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White Paper

EMC CLARiiON SAN Copy

A Detailed Review

Abstract

This white paper presents the features, functionality, and performance characteristics of EMC® CLARiiON® SAN Copy™, as well as examples for use. It outlines the benefits and functionality of SAN Copy and how it can be used to solve problems involving data replication within and between data centers. It also provides SAN Copy configuration details.

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Executive summary

EMC® CLARiiON® SAN Copy™ is an optional software application available on CLARiiON storage systems. SAN Copy moves data to and from CLARiiON storage systems on a per-logical-unit (LUN) basis. A CLARiiON storage system running SAN Copy can transfer data to and from other CLARiiON systems, Symmetrix® systems, and supported third-party systems. This functionality can be used for a number of purposes, including data movement for consolidated business processing activities, backup to tape, backup to disk, data warehouse refreshes, and replication of databases from one storage system to another over the SAN without the need for host-based replication software.

Introduction

This white paper presents the features, functionality, and performance characteristics of EMC CLARiiON SAN Copy, as well as examples of its use. It outlines the benefits and functionality of SAN Copy and how it can be used to solve problems involving data replication within and between data centers. It also provides SAN Copy configuration details.

Audience

This white paper is intended for systems integrators, systems administrators, and members of the EMC and partners professional services community. It is assumed that the audience is familiar with CLARiiON storage systems and other optional applications such as SnapView™ and MirrorView™. The intent of this paper is to present guidelines for architecting SAN Copy-based solutions.

Introduction to CLARiiON SAN Copy

EMC CLARiiON SAN Copy is a storage-system-based application that is available for certain CLARiiON storage systems as an optional package. It enables the storage system to copy data at a block level directly across the SAN from one storage system to another or within a single CLARiiON system. While the software executes on a CLARiiON storage system, it can copy data from and send data to other supported storage systems on the SAN. SAN Copy software can move data from one source to one or multiple destinations concurrently. Figure 1 illustrates some of the ways SAN Copy can be used to move data.

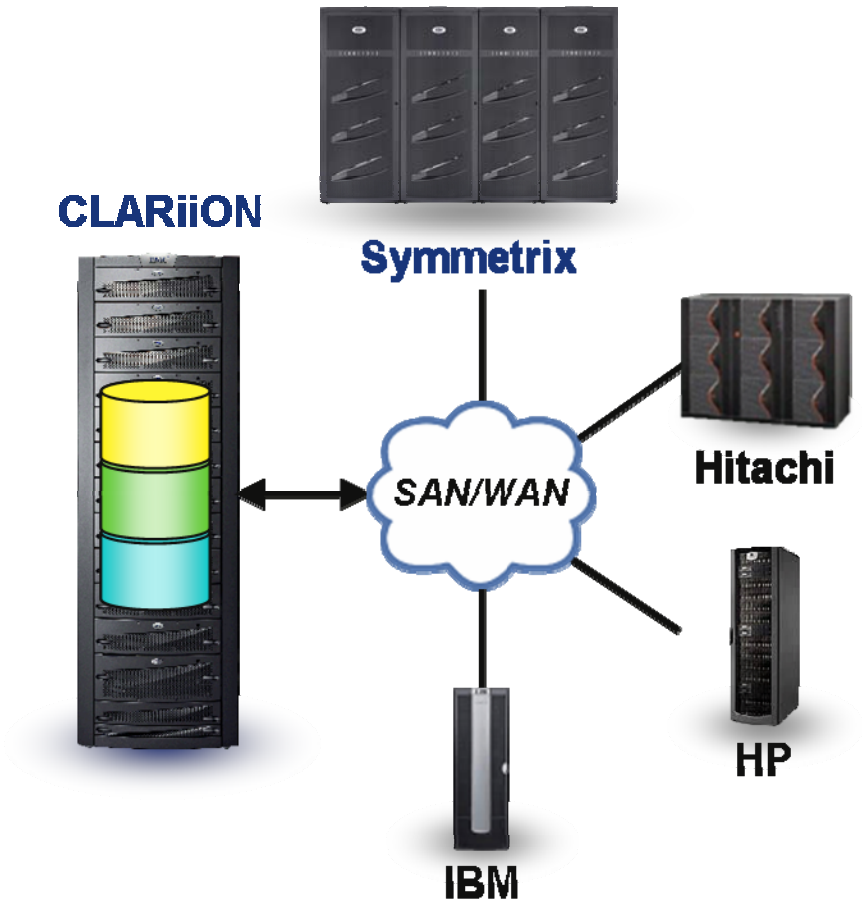

Figure 1. SAN Copy topology

SAN Copy is designed as a multipurpose replication product for data mobility, migrations, content distribution, and disaster recovery (DR). However, SAN Copy does not provide the complete end-to-end protection that MirrorView provides.

MirrorView is storage system-based DR software. MirrorView replicates the contents of a primary volume to a secondary volume that resides on a different CLARiiON storage system. When MirrorView performs this replication to a secondary volume, all server access to the secondary volume must be initiated through MirrorView, thus ensuring end-to-end data protection.

SAN Copy provides an efficient replication mechanism that can be used as part of a DR strategy with Replication Manager. Table 1 compares MirrorView and SAN Copy.

Table 1. MirrorView and SAN Copy use case comparison

Product	**MirrorView**	**SAN Copy**
Storage system support	Replication between CLARiiON primary and secondary systems	Replication between CLARiiON, Symmetrix, and non-EMC systems
Content distribution	1 primary to 1 secondary async; 2 secondaries sync (1:1 with con groups)	1 source copied to up to 100 targets (50 targets for lower-end systems)
Data protection	Continuous data protection of secondary volumes	Remote copy is available for server access

Consistency across volumes	Native consistency group support	Consistency managed by the user (such as hot backup mode) or another application (such as EMC Replication Manager)

SAN Copy is useful for:

- **Data mobility**
  - Rapidly copy data—where and when you need it.
  - Eliminate impact on production activities during data mobility tasks.
- **Data migration**

  Easily migrate data from qualified storage systems to CLARiiON CX series networked storage systems.
- **Content distribution**
  - Push pricing and inventory data to remote locations each day.
  - Copy production data into development environments for testing new applications.
- **Disaster recovery**
  - Protect and manage Microsoft Exchange and SQL environments via integration with EMC Replication Manager.

SAN Copy concepts and definitions

The following basic SAN Copy concepts and definitions will help you better understand how SAN Copy operates. These terms are used throughout the paper:

LUN – Typically refers to a CLARiiON logical unit. That definition is relaxed slightly in this paper when talking about source and destination LUNs. It may refer to a CLARiiON LUN, SnapView snapshot, SnapView clone, Symmetrix volume, Symmetrix BCV, or a logical volume on a third-party storage system.

Source LUN – The LUN that will be replicated.

Destination LUN – The LUN to which the data will be replicated.

SAN Copy session – A persistent definition that consists of a source LUN and one or more destination LUNs.

SAN Copy (hosting) storage system – The CLARiiON storage system(s) on which SAN Copy is installed. The SAN Copy storage system will be the initiator of the session and perform the data transfer.

SAN Copy port – CLARiiON storage processor port(s) to be used by SAN Copy. It provides the behavior of a SAN initiator, as well as the usual target behavior.

Quiesce – To halt all activity on a LUN. This means no I/O in progress.

Block-level copy – SAN Copy reads and writes data at the block level. This means that SAN Copy operates at the LUN level and is not aware of any partitions or file systems that exist on that LUN.

Push – The operation in which the SAN Copy storage system reads data from one of its LUNs and writes that data to a destination LUN(s).

Pull – The operation in which the SAN Copy storage system reads data from a source LUN on another system and writes that data to one of its LUNs.

Inter-system transfer – Data movement between two (or more) storage systems.

Intra-system transfer – Data movement within a CLARiiON storage system.

Third-party storage system – Refers to any SAN Copy-compatible storage system not manufactured by EMC.

Fibre preferred – A fibre-preferred connection type allows you to search for a Fibre Channel path to the remote LUN first; if a Fibre Channel path is not found, it searches for an iSCSI path to the remote LUN.

iSCSI – Internet SCSI.

iSCSI LUN – The LUN that resides on an iSCSI array.

SAN Copy array – The array on which SAN Copy software resides.

Within Domain – This refers to a LUN that resides in the same Navisphere® administrative domain as the SAN Copy array. LUNs that reside on non-CLARiiON arrays are *not* within domain.

SAN Copy benefits

SAN Copy has several benefits over host-based replication options:

- Performance is optimal because data is moved directly across the SAN.
- No host software is required for the copy operation because SAN Copy executes on a CLARiiON storage system.
- SAN Copy offers interoperability with many non-CLARiiON storage systems.

Performance

The advantage of SAN Copy is that the data to be replicated only moves once across the SAN. Host-based replication products move data twice: first from a SAN-attached storage system to the host, and then writing the same data to another host. With SAN Copy, all processing takes place at the storage-system level. For remote copies, SAN Copy balances sessions across available paths and has algorithms designed for efficient link utilization. When the source and destination LUNs are on the same system, the copy operation takes place internally and does not require any data traffic on the SAN. SAN Copy has a large performance advantage over host-based replication technologies because it moves data directly between storage systems.

Host independence

The copy operation of SAN Copy does not require host CPU processing, which leaves more resources available for applications. SAN Copy transfers are independent of the host OS or file-system type. As a result, customers have more flexibility in their heterogeneous OS environments. SAN Copy can be used for all data transfers rather than having to rely on different replication software for each OS.

Connectivity options

SAN Copy supports connections with many non-CLARiiON storage systems, including Symmetrix and third-party storage systems. This allows SAN Copy to be deployed in heterogeneous storage environments. It can be used in place of a host to move data between several different storage systems where data transfer between them wouldn't normally be supported.

SAN Copy may also be used over an IP-extended SAN. This allows data to be replicated over long distances where fibre connectivity may not be available.

SAN Copy uses

SAN Copy has many uses, including but not limited to data migration, content distribution, and disaster recovery (when used with Replication Manager).

Data migration

Data migration is the process by which data is relocated from one system to another. SAN Copy can migrate data to and from a CLARiiON storage system.

Data migration for storage-system replacement

If upgrading to a CLARiiON CX series storage system from a previous-generation CLARiiON storage system or third-party storage system, SAN Copy can migrate the data from one system to another.

Data migration within a single CLARiiON

A storage system that hosts SAN Copy may use SAN Copy to migrate data within itself. However, since the release of LUN migration (in release 16), it is the optimal way to migrate LUNs within a CLARiiON storage system, because it performs data movement without disrupting the host's access to the data.

Data migration between storage tiers

In an environment with multiple storage tiers, SAN Copy can move data between the tiers. For example, SAN Copy can move between tiers based on Symmetrix or third-party storage systems. It can also move data from a tier based on CLARiiON with Fibre Channel drives to a tier based on CLARiiON with Advanced Technology-Attached (ATA) drives.

LUN expansion

SAN Copy software can copy data from a smaller-capacity LUN to a larger-capacity LUN. However, CLARiiON metaLUNs and LUN migration allow you to expand LUNs without disrupting applications. Please see the white paper *EMC CLARiiON MetaLUNs: Concepts, Operations, and Management* on EMC Powerlink® for more information. For a detailed description of how to expand LUNs on different operating systems, see the Host Connectivity Guide for each operating system. For more information on strategies for migrating data to CLARiiON storage systems, see the white paper *Strategies for Migrating Data to EMC CLARiiON CX3 Series* available on Powerlink.

