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EMC CLARiiON Open Systems Configuration Guide

For CX200, CX400, CX600, FC4500, FC4700, FC5300, FC5500, and FC5700 Systems

Notice and Trademark Information

Trademark Information

EMC CLARiiON Open Systems Configuration Guide
CX200[1], CX400, CX600, FC4500, FC4700[2], FC5300[3], FC55003, and FC5700 Storage Systems

This document describes the supported configurations for the EMC CLARiiON Fibre Channel disk-array storage-systems. It lists general configuration rules for storage area network storage (SAN), direct attached storage (DAS), hub attached storage, clustered servers, non-disruptive software installation (NDU), EMC PowerPath, CLARiiON Driver Extensions (CDE) and Application-Transparent Failover (ATF), Access Logix, SnapView, and MirrorView. For each supported operating system, it describes the valid server-to-storage system configurations. The descriptions reference sample configuration diagrams at the end of the guide. Accompanying each diagram is a table that lists the supported operating systems, storage systems, and server and storage-system software requirements. The operating systems and storage systems shown in the diagrams are representative only.

This document also describes the supported backup configurations for EMC CLARiiON Fibre Channel disk-array storage-systems.

Changes from the previous revision are in blue bold.

Changes with This Revision

IMPORTANT: To avoid confusion between *PowerPath Base* (the new version of PowerPath) and *PowerPath Basic* (the term used to refer to the PowerPath functionality that ships with the CLARiiON server utility kits), we use the term *Utility Kit PowerPath* instead of *PowerPath Basic*. For more information on PowerPath Base and Utility Kit PowerPath, see *Failover Configuration Rules* (page 15).

- **Adds PowerPath Base to places in the following sections from which it was missing**
  - *Path Rules* **(page 11)**
  - *NetWare Configurations* **(page 54)**
  - *Windows 2000 Configurations* **(page 73)**
  - *Sample Configuration Diagrams* **(page 88)**

- **Adds support for Linux PowerPath and Linux PowerPath Base *without* an RPQ and for Utility Kit PowerPath to the**
  - *Path Rules* **(page 11)**
  - *Failover Configuration Rules* **(page 15)**
  - *Linux Configurations (*page 46*)*
  - *Sample Configuration Diagrams* **(page 88)**
  Note that PowerPath for Linux is currently only supported on non-clustered servers.

- **Deletes lack of SP failover or non-disruptive software installation (NDU) for NetWare with ATF or CDE from**
  - *Non-Disruptive Software Installation (NDU) Configuration Rules* **(page 16)**
  - *NetWare Configurations* **(page 54)**
  - *Sample Configuration Diagrams* **(page 88)**
  Note: NDU is supported for NetWare CDE and ATF with currently shipping revisions of HBA drivers.

- **Adds a *QuickLoop* section (page 22) to the *DS-xxB Series Switches* section.**

- **Adds Netware Cluster Service support for the CX200 in direct connect configurations to the**
  - *NetWare Direct Connections* **table (page 59)**
  - *Dual Server Direct - Dual HBA Ports /Dual Ports Per SP (CX200, CX400, CX600, FC4500, FC4700, FC5300)* **configuration drawing (page 114)**

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1. CX200 storage systems available from selected channels only.
2. FC4700 refers to both the FC4700 and FC4700-2 models everywhere except in *Port Speed Rules* section and the *Backup Configurations (CX200, CX400, CX600, FC4500, FC4700, FC5300, FC5700)* section.
3. Support only - no new shipments.

Contents

For details on server environments, including supported host bus adapters (HBAs), see the CLARiiON sections in the *EMC Support Matrix.*

For Symmetrix switch topology information, see the following documents on the EMC Sales Web Site:

- *EMC DS-8B and DS-16B Topology Guide for Departmental Switches in a Symmetrix Environment* P/N 300-999-161
- *EMC Connectrix Enterprise Storage Network System Topology Guide* P/N 300-600-008
- *Connectrix Enterprise Storage Network System Planning Guide* P/N 069001082

EMC Policies and Requirements for Open Systems Server Support

This section describes EMC's policies and requirements for any document characterized as an *EMC Open Systems Support Matrix*[1].

Purpose and Limitations of this Document

This document is being provided for informational purposes only and may change at any time. This version supersedes and replaces all previous versions. The information is to serve only as a guide for those configurations/products, which EMC has qualified. This document identifies and lists various vendor servers and integral components that have been tested and qualified by EMC for use with EMC products. Vendor components include, but are not limited to, server operating systems, HBAs (host bus adapters), associated drivers, firmware and BIOS; Fibre Channel switches, hubs and bridges. This document also lists various vendors' software, cluster software, tape hardware, heterogeneous information storage, and configurations that EMC has tested and/or qualified for use with EMC products. The information included in this document is intended as a guide in the configuration of systems for EMC's products. It is not intended to be the sole resource for system configuration. For more information or questions not found in this document, please see relevant vendor documentation, or contact your EMC Sales or EMC Customer Service representative.

Policies for Qualifying Systems

Policies and procedures for support of EMC products are set forth in the customer's applicable agreements. EMC's publication of information relating to system configurations covers only those outlined in this document or by approval from EMC Engineering. Other system configurations not found in this document are not qualified without EMC engineering approval. EMC has qualified hardware and software provided only by the vendors listed in this document, and servers, hardware and software from other vendors are not qualified, and may never be. Please contact your EMC Sales or EMC Customer Service representative for updates or information not included in this document. EMC maintains a large collection of the products listed above as well as third-party application software for qualification with EMC storage hardware and software to simulate customer environments, but you must consult the vendors for information about their system internals, such as hardware and associated drivers.

Policy for Future Qualification of Operating System Software Releases

The information in this document is maintained by EMC, and EMC strives to update this document with new releases of hardware, operating systems, firmware, BIOS, switch software, etc., as they become available from the vendors. EMC works with the vendors during their development and release processes in order to be fully informed at the time the vendors release new versions. EMC CLARiiON's policy is to support the latest "dot" release of the latest major release of an Operating System and the latest "dot" release of one major release back (e.g. AIX 4.3.3 and 4.2.1, or Solaris 7 and 2.6). EMC CLARiiON makes every attempt to support new major releases within 60 to 90 days of when they ship from the server vendor. When we support a new major release, the previous ("one back") release is dropped from our standard operating systems support list. For early support of such products, including vendor beta participation, contact your EMC Sales or EMC Customer Service representative.

Policy for End of Life Support

EMC strives to continue support for any installed platforms, but may remove support from this server matrix for new installations within 3 months after the vendor has announced that this platform has reached the End Of Life. EMC will continue support for existing installations of hardware, Operating Systems, and components that the vendor has officially declared to have reached End Of Life as long as support is available from the vendor.

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1. Documents characterized as an *EMC Open Systems Support Matrix* include any of the following: *EMC Open Systems Support Matrix; EMC CLARiiON Open Systems Configuration Guide; ESN Topology Design Guide; EMC Data Manager – Supported Devices, Platforms, and Clients* and the *EMC Software Support Matrix.*

General Configuration Rules

This section explains

Mixing Configurations

The ports on an SP are either unshared or shared.

The 2 ports on an SP in a CX400 or FC4700 storage system and the 4 ports on an SP in a CX600 storage system are unshared. Each unshared SP port has its own independent Fibre Channel host interface with its own unique World-Wide Port Name (WWPN). This means that you can connect

- A CX400 or FC4700 storage system to a maximum of 4 distinct direct attach (FC-AL) configurations or 4 separate fabrics in the same or different SAN (FC-SW) configurations.
- A CX600 storage system to a maximum of 8 distinct direct attach (FC-AL) configurations or 8 separate fabrics in the same or different SAN (FC-SW) configurations.

The 2 ports on an SP in a CX200[1], FC4500, or FC5300 storage system share a common Fibre Channel interface with one WWPN. This means that for a CX200, FC4500, or FC5300 storage system you can connect

- One port on each SP to the same server directly (FC-AL)
- One port on one SP to one server directly (FC-AL) and one port on the other SP to a different server directly (FC-AL) in a split-bus configuration.
- One port on each SP to one server directly (FC-AL) and the other port on each SP to another server directly (FC-AL) in a cluster configuration.
- One port on one SP to one fabric in a SAN configuration and one port in the other SP to a fabric in the same or in a different SAN configuration (FC-SW).

