White Paper

EMC DiskXtender for Windows and MirrorView/S Interoperability

Applied Technology

Abstract

This white paper explains how the combination of EMC® DiskXtender® for Windows and MirrorView®/Synchronous can be used to implement a solution that offers efficient storage management, data protection, and disaster recovery. This paper guides you through installing and setting up DiskXtender for Windows and MirrorView/S, and also outlines various scenarios where this technology can be very helpful.

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Executive summary

EMC® DiskXtender® for Windows and MirrorView®/Synchronous are complementary EMC products that can be used together to help achieve efficient storage management, data protection, and disaster recovery.

EMC DiskXtender for Windows (DXW) is an automated file archiving solution. It delivers a policy-based, file system-centric solution for migrating inactive data off higher-cost storage to lower-cost disk, tape, or optical devices. With DiskXtender for Windows, it is possible to implement a tiered storage solution, mapping data to the appropriate storage tier according to its value to the business. DiskXtender for Windows also enables organizations to achieve data retention and compliance goals while maintaining service level agreements (SLAs). It helps reduce primary storage acquisition costs, management overhead, and backup and recovery times.

MirrorView/Synchronous (MirrorView/S) leverages the power of EMC CLARiiON® networked storage systems to offer synchronous remote mirroring capabilities. MirrorView/S provides a disaster recovery solution that protects critical data in the event of an outage. It resides on the CLARiiON and provides an online, host independent, mirrored data storage and protection solution that duplicates production site data (primary) to one or two secondary sites (only one secondary site in case of consistency groups) in a campus environment.

Introduction

This white paper documents the results of the interoperability testing of DiskXtender for Windows and MirrorView/S that was carried out at the EMC IIS Lab. It outlines the configuration, setup, and best practices involved in creating a formidable combination of the two products. This white paper deals only with topics relating to the coexistence of DiskXtender for Windows and MirrorView/S. It does not deal with extensive functionality testing of either product.

It also focuses on the procedure for disaster recovery in each of the outlined scenarios. The "References" section provides a list of where to find detailed information about the individual products.

Audience

This white paper is intended for customers, system integrators, system administrators, EMC Customer Support, and members of the EMC and partner professional services community. It is assumed that the audience has some familiarity with CLARiiON storage systems.

This white paper provides an overview of both DiskXtender for Windows and MirrorView/S software and discusses the interoperability scenarios and the issues arising out of environmental constraints, their impact on the interoperability, and solutions; and best practices.

Terminology

The following is a list of terms frequently used in this white paper.

CLARiiON terminology

- **LUN (logical unit):** Hosts access storage using logical unit numbers, which are exported by a SCSI target. The actual storage object is a logical unit, which is often referred to as a LUN.
- **Navisphere® Management Suite:** Simplifies and automates the management of the CLARiiONs through a simple-to-use, browser-based GUI or via the command line interface (CLI). Navisphere is common across the CX series and previous generations of CLARiiON arrays.
- **Navisphere Manager (Navisphere):** Software bundled in the EMC Navisphere Management Suite. It lets you manage multiple storage systems on multiple servers simultaneously. With Navisphere Manager, you can create RAID groups, LUNs, and storage groups; manipulate caches; examine storage-system status and logged events; transfer control from one storage processor (SP) to another; and examine events recorded in storage-system event logs.

DiskXtender for Windows terminology

- **Background Scan:** The scanning of the extended drive that evaluates the files on the drive against configured rules, and performs any necessary system activity resulting from that evaluation (such as writing files to the move or purge list, or deleting files). This scan is a background activity and does not disrupt the system configuration.
- **Delete rules:** These rules define which files should or should not be automatically deleted from the extended drive (and from media, if the media allows it).
- **Direct read:** The method of marking files that have been migrated to media so that they are opened directly from the media when requested, rather than being copied back to the extended drive.
- **Extended drive:** This is an NTFS volume such as the hard drive or a partitioned part of the hard drive, for which File System Manager provides file migration services by moving files to media and fetching files from media according to the set parameters.
- **Media folder:** This directory defines a point in the directory tree (from the root of the extended drive) where the files on a piece of media are located. This folder is created as a physical folder (or subfolder) on the extended drive, and can be viewed through Windows Explorer.
- **Move rules**: These rules define which files should or should not be moved to the media.
- **Purge rules:** These rules define which files should or should not be purged from the extended drive.
- **Purging:** The process of removing file data from the extended drives (after the file has been moved to media), while leaving a file tag behind. The file appears to reside on the drive.
- **Storage media:** The media external to the extended drive, to which DXW moves files.

