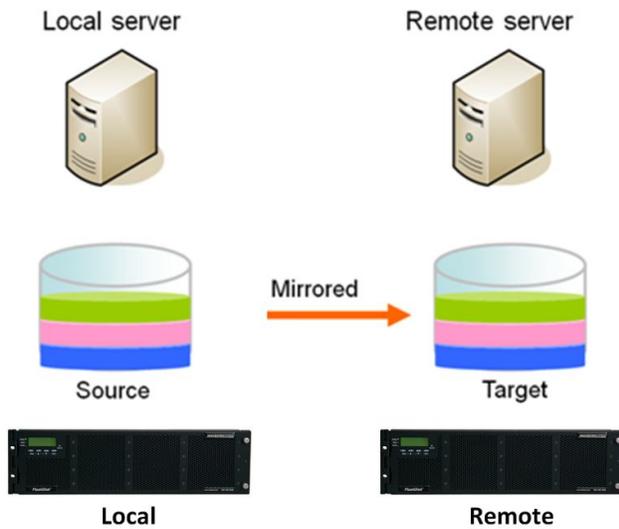
Step 6: Split the replication pair.



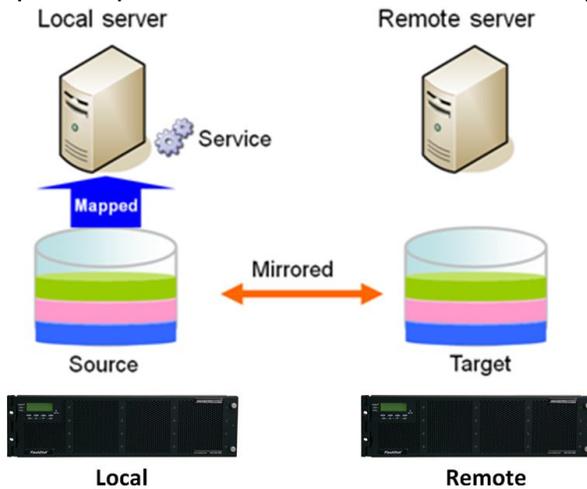
Step 7: Switch source and target roles.



Step 8: Sync from local to remote.



Step 9: Map source and restart service to complete failback procedure.



Best Practice

In this section, we provide two examples to illustrate how to design a best practice for FlashDisk remote replication deployment. In addition, we also demonstrate the experimental results to showcase FlashDisk remote replication performance and reliability.

Customers can design a remote replication operation from a bandwidth selection or remote replication time perspective.

1. Sample bandwidth calculation

RPO = 6 hours

Size of data volume = 1TB

Total amount of data = 300GB

Average daily change rate = 3%

Average hourly change rate = $0.03/24 = 0.00125$

Amount of hourly replication data = $300\text{GB} * 0.00125 = 0.375\text{GB}$

Bandwidth utilization rate = 80%

The ideal bandwidth for replication should be able to support transferring 3 hours of data in 3 hours.

3 hours of replication data = $0.375\text{GB} * 3 = 1.125\text{GB}$

$1.125\text{GB} = 1,152\text{MB} = 9,216\text{Mb} = 9437,184\text{Kb}$

$9437,184\text{Kb} / (3600\text{sec} * 3) = 873.813\text{Kbps}$

$873.813\text{Kbps} / 0.8 = 1,092.26625\text{Kbps} = 1.1\text{Mbps}$

Based on the calculation, users will need one T1 network pipe (1.544Mb/s) at least for replication.