IMPORTANT You can connect two servers, each with two HBA ports, directly to a CX200, FC4500, or FC5300 storage system *only if* the storage system does *not* have Access Logix and the servers are clustered. You can use a CX200, FC4500, or FC5300 with Access Logix only in a SAN configuration and any CX200, FC4500, or FC5300 in a SAN configuration requires Access Logix.

Multiple Configurations for a Single Server

Depending on the number of HBA ports in a server, any server can support multiple configurations, as shown in the example on the next page. For example, a Solaris server with 12 HBA ports could be in the following configurations:

- One direct attached storage configuration with 4 HBA ports connected to a CX400.
- One direct attached storage configuration with 2 HBA ports connected to an FC4500.
- Two dual-fabric SAN configurations with 4 HBA ports connected to one fabric and 2 HBA ports connected to the other fabric.

Multiple Configurations for a Single Storage System

Since each SP in a CX400, CX600, or FC4700 storage system has unshared ports (unique WWPNs), it can be in multiple instances of the same or different configurations. In other words, a CX400, CX600, or FC4700 storage system can support simultaneous direct attach and SAN configurations, as shown in the example on the next page.

Since each SP in a CX200, FC4500, or FC5300 storage system has shared ports (same WWPN), it can support only one configuration (direct-attach or SAN), as shown in the example on the next page.

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1. CX200 storage systems available from selected channels only.

Example of a Server and a Storage System in Both SAN and Direct Attach Configurations
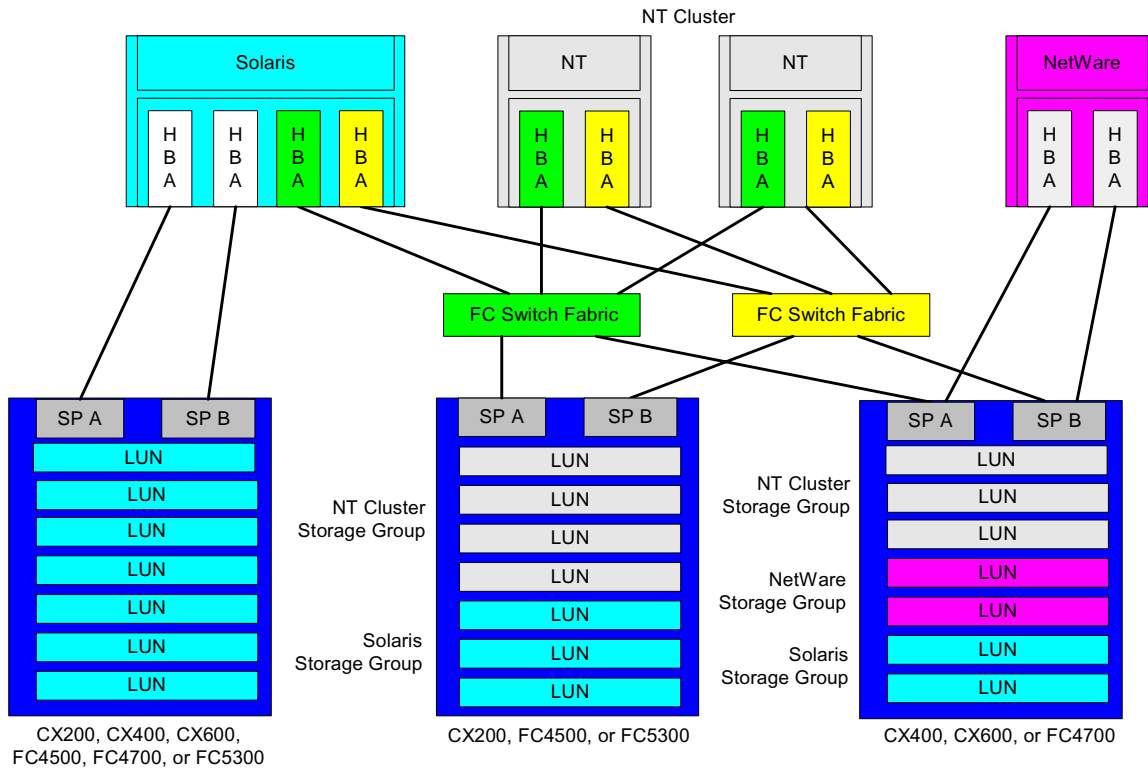
LUN Counts

The maximum number of LUNs that a single server can access on a storage system is 256 for a CX-Series storage system and **223** for an FC-Series storage system. This number may be lower depending on the operating system running on the server. For details, see the *CLARiiON Open Systems Support, Fibre Connectivity* table in the *EMC Support Matrix* (ESM).

Storage Area Network (SAN) Configuration Rules

Switch Terminology

Arbitrated Loop connection - Equivalent to a QuickLoop connection in a CLARiiON switch environment.

Domain - Equivalent to a single switch.

DWDM - (Dense Wavelength Division Multiplexing). WDM technology uses multiple lasers and transmits several wavelengths of light simultaneously over a single optical fiber. Dense WDM adds significantly more channels.

Fabric - One or more switches connected by E-Ports.

GBIC - (GigaBit Interface Converter). The GBIC converts serial electrical signals to serial optical signals and vice versa.

Hops - Number of ISLs a frame needs to traverse between the communicating server and storage system.

ISL - (Inter Switch Link). A link that connects two E_Ports on two different switches.

Path - A path is a connection between an initiator (such as an HBA port) and a target (such as an SP port in a storage system). Each HBA port that is zoned to a port on an SP is one path to that SP and the storage system containing that SP. Depending on the type of storage system and the connections between its SPs and the switch fabric, an HBA port can be zoned through different switch ports to the same SP port or to different SP ports, resulting in multiple paths between the HBA port and an SP and/or the storage system. Note that the failover software running on the server may limit the number of paths supported from the server to a single storage-system SP and from a server to the storage system. Refer to the *Path Rules* (page 11).

Quad - (DS-xxB series switches only) Ports 0-3, 4-7, 8-11, 12-15 where applicable.

SFP - Small Form factor Plugable transceiver.

Single-initiator Zoning - Each HBA port has a separate zone that contains it and the SP ports with which it communicates.

Trunking - Logically merging up to four ISLs into a single link, which enables dynamic load balancing.

Number of Servers and Storage Systems
As many as the available switch ports, provided each server follows the fan-out rule below and each storage system follows the fan-in rule below, using WWPN switch zoning.

Switches
8-port, 16-port, 32-port departmental switches; 32-port and 64 port director-class switches. For more information, see the Switch Topology Rules (page 20).

Fibre Connectivity
Fibre Channel Switched Fabric (FC-SW) connection to all server types, subject to the restrictions in the CLARiiON sections of the *EMC Support Matrix*; Arbitrated Loop Emulation mode (QuickLoop) for connection to FC-AL HP-UX servers.

Fan-In Rule
A server can be zoned to a maximum of 4 storage systems.

Fan-Out Rule
An initiator is any of the following devices that have access to an SP:
- HBA port in a server
- Remote mirror port in another storage system.

Note that some HBAs have multiple ports. Each HBA port that is zoned to an SP port is one path to that SP and the storage system containing that SP. Depending on the type of storage system and the connections between its SPs and the switch fabric, an HBA port can be zoned through different switch ports to the same SP port or to different SP ports, resulting in multiple paths between the HBA port and an SP and/or the storage system. Note that the failover software running on the server may limit the number of paths supported from the server to a single storage-system SP and from a server to the storage system. Refer to the *Path Rules* (page 11).

For CX200[1]
15 initiators per SP, each with a maximum of one (single) path to an SP; maximum of 15 servers.

For CX600
32 initiators per SP port and maximum of 256 initiators per CX600 available for server connections. Ports 0, 1, 2, and 3 on each SP in any CX600 handle server connections. Port 3 on each SP in a CX600 *with* MirrorView also handles remote mirror connections. In a remote mirror configuration, each path between SP A port 3 on one storage system and SP A port 3 on another storage system counts as one initiator for each port 3. Likewise, each path between SP B port 3 on one storage system and SP B port 3 on another storage system counts as one initiator for each port 3.

For FC4500 with Access Logix or FC4700 with Base or Access Logix software 8.41.xx or lower
15 servers to 1 storage system; each server with a maximum of one (single) path to an SP.