Content distribution

In today's business environment, it is common for a company to have multiple data centers in different regions. Customers frequently need to distribute data from headquarters to regional offices and collect data from local offices to send to headquarters. Such applications are defined as *content distribution*. Web content distribution, which involves distributing content to multiple servers on an internal or external website, is an example of content distribution. SAN Copy is ideal for content distribution. A session can have multiple destination LUNs. After setting up the session, data can be copied simultaneously to several LUNs with the same management effort as copying to a single LUN.

Disaster recovery

SAN Copy, in combination with SnapView and Replication Manager, offers a disaster-recovery solution for applications consolidated on CLARiiON storage systems. SnapView clones provide for local operational recovery, while SAN Copy is used to copy data to a remote system for disaster recovery. Replication Manager streamlines the process by coordinating with the host/application to create an application-consistent clone, managing the copy process to the second storage system, and handling the steps required in the event of a recovery.

SAN Copy functionality

This section describes SAN Copy features and functionality.

Supported storage systems[1]

The following sections describe the storage systems capable of running SAN Copy software, as well as those capable of participating in SAN Copy sessions.

SAN Copy storage systems

CLARiiON storage systems that are qualified to host SAN Copy software are called hosting storage systems. The hosting system will be the one initiating SAN Copy sessions. Qualified hosting systems are:

- All CX3 systems
- CX400/500/600/700
- AX4-5 series expanded models[2]
- CX300 and AX100/150 (SAN Copy/E only[3])

SAN Copy compatible storage systems

These storage systems cannot host the SAN Copy application, but they can participate in SAN Copy sessions by serving as a source or a destination[4]. SAN Copy compatible storage systems include:

- CLARiiON: CX300/200, AX100/150
- AX4-5 series basic models[5]
- Symmetrix: 8000 series, DMX-3, DMX-2
- Select third-party storage systems[6]: (Please refer to the EMC SAN Copy pdf document available via E-Lab™ Navigator at EMC.com for a complete list.)
    - HP: EMA12000, EMA16000, ESA12000, EVA3000, EVA4000, EVA5000, EVA6000, EVA8000, HSG80, MA8000, MSA−1000, RA8000, XP−1024, XP−12000, XP−128, XP−512
    - IBM: DS4500, DS4400, DS4300, DS4100, FAStT500, FAStT600, FAStT700, FAStT900, 2105-F20, 2105-E20, 2105-800
    - HDS: 9980V, 9970V, 9960, 9920
    - Sun: StorEdge 9990, T3/T3+

SAN Copy over iSCSI (new for FLARE release 26)

SAN Copy over iSCSI is supported between CX3 FC/iSCSI systems (CX3-10c, CX3-20c, and CX3-40c). The storage systems must be running release 26 of FLARE®. It is possible to have iSCSI connections

[1] Refer to E-Lab Navigator for the most recent support information. Under the PDFs and Guides tab, choose the SAN Copy PDF.
[2] AX4-5 Series refers to the Fibre Channel models only. The expanded model requires a dual-SP configuration with full Navisphere Manager.
[3] Appendix B, "SAN Copy/E for CX300 and AX100/150," provides a detailed description of SAN Copy/E functionality.
[4] Since the SAN Copy application is not running on these storage systems, it cannot be used to copy LUNs within these storage systems.
[5] The AX4-5 Series basic model refers to the Fibre Channel host connection array with the NaviExpress graphical user interface.
[6] Information on setting up SAN Copy with third-party storage systems is provided in the "SAN Copy Configuration Requirements for Non-EMC Storage Systems" section of the most recent SAN Copy Release Notes.

between CX3 FC/iSCSI systems and CX300i and CX500i storage systems. These connections are valid for SAN Copy use only (not MirrorView).

The SAN Copy Wizard has been enhanced to support SAN Copy over iSCSI. If both Fibre Channel and iSCSI connectivity exists, you can choose the desired connection type. As long as connectivity exists over the preferred link, the wizard will perform the setup and configuration steps.

SAN Copy can maintain two connection types (Fibre Channel and iSCSI) to the same destination. Fibre Channel, iSCSI, and Fibre Preferred are the possible connection types. If your storage system is configured with Fibre Channel as well as iSCSI connections, the wizard will automatically choose Fibre Preferred as the connection type. The connection type can also be modified in Session properties and when creating a LUN. Additional information for advanced users is available in the "iSCSI connections" section.

SAN Copy management

SAN Copy software can be managed in several ways, including:

- Navisphere Manager
- Navisphere command line interface (NaviSecCLI)
- EMC Replication Manager

Managing with Navisphere Manager

As soon as SAN Copy is enabled on a CLARiiON storage system, functionality is added into Navisphere that allows users to create, execute, and control SAN Copy sessions. It includes a wizard for creating sessions and familiar object-based management of existing sessions.

Managing with Navisphere command line interface

SAN Copy operations can also be executed using NaviSecCLI. All CLARiiON storage systems come with Navisphere Secure CLI. It is a command line interface that enables expert users to write scripts for configuring, monitoring, and managing CLARiiON storage systems. This allows you to automate SAN Copy operations.

Managing SAN Copy sessions across Navisphere domains

Prior to release 19, all CLARiiON storage systems involved in the same SAN Copy session were required to be in the same Navisphere management domain in order to see LUN information on each system. If a SAN Copy session were to be created across domains, the user would have to obtain the WWNs of any remote LUNs and enter them into the Navisphere GUI or CLI. With the introduction of Navisphere multidomain management in release 19, it is now possible to easily manage SAN Copy sessions that span Navisphere domains. The white paper *Domain Management with EMC CLARiiON Storage Systems* provides more information on multidomain management.

Managing with Replication Manager

EMC Replication Manager (RM) simplifies the management of EMC SAN Copy and EMC SnapView software. RM automates many tasks, including the creation and execution of SAN Copy sessions – tasks that may otherwise require custom scripting. It also provides a graphical user interface that establishes replicas from the application's point of view. Figure 2 shows an example of an incremental session being created from clones of a local Microsoft Exchange database.

RM supports Microsoft's VSS architecture, allowing you to make hot point-in-time Exchange copies without disrupting your production server. Replication Manager also has interfaces to SQL and Oracle, and can be integrated with custom scripts to simplify management of SAN Copy in any application environment.

For more information on EMC/Microsoft Exchange DR solutions, see *EMC CLARiiON Storage Solutions Microsoft Exchange 2003 Best Practices: Storage Configuration Guidelines.* For more information on SQL, see *EMC Replication Manager and Microsoft SQL Server - A Detailed Review* and on Oracle, read *EMC Replication Manager Integration with Oracle Database Server- A Detailed Review*.

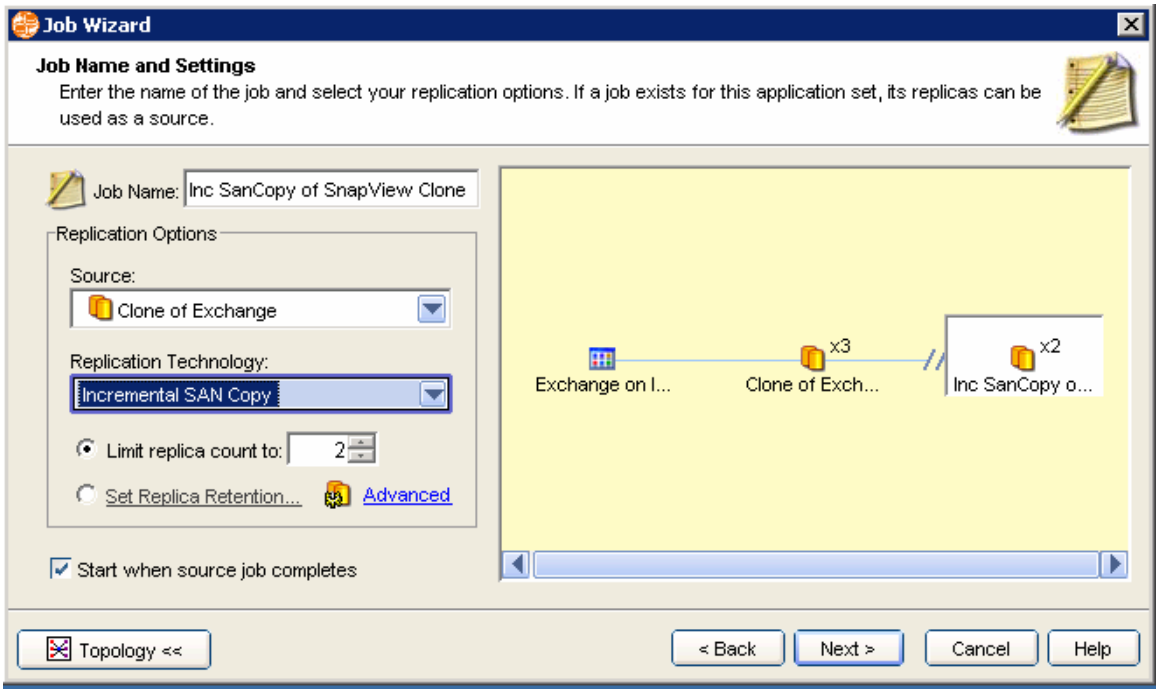

Figure 2. Creation of an incremental session using Replication Manager

SAN Copy full and incremental sessions

SAN Copy supports the incremental update of destination LUNs with only the data that has changed on the source since the last update. This gives SAN Copy users a choice of two session types: full and incremental.

- A *full* session copies the entire contents of the source LUN to the destination LUN(s) every time the session is executed. Full sessions can be a push or a pull with any qualified storage system. Users usually use full SAN Copy session for migrating data to and from a CLARiiON storage system.
- An *incremental* session requires a full copy only once. This is called an initial synchronization. After the initial synchronization, each incremental update copies only the data that has changed on the source LUN since the beginning of the last update. For incremental sessions the source LUN must reside on the SAN Copy storage system, but the destination LUN can reside on any qualified system. Users usually use incremental sessions for ongoing backups, such as daily sales updates.

Source LUN quiesce requirements

When creating a full session data is copied directly from the source; therefore, in order to create a consistent copy of the data, I/O must be quiesced on the source for the duration of the session. To allow the production LUN to be active during the SAN Copy transfer, a full session may be created using a SnapView snapshot or a fractured clone as the data source.

With incremental sessions, it is not necessary to keep the host I/O quiesced during the entire session. Before a transfer, host buffers should be flushed, and I/O should be momentarily quiesced. On Windows, when you manually control SAN Copy session updates with Navisphere on Windows, you can use admhost

to quiesce the host and flush the buffers. If this is not possible, the destination LUN will be a crash-consistent image at the end of the transfer. Alternatively, if you use Replication Manager to manage the SAN Copy session, Replication Manager will work with server applications to facilitate application-consistent copies.

Considerations for mounting the destination LUN

Once a LUN is designated as a destination LUN of an incremental session, it should not be mounted by a host. SAN Copy does not track changes on the destination LUN. For example, if a destination LUN is mounted and changed due to host I/O, SAN Copy will not be aware of these changes. Even mounting a read-only file system is not guaranteed to be read-only to the disk. File systems may write metadata out to the disk, and that metadata will be inconsistent with what will be copied over in the next update. In any case where the destination LUN is modified, a full synchronization from source to destination is required to bring the destination to a consistent, known state.