MirrorView terminology

- **Fracture:** This is the condition in which I/O is not mirrored to the secondary image. This can be caused when you initiate the fracture (Admin Fracture) or when the system determines that the secondary image is unreachable (System Fracture).
- **Mirror ID:** The unique identifier assigned by MirrorView to each mirror.
- **Primary image:** The LUN on the production storage system that contains user data and is the source for data copied to the secondary image. There is one primary image and there could be zero, one, or two secondary images. A mirror is ineffective for recovery unless it has at least one secondary image. This white paper refers to the primary image as primary.
- **Promote:** The operation by which the administrator changes an image role from secondary to primary. As part of this operation, the previous primary image becomes a secondary image. If the previous primary image is unavailable when you promote the secondary image (perhaps because the primary site suffered a disaster), the software does not include it as a secondary image in the new mirror. A secondary image can be promoted if it is in either the Synchronized state or the Consistent state. An image cannot be promoted if it is in the Out-of-Sync or Synchronizing states.
- **Secondary Image:** The LUN that contains a mirror of the primary image LUN. This white paper refers to the secondary image as secondary.
- **State:** The states of the remote mirror and the image. The mirror states are **Active** and **Attention.** The image states are **Synchronized**, **Consistent, Synchronizing**, and **Out-of-Sync**.

Introduction to DiskXtender for Windows

EMC DiskXtender for Windows is a robust storage management solution that extends the amount of space available on a computer's local NTFS volume. DXW does this by migrating files from the local drive to an external media, while making it appear that the files still reside on the local volume. Figure 1 shows the DiskXtender solution in more detail.

DXW provides support to multiple hardware types, multiple media types, flexible data organization, and rule-based file migration. It extends the storage capabilities of NTFS volumes by using the file migration services of the DXW File System Manager component. The storage media is available through

communicating with media services, like EMC Centera® (which provides access to a Centera device) or DXW MediaStor™ (which provides access to a variety of library device and media types).