For FC4700 with Base or Access Logix software 8.42.xx or higher or for CX400
32 initiators per SP port for a maximum of 128 initiators per CX400 or FC4700. Each port on each SP supports 32 initiators. Ports 0 and 1 on each SP in a CX400 or FC4700 handles server connections. Port 1 on each SP in a CX400 or FC4700 *with* MirrorView also handles remote mirror connections. In a remote mirror configuration, each path between SP A port 1 on one storage system and SP A port 1 on another storage system counts as one initiator for each port 1. Likewise, each path between SP B port 1 on one storage system and SP B port 1 on another storage system counts as one initiator for each port 1.

For FC5300 with Access Logix software[2]
4 servers (eight initiators) to 1 storage system.

Paths from a Server to an SP

Access from a server to a Storage Processor (SP) in a storage system can be either single path, multi-path, or alternate path. Cabling HBA ports, SP ports, and optional switch fabrics in specific ways, *enables* paths from a server to an SP. Switch zoning *allows* the paths and *enforces* the paths rules.

Note: Some HBAs have two ports. Each port that is zoned to a port on an SP is one path to that SP and the storage system containing that SP. Depending on the type of storage system and the connections between its SPs and the switch fabric, an HBA port can be zoned through different switch ports to the same SP port or to different SP ports, resulting in multiple paths between the HBA port and an SP and/or the storage system. Note that the failover software running on the server may limit the number of paths supported from the server to a single storage-system SP and from a server to the storage system. Refer to the *Path Rules* (page 11).

Single Path - A server has only one path to one or both storage processors (SPs) in a storage system. All I/O to a LUN is sent down the path to SP that owns the LUN.

Multi-Path - A server with multiple active paths to an SP in the storage system. The server can use each path to send I/O to the same LUN (a LUN is owned by a specific SP). Supporting multiple paths to an SP also allows dynamic load balancing, which distributes I/O to a LUN across the multiple paths to the SP that owns the LUN. PowerPath distributes I/O across multiple paths using one of several user-selectable algorithms. Multi-path ATF distributes I/O across multiple paths using a "round-robin" algorithm.

Alternate Path - A server has more than one path to each SP in the storage system, but only one is active. Each HBA in the server can have more than one path to the storage system, but the server can use only one HBA port (the primary) for I/O to a LUN. If the primary path becomes unavailable, the server uses the HBA ports designated as "alternates" to that SP. Alternate path access is effectively equivalent to multi-path access with dynamic load balancing disabled. Some operating systems (such as HP-UX PVLinks and IRIX) support static load balancing by letting you assign a primary path to each LUN. With static load balancing, I/O occurs over the primary path only (the alternate paths are for failover only).

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1. CX200 storage systems available from selected channels only.

2. FC5300 SAN configuration available from selected channels only; MIA required for optical connect.

Path Rules

The table below is for servers with failover software. If a server does not have failover software, only one path from the server to an SP is supported. For information on the storage systems supported by each type of failover software, see Failover Configuration Rules (page 15).

Server	Failover Software	Access Type[a]	Number of Paths Supported From a Server to One			
			CX200 SP	CX400 or CX600 SP	FC4700-Series SP	Storage System
AIX	PowerPath	Multi-Path	N/A	8	8	16
	Utility Kit Power Path[b]	Single Path	N/A	1	1	1
	ATF	Single Path	N/A	N/A	1	2
	CDE	Single Path	N/A	N/A	1	1
HP-UX	Native	Alternate Path[c]	N/A	4	4	8
IRIX	Native	Alternate Path[d]	N/A	2	2	4
Linux	None	Single Path	1	1	1	2
	PowerPath	Multi-Path	8	8	8	16
	PowerPath Base[b]	**Single Path**	**1**	**N/A**	**N/A**	**2**
	Utility Kit Power Path[b]	Single Path	1	1	1	1
NetWare	PowerPath	Multi-Path	N/A	8	8	16
	PowerPath Base[b]	**Single Path**	**1**	**N/A**	**N/A**	**2**
	Utility Kit Power Path[b]	Single Path	N/A	1	1	1
	ATF	Single Path	N/A	N/A	1	2
	CDE	Single Path	N/A	N/A	1	1
Solaris	PowerPath	Multi-Path	N/A	8	8	16
	Utility Kit Power Path[b]	Single Path	N/A	1	1	1
	DMP with CLR-ASL	Alternate Path	N/A	8	8	16
	ATF	Single Path	N/A	N/A	1	2
	CDE	Single Path	N/A	N/A	1	1
Tru64 UNIX	Native	Multi-Path[e]	N/A	4	4	8
Windows 2000	PowerPath	Multi-Path	8	8	8	16
	PowerPath Base[b]	**Single Path**	**1**	**N/A**	**N/A**	**2**
	Utility Kit Power Path[b]	Single Path	1	1	1	1
	multi-path ATF v2.1.4 or greater	Multi-Path[f]	N/A	N/A	8	16
	CDE	Single Path	N/A	N/A	1	1
Windows NT	PowerPath	Multi-Path	8	8	8	16
	Utility Kit Power Path[b]	Single Path	1	1	1	1
	multi-path ATF v2.0.7 or greater	Multi-Path[f]	N/A	N/A	8	16
	CDE	Single Path	N/A	N/A	1	1

a. Failover software that supports alternate path or multi-path access to an SP also supports single-path access to an SP. Only single-path access is supported to a FC4500, FC5300, FC5500, or FC5700.

b. For a description of PowerPath Base or Utility Kit PowerPath, see page 15.

c. Alternate path access from an HP-UX server is supported only to a CX400, CX600, CX4500, or FC4700.

d. Alternate path access from an IRIX server is supported only to a CX400, CX600, or FC4700.

e. Multi-path access from a Tru64 UNIX server is supported only to a CX400, CX600, or FC4700.

f. Multi-path access from a Windows 2000 or Windows NT server is supported only to an FC4700.

Sample CX600 configurations

Some examples of valid server connections to a CX600 without MirrorView are

- Highly-available dual-HBA configuration with minimum load-balancing:
  - 128 servers, each with 2 HBA ports
  - Each HBA port cabled and zoned to allow it a path to only one port on one SP
    (256 HBA ports x 1 path = 256 initiators, the maximum number per CX600)
  Note that each server has one path to each SP for a total of two paths per server to the storage system.

- Highly-available dual-HBA configuration with maximum load-balancing:
  - 16 servers, each with 2 HBA ports
  - Each HBA port cabled and zoned to allow it a path to all four ports on each SP
  - Each server must support eight paths to an SP
    (32 HBA ports x 8 paths = 256 initiators, the maximum number per CX600)
  Note that each server has sixteen paths to the storage system.

Some examples of valid server connections to a CX600 with MirrorView are

- Highly-available dual-HBA configuration with minimum load-balancing
  - 127 servers, each with 2 HBA ports
  - Each HBA port cabled and zoned to allow it a path to only one port on one SP
  - MirrorView connections from the CX600 to one other storage system
    (254 HBA ports x 1 path = 254 initiators. These 254 initiators + 2 MirrorView initiators = 256 initiators, the maximum number per CX600)
  Note that each server has one path to each SP for a total of two paths per server to the storage system.

- Highly-available dual-HBA configuration with maximum load-balancing
  - 15 servers each with 2 HBA ports
  - Each HBA port cabled and zoned to allow it a path to all four ports on each SP
  - MirrorView connections from the CX600 to four other storage systems
  - Each server must support eight paths to an SP
    (30 HBA ports x 8 paths = 240 initiators. These 240 initiators + 8 MirrorView initiators = 248 initiators, which leaves 8 initiators available for one or more servers with less paths to the CX600.)
  Note that each server has sixteen paths to the storage system.

Sample CX400 or FC4700 configurations

Some examples of valid server connections to a CX400 or FC4700 without MirrorView are

- Highly-available dual-HBA configuration with minimum load-balancing
  - 64 servers, each with 2 HBA ports
  - Each HBA cabled and zoned to allow it a path to only one port on one SP
    (128 HBA ports x 1 path = 128 initiators, the maximum number per CX400 or FC4700)
  Note that each server has one path to each SP for a total of two paths per server to the storage system.

- Highly-available dual-HBA configuration with maximum load-balancing
  - 16 servers each with 2 HBA ports
  - Each HBA port cabled and zoned to allow it a path to both ports on each SP
  - Each server must support four paths to an SP
    (32 HBA ports x 4 paths =128 initiators, the maximum number per CX400 or FC4700)
  Note that each server has eight paths to the storage system.