One of the following methods can be used to access the data on a destination LUN:

- Create a SnapView clone of the destination LUN, fracture it, and mount the clone.
- Create a SnapView snapshot of the destination LUN and mount it.

Note: *During a SAN Copy transfer,* an active SnapView session or unfractured clone may reduce transfer throughput.

Interaction between SAN Copy incremental sessions and SnapView software

A SAN Copy incremental session internally uses SnapView to create a snapshot of the source LUN, and actually reads from the snapshot during the update, so that there is a consistent point-in-time view of the data being transferred. The following sections describe the objects managed by SAN Copy incremental sessions and their roles.

Reserved objects

When an incremental session is created, a reserved SnapView snapshot and SnapView session are created as well. These reserved objects are visible via Navisphere Manager or Navisphere CLI, but cannot be manipulated or used by the end user. When the incremental SAN Copy session is destroyed, these reserved objects are automatically destroyed.

Reserved LUN pool considerations

The reserved SnapView sessions allocate LUNs from a shared resource called the reserved LUN pool. Before creating an incremental session, storage must be allocated to the reserved LUN pool. The number and size of these LUNs will depend on the rate of the change on the source LUN during the update operation. *EMC CLARiiON Reserved LUN Pool Configuration Considerations* provides best practices on configuring the reserved LUN pool.

Internal objects

During a SnapView session, two bitmaps, called the *tracking* map and *transfer* map, are created internally to track the changes on the source LUN and to track the progress of transfer of the changed data to the destination LUNs. This information is saved on the reserved LUNs. The space required for storing these chunk maps entries is negligible; typically, it adds about 0.02 percent of the source LUN size.

Additional definitions

Region – The smallest amount of sequential data that SAN Copy can track and transfer. For release 19 and earlier, the value is 64 KB; for release 19 and later, the value is 2 KB.

Copy on first write – While a copy operation for an incremental session is running, if a write is received for the source LUN for a region that is designated to be transferred but has not yet done so, the region (and possibly data surrounding it) is copied to the SnapView session's reserved LUN(s). Copy-on-first-write operations work on 64 KB chunks.

Chunk – The amount of data that is copied in a copy-on-first-write operation (64 KB).

Tracking map

The tracking map is a persistent disk-resident bitmap that is used to keep track of which regions need to be transferred in the next transfer from the source LUN. When a write changes a region, a bit is set in the tracking map indicating the change. By default, SAN Copy incremental sessions mark all regions for transfer to perform a full synchronization the first time it is run. After the initial sync, only regions receiving writes will be designated for transfer.

Transfer map

When the transfer begins, the current tracking map is frozen, and is then designated as the transfer map. (A new tracking map is created to track changes until the next transfer.) The transfer map denotes the regions that need to be transferred in the current transfer. As data is transferred over to the destination LUN(s), the bits are changed from 1 to 0 to indicate that the corresponding region has been transferred. If there are multiple destinations, the transfer map keeps the bit as 1 until all the destinations have received a copy of the region.

For example, a 4 KB host write would result in two marked 2 KB regions (for FLARE® 19 and later) or one marked 64 KB region (for FLARE 17 and earlier). At transfer time, sequential regions are coalesced to form writes of up to 64 KB. In this example, SAN Copy would generate writes of 4 KB and 64 KB, respectively, to the destination. With host I/O profiles characterized by small I/O sizes, the smaller granularity in release 19 results in lower bandwidth usage, benefiting low-bandwidth intersite links, such as (T1/T3).

SAN Copy operations and management

SAN Copy-related operations are managed either by the Navisphere Manager GUI or by NaviSecCLI.

The core operations are:

- Create a SAN Copy session.
- Start/Stop/Pause/Resume/Remove a SAN Copy session.
- Throttle a SAN Copy session.

Create a SAN Copy session

A SAN Copy session defines the LUNs involved in the relationship, as well as other session parameters. Navisphere Manager's SAN Copy create session wizard walks the user through the process of selecting a source, one or multiple destinations, and the initial throttle value for the session. Each session is unique to each storage processor (SP) and is stored persistently in the storage-system database. Once defined, the SAN Copy session can be started any number of times subsequently. You can do this with Navisphere Manager, NaviSecCLI scripts, or Replication Manager.

Session attributes include:

- SAN Copy session name: user-defined name used for future reference
- Source and destination LUN(s)
- Throttle value
- Latency and bandwidth control for incremental sessions

Beginning with release 19, provisions have been added that give SAN Copy the ability to address LUNs on select HDS and IBM Shark storage systems as source or destination LUNs. These storage system models require a port WWN and a LUN number (rather than the standard LUN WWN) to address their LUNs.

SAN Copy has modified both the Navisphere GUI and the Navisphere CLI to accommodate these nonstandard requirements.

Start, stop, pause, resume, remove operations

To start a SAN Copy session, right-click the session in Navisphere or issue the appropriate NaviSecCLI command. A currently active session can be stopped (or paused), and then restarted. When a session is stopped, it has to be restarted from the beginning. When a session is paused, you can resume the session at the point at which you paused. The remove operation destroys the session. These tasks can be automated using Replication Manager.

Throttle

This parameter is defined on a per-session basis. **Throttle** values range from 1 to 10, where 1 is the slowest, 10 is the fastest, and 6 is the default value. When **throttle** is set to 10, the system reads from the source and writes to the destination as quickly as it can, which causes many system resources to be allocated to that session. SAN Copy reduces the internal buffer size and inserts longer delays between I/Os. This allows the session to run with less performance impact on other applications. The throttle value can be changed dynamically after the session is created and during the progression of the session. For example, you can start a session with the throttle set to 6 and, in the middle of the session, increase the throttle to 10.When a new session is started after completion of this session, the default throttle value of 6 is retained.

Latency and bandwidth control

SAN Copy incremental sessions have enhanced algorithms for link and network resource management. The goal is to:

- Maximize utilization of the available link bandwidth.
- Allocate buffer space to deal with high-latency lines and to ensure most efficient memory utilization.

When an incremental session is created, the available bandwidth and latency[7] can be specified.[8] These two values are used to calculate and allocate an optimal buffer configuration for the session. The bandwidth value is required, but the value for the latency parameter can be left at the default value, in which case the SAN Copy driver will measure latency by sending test I/O to the destination.

Transfer of session ownership

When a SAN Copy session is created, it is owned by the SP that currently owns the LUN on that system. If that LUN is trespassed to the other SP, the SAN Copy session will pause if it is currently running. The SAN Copy session must be transferred to the other SP (right-click on the session and choose **transfer SP owner**) before it can be restarted. This will allow a SAN Copy session to continue if the original SP is rebooted or it loses the paths that were available to SAN Copy.

Mark and unmark operations

The *mark* and *unmark* operations are specific to SAN Copy incremental sessions. These operations are useful in a situation where the customer wants to create a snapshot of the source LUN at a point in time and perform the transfer at a later time.

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[7] When creating a session in Navisphere Manager, latency can be set by accessing the properties dialog box of an existing incremental session.

[8] You can specify the interconnection bandwidth when you create the session using the SAN Copy user interface. After the session is created, you can specify the latency in the **session properties** dialog box. If you use the SAN Copy CLI, bandwidth and latency can be specified as parameters to the **sancopy –create – incremental** command.

Mark operation

A mark operation is SAN Copy software's mechanism to communicate with SnapView software and create a snapshot of the source LUN.

The mark operation is executed in one of the two ways:

- The SAN Copy software automatically invokes the mark operation during initial synchronization and at the beginning of an incremental update operation.
- A user explicitly initiates the operation as desired.

Unmark operation

In an unmark operation, SAN Copy destroys the snapshot that was created during the mark operation, discarding any changes. Regions in the transfer map are added back into the tracking map so that they will be transferred on the next update.

The unmark operation is executed in one of the two ways:

- The SAN Copy software automatically invokes the unmark operation after SAN Copy successfully completes a session transfer. In this case, there are no marked regions to merge back into the tracking map.
- Before a marked session is started, a user can explicitly initiate the operation as desired to discard a previously created point-in-time snapshot of the source LUN created with a previous mark operation.

Nomark operation (also known as "bulk copy")

When performing the initial synchronization of an incremental session, there may be an effect on the response times for host I/O if a lot of copy-on-first-write operations are taking place. Since some initial synchronizations can take a long time, it may be desirable to minimize the performance impact while the transfer is active. This can be done by using the *nomark* operation, which skips copy-on-first-write operations during the initial synchronization.

Since the source LUN may be open to host I/O during the transfer and a static point in time is not being preserved with copy-on-first-write, a bulk copy will result in destination LUNs being temporarily in an inconsistent state with respect to the data on the source LUN. Once the transfer completes successfully, an incremental update session must be executed to make all destinations consistent.

This feature is available via CLI only. A bulk copy operation can only be executed on an unmarked incremental session. After creating the session, run the following Navisphere CLI command:

```
sancopy –start –name sessionName –copywholelun –nomark all
```

Global settings

These are global settings for each SP. Several parameters can be set to tune the performance of SAN Copy sessions. However, the defaults have been carefully researched, and benefit most configurations in most environments.

Number of concurrent sessions

This is the number of full and incremental sessions that can be transferring data at the same time on that SP. Additional sessions that are started are queued for transfer.

Checkpoint interval

Checkpointing applies to full sessions only, as incremental sessions have built-in checkpointing via the transfer map. The checkpoint records the progress of a full session during the update by storing a pointer referencing the number of the last block successfully copied from the source to the destination. The default checkpoint interval is 10 minutes and is user adjustable from 5 to 90 minutes. If a SAN Copy operation is interrupted —for example, if the destination LUN becomes temporarily inaccessible—the SAN Copy operation can be restarted manually from the last checkpoint when the LUN becomes available again. This checkpoint interval mechanism does not apply to incremental sessions, where progress is checkpointed at each write via the transfer map.

Buffers per session and buffer size

These parameters define the amount of memory SAN Copy full sessions allocate to queue outgoing writes. For incremental sessions, SAN Copy will automatically determine the correct number of buffers to use and their size to maximize the throughput of the available transfer medium. These values should only be changed if the copy is between storage systems connected over a local SAN, in which case these values may be increased to their maximum values. By buffering more data blocks into memory, disk response times become less of a bottleneck.

SAN Copy configuration

Before SAN Copy sessions can be created, supporting software packages must be installed on the CLARiiON storage system, and connections must be established between the storage systems that will be participating in the sessions.

SAN Copy zoning[9]

Guidelines for SAN Copy zoning are available in Navisphere Manager's online help. To read these guidelines, open the manager's online help and follow this path: **SAN Copy > Configuring SAN Copy > Zoning Recommendations.** (To download this help, open Powerlink and follow this path: **Support >Technical Documentation and Advisories > Software ~ J-O ~ Documentation > Navisphere Management Suite > Maintenance/Administration**.)

EMC recommends that you only place one initiator (host initiator or SAN Copy initiator) in each zone. There are two exceptions to this rule, which are explained in the SAN Copy zoning guidelines.

Each SAN Copy port that will be participating in a SAN Copy session must be zoned to one or more ports of each SP on the destination storage system(s). At least one zone is necessary between two storage systems that will participate in a session. We recommend that you have at least one zone per SP pair.

SAN Copy LUN masking

Each front-end port in a SAN Copy storage system is a dual-mode port. When the port is participating in a copy session, it acts as an initiator to the destination storage system. When the host initiators are using the port to transfer I/O, the port acts as a target to the host initiator.