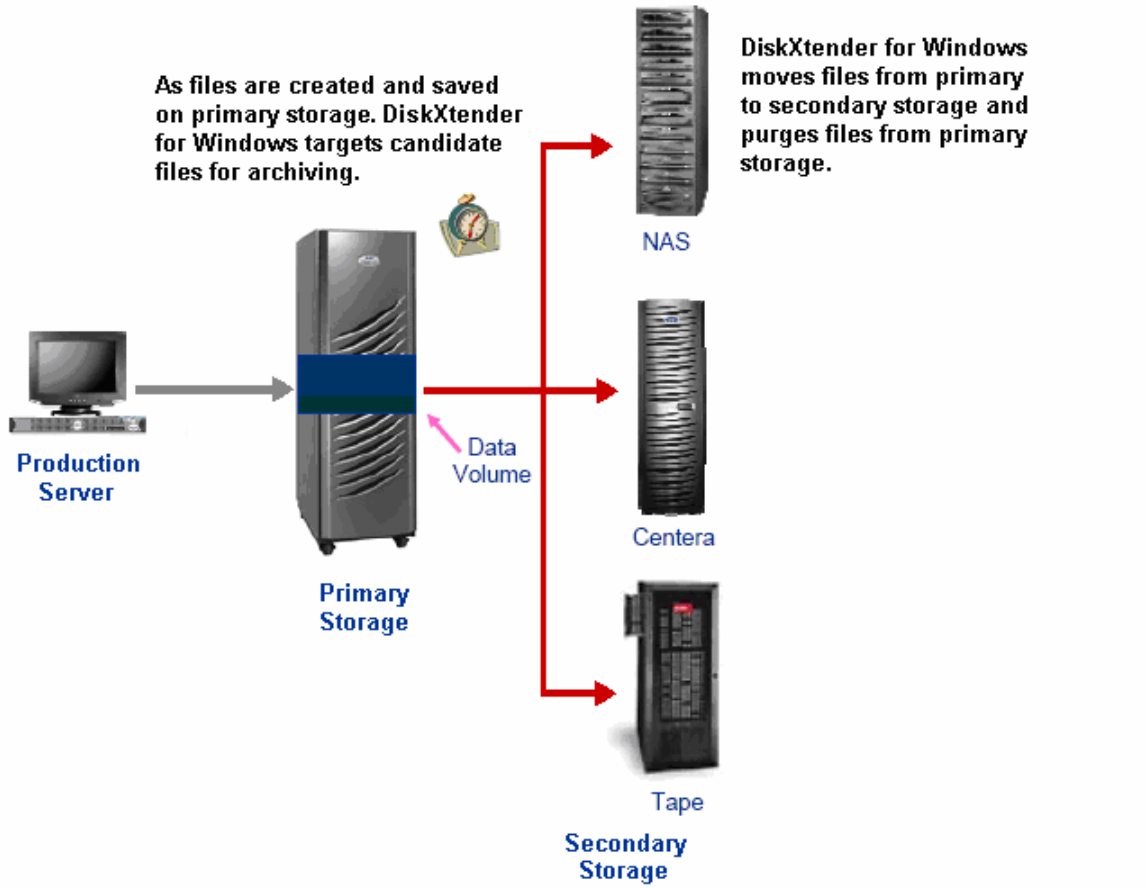

Figure 1. The DiskXtender solution

DXW supports several media services, media types, and file systems, allowing the user to select the storage configuration best suited to the available resources and storage needs of the organization. Transfer of files to media can be controlled by designing rules that detail criteria such as the file age, size, type, and attributes.

DXW has two main software components: File System Manager and MediaStor. The File System Manager (FSM) is a data mover and manages files saved to the extended drives to provide a complete storage solution. DXW uses media services (like MediaStor) to manage the external media to which files are written and to connect to various storage device types. However, the FSM is itself capable of handling media such as EMC Centera, NAS, TSM, or ACSLS. Hence, although MediaStor is shipped along with the FSM, it is used only for media other than that handled by the FSM.

File migration services include moving files to media and fetching files from media, according to a set of parameters. To a client retrieving files from the drive extended by the FSM, all files (whether on the extended NTFS volume or on the storage media) appear to be present locally on the NTFS volume.

FSM automates the migration of files to storage media using a rule-based system. Various rules like move rule, purge rule, and delete rule are created to define the criteria to be used for moving files from the extended drive to one or more pieces of storage media.

Introduction to MirrorView/Synchronous

MirrorView/Synchronous is a software application that is used to copy data between two arrays. It maintains images of a logical unit (LUN) at separate locations in order to provide recovery in case of hardware failure or disaster.

The production image is called the primary image, and the copy image is called the secondary image. MirrorView/S supports up to two remote images. Although it is capable of having two secondary images, only one secondary can be promoted at a time. This white paper focuses on scenarios when only a single secondary image is used.

Each image resides on a separate storage system. The primary image receives I/O from a server called the production server; the secondary image is maintained by a separate storage system that can be a stand-alone storage system or connected to a secondary server. Both the storage systems are managed by a single client, which can also promote the secondary image if the primary image is inaccessible. Figure 2 demonstrates the synchronous mirroring process.