Some examples of valid server connections to a CX400 or FC4700 with MirrorView are

- Highly-available dual-HBA configuration with minimum load-balancing
  - 63 servers, each with 2 HBA ports
  - Each HBA port cabled and zoned to allow it a path to only one port on one SP
  - MirrorView connections from the CX400 or FC4700 to one other storage system
    (126 HBA ports x 1 path = 126 initiators. These 126 initiators + 2 MirrorView initiators = 128 initiators, the maximum number per CX400 or FC4700).
  Note that each server has one path to each SP for a total of two paths per server to the storage system.

- Highly-available dual-HBA configuration with maximum load-balancing
  - 15 servers each with 2 HBA ports
  - Each HBA port cabled and zoned to allow it a path to both ports on each SP
  - MirrorView connections from the CX400 or FC4700 to four other storage systems
  - Each server must support four paths to an SP
    (30 HBA ports x 4 paths = 120 initiators. These 120 initiators + 8 MirrorView initiators = 128 initiators, the maximum number per CX400 or FC4700.)
  Note that each server has eight paths to the storage system.

Sample CX200 configurations

- Highly-available dual-HBA configuration with no load-balancing
  - 15 servers, each with 2 HBA ports
  - Each HBA port cabled and zoned to allow it a path to only one port on one SP
    (30 HBA ports x 1 path = 30 initiators, the maximum number per CX200)
  - Each server runs PowerPath Base to provide HBA failover, but no load balancing.

  Note that if the server has more than 2 HBA ports, you can have load-balancing between the server and the fabric, but not between the server and the storage system because a CX200 can have only one port per SP connected to a fabric.

Access Logix Models

AL200-Tx for CX200, AL400-Tx for CX400, AL600-Tx for CX600, ACLG47-Tx for the FC4700, ACLG45-Tx for the FC4500, ACLG53-Tx or AL53Ty-Tx for FC5300[1], where x is the storage tier and y is either 1 or 5. For FC4500 SAN configuration, ACLG45-Tx must be v6.32.01 or higher with PROM v2.08 or higher.

Direct Attached Storage (DAS) Configuration Rules

Storage System without Access Logix

Storage Systems - Any
If more than one server is directly attached to a storage system, all servers attached to the storage system must be in the same cluster.

Storage System with Access Logix

Storage Systems - CX400, CX600, and FC4700. AL400-Tx for CX400, AL600-Tx for CX600, and ACLG47-Tx for the FC4700, where x is the storage tier.
Number of Servers
  CX600 - 8 servers maximum
  CX400 or FC4700 - 4 servers maximum
Note: Direct attach is not supported for a CX200, FC4500, or FC5300 with Access Logix.

Hub Attached Configuration Rules

Number of Servers and Storage Systems

Servers - 1 to 2, running the same operating system.
Storage Systems - 1 to 4 FC4500, FC5300, FC5500, and FC5700.

Port Speed Rules

Storage-System SP Port Speed

Storage System	SP Port Speeds
CX-Series	1 or 2 Gbits[a]
FC4500	1 Gbit
FC4700-2	1 or 2 Gbits[a]
FC4700	1 Gbit
FC5300	1 Gbit

a. The factory default setting for a CX-Series SP
is 2 Gbits and for an FC4700-2 SP is 1 Gbit

The speed of each port on a CX-Series or FC4700-2 SP can be set individually using Navisphere Manager or CLI.

Switch Port Speeds

The speed (auto-negotiate, 1 Gbit, or 2 Gbit) of the each port on a DS-16B2, DS-24M2, or DS-32B2 switch can be set individually. The default speed of each port is auto-negotiate. If a switch port is connected to an LP7000 HBA port, the switch port's speed must be set to match the speed (1 Gbit or 2 Gbit) of the HBA port. For example, if you connect an LP7000 HBA to a 2-Gbit switch port, you must set the switch port's speed to 1 Gbit.

Clustered Server Configuration Rules

Clustering software is required whenever multiple servers running the same operating system are connected to the same storage system (non-Access Logix) or to the same Storage Group (Access Logix). The servers must be part of the same cluster.

Number of Nodes

See the CLARiiON sections in the *EMC Support Matrix*.

Supported Operating Systems

All. Note clustering is not currently supported on a Linux server running PowerPath.

Number of HBA Ports

The number of HBA ports depends on the operating system and the failover software on the server. For information on the failover software supported for a particular operating systems, see the *Failover Configuration Rules* section later on this page.

For PowerPath - 2 or more per server, except for Linux, which can have only 1 per server, and NetWare, Windows 2000, and Windows NT servers, which can have 1 or more.

For PowerPath Base - 1 or 2 per server, except for Linux, which must have only 1 per server.
For ATF - 2 per server, except for IRIX, NetWare, Windows 2000, and Windows NT servers, which can have 1 to 2 HBA ports.

Note: Oracle9iRAC for Windows 2000 requires 2 HBA ports. If a Windows 2000 or Windows NT server running MicroSoft Cluster Server is connected to a storage system containing the boot device, it must have 2 HBA ports: 1 for the boot device and 1 for cluster services.

HBA-Port Types

HBA ports from the same HBA vendor, server bus type, and Fibre Channel link speed are required for each path to a storage system.

Paths to SP
With PowerPath - 8 paths maximum from a server to each SP.
Without PowerPath - 1 path maximum from a server to each SP.

Software Requirements
PowerPath or ATF where available. PVLinks for HP-UX. Native failover for IRIX (IRIX logical volume manager (xlv) must manage all LUNs). TruCluster for Tru64 UNIX.

Notes
Clusters are not supported over extended distances.
Clustered servers on fabrics connected to FC-Series storage systems running 8.41.xx software must be zoned to the same SP ports. FC-4700 Series storage systems connected directly to clustered servers must run 8.41.xx or higher software.

Failover Configuration Rules

IMPORTANT: To avoid confusion between *PowerPath Base*[1] and *PowerPath Basic* (the term used to refer to the PowerPath functionality that ships with the CLARiiON server utility kits), the term *Utility Kit PowerPath* will be used in place of *PowerPath Basic*. Utility Kit PowerPath is for servers with a *one* HBA connected to the storage system, and PowerPath Base for servers with *two* HBAs connected to the storage system. Both Utility Kit PowerPath and PowerPath Base support only a *single path* to each SP, and *neither* supports load balancing. Utility Kit PowerPath is a replacement for CDE. The term *PowerPath* refers to PowerPath with all its features, that is, support for servers with single or multiple HBAs with *multiple paths* to an SP and load balancing.

Supported Hosts
PowerPath and Utility Kit PowerPath
  AIX, Linux, Netware, Solaris, Windows 2000, and Windows NT. Utility Kit PowerPath for Linux will be available when PowerPath for Linux becomes a standard product.
PowerPath Base
  Linux, NetWare, and Windows 2000.
DMP
  Solaris; requires Veritas Volume Manage r3.2 or higher and EMC CLR-ASL.
  Cluster support is restricted to Veritas Cluster Server. DMP with CLR-ASL can be used instead of PowerPath for failover without load balancing. DMP limits cluster support to Veritas Cluster Server.
ATF or CDE
    AIX, NetWare, Solaris, Windows 2000, and Windows NT.

Failover Coexistence
Only one of the following EMC failover software applications can run on a server: PowerPath, PowerPath Base, Utility Kit PowerPath, DMP with CLR-ASL, ATF, or CDE.

Supported Storage Systems
PowerPath and Utility Kit PowerPath
  CX200, CX400, and CX600.
  FC4500 with Access Logix 6.32.16 or higher or Base Software 5.32.16 or higher (no AIX support).
  FC4700 with Access Logix 8.45.52 or higher or Base Software 8.45.02 or higher.
  FC5300 with Access Logix 6.24.07 or higher or Base Software 5.24.07 or higher (no AIX or Linux support).
PowerPath Base
  CX200 with shipping Access Logix and Base software and FC4500 with Access Logix 6.32.16 or higher or Base Software 5.32.16 or higher.
DMP
  CX400 and CX600.
  FC4700 with Access Logix 8.46.56 or higher or Base Software 8.46.06 or higher.

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1. PowerPath Base is available from selected channels only.

ATF or CDE
  All except CX200, CX400, and CX600.