Once the appropriate ports have been zoned, the SAN Copy storage system's initiators must be added to the SAN Copy storage group. It may be necessary to select **Update Connections** in the SAN Copy menu to force the SAN Copy storage system to log in to every storage system to which it is zoned. Each port of the SAN Copy storage system appears as a separate "host" to destination storage systems.

You can then assign SAN Copy initiator ports to storage groups on the destination storage system, as shown in Figure 3. Multiple SAN Copy ports can be assigned to the same storage group. You can assign a SAN Copy port to an existing storage group or you can create storage groups for SAN Copy's specific access. For example, you can create a storage group for each SAN Copy port and add LUNs to be used by the port to the storage group.

[9] MirrorView uses the highest numbered port on each SP. If MirrorView is installed, SAN Copy may not make use of these ports.

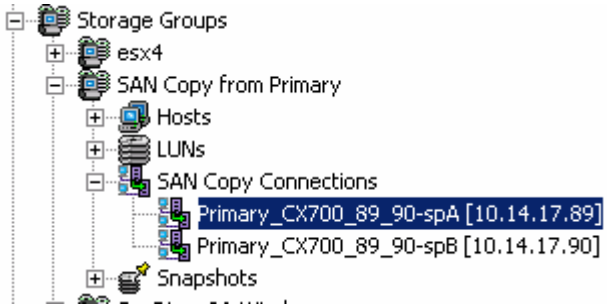

Figure 3. SAN Copy connection to a storage group

SAN Copy path balancing

SAN Copy allows the use of all available ports of a local SP to perform data movement. An available port is defined as one that is zoned and masked to have access to the destination LUN. In the case of a CX3-80, for example, all eight SP ports could be used for SAN Copy sessions. In total, there can be up to eight ports available for SAN Copy.

When a user starts a session, SAN Copy selects the local SP port with the fewest SAN Copy sessions running on it. Next, it randomly picks any port on the destination storage system through which it can see the destination LUN. The ports and the path remain unchanged for the duration of the session. If a session is stopped—either by the user or due to hardware failure—it might take a completely different path when restarted. Multiple SAN Copy sessions can share the same port, though this will only take place when all available ports are already in use.

Optimal load balancing for SAN Copy is achieved by balancing total destination LUN capacities between the two SPs. For example, if 4 TB of data is to be migrated, 2 TB of destination LUNs should be owned by SPA, and the other 2 TB should be owned by SPB.

SAN Copy scalability

SAN Copy scales up to storage-system-specific maximums on the number of sessions that can be run concurrently and the number of sessions that can be defined. In some cases, these limits are shared with other CLARiiON applications.

SAN Copy system limits

Table 2 lists various limits associated with SAN Copy. For example, the Maximum Destinations Per Session column indicates the limit on the total number of LUNs to which a source LUN can be copied. These limits are for the entire storage system and they are evenly split over the two SPs.

Table 2. SAN Copy limits

Storage system	CX3-80, CX3-40, CX3-40c, CX700, CX600,	CX3-20, CX3-20c, CX3-10, CX500, CX400	AX4-5
Maximum concurrent sessions[10]	16	8	4
Maximum destinations per session	100	50	50
Maximum incremental source LUNs[11]	100	50	64
Maximum defined sessions	300	150	25

SAN Copy over extended distances

For implementations over extended distances, users may want to extend their fabric by using protocol converters to send Fibre Channel frames across the IP WAN.

To get the best performance when implementing SAN Copy over IP, consider these performance factors:

- Network performance (network latency, bandwidth, and quality)
- Compressibility of data
- SAN Copy operation (push versus pull copy)
- Write acceleration

Network performance and compressibility of data are outside the scope of this paper. Write acceleration and whether a push or a pull are being performed do have performance effects specific to SAN Copy.

Push and pull copy operations

The SCSI protocol requires one round trip for a read and two round trips for a write as shown in Figure 4. The higher the latency of the connection between systems, the more noticeable the impact of the extra round trip is. Therefore, when you use SAN Copy over extended distances (higher latencies), a pull operation (reads) is generally faster than a push operation (writes).

[10] Running multiple SAN Copy sessions can improve the overall transfer rate; however, it can also slow down other active host I/O during the copy session.

[11] This total is shared with MirrorView/Asynchronous and SnapView. Each source LUN for these applications requires at least one LUN from the reserved LUN pool. This number is actually the total number of LUNs that can be allocated to the reserved LUN pool.

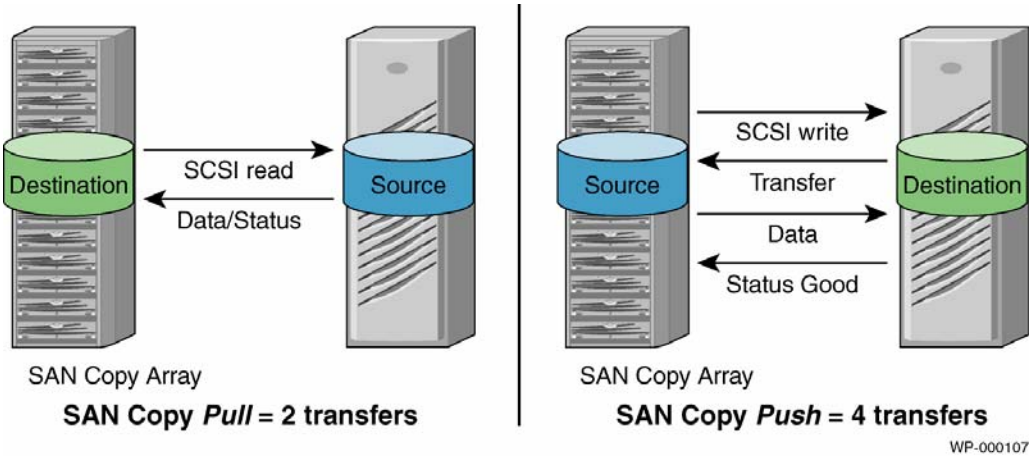

Figure 4. Pull versus push operations with SAN Copy

Write acceleration

To optimize data copy operations over IP, some protocol converters implement a technique called *write acceleration*. Instead of the standard command/response communications—which generate four round trips over the WAN for each write operation and incur the resulting latency delays—the standard command/response sequence is modified so that the interleaving communications do not travel over the WAN. Instead, a local acknowledgment to the initiating storage system is spoofed by the local protocol converter. In other words, the XFR Ready does not traverse the IP wire, allowing data to be sent to the destination sooner, as illustrated in Figure 5.

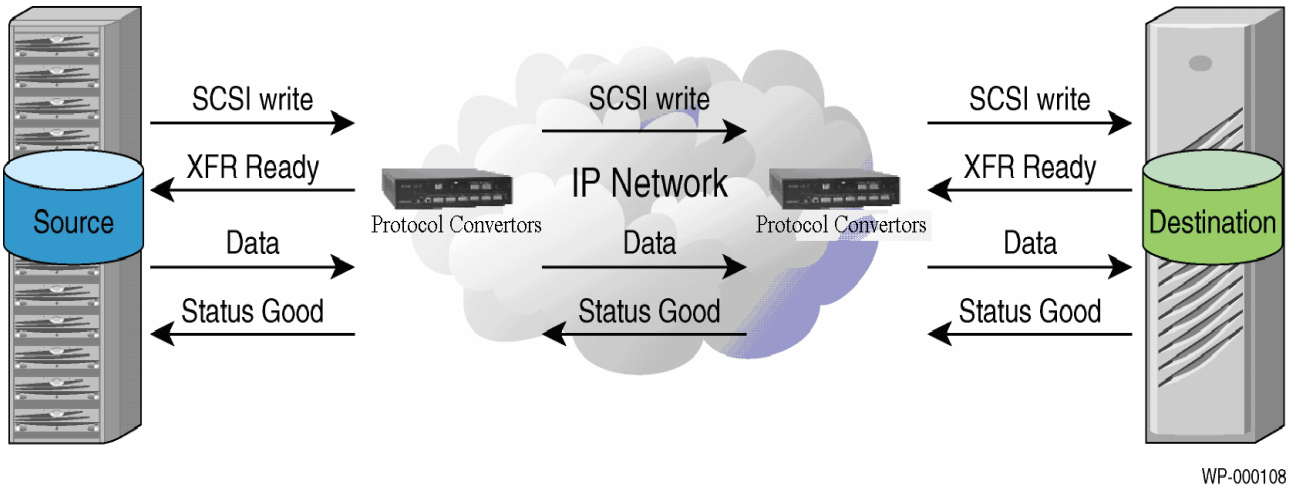

Figure 5. Write acceleration technology via protocol converters

Although the interleaving messaging is modified, the actual status generated by the successful completion of the entire data transfer is returned to the initiator— thus ensuring data integrity.

Table 3 compares the measured effects of write acceleration and push and pull on SAN Copy throughput for full sessions. These transfers were performed over a Gigabit IP network with simulated latency. Source and destination LUNs were both on dedicated disks.

The experimental results support the theories stated previously. On a low-latency link, write acceleration had no benefit and neither did push or pull. On a higher-latency link, write acceleration made a significant difference and resulted in throughput similar to a pull operation at the same latency. Without write acceleration, a pull operation was about twice as fast as a push.

Table 3. Effects of write acceleration and push and pull on SAN Copy throughput

Latency (ms)	Write accel	Push and pull throughput
0	N/A	Similar
50	ON	Similar
50	OFF	Push takes appoximately twice as much time as pull and write acceleration*

*The push operation takes twice as much time because it requires twice as many transfers.

Incremental session performance over IP SAN

The following example demonstrates the performance of incremental SAN Copy, and its impact on the response time performance of an OLTP application, when the source and destination storage systems are connected over an IP-extended SAN via a T3 line. The storage system test configuration consisted of two CLARiiON CX3-80 systems, each connected to a McData Eclipse 1620 SAN Router multi-protocol switch, as shown in Figure 6. Data compression and write acceleration were enabled on the switches to increase throughput and reduce latency. A 50 ms delay was added to the 45 Mb/s T3 line between the switches to simulate a 2,500-mile separation.