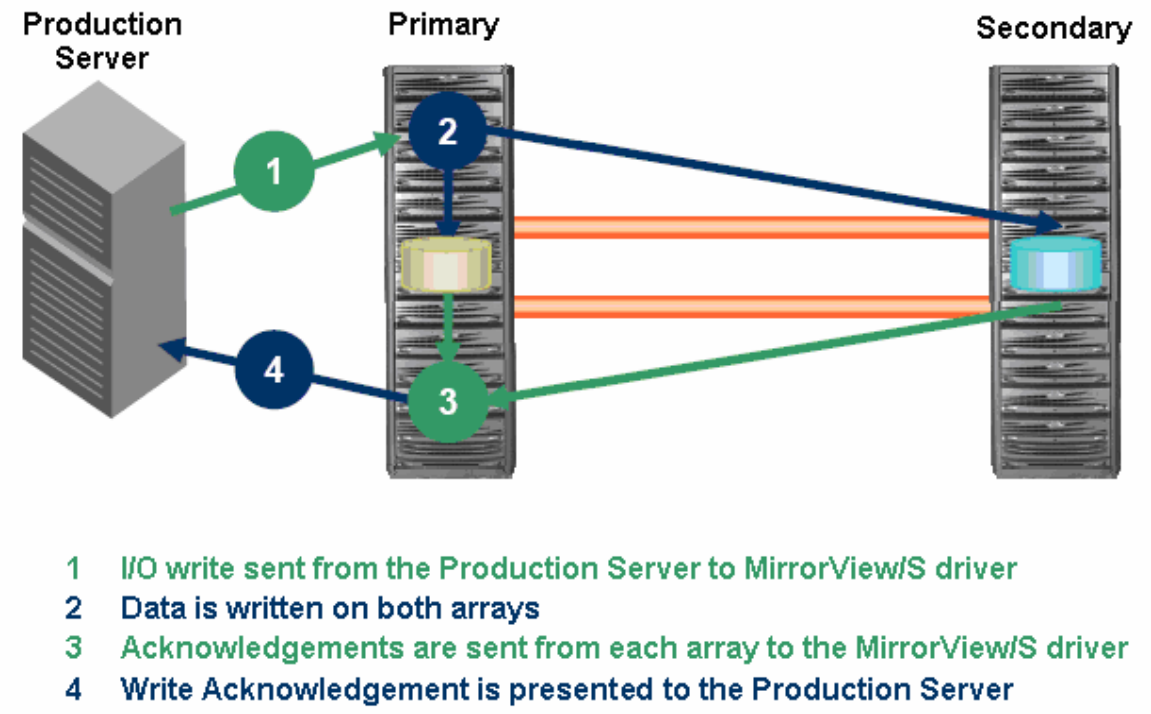

Figure 2. Synchronous mirroring

MirrorView/S supports consistency groups. A consistency group is a set of synchronous mirrors whose secondary images need to be kept consistent with each other in order to be useful. The data on the set of secondary images must have existed on the set of primary images previously. This allows an application to use the secondary images if the primary storage system fails.

Installation, configuration, and default behavior

Installation prerequisites

The installation prerequisites for the interoperability of DXW-MirrorView/S are as follows:

- EMC Navisphere Manager is enabled on the storage processors (SP) in at least one storage system in the Navisphere domain. (For information on Navisphere domains, see the *EMC Navisphere Security Administrator's Guide*.)

- The production server is connected to the primary storage system. Connecting a second server to the second storage system is optional. Both storage systems must be in the same Navisphere domain.
- The connection between the two storage systems may be direct or through a switched fabric.

The *EMC MirrorView Installation Guide* has more information.

Configuration diagram

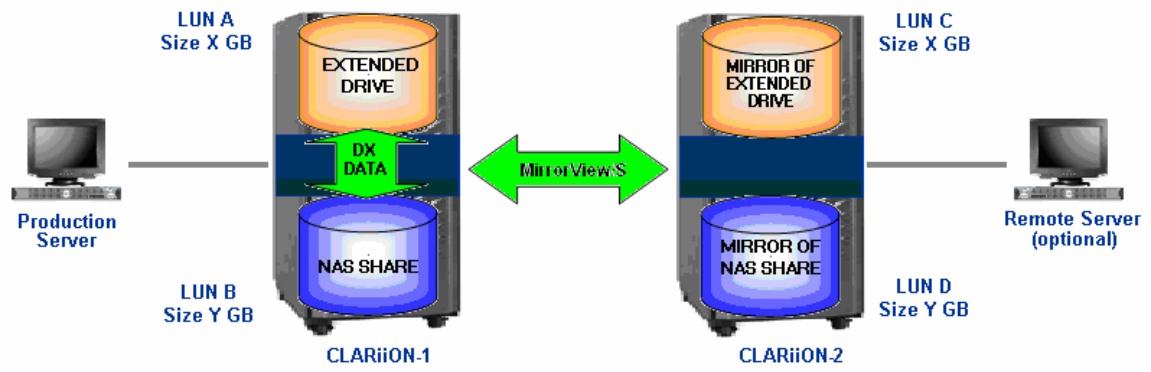

Figure 3. Schematic DXW-MirrorView/S interoperability test setup

MirrorView/S best practices require that a standby remote server be connected to the secondary CLARiiON. However, such a setup is not suited for a DXW environment. Typically, DXW does not have a standby remote server, unless clustering is involved.