Number of HBA Ports

If the server has *multiple* HBAs connected to the same storage system, and has
- Only one path connected to each SP: PowerPath, PowerPath Base, DMP with CLR-AS, or ATF is supported.
- Multiple paths connected to each SP: PowerPath, DMP with CLR-ASL, or multi-path ATF is supported.
  (Only ATF for Windows 2000 and Windows NT has multipath support.)
If a server has a *single* HBA connected to the storage system, and has
- Only one path connected to each SP: PowerPath, PowerPath Base, Utility Kit PowerPath, DMP with CLR-ASL, ATF, or CDE is supported.
- Multiple paths connected to each SP: PowerPath, DMP with CLR-ASL, or ATF is supported.
If the server is part of a split-bus configuration, *none* of the following are supported: PowerPath, PowerPath Base, Utility Kit PowerPath, DMP with CLR-ASL, ATF, or CDE.

HBA-Port Types

HBA ports from the same HBA vendor and with the same server bus type are required for each path to a storage system. For example, on a Solaris server you can connect either Emulex PCI or SBus HBA ports, but not both types, to the same storage system.

Non-Disruptive Software Installation (NDU) Configuration Rules

Supported Servers
Servers - All **but Linux without PowerPath Base, PowerPath or Utility Kit PowerPath.**

Supported Storage Systems
CX200, CX400, CX600, and FC4700.

Supported Configurations
Any with PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, CDE, HP-UX PVLinks, IRIX native failover (requires that IRIX volume manager, **xlv**, manage all LUNs, or Tru64 UNIX native failover.

Access Logix Configuration Rules

Supported Storage Systems
CX200, FC4500, and FC5300[1]

Access Logix required in all SAN configurations.

Access Logix is *not* allowed in any direct-attach configuration or with hub connections.

CX400, CX600, and FC4700

Access Logix is required for

- Multiple direct-attached independent servers (not split-bus)
- Multiple independent servers or clusters in all SAN configurations
- SnapView and MirrorView
- More than 256 LUNs for CX400 or CX600. Note that an FC4700 supports a maximum of 223 LUNs. Note that this limits the maximum number of LUNs that a single server can access to 256 on a CX400 or CX600 and to 223 on an FC4700. This number may be lower depending on the operating system running on the server; see the *CLARiiON Open Systems Support, Fibre Connectivity* table in the *EMC Support Matrix* (ESM) for details.

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1. FC5300 SAN configuration available from selected channels only; MIA required for optical connect.

Access Logix is not required for

- Single server or single cluster in a SAN or direct-attach configuration
- Multiple independent servers in a direct-attach split-bus configuration.

Models

AL200-TX for CX200, AL400-TX for CX400, AL600-Tx for CX600, ACLG47-Tx for the FC4700, ACLG45-Tx for the FC4500, and ACLG53-Tx for FC5300[1], where x is the storage tier. For FC4500 SAN configuration, ACLG45-Tx must be v6.32.01 or higher with PROM v2.08 or higher.

Storage Groups

1 per server per storage system.

Software Requirements

Navisphere Manager for any storage systems or Navisphere Manager Base for CX200.

SnapView Configuration Rules

Supported Storage Systems

CX400, CX600, and FC4700.

Models

SV-Tx where x is the storage tier.

Software Requirements

Access Logix.

Clones

8 maximum per source LUN.
50 maximum (includes source LUN and primary or secondary MirrorView images) per CX400 storage system.
100 maximum (includes source LUN and primary or secondary MirrorView images) per CX600 or FC4700 storage system.

Clone Groups

25 maximum per CX400 storage system.
50 maximum per CX600 or FC4700 storage system.

Clone Private LUNs

2 per storage system required.

Snapshot Cache LUNs

50 maximum per CX400 storage system.
100 maximum per CX600 or FC4700 storage system.

Snapshots (Snapshot LUNs)

8 maximum per source LUN.
150 maximum per CX400 storage system.
300 maximum per CX600 or FC4700 storage system.
Cannot be in the same Storage Group as the corresponding source LUN.

Snapshot Sessions

8 maximum per source LUN.
50 maximum concurrent sessions (sessions running at the same time) per CX400 storage system.
100 maximum concurrent sessions per CX600 or FC4700 storage system.

Supported Servers

All. Servers connected to the Storage Group with the snapshot source LUNs and servers connected to the Storage Group with the snapshots of the source LUNs must run the same operating system.

Number of Servers

At least 1 whose LUNs you want to snapshot (the source LUNs) and 1 for the snapshot LUNs.

Clustered Servers

You can configure a clustered server to access a source LUN, but not to access both the source LUN and its snapshot. Only a server outside the cluster should access the snapshot.

Example of a Windows Cluster in a SnapView Configuration with Tape Backup

Windows 2000 Microsoft Cluster Server   Backup Server

Windows 2000   Windows 2000   Windows 2000

HBA HBA   HBA HBA   HBA HBA

FC Fabric   FC Fabric

SP A   SP B   FC-to-SCSI Bridge

Windows 2000 Cluster Storage Group

SnapView Source LUN 1 (Database Log)	→	SnapView Snapshot of LUN 1 (Database Log)
SnapView Source LUN 2 (Database Files)	→	SnapView Snapshot of LUN 2 (Database Files)
LUN 3		LUN 13
SnapView Souce LUN 4	→	SnapView Clone of LUN 4
		LUN 15

Backup Storage Group

Tape Library

Tape Drive

Tape Drive

Tape Drive
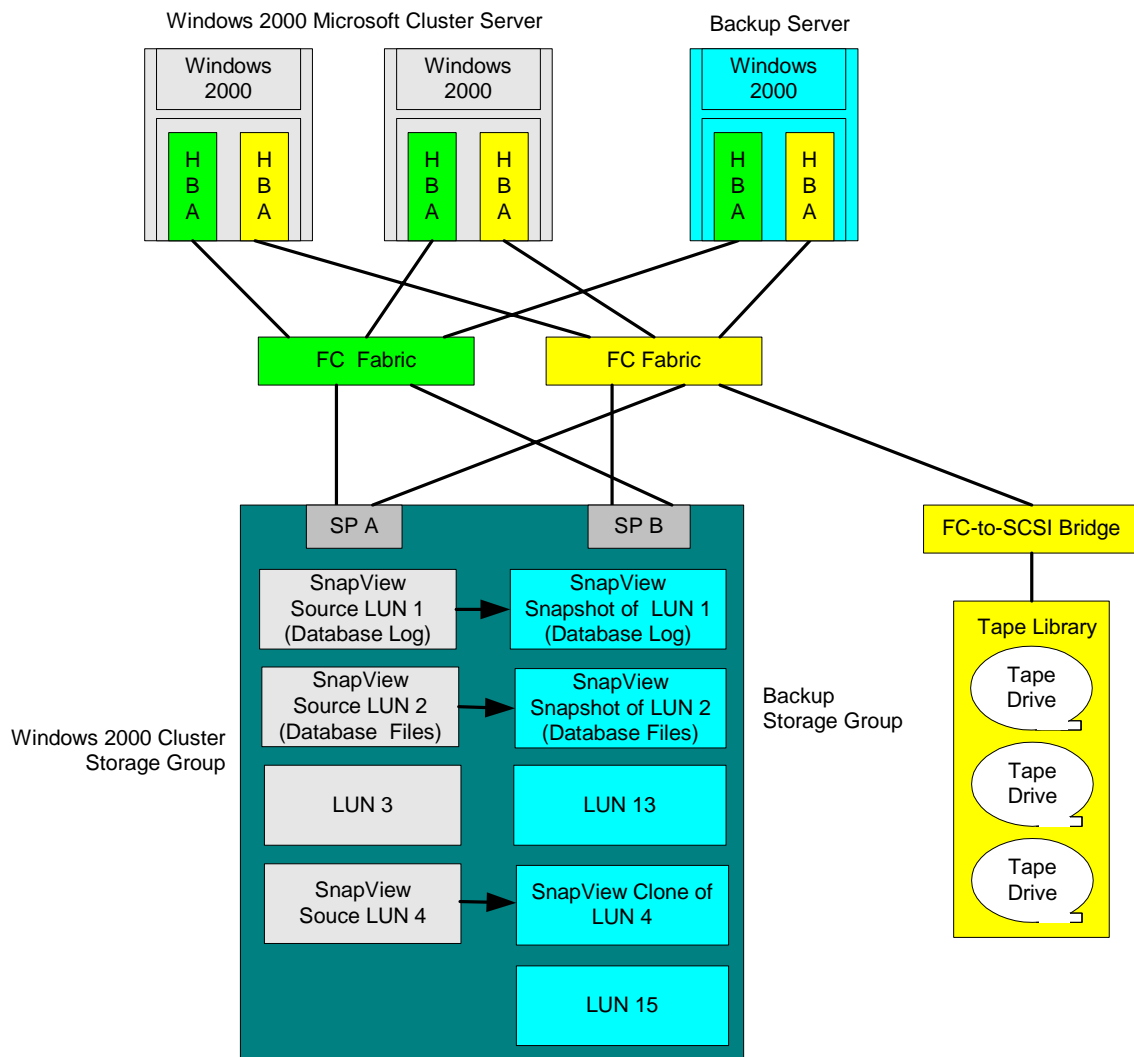
MirrorView Configuration Rules