2. Sample remote replication time

Transfer Size: 100GB

Maximum Throughput in MB/s = Link speed (Mb/s) / 8 bits per byte x 90% protocol efficiency

Replication Time = Transfer Size (MB) / Throughput

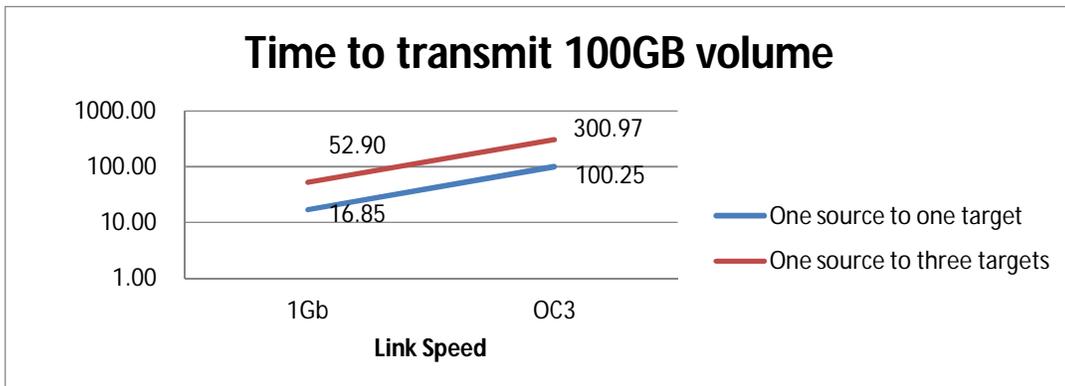
Take T3 for example, which is rate 43.232Mb/s.

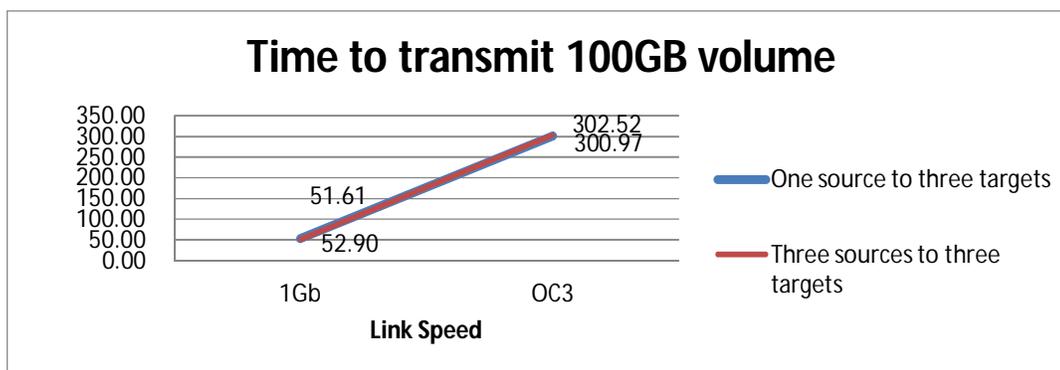
Maximum Throughput in MB/sec = 4.86 MB/s

Time to transmit 100GB volume = $102400 / 4.86 = 21070 \text{ sec } (\sim 351 \text{ min})$

******Note******

To ensure successful remote replication in any scenario, users are advised to reserve extra space in the source logical volume equal to the size of the source partition. For example, if a source logical volume consists of one partition of 50GB, the source logical volume in which the partition resides needs to have a size of 100GB if the partition is needed for asynchronous remote replication.





Moreover, if customers want to replicate one source volume to three target volumes or three sources to three targets, FlashDisk remote replication can provide linear remote replication time as above two figures show.

Conclusion

Winchester Systems FlashDisk Remote Replication provides the capability to implement a disaster recovery solution. The Remote Replication facilitates the easy and reliable synchronization between the headquarter office and the remote sites with minimal disruption of the host performance. The remote replication solution must be planned, designed, implemented and tested to address all the topics covered in this white paper.

Remote replication using FlashDisk offers a strong defense against major disruption to IT continuity, especially due to natural disasters. In combination with data services such as snapshot and volume copy, remote replication allows entire data sets to be saved at physically separate locations. If one location becomes inaccessible, data can still be used from the remotely replicated data set. Additionally, FlashDisk remote replication supports multiple modes and scenarios, with up to 64 replication pairs per system for maximum flexibility and redundancy. FlashDisk systems also feature shorter replication times and higher bandwidth utilization to minimize delays and latency.