Test setup

The test setup used for DXW and MirrorView/S is as follows. This is the recommended configuration to be used.

DiskXtender setup

The version of DXW used for the testing is as follows:

Server	**Windows 2003**
DXW version	6.2

MirrorView setup

The following table depicts the MirrorView setup used for testing:

	CLARiiON-1 (primary)	**CLARiiON-2 (secondary)**
Model	CX3-80	CX3-80
Storage processor (physically connected)	i) SP-A (Port 3) ii) SP-B (Port 3)	i) SP-A (Port 3) ii) SP-B (Port 3)
FLARE® version	3.24.080.5.008	3.24.080.5.008
LUN ID	i) A ii) B	i) C ii) D
Included in storage group	Yes	Yes

SP-A of CLARiiON-1 is connected to SP-A of CLARiiON-2. Similarly, the SP-B ports on the two CLARiiONs are connected.

Steps to configure MirrorView/S

The following procedure is used to configure MirrorView/S:

1. Establish a connection between the two CLARiiONs.
2. Configure both CLARiiONs to be in the same management domain.
3. Create LUNs of identical size on both CLARiiONs (Example: LUN A of x GB on CLARiiON-1 and LUN C of x GB on CLARiiON-2). It is recommended that both LUNs are of the same RAID type.
4. Create a primary mirror (synchronous) in LUN A of CLARiiON-1.
5. Assign LUN C of CLARiiON-2 as the secondary image. (The mirrored LUNs should be on the same SP of their respective CLARiiONs.)
6. LUN B on CLARiiON-1 and LUN D on CLARiiON-2 must be configured in the same way, when required.

The secondary LUN must be the same size as the primary LUN.

The *EMC MirrorView/Synchronous for Navisphere Administrator's Guide* has more detailed configuration instructions.

Steps to configure DiskXtender for Windows

The following procedure is used to configure DXW:

1. Connect the host to both CLARiiONs.
2. Assign the primary images (that is, LUN A and LUN B of CLARiiON-1) to the host.
3. Configure DXW with the primary image(s) as extended drive/NAS-share, as related.
4. Allocate media (NAS-share) to the extended drive.

Steps to simulate failure of the primary CLARiiON

The following procedure is used to simulate the failure of the primary CLARiiON:

1. Remove the zoning between the two CLARiiONs so that the mirror is broken.
2. Remove the zoning of the primary CLARiiON (this destroys the connection between the switch and the primary CLARiiON).
3. Remove the LUN containing the primary mirror from its storage group (this makes it invisible to the host).

MirrorView/S behavior

Scenario: When secondary mirror is promoted

When the previous configuration is in use and the secondary mirror is promoted, the original primary mirror is automatically assigned as the new secondary. MirrorView/S assigns a new mirror ID to the promoted image to distinguish it from the original mirror, even though the mirrors have the same name.

	Before promotion	**After promotion**
Mirror ID	Aaa	Bbb
Primary image	LUN xxx on CLARiiON-1	LUN yyy on CLARiiON-2
Secondary image	LUN yyy on CLARiiON-2	LUN xxx on CLARiiON-1

Features and scenarios

The "DiskXtender functional verification" section has detailed steps to execute the DXW functional verification.

Scenario: Mirroring of extended drive

Configuration

The following configuration is used to test the mirroring of the extended drive:

- Set up an extended drive using DXW on LUN A.
- Configure the mirroring of the DXW extended drive from LUN A to LUN C.
- Run the DXW test cases identified in the "DiskXtender functional verification" section.

Functionality

Functional verification can be performed by the following steps:

DXW operation	**Result**
File Move	Files in the DXW extended drive (media folder) are mirrored.
File Purge	After DXW performs purging, the file stubs are mirrored.
File Fetch	The DXW stubs are replaced by the actual files and these are mirrored.
File Delete	File delete operations on the extended drive are mirrored.