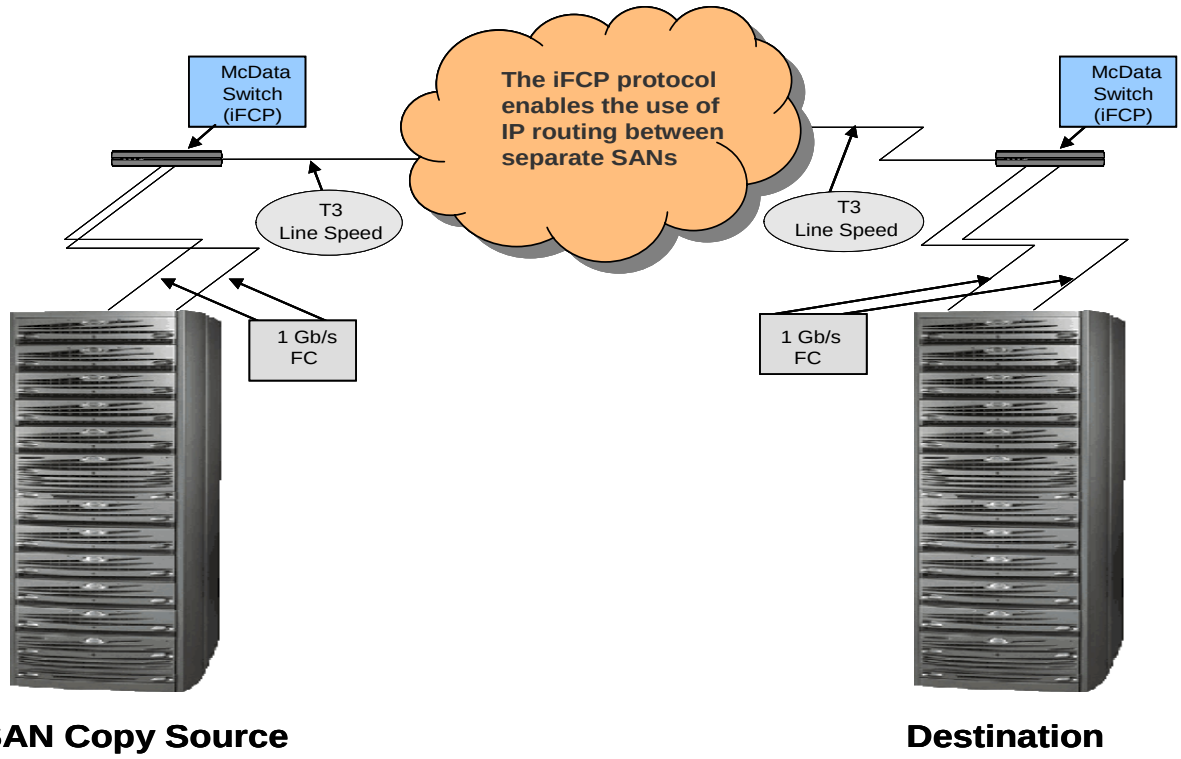

Figure 6. Test configuration: SAN Copy incremental updates over IP SAN

It should be noted that the duration of a transmission is a function of the amount of data to be transmitted and type of line (T3, 100 Mb, 1000 Mb) that is used. IP extender features such as compression, fast/smart writing, and larger receive window sizes can reduce the duration of the update. The compression feature typically reduces the data to half of its original size. The fast/smart feature reduces the impact of round trip time (Update I/O reduced from 2 to 1). Larger receive window sizes allow for concurrent transmission of more data.

Please note that in FLARE 26, when native ISCSI was used, rapid degradation occurred over distance because Native iSCSI lacks fast writing capabilities. In McData 1620, using larger windows and fast write resulted in higher throughput as latency increased. Changing bandwidth latency settings allows fine tuning of buffer configuration for better bandwidth utilization.

iSCSI connections

iSCSI connections define the initiator/target pairs for iSCSI remote replication between CLARiiON storage systems. Similar to zoning in a Fibre Channel environment, they determine which target the initiators log in to. Since all necessary iSCSI connections are automatically created with the SAN Copy Wizard or the SAN Copy Connections dialog box, explicit management of iSCSI connections for SAN Copy is a rare scenario.

To configure and start an ISCSI replication session, you must configure the iSCSI connection set. A connection set is a set of information used by a CLARiiON iSCSI initiator to establish a replication session with an iSCSI target. A connection set consists of a unique user-defined name, credentials usage (connection specific, array-shared, or none), one or more connection paths, and an optional username and password.

You can create iSCSI connections in two ways – using the Navisphere wizard or manually. EMC strongly recommends that you create the connections sets using the SAN Copy Create Session wizard, since the wizards automatically configure the appropriate connection sets using default values. The current release of the SAN Copy wizard does not add the iSCSI initiator ports to the destination storage group. You must exit the wizard and use the management software to add the iSCSI initiator ports to the destination storage group. The wizard will prompt you when this needs to be done. Return to the wizard after verifying that the ports were successfully added to the storage group.

Use Navisphere Manager to register the copy ports with the remote storage systems by performing the following steps:

- In the Storage tree in the Enterprise Storage window, right-click the icon for the SAN Copy storage system.
- Click SAN Copy > Update Connections.

Each copy port registers with each storage system to which it has a connection. Then, the software adds a record for each copy port to the storage system's host initiator table. Navisphere Manager displays an entry for each registered copy port in the Connectivity Status dialog box and the SAN Copy Summary dialog box. For the LUNs to be accessible to the copy ports, you must connect the ports to the storage groups in which the LUNs reside. When connecting to the storage group, you can select all the available SP ports with valid connections to that particular storage group. You can also select specific ports.

For more information about connecting copy ports to CLARiiON storage groups, please refer to Navisphere Manger's online help by following this path: **SAN Copy > Configuring SAN Copy > San Copy over iSCSI > Zoning Recommendations.**

(To download this help from Powerlink, follow this path: **Support > Technical Documentation and Advisories > Software ~ J-O ~ Documentation > Navisphere Management Suite > Maintenance/Administration**.)

Interoperability with other CLARiiON replication software

SnapView and MirrorView can be used with LUNs that are in SAN Copy relationships. One benefit of this flexibility is that it allows for both local and remote replicas of the same LUN(s). Starting with FLARE 24, EMC software also allows LUNs to be MirrorView image LUNs (MV/S and MV/A) *and* clone source LUNs. This provides users with array-based disaster recovery and full binary copies for local rapid recovery. Thus, using the clone of a mirror is more advantageous than using SAN Copy.

SAN Copy and SnapView

SnapView and SAN Copy can operate on the same source and destination LUNs. SAN Copy can also use SnapView replicas as source LUNs in most cases. This allows for several configurations, including:

- Maintaining a local replica of a source LUN with a SnapView snapshot or clone while maintaining a remote replica of the same LUN on another storage system with SAN Copy.
- Maintaining a local replica of a source LUN with a SnapView clone while using the clone as a source for a SAN Copy session.

  Clone must be fractured during the SAN Copy transfer.

- Accessing the destination LUN via a SnapView snapshot or clone. The section "Considerations for mounting the destination LUN" provides more information.

SAN Copy and MirrorView

Incremental SAN Copy may be used to make copies of MirrorView mirrors. This allows for the creation of full binary copies of mirrors, in addition to the pointer-based snapshots possible with SnapView.

Valid SAN Copy source LUNs

SAN Copy can copy data from sources involved in other replication relationships. To avoid having to quiesce the source LUN for the duration of the transfer, SnapView snapshots, SnapView clones, and Symmetrix BCVs can be used as sources for full SAN Copy sessions. The data at the SAN Copy destination will be consistent with the last time the replica was fractured. Table 4 outlines the LUN types that may be used as a source.

Table 4. Valid SAN Copy source LUNs

LUN type	Valid source for a full SAN Copy session?	Valid source for an incremental SAN Copy session?
LUN or metaLUN not in use with any replication software	Yes (Caution – source LUN should not change during the copy)	Yes
SnapView snapshot	Yes	No (Incremental sessions use snapshots internally)
SnapView clone	Yes (Caution – source clone should not change during the copy)	Yes
MirrorView source LUN	Yes (Caution – source LUN should not change during the copy)	Yes
MirrorView destination LUN	No (A snapshot of the LUN may be used as a SAN Copy source)	Yes
Symmetrix TimeFinder® BCV	Yes (Caution – source should not change during the copy)	No
Symmetrix TimeFinder Snap	Yes (Caution – source should not change during the copy)	No

If MirrorView (meaning MirrorView/Synchronous and/or MirrorView/Asynchronous) is installed on the storage system, then SAN Copy cannot use the MirrorView port[12]. However, if MirrorView is not installed on the storage system, then SAN Copy can use all of the ports.

SAN Copy performance

The following information provides a general overview of various performance considerations when using SAN Copy. For details around performance expectations for a specific environment, users should engage their account team and designated CLARiiON C-Speed representative, so that all relevant aspects of the environment are factored in as appropriate.

Test configuration

The performance results were obtained using Fibre Channel interconnected CLARiiON CX3-80 systems running FLARE 26 with no distance between two arrays. The following are true unless otherwise noted:

- All graphs indicate the performance of a single SP pair (one source, one destination).
- For tests that utilized write cache, cache utilization stayed under the high-water mark.
- For the full session and the initial incremental synchronization session tests, SAN Copy I/O was the only I/O performed on the CLARiiONs during the tests.

Full session push performance over Fibre Channel

Figure 7 shows how different SAN Copy settings for throttle and destination storage system affect throughput performance. Each concurrent full copy session represents a full SAN Copy session push with one source LUN and one destination LUN. The lower curve shows the performance with a throttle value of 6 (the default). The upper curve shows the performance with a throttle value of 10.

[12] Port 1 on CX3-40, CX3-20, CX400/500; port 3 on a CX-80 and CX600/700; FC MV port 5 on CX3-40c and CX3-20c; iSCSI MV port 3 on CX3-40c and CX3-20c; FC MV port 3 on CX3-10c; iSCSI MV Port 1 on CX3-10c; FC MV Port 1 on AX4-5

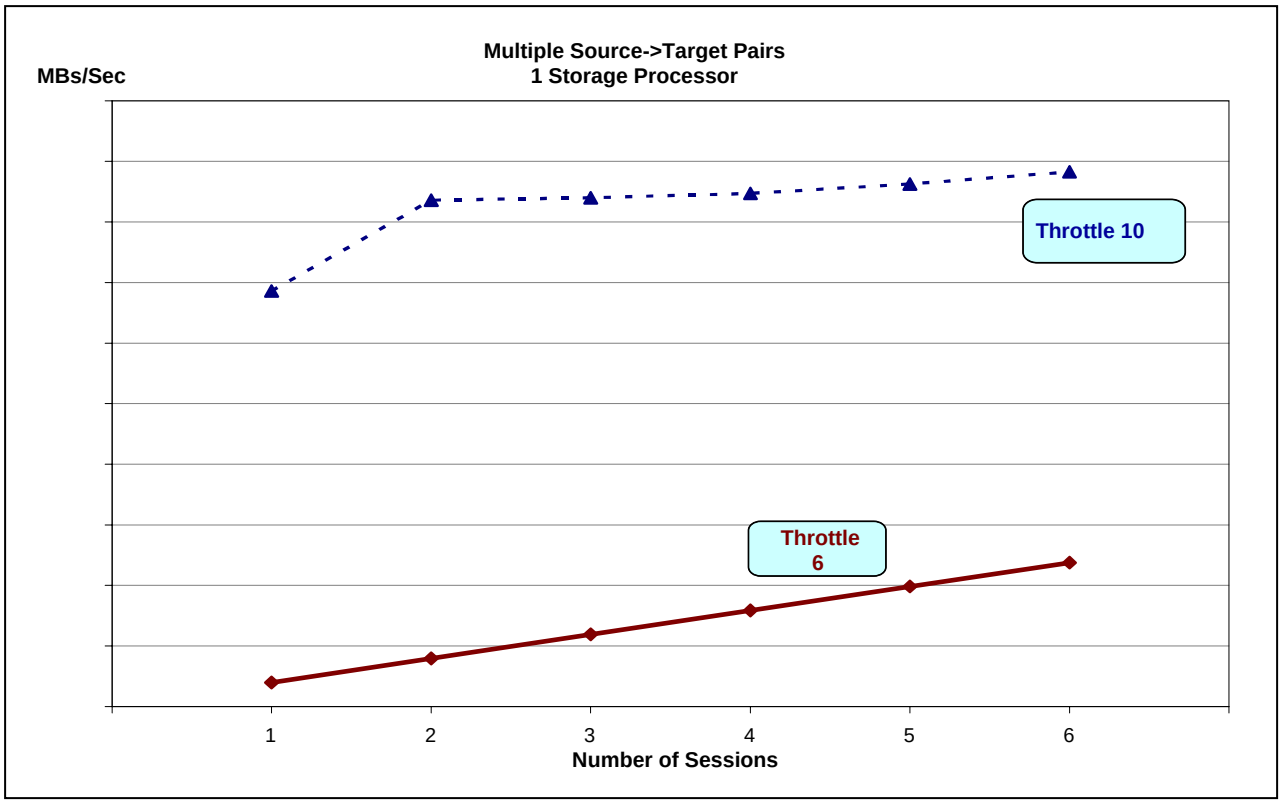

Figure 7. SAN Copy Fibre Channel full session push performance versus number of concurrent one source LUN to one destination LUN copy sessions

Figure 7 shows what happens when each session copies one source LUN to one destination LUN for multiple sessions. The lower curve shows the lower bandwidth at the default throttle of 6. The bandwidth at the lower throttles (6 and below) are controlled by inserting delays. At throttle 6, this throughput performance is the same across all models of the CX3 line, for both Fibre and iSCSI connections.