Supported Storage Systems

CX400, CX600, and FC4700, mirrored to themselves or each other. (See the *EMC Support Matrix* for the required revisions of FC4700 Access Logix and MirrorView). Port 3 on each CX600 SP and port 1 on each CX400 or FC4700 SP is used for remote mirror connections. SP mirror ports and SP non-mirror ports (host I/O ports) must *not* be in the same switch zone. If an HBA port is using CX600 SP ports 0, 1, 2, and/or port 3 for normal I/O and is also using port 3 for remote mirror data, you should have one switch zone for the HBA port and the normal I/O ports and one zone for the HBA port and the ports for remote mirror data. Similarly, if an HBA port is using CX400 or FC4700 SP port 0 and/or port 1 for normal I/O and is also using port 1 for remote mirror data, you should have one switch zone for the HBA port and the normal I/O ports and one zone for the HBA port and the ports for remote mirror data.

Note: In a MirrorView-over-IP configuration, the mirror ports are dedicated to mirroring and cannot be used for host I/O.

Models

MV-Tx where x is the storage tier.

Software Requirements

Access Logix.

Mirror Images

1 primary image per mirror. Mirroring a system disk is not supported for MirrorView-over-IP.
0 to 2 secondary images per mirror. For MirrorView-over-IP, only 0 to 1 secondary images. For a CX400 storage system, 50 images maximum (total of primary and secondary images) per storage system with 25 primary images maximum configured to use the write intent log. For a CX600 or FC4700 storage system, 100 images maximum (total of primary and secondary images) per storage system with 50 primary images maximum configured to use the write intent log.

Note: A storage system can have only one image of a mirror.

Supported Servers

All.

SP Port Connections

SP A port 3 (CX600) or port 1 (CX400, FC4700) and SP B port 3 (CX600) or port 1 (CX400, FC4700) on both the primary and secondary storage systems must run at the same Fibre Channel link speed.

SP Port Direct Connections - Direct connection between:
- SP A port 3 (CX600) or port 1 (CX400, FC4700) on primary and secondary storage systems
- SP B port 3 (CX600) or port 1 (CX400, FC4700) on primary and secondary storage systems

SP Port Switch Connections - 2 switch zones:
- SP A port 3 (CX600) or port 1 (CX400, FC4700) on primary storage system and SP A port 3 (CX600) or
  port 1 (CX400, FC4700) on secondary storage system
- SP B port 3 (CX600) or port 1 (CX400, FC4700) on primary storage system and SP B port 3 (CX600) or
  port 1 (CX400, FC4700) on secondary storage system
If a host HBA port uses port 3 (CX600) or port 1 (CX400, FC4700) on SP A and SP B of the primary or secondary storage system for host I/O it should be included in separate zones.

NOTE: A storage system can have mirroring connections to a maximum of four other storage systems concurrently.

Management of Primary and Secondary Storage Systems

A single Navisphere management station must manage both storage systems.

Note: Both the primary and secondary storage systems can each contain secondary mirror images as well as the primary mirror image (cross mirroring).

Switch Topology Rules

General Switch Topology Rules

For information on switch fabric configurations, also refer to *EMC Networked Storage Topology Guide.*

Switches in Fabric

<u>All switches except ED-12000B</u>
A fabric can contain only EMC storage, supported non-EMC storage, and EMC supported servers.

- A maximum of 16 switches may form a single fabric via E-port, except for a single fabric with multiple HBA-port servers, which has a maximum of 2 switches. In a dual-fabric configuration, the switches in each fabric can differ in quantity.
- A maximum of 3 hops may exist between a communicating server and a storage system.

<u>ED-12000B switch</u>

- Each ED-12000B switch consists of two switches (domains), and a maximum of 2 ED-12000B switches may form a single fabric.
- Maximum of 3 hop may exist between a communicating server and a storage system.

Note: The ED12000B does not support QuickLoop.

Inter Switch Links (ISLs)

A maximum of 8 ISLs may exist between two directly communicating switches in a fabric, regardless of the number of switches in the fabric.

<u>In a non-remote mirror configuration</u>
Minimum of 2 Inter Switch Links (ISLs) between two directly communicating switches are required, regardless of the number of switches in the fabric.

<u>In a remote mirror configuration</u>
Single ISL can connect a remote and local switch. However, for optimal performance, availability, and support, we strongly recommend a minimum of two ISLs between the switches. For mirroring over IP, an ISL is connected to the IP network through an FC-to-IP device. For supported FC-to-IP devices, refer to the E*MC Support Matrix*.

<u>Maximum ISL lengths</u>
  - 500 meters using SWL optics (GBICs or SFPs) and 50/125 multi-mode fiber cable at 1Gbps operation.
  - 300 meters using SWL optics (GBICs or SFPs) and 50/125 multi-mode fiber cable at 2Gbps operation.
  - 10 kilometers with LWL optics (GBICs or SFPs) and 9/125 single-mode fiber cable at 1Gbps or 2Gbps operation.
  - 20 kilometers with LWL optics (SFPs) and 9/125 single-mode fiber cable at 1Gbps or 2Gbps operation for the DS-16B2, DS-16M, DS-16M2, DS-32M, DS-32M2, DS-32B2, ED-64M, ED-140M, and ED-12000B switches.

Note: Support for distances greater than 10 kilometers is dependent on the quality of the fiber cable between the two data centers. When deploying any length of longwave/singlemode media for mission-critical business environments, EMC advises customers to hire a fiber-cable specialist who can measure the quality of the fiber cable and compare it to expected standards.

Adding ISLs to an operational fabric - Causes the fabric to rebuild routing tables, which may interrupt I/O flow.

CAUTION: Be careful when attempting to connect two previously isolated fabrics with a new ISL. If a parameter conflict exist (identical domain IDs, for example), the resulting fabric might be segmented, and not joined to form a single fabric.

Number of Fabrics

If any server on a SAN with departmental switches (DS-8B, DS-16B, DS-16B2, DS-32B2, DS-16M, DS-16M2, DS-24M2, DS-32M, DS-32M2) has multiple HBA ports, the SAN must have either 2 separate fabrics with 1 to 16 switches or 1 fabric with 2 switches maximum. Multiple HBA-port servers are supported in a SAN with 1 fabric consisting of only Director class Fibre Channel switches up to the maximum number of Director class Fibre Channel switches supported in such a fabric.

CX200, CX400, CX600, FC4500, FC4700, or FC5300[1] Single SP Port Connection to Fabric
In a SAN with 1 multi-switch fabric, connect one SP A port to one switch and one SP B port to another switch. In a SAN with 2 fabrics, connect one SP A port to one fabric and one SP B port to the other fabric.

CX600 Multiple SP Port Connections to One Multi-Switch Fabric
Either
Connect SP A ports 0 and 1 and SP B ports 2 and 3 to one switch and SP A ports 2 and 3 and SP B ports 0 and 1 to another switch
Or
Connect SP A ports 0 and 2 and SP B ports 1 and 3 to one switch and SP A ports 1 and 3 and SP B ports 0 and 2 to another switch.

Note: Connecting port 3 of each SP to different switches, makes these connections ready for remote mirroring through switches and allows access to both SPs.

CX600 Multiple SP Port Connections to Two Fabrics
Either
Connect SP A ports 0 and 1 and SP B ports 2 and 3 to one fabric and SP A ports 2 and 3 and SP B ports 0 and 1 to the other fabric
Or
Connect SP A ports 0 and 2 and SP B ports 1 and 3 to one fabric and SP A ports 1 and 3 and SP B ports 0 and 2 to the other fabric.

Note: Connecting port 3 of each SP to different fabrics, makes these connections ready for remote mirroring through switches and allows access to both SPs.