Scenario: Mirroring of NAS media

Configuration

The following configuration is used to test the mirroring of NAS media:

1. Set up an extended drive using DXW, with NAS as the media service on LUN B.

2. Configure mirroring of the NAS media service from LUN B to LUN D.

3. Run the DXW test cases identified in the "DiskXtender functional verification" section.

Functionality

Functional verification can be performed by the following steps.

DXW operation	Result
File Move	Files moved by DXW to the NAS-share are mirrored.
File Purge	After DXW performs purging, the file stubs are mirrored.
File Fetch	Files are fetched from the NAS-share from the (current) primary mirror.
File Delete	Files deleted from NAS-share are also deleted from the mirror.

Scenario: Mirroring of both extended drive and NAS media

Configuration

The following configuration is used to test the mirroring of both the extended drive and the NAS media:

1. Configure an extended drive using DXW on LUN A, with NAS as the media service on LUN B.

2. Configure mirroring of the DXW extended drive from LUN A to LUN C.

3. Configure mirroring of the DXW NAS media folder from LUN B to LUN D.

4. Run the DXW test cases identified in the "DiskXtender functional verification" section.

Functionality

Functional verification can be performed by the following steps:

DXW operation	Result
File Move	Files in the DXW extended drive (media folder) are mirrored.
	Files moved by DXW to the NAS-share are mirrored.
File Purge	After DXW performs purging, the file stubs are mirrored.
	Files purged by DXW to the NAS-share are mirrored.
File Fetch	The DXW stubs are replaced by the actual files and these are mirrored.

	Files are fetched from the NAS-share from the (current) primary mirror.
File Delete	File delete operations on the extended drive are mirrored.
	Files deleted from NAS-share are also deleted from the mirror.

Scenario: Backup and restore of stubbed files on the mirrored extended drive

Configuration

The following configuration is used to test the mirroring of the extended drive:

1. Set up an extended drive using DXW on LUN A.
2. Configure the mirroring of the DXW extended drive from LUN A to LUN C.
3. Run the test cases identified in the "Functionality" section.

Functionality

The following steps are used to verify whether backing up stubbed files and restoring them after a mirror switch does not affect access to the files in any manner:

Operation	**Result**
Purge files	Only the file stubs of the purged files remain on the extended drive.
Promote the secondary mirror	CLARiiON-2 becomes the new primary.
Back up the file stubs using EMC NetWorker®	The file stubs are backed up. NetWorker is aware of the extended attribute.
Restore the purged files from NetWorker	The file stubs are restored.
Perform a DXW File-Fetch	Access to the file is transparent. The file is fetched and opened properly.

The above result assumes that the DXW configuration is intact, that is, the DX server (production server) is operational at the time of promotion.

Scenario: Disaster recovery

Production server fails at primary data center (production array is still online and operational)

In this scenario although the DXW server fails, the primary CLARiiON LUN is still operational.

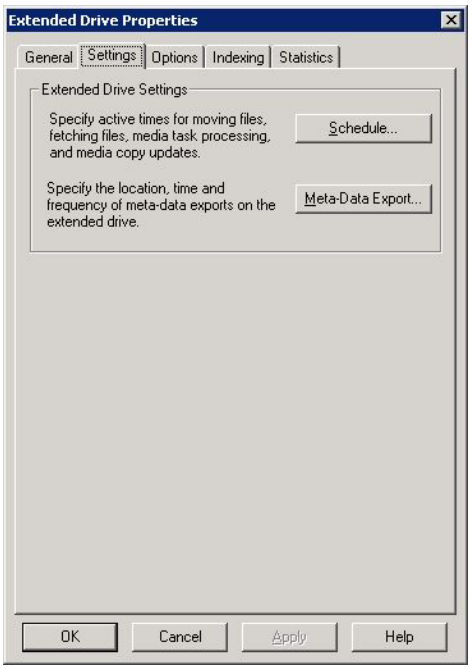

Figure 4. Metadata export

Figure 5. Registry log

DXW provides options for scheduling metadata export (Extended Drive Properties > Settings tab > Meta-Data Export, as shown in Figure 4) and also records registry details in a log on a daily basis (Menu > Tools > Registry log, as shown in Figure 5). In the event of a production server failure, DXW (on the production server itself or the DR site) can be recovered until the time when the metadata export and registry logs were created. It is necessary to store this metadata and registry log in a place that is also accessible to the DR site. After DXW has been reinstalled, the user only has to import the registry log and the metadata to get DXW up and running. This procedure is the same in for the DR site also.