Total CLARiiON throughput can be increased by performing SAN Copy sessions on both SPs (SPA and SPB) simultaneously, where each source SP is connected to a separate destination SP.

Incremental session initial synchronization performance over Fibre Channel

Figure 8 shows the incremental SAN Copy MB/s throughput performance changing the throttle during the initial synchronization of a destination LUN with a source LUN as the number of concurrent incremental sessions is increased. No other I/O was being performed to the source LUNs during the tests. Each incremental session synchronizes one destination LUN with one source LUN. The lower curve shows the performance at throttle value 6 while the upper curve was obtained with throttle value 10. At throttle value 6, the throughput performance of incremental SAN Copy during initial synchronization is similar to full SAN Copy as shown in Figure 7. However, at higher throttle values, single session (one target to one destination) full session SAN Copy throughput is higher than incremental SAN Copy initial synchronization.

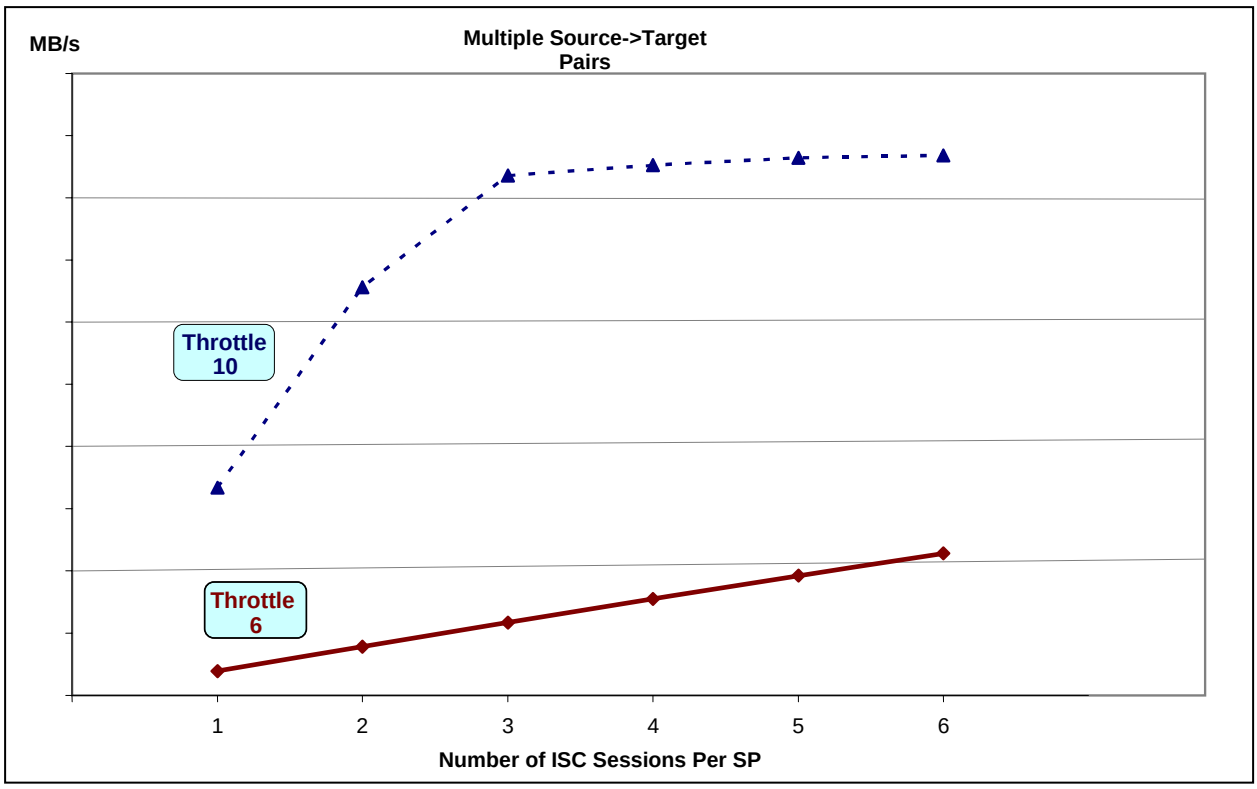

Figure 8. SAN Copy Fibre Channel incremental session initial synchronization performance versus number of concurrent one source LUN to one destination LUN sessions

The bulk copy option is a good choice for the initial synchronization. At throttle value 6, the synchronization throughput performance of incremental SAN Copy is the same whether it is performing a full initialization or using the BulkCopy Nomark feature. When multiple sessions are active, Bulkcopy throughput is 5 percent to 10 percent higher than Full Initialization throughput.

Incremental session update performance over Fibre Channel

Figure 9 shows the update performance of incremental SAN Copy over Fibre Channel for two different I/O profiles. The first profile consisted of random 4 KB I/Os that generated approximately 8 GB of changed blocks. The second profile used random 8 KB I/Os and generated approximately 16 GB of changed blocks. SAN Copy coalesces changes that occur in contiguous 2 KB areas into I/O sizes of up to 64 KB. For the two curves shown in Figure 9, 90 percent to 95 percent of the I/Os written to the destination LUN were 4 KB and 8 KB, respectively, indicating that there was not much coalescing. The update bandwidth scales linearly with the I/O size. The updates were performed with no host activity on the source LUNs, the bandwidth throttle value set at 10, the latency control values set to their defaults, and write cache enabled at the destination.

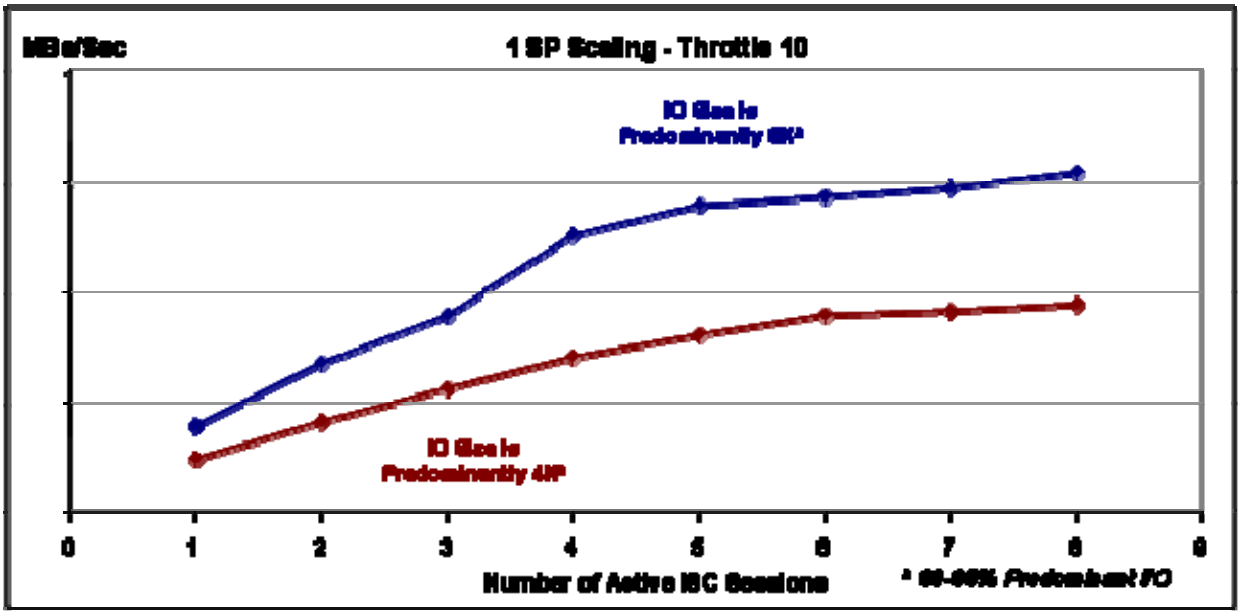

Figure 9. SAN Copy incremental multiple session update performance over Fibre Channel

Transfer bandwidth is a complex function of a large number of parameters, including the success in coalescing the source updates into larger contiguous I/Os for transfer, the channel bandwidth between the storage systems and the switches, the rate at which the source system can fill the channel, the compressibility of the data to be transferred, the ability of the switches to perform compression and write acceleration, the bandwidth and delay on the line between the switches, and the rate at which the destination can absorb the updates

The duration of transmission is primarily a function of the amount of data to be transmitted, the compressibility of the data, and the bandwidth and latency of the line.

Conclusion

EMC SAN Copy software performs data consolidation and data distribution, and disaster recovery with Replication Manager. SAN Copy copies data between CLARiiON storage systems, within CLARiiON storage systems, between CLARiiON and Symmetrix storage systems, and between CLARiiON and qualified non-EMC storage systems. SAN Copy can copy data directly from a source LUN on one storage system to a destination LUN on another storage system without using host resources. SAN Copy can also perform multiple copy operations simultaneously.

You can use SAN Copy to create full or incremental copies of a source LUN. An incremental copy session copies only the data that has changed since the last copy session. This can significantly reduce the time needed to copy the data, thereby allowing the copy operation to be performed more frequently and more effectively. Unlike full-copy sessions, the source LUN for an incremental session can remain online during the copy process (which means that a host application can continue to send I/O to that source LUN).

References

The following titles can be found on Powerlink:

- Navisphere Manager Online Help
- *MirrorView Knowledgebook: FLARE 26* white paper
- *Navisphere Task Bar Explained – A Detailed Review* white paper
- *EMC CLARiiON Best Practices for Fibre Channel Storage: FLARE Release 26 Firmware Update - Best Practices Planning* white paper (This paper provides general guidelines and best practices for optimizing CLARiiON performance.)
- *EMC CLARiiON Replication Specifications: Quick Reference Tables*
- E-Lab Navigator (also at EMC.com)

Appendix A: Symmetrix-to-CLARiiON migration guide

Prior to performing the migration, ensure that the necessary software is in place. The CLARiiON storage system will need to be accessible for management: via the Navisphere GUI or CLI. SAN Copy must be enabled on the CLARiiON storage system. The Symmetrix system must be accessible for management via either ESN manager or EMC ControlCenter® SAN Manager™. Optionally, Navisphere Host Agent may be installed on a host connected to the Symmetrix system to obtain volume information.