CX400, FC4700 Multiple SP Port Connections to One Multi-Switch Fabric
Connect SP A port 0 and SP B port 1 to one switch and SP A port 1 and SP B port 0 to another switch. Connecting port 1 of each SP to different fabrics, makes these connections ready for remote mirroring through switches and allows access to both SPs.

CX400, FC4700 Multiple SP Port Connections to Two Fabrics
Connect SP A port 0 and SPB port 1 to one fabric and SP A port 1 and SP B port 0 to the other fabric. Connecting port 1 of each SP to different fabrics, makes these connections ready for remote mirroring through switches and allows access to both SPs.

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1. FC5300 SAN configuration available from selected channels only; MIA required for optical connect.

Common Rules for DS-xxB and DS-xxM Switches

Connection to Dual Fabrics
For servers with two or more HBA ports connected to the same storage system
- One HBA port and one storage-system SP must be connected to one fabric and the other HBA port and other storage-system SP must be connected to the other fabric.

- Individual ports on each FC 4700 SP must be connected to different fabrics. For example, if SP A port 0 is connected to fabric Z, then SP A port 1 connects to fabric Y. For maximum availability, the port connections on the two SPs should reverse each other; in the example, SP B Port 0 connects to fabric Y, and SP B port 1 to fabric Z.

DS-xxB Series Switches

DS-8B-00D Switch
8 shortwave length (SWL) GBICs.

DS-16B-00D Switch
16 shortwave length (SWL) GBICs.

DS-16B2-0D Switch
16 shortwave length (SWL) SFPs.

DS-32B2-0D Switch
32 shortwave length (SWL) SFPs.

Switch Port Connections
Groups of four consecutively numbered ports on a switch comprise a quad. For example, a DS-16B switch has four quads consisting of ports 0-3, 4-7, 8-11, and 12-15. You can connect only one port in a quad to a storage-system SP port. You connect the remaining three ports in the quad to HBA ports or to ports on other switches.

QuickLoop
All DS-xxB switches support QuickLoop, except for DS-16B2 and DS-32B2 switches in 2Gbit mode.

Trunking
Supported only on ISLs between any combination of two DS-16B2, DS-32B2, or **ED-12000B** switches, and requires that the connected ports be set to operate at 2 Gigabit speeds. You can configure a trunked port by setting the port to auto-negotiate or 2 Gigabit operation.

Note: Refer to the CLARiiON sections in the *EMC Support Matrix* for details on attach-specific support for switch auto negotiation.

Extended Distances
DS-8B, DS-16B, DS-16B2, and DS-32B2 switches can operate beyond 500 meters with LWL optics (GBICs or SFPs), DWDM devices, or Fibre Channel to IP devices.

Extended Fabric Licensing

Enables each DS-xxB, DS-xxB2, or ED-12000B quad in an extended fabric to use a total of 108 buffer-to-buffer credits shared between the four ports. The number of credits used by each port depends on the switch operating speed and connection length and type, as shown in Table 1. Extended fabric licensing is not required for distances under 10 kilometers.

Table 1   Buffer-to-Buffer Credits for DS-xxB and ED-12000B Extended Fabric Connections

Operating Speed	Level 0 (<10 km) F Port	Level E (<10 km) E Port	Level 1 (10-50 km)	Level 2 (50-100 km)
1 Gbps	16 credits	26 credits	27 credits	60 credits
2 Gbps (DS-16B2, DS-32B2, ED12000B)	16 credits	26 credits	54 credits	108 credits

Table 2 provides examples of how expenditures within the 108-credit limit restrict port availability within quads in extended fabric configurations.

Table 2   Extended Fabric Port Configuration per Quad (DSxxB Series and ED-12000B)

Operating Speed	Port 0	Port 1	Port 2	Port 3	B-B Credit Total
1 Gpbs	Level 2/E-port (60)	Level 1/E-port (27)	Level 0/F-port (16)	Not available	103
	Level 2/E-port (60)	Level 0/E-port (26)	Level 0/F-port (16)	Not available	102
	Level 1/E-port (27)	Level 1/E-port (27)	Level 1/E-port (27)	Level 1/E-port (27)	108
2 Gbps (DS-16B2, DS-32B2, ED12000B)	Level 0/E-port (26)	Level 0/E-port (26)	Level 0/E-port (26)	Level 0/E-port (26)	104

Fabrics Including DWDM Connections

Switches with SWL GBICs that connect directly to DWDM devices require an extended distance license, which provides access to the buffer-to-buffer credits total of 108.

All switches in a DWDM fabric must be enabled for long distance operations. Use either the telnet.exe CONFIGURE command to set Long Distance Fabric to [1] or the WebTools Switch Admin user interface to ENABLE extended fabric mode.

Refer to *EMC Support Matrix* for a list of the supported DWDM devices.

DS-xxM Series Switches

DS-16M-0D or DS-16M2-0D Switch

16 shortwave length (SWL) SFPs; maximum of 8 ISLs.

DS-24M2-08C Switch

8 shortwave length (SWL) SFPs standard that can be expanded to 16 or 24 ports.

DS-32M-0D or DS-32M2-0D Switch

32 shortwave length (SWL) SFPs; maximum of 16 ISLs.

ED-12000B Enterprise Switches

128 shortwave length (SWL) SFPs, divided into two domains. Trunking is supported only on ISLs between any combination of two **ED-12000B**, DS-16B2, or DS-32B2 switches, and requires that the connected ports be set to operate at 2 Gigabit speeds. No longwave length, DWDM, or MirrorView support. Extended fabric licensing is not available.

ED-64M, ED-140M, and ED-1032 Enterprise Directors

Storage-System Support
One single and dual fabrics of ED-64M, ED-140M, or ED-1032 Enterprise Directors.

ED-64M Switch
Maximum of 32 ISLs with a maximum of 8 ISLs between any two switches.

ED-140M Switch
Maximum of 70 ISLs with a maximum of 8 ISLs between any two switches.

ED-1032 Switch
Maximum of 16 ISLs with a maximum of 8 ISLs between any two switches.

Switch Interoperability

For information on switch interoperability, see the *EMC Support Matrix (ESM)* and the *Connectrix Interoperability Solution Statement* on AVATAR or Powerlink.

AIX Configurations

AIX Single Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: Multiple CX400, CX600, FC4700, FC5300 (FC5300 configuration available from selected channels; MIA required for optical connect).
See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9),
Port Speed Rules (page 14), and *General Switch Topology Rules* (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4500 FC4700 FC5300	Single	PowerPath - multiple ATF - 1 or 2	PowerPath - multiple ATF - 1	PowerPath or ATF. Clusters not applicable. Access Logix required for FC4500, FC5300, and optional SnapView (CX600,FC4700).	1 on page 89
CX400 CX600 FC4700	Multiple	PowerPath - multiple ATF - 2	PowerPath - multiple ATF - 1	PowerPath or ATF. Clusters required. Access Logix required for optional SnapView **and optional MirrorView**.	2 on page 90
CX400 CX600 FC4500 FC4700 FC5300	Multiple	1	1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Clusters not supported. Access Logix, optional SnapView (CX400. CX600, FC4700, **optional MirrorView (CX400. CX600, FC4700)**	3 on page 91
CX400 CX600 FC4700	Multiple	1	PowerPath - multiple Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Clusters not supported. Access Logix, optional SnapView, optional MirrorView.	4 on page 92
CX400 CX600 FC4500 FC4700 FC5300	Multiple	PowerPath - multiple ATF - 1 or 2 Utility Kit PowerPath, CDE- 1	PowerPath - multiple Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Clusters optional for multiple HBA-port servers *not* connected to FC5300 - HACMP, HACMP/ES. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	5 on page 93
CX400 CX600 FC4700	Multiple	PowerPath - multiple ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath - multiple Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Clusters optional for multiple HBA-port servers - HACMP, HACMP/ES. Access Logix, optional SnapView, optional MirrorView.	6 on page 95

AIX Dual Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                      See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                      Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: Multiple CX400, CX600, FC4500, FC4700, FC5300 (FC5300 configuration available from
                      selected channels; MIA required for optical connect).
                      See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                      Failover Configuration Rules (page 15).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9),
                      Port Speed Rules (page 14), and *General Switch Topology Rules* (page 20)**.**

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4500 FC4700 FC5300	Multiple	PowerPath - multiple ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath - multiple Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Clusters optional for servers *not* connected to FC5300 - HACMP, HACMP/ES. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	7 on page 96

AIX Fabric Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                          See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                          Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 to 5 CX400, CX600, FC4700 for remote mirroring.
                          1 per site per mirror configuration.
                          See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                          Failover Configuration Rules (page 15).