If DXW is restored at a DR site, then it is necessary to ensure that the original media is also accessible from the DR site. The secondary LUN has to be promoted for it to be visible to the DR site. In this scenario, the original primary becomes the new secondary and all operations carried out on the DR site are also reflected on CLARiiON-1.

At the end of the restoration, DXW functions normally.

Primary CLARiiON fails

When the primary CLARiiON fails, DXW will function abnormally since it cannot detect the data. This is because MirrorView/S is unable to route the requests to the secondary CLARiiON mirror seamlessly. All file access requests (from any application) to files existing on the primary LUN fail.

DXW functionality is restored by manually promoting the secondary image from the Navisphere console. The data is successfully retrieved and DXW is fully operational, without requiring any more changes from the user.

Entire primary data center fails

In the case of a complete disaster at the primary data center, both the DXW server and the primary CLARiiON are unavailable.

In such a scenario, DXW is brought up on the DR site as explained in the “Production server fails at primary data center” section. The difference is that when we promote the secondary, the original mirror

setup is lost due to CLARiiON-1 being down. The operations carried out at the DR site on the extended drive won't be reflected in the original primary.

When CLARiiON-1 is up, we can set up a new mirror to record operations carried out at the DR site. The procedure is as follows:

1. Remove the earlier mirror setup on CLARiiON-1 using the **Force Destroy** option.

2. Set up a new mirror with CLARiiON-2 as primary and CLARiiON-1 as secondary.

3. Synchronize the LUN on CLARiiON-1 to record operations carried out at the DR site.

4. Promote CLARiiON-1 when we have to revert back to the original setup. Also reconfigure DXW on production site using the metadata and registry log created at the DR site.

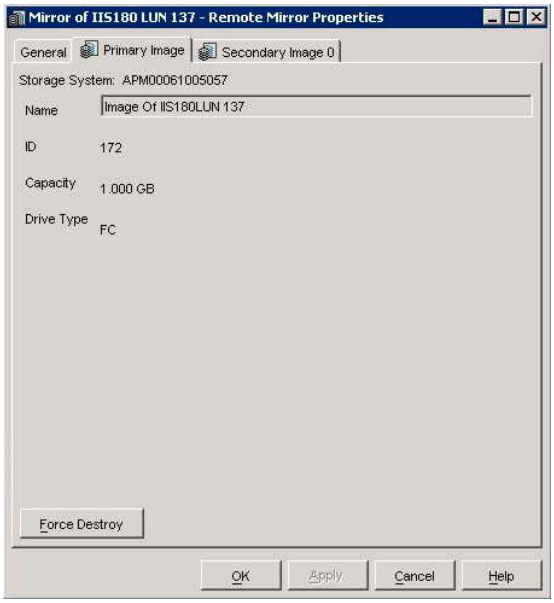

Figure 6. Force Destroy option

This procedure has to be carried out manually.

Link failure between data centers

Whenever the mirroring between the two CLARiiONs fails, there is no data loss if the mirror has been configured with a write intent log. Once the connection between the two CLARiiONs is restored, the two images are synchronized.

DiskXtender functional verification

Use the following procedures to verify specific DXW functions:

DiskXtender setup

The following must occur for DiskXtender setup:

- Install DiskXtender for Windows.
- Add NAS media service.
- Create NAS media.
- Create an extended drive.

- Use the DXW scheduler to set up active times for the operations.
- Allocate NAS media to the extended drive.
- Create a media folder.
- Create a media group.
- Add the NAS media to the media group.
- Create a move rule.
- Write files to media.

When DXW is first installed, the 9 A.M. – 5 P.M. time slot is not enabled for any DXW activity, that is, all DXW operations like migration, purging, and so on will be scheduled after the working hours**.**

MOVE operation

Follow the steps below and verify the outcome for a MOVE operation of DXW.