Zoning

Identify the CLARiiON SP port(s) and Symmetrix front adapter (FA) port(s) you will use for SAN Copy data transfer. Create a zone between each CLARiiON SP port and Symmetrix FA port. This can be done using ESN Manager or EMC ControlCenter SAN Manager; or it may be done directly from the switch management console. Figure 10 shows the zone between an FC4700 port and a Symmetrix FA port.

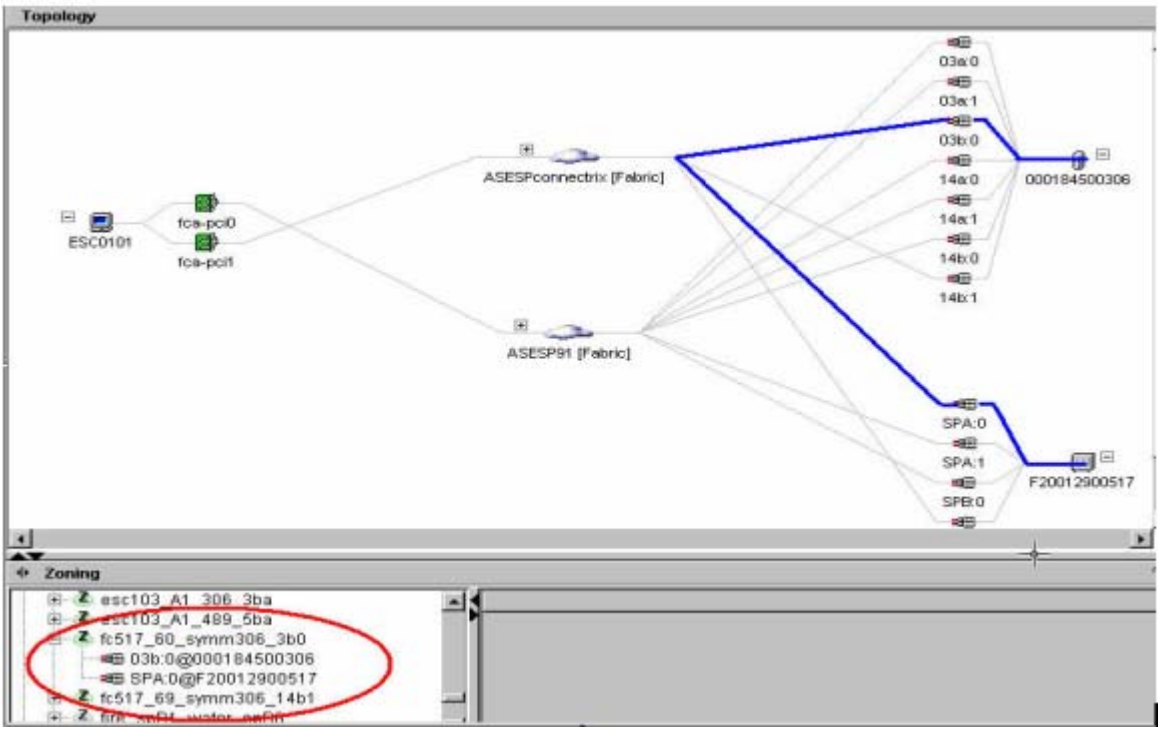

Figure 10. Zone between a CLARiiON system and a Symmetrix FA port

Establishing port connectivity

Once the zones have been created, use either the Navisphere GUI or CLI to perform an update connections operation. This will force the CLARiiON SP ports to log in to the FA ports. To verify that the CLARiiON SP ports are logging in successfully to the Symmetrix FA, check the login history table on the Symmetrix system. This is accomplished with ESN Manager/EMC ControlCenter SAN Manager on a per-FA port basis. Select the FA port, right-click, and select **Properties**. One of the properties is called logins.

Symmetrix volume access

Identify the Symmetrix volumes that are the source or destination for SAN Copy data transfer. This may be a standard volume, BCV, or a metavolume. Use either ESN Manager or EMC ControlCenter SAN Manager to give the connected host and CLARiiON SP ports access to destination volumes. When the Symmetrix

system assigns access for a volume to a CLARiiON SP port, it is no different than assigning access to a regular host connected by means of a fabric. Figure 11 illustrates how the volume access is granted to a Symmetrix volume.

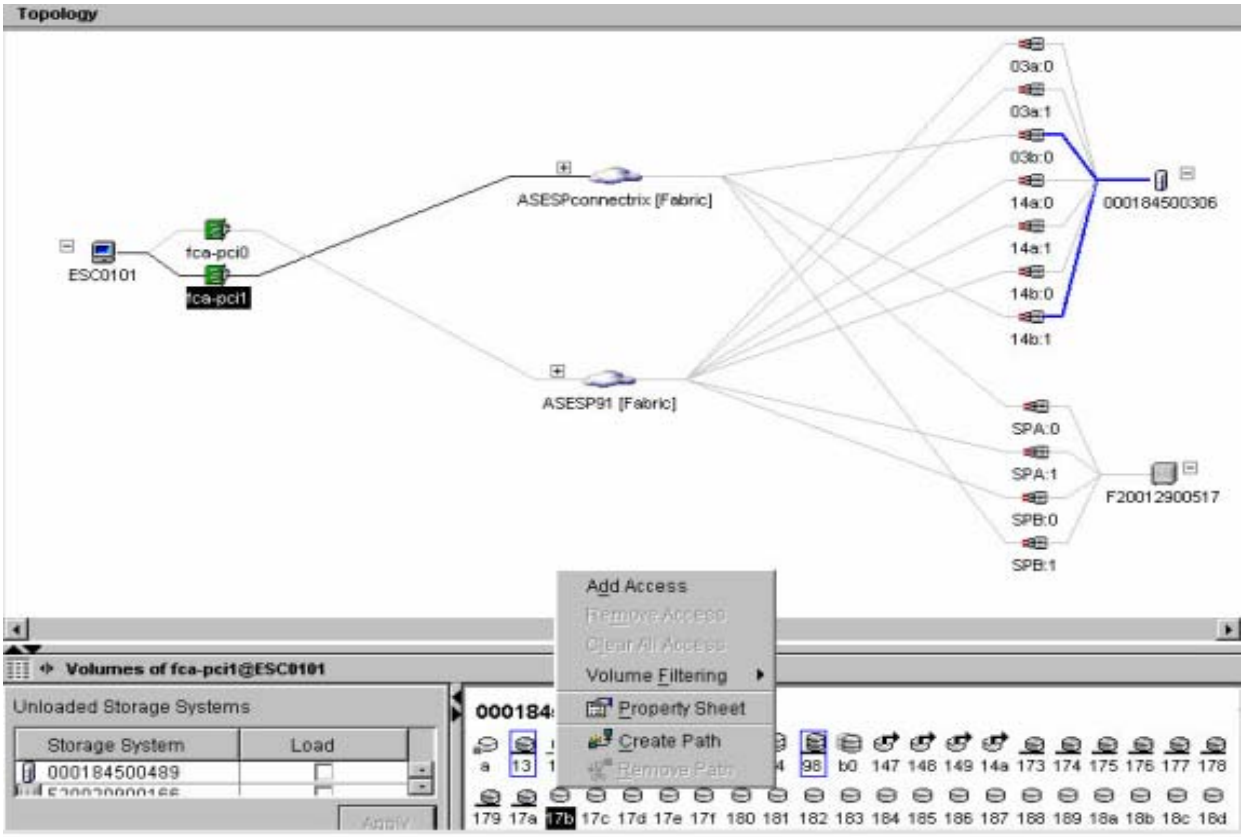

Figure 11. ESN Manager adds access to a Symmetrix volume

Obtaining Symmetrix volume information

Symmetrix volume information may be obtained by one of two methods. In order to have Symmetrix volume information displayed in the Navisphere SAN Copy wizard, Navisphere Host Agent must be installed on a host connected to the Symmetrix system and configured as a Navisphere portal. Alternatively, the Symmetrix volume WWN may be retrieved by using the **symdev** command and entered directly into the SAN Copy session.

Navisphere portal is a functionality built into the Navisphere management suite that allows for the management of out-of-band objects. If the Symmetrix-connected host is also connected to the CLARiiON system and is a managed host, there is no need to add it to the Navisphere portal. But if the Symmetrix-connected host is only connected to the Symmetrix system, then the host needs to be made part of a Navisphere portal running on the CLARiiON storage system.

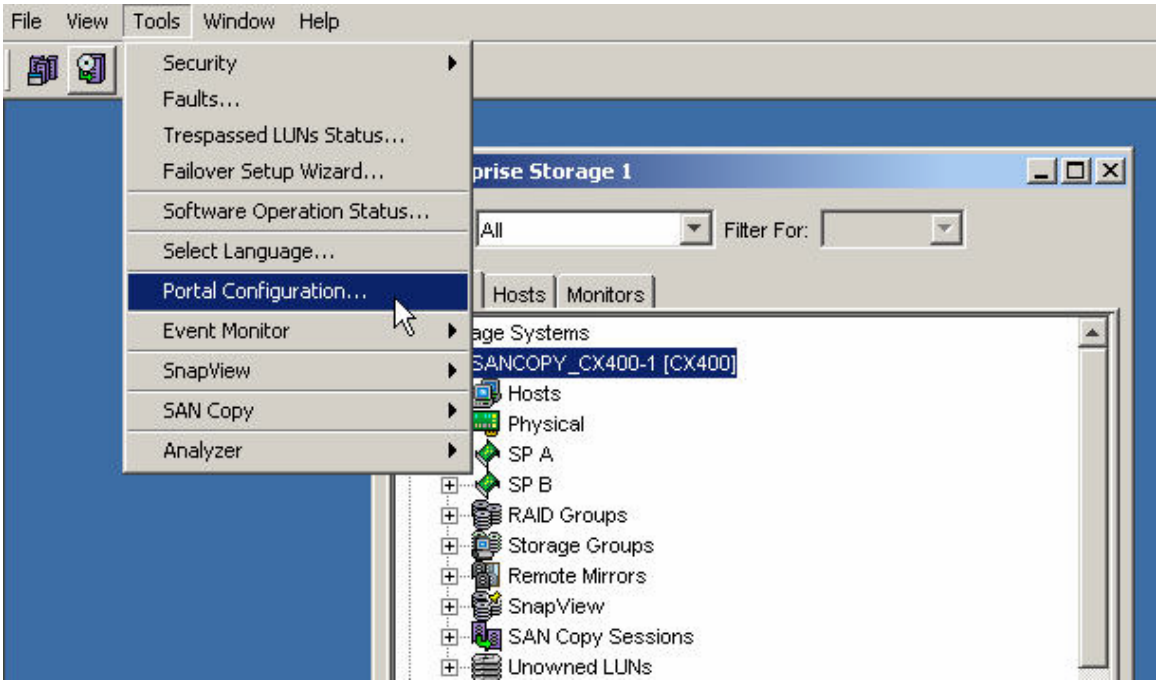

Figure 12. Configuring a portal in Navisphere

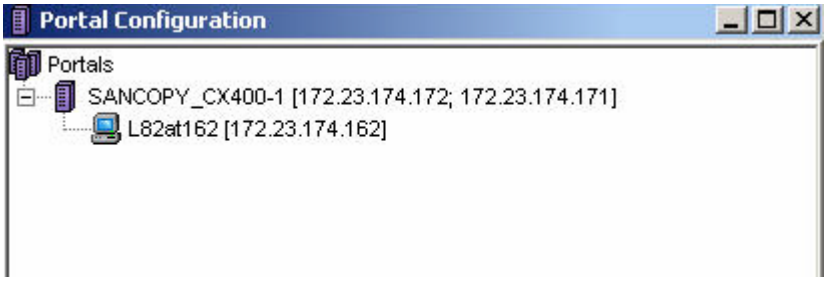

Figure 13. Host shown as a part of portal running on a CLARiiON system

As shown in Figure 13, a host directly connected to the Symmetrix storage system (in this case, L82at162) is added to a portal running on a CX400 storage system: SANCOPY_CX400-1.