Step	**Result**
Create a move rule as follows. Check the **Move file for direct read** option. Check the **Purge file immediately after move** option.	File is marked for "direct read" after move. File is purged after move.
Move files to media folder and force a Background Scan.	All files are pending move under the move rule (Move rule statistics page).

FETCH operation

Follow the steps below and verify the outcome for a FETCH operation of DXW.

Step	**Result**
In Windows Explorer, open the folder on the extended drive. Double-click on each purged file.	The entire file is displayed.

DELETE operation

Follow the steps below and verify the outcome for a DELETE operation of DXW.

Step	**Result**
Right-click the Delete Rules node under the root folder. Select **New**.	A DXW warning is displayed.
Select **Yes**.	Delete Rule wizard, File Name option is displayed.
Folder should be root (\).(media folder) Type *.* in the File Name text box. Select **Next**.	Size page is displayed.
Select **Next**.	Attributes page is displayed.
Select **Next**.	Age page is displayed.
Select **Next**.	Summary page displays default options.
Select **Finish**.	Delete Rule is created and is displayed under the Delete Rules

	node.
Under the Delete Rules node, highlight the delete rule and verify that the text view displays the correct options.	Delete rule information in text view displays the default options.
Force a Background Scan.	All files were deleted from the extended drive and from the media (already mounted).
Run a Restore task on the media.	No files are restored.

PURGE operation

Follow the steps below and verify the outcome for a PURGE operation of DXW.

Step	**Result**
Purge After Move	
Change the move rule by selecting the move option **Purge After Move**. Write one file to the media folder.	The file is in the media folder. The Pending Move value increases from 0 to 1. The Pending Purge value does not change.
Activate the move schedule. Watch for the file move to take place.	Pending Move will decrease from 1 to 0. Pending Purge should not change, Purged should increase by 1 and Moved should increase by 1.
Verify that file is purged by checking Migration status through DXWShell Extensions.	Migration status should be **Purged**.
Purge by DXWShell Extensions	
Fetch one file written to the media folder during the preceding test. Verify that the file is now fetched by checking the Migration status through DXWShell.	Migration status should be **Fetched**.
Right-click on the file through Explorer, and select DiskXtender. Click **View File Properties > File Settings > Purge File** button.	The Migration status changes from **Fetched** to **Purged**.
Purge During Scan	
Set a default Move Rule, set a Purge Rule with the setting **Purge files …during Background Scans**. All other settings are default. Set a 24-hour move schedule. Write one small file to the extended drive. Let those files migrate.	Move statistics show that files are moved and purge statistics show that no files are purged.
Force Background Scan.	Purge statistics show that files are purged.

DATA validation

Follow the steps below and verify the outcome of the DATA validation operation of DXW.

Step	**Result**
Remove the media from the media folder.	
Add media to the media folder and schedule the media for File Restore ASAP. Set Direct read.	File restore will start immediately
After restore: Compare the contents of the media folder with the original files.	The comparison is successful. All files are identical.

Conclusion

DiskXtender for Windows may be operated in conjunction with MirrorView/Synchronous. The solution offers efficient storage management using the capabilities of DXW. It also ensures quick recovery and availability of data in case of a disaster by exploiting the capabilities of MirrorView/S. The two products function independently but offer a better solution when used together.

References

Document title	Date
EMC CLARiiON Fibre Channel Storage Fundamentals white paper	April 2007
EMC CLARiiON CX300, CX300i, CX500, CX500i, and CX700 Storage Systems Configuration Planning Guide	August 2005
EMC MirrorView Installation Guide	May 2004
EMC MirrorView/Synchronous for Navisphere Administrator's Guide	August 2006
MirrorView KnowledgeBook: FLARE 26 white paper	March 2007
EMC DiskXtender Release 6.2 Microsoft Windows Version Installation Guide	March 2007
EMC DiskXtender Release 6.1 Microsoft Windows Version Best Practices Guide	September 2006
EMC DiskXtender Guide File System Manager Release 6.1 Microsoft Windows Version Administrator's Guide	May 2006