As an alternative to configuring a portal, the **symdev** command gives the necessary output to determine volume WWNs. The volume WWN will have to be entered into the SAN Copy session as source or destination storage.

```
$>symdev -sid SymmID -wwn

Symmetrix ID: 000184700643

        Device Name                          Device
---------------------------- ----------------------------------
Sym  Physical                                 WWN
---------------------------- ----------------------------------

0000 \\.\PHYSICALDRIVE3      60060480000184700643564 34D303030
0001 Not Visible             60060480000184700643464241303031
0002 Not Visible             60060480000184700643464241303032
```

The Symmetrix volume number is on the left, followed by the host's name for the device, if any, and then the WWN.

Creating a SAN Copy session

The SAN Copy Create Session Wizard can be used to create a SAN Copy session between a CLARiiON and Symmetrix system. To access the Symmetrix volume from the Storage Source list, select the host system that is connected to the Symmetrix system. As shown in Figure 14, host L82at162 is selected from the list. After the host is selected as a storage source, all the volumes that are presented to this host by the Symmetrix system are visible. These volumes can be selected as either the source or destination for the SAN Copy session.

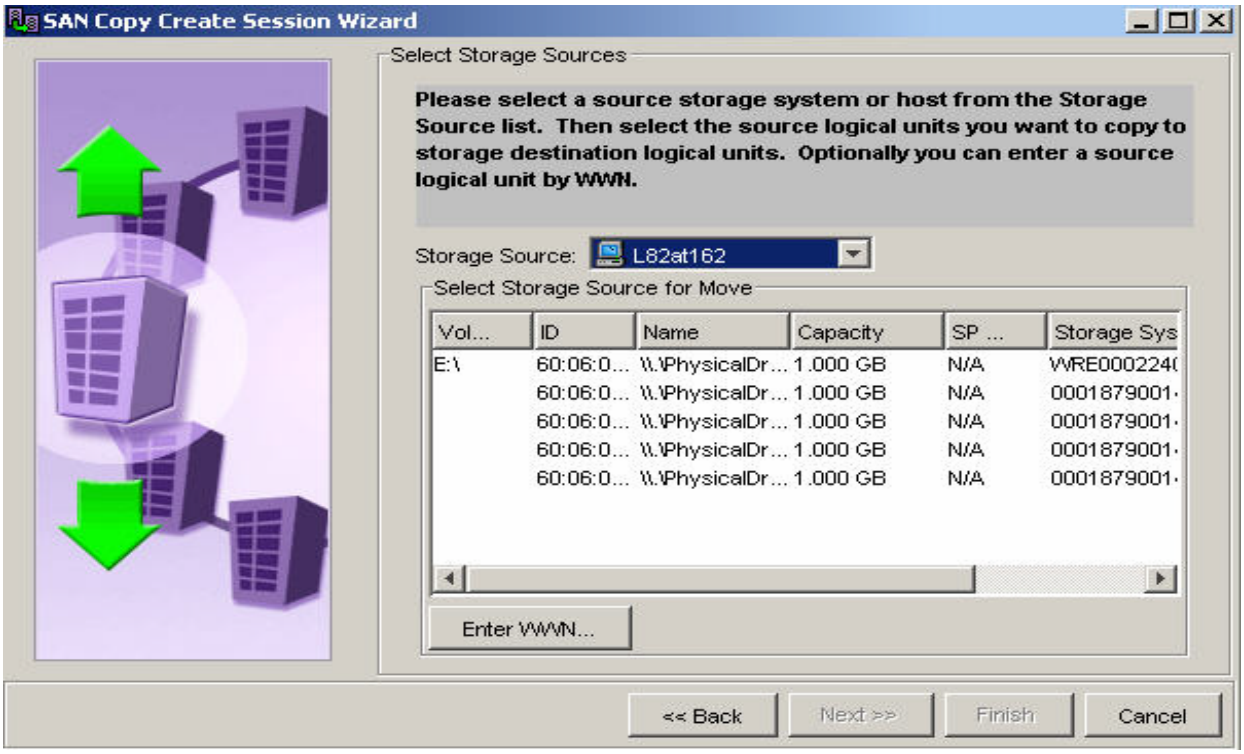

Figure 14. Symmetrix volume as seen from Navisphere

Figure 15 shows an example of a SAN Copy session that has a source on a Symmetrix storage system and a destination on a CX400 (SANCOPY_CX400-1).

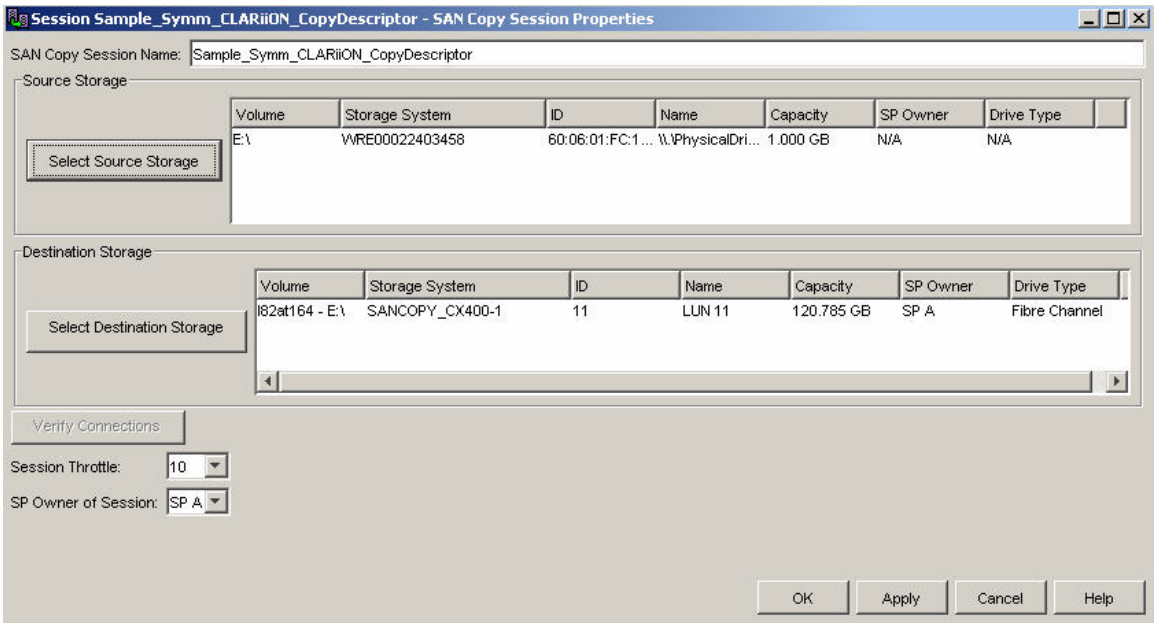

Figure 15. SAN Copy session property sheet

In addition to choosing the Symmetrix storage device in Navisphere, the WWN of the device can be entered directly. To discover the volume WWN, use the **symdev** command, as instructed in the previous section. Then, enter the device WWN using the Enter WWN button in the dialog box to select source or destination storage.

Running the SAN Copy session

Once the session is created, it can be started from within Navisphere or using NaviSecCLI. Figure 16 illustrates how the SAN Copy session is started from within the Navisphere GUI.

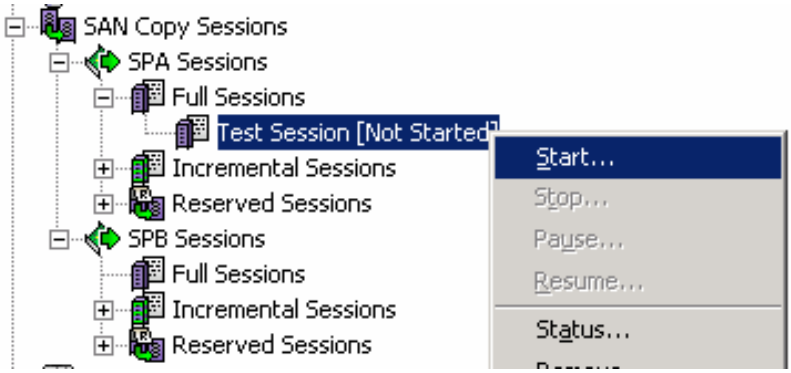

Figure 16. Starting the SAN Copy session

To start the SAN Copy session, simply right-click the session in Navisphere. To check the progress of the SAN Copy session through Navisphere, right-click the session and select **Status**.

Appendix B: SAN Copy/E for CX300 and AX100/150

SAN Copy/E is a modified version of the SAN Copy application that runs only on a CX300 or an AX100/150. SAN Copy/E was developed to extend the core-to-edge replication options. Before SAN Copy/E, SAN Copy allowed data to be incrementally copied *to* a CX300 or AX100/150, but it could only perform full transfers *from* the CX300 or AX100/150 by a SAN Copy hosting system; SAN Copy/E allows data to be incrementally copied *from* a CX300 or AX100/150 system. As with SAN Copy, SAN Copy/E can be used over IP, provided that EMC-supported distance extenders (FC to IP switches) are used.

SAN Copy/E is designed to perform incremental pushes to a CX400 or above storage system with SAN Copy installed. Therefore, with SAN Copy/E, the following operations are *not supported:*

- Copying between a CX300 and an AX100/150
- Copying between two CX300s, or between two AX100/150s
- Intra-storage-system copies within CX300s or AX100/150
- Copying to third-party storage systems.

SAN Copy/E management

The Navisphere Manager GUI and CLI provide the same look and feel for SAN Copy/E as for SAN Copy. This means that Navisphere Manager must be installed on an AX100/150 to use SAN Copy/E. Like SAN Copy, the user can launch the SAN Copy/E wizard by right-clicking the storage system and selecting **SAN Copy** > **Create Session**. Alternatively, the user can create a SAN Copy session by right-clicking on the LUN and selecting **SAN Copy** > **Create Session** from the LUN.

SAN Copy/E system limits

Table 5 provides the limits associated with SAN Copy/E.

Table 5. SAN Copy/E storage system limits

Storage system	CX300	AX150, AX100
Sessions per Storage System (full or incremental)		
Defined sessions	300	100
Running sessions (split over two SPs, if present)	4	2
Destination LUNs		
Per source	50	50
Incremental Sessions		
Per storage system	25	10
Per source LUN	8	1

On the CX300, the SAN Copy incremental session limits are shared with SnapView; on the AX100/150, they are not. For instance, if a LUN on a CX300 already has eight SnapView sessions running on it, an incremental SAN Copy/E session cannot be created on the same source LUN until the user stops at least one SnapView session. Alternatively, on an AX100/150, a user may have an existing SnapView session, as well as an incremental SAN Copy/E session.