Server Connection: 1 to 2 fabrics.
                          See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and
                          General Switch Topology Rules (page 20).

Mirror Connection: SPA port 3 (CX600) or SPA port 1 (CX400, FC4700) on local and remote storage systems connected
                          to one switch (single fabric) or one fabric (dual fabric), and SPB port 3 (CX600) or SP port (CX400,
                          FC4700) on local and remote storage systems connected to other switch (single fabric) or other
                          fabric (dual fabric).

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath - multiple ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, CDE. Optional multiple paths from multiple HBA-port server to each SP. Clusters not supported. Access Logix, MirrorView, optional SnapView.	8 on page 98 9 on page 100 10 on page 102

AIX IP Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                          See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                          Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                          1 per site per mirror configuration. |
                          For the failover software supported for a storage system, see *Failover Configuration Rules*
                          (page 15).

Server Connection: 1 to 2 local and remote fabrics.
                          See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and
                          General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                          2 or 4 FC-to-IP devices required for Fibre Channel to IP network connection.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath, ATF - multiple Utility Kit PowerPath, CDE -1	MirrorView - 1 PowerPath - multiple Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Optional multiple paths from multiple HBA-port server to each SP. Clusters not supported. Access Logix, MirrorView, optional SnapView.	11 on page 104 12 on page 106

AIX Direct Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
1 per site per mirror configuration.
For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Server Connection: 1 to 2 local and remote fabrics.
See *Storage Area Network (SAN) Configuration Rules* (page 9),
Port Speed Rules (page 14), and *General Switch Topology Rules* (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath, ATF - multiple Utility Kit PowerPath, CDE -1	MirrorView - 1 PowerPath - multiple Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Clusters not supported. Access Logix, MirrorView, optional SnapView.	13 on page 108

AIX Direct Remote Mirror with Direct Server Connections

See *General Configuration Rules* (page 6).

Servers: 1 per site.
See *Paths from a Server to an SP (*page 10*)*, *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
1 per site per mirror configuration.
For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Server Connection: Direct

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	1 per site	Multiple	MirrorView - 1 PowerPath - multiple (CX600) or 1 (CX400, FC4700) ATF - 1	PowerPath or ATF. Clusters not applicable. Access Logix, MirrorView, optional SnapView.	14 on page 110

AIX Direct Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 4 depending on configuration.
                          See *Paths from a Server to an SP (*page 10*)*, *Clustered Server Configuration Rules* (page 14),
                          Failover Configuration Rules (page 15).

Storage Systems: 1 CX400, CX600, FC4500, FC4700, FC5300, or FC5700.
                          For the failover software supported for a storage system, see *Failover Configuration Rules*
                          (page 15).

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4500 FC4700 FC5300 FC5700	1	1	1	No PowerPath, Utility Kit PowerPath, ATF, or CDE. No non-disruptive software installation (NDU). Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	None
		2	1	PowerPath or ATF. Clusters not applicable.7 No Access Logix, no SnapView, no MirrorView.	15 on page 111
CX400 CX600 FC4700	1	Multiple	Multiple	PowerPath. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	16 on page 112
CX400 CX600 FC4500 FC4700 FC5300 FC5700	2	1	1	No PowerPath, Utility Kit PowerPath, ATF, or CDE. No non-disruptive software installation (NDU). Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	17 on page 113
CX400 CX600 FC4500 FC4700 FC5300	2	2	2	PowerPath or ATF. Clusters required for storage system *without* Access Logix; optional for storage system *with* Access Logix - HACMP, HACMP/ES. No Access Logix (FC4500, FC5300), optional Access Logix (CX400, CX600, FC4700), optional SnapView (CX400, CX600, FC47600), optional MirrorView (CX600).	18 on page 114
CX400 CX600 FC4700	Multiple	1	Multiple	No PowerPath, Utility Kit PowerPath, ATF, or CDE. No non-disruptive software installation (NDU). Clusters not supported. Access Logix, optional SnapView, optional MirrorView (CX600).	19 on page 115

AIX Hub Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 2 with same operating system.
                        See *Paths from a Server to an SP (*page 10*)*, *Clustered Server Configuration Rules* (page 14),
                        Failover Configuration Rules (page 15).

Storage Systems: 1 to 4 FC4500, FC5300, FC5700.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
FC4500 FC5300 FC5700	1	2	1	ATF. Clusters not applicable. No Access Logix.	20 on page 117
	2	2	1	ATF. Clusters required - HACMP, HACMP/ES. No Access Logix.	21 on page 118

HP-UX Configurations

HP-UX Single Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                      See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                      Clustered Server Configuration Rules (page 14).

Storage Systems: Multiple CX400, CX600, FC4500, FC4700, or FC5300 (FC5300 configuration available from
                      selected channels; MIA required for optical connect).
                      See *Fan-In Rule* (page 9).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                      General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA-ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4500 FC4700 FC5300	Single	Multiple	CX600, CX400, FC4700 - multiple FC4500, FC5300 - 1	PVLinks. Clusters not applicable. Access Logix required for FC4500, FC5300, and optional SnapView (CX400, CX600, FC4700).	1 on page 89
CX400 CX600 FC4700	Multiple	2	Multiple	PVLinks. Clusters required. Access Logix required for optional SnapView **and optional MirrorView.**	2 on page 90
CX400 CX600 FC4500 FC4700 FC5300	Multiple	1	1	PVLinks. Clusters not supported. Access Logix, optional SnapView (CX400, CX600, FC4700, **optional MirrorView (CX400, CX600, FC4700).**	3 on page 91
CX400 CX600 FC4700	Multiple	1	Multiple	PVLinks. Clusters not supported. Access Logix, optional SnapView, optional MirrorView.	4 on page 92
CX400 CX600 FC4500 FC4700 FC5300	Multiple	Multiple	CX400, CX600, FC4700 - multiple FC4500, FC5300 - 1	PVLinks. Clusters optional for multiple HBA-port servers *not* connected to FC5300 - MC/ServiceGuard. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	5 on page 93
CX400 CX600 FC4700	Multiple	Multiple	Multiple (optional - 1 port for QuickLoop)	PVLinks. Optional alternate paths from multiple HBA-port non-clustered server to each SP. Clusters optional for multiple HBA-port servers - MC/ServiceGuard. Access Logix, optional SnapView, optional MirrorView.	6 on page 95

HP-UX Dual Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                         See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                         Clustered Server Configuration Rules (page 14).

Storage Systems: Multiple CX400, CX600, FC4500, FC4700, or FC5300 (FC5300 configuration available from
                         selected channels; MIA required for optical connect).
                         See *Fan-In Rule* (page 9).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                         General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4500 FC4700 FC5300	Multiple	Multiple	CX400, CX600, FC4700 - multiple FC4500, FC5300 - 1	PVLinks. Optional alternate paths from multiple HBA non-clustered server to each SP. Clusters optional for servers *not* connected to FC5300 - MC/ServiceGuard. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	7 on page 96

HP-UX Fabric Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                         See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                         Clustered Server Configuration Rules (page 14).

Storage Systems: 2 to 5 CX400, CX600, or FC4700 for remote mirroring.
                         1 per site per mirror configuration.
                         See *Fan-In Rule* (page 9).

Server Connection: 1 to 2 fabrics.
                         See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                         General Switch Topology Rules (page 20).

Mirror Connection: SPA port 3 (CX600) or SPA port 1 (FC4700) on local and remote storage systems connected to one
                         switch (single fabric) or one fabric (dual fabric), and SPB port 3 (CX600) or SP port 1 (CX400,
                         FC4700) on local and remote storage systems connected to other switch (single fabric) or other
                         fabric (dual fabric).

Configurations:

Storage Systems	Servers	HBAs per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	Multiple	Multiple	PVLinks. Optional alternate paths from multiple HBA non-clustered server to each SP. Clusters optional - MC/ServiceGuard. Access Logix, MirrorView, optional SnapView.	8 on page 98 9 on page 100 10 on page 102

HP-UX IP Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                          See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                          Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                          1 per site per mirror configuration.

Server Connection: 1 to 2 local and remote fabrics.
                          See *Storage Area Network (SAN) Configuration Rules* (page 9),
                          Port Speed Rules (page 14), and *General Switch Topology Rules* (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                          2 or 4 FC-to-IP devices required for Fibre Channel to IP network connection.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	Multiple	Multiple	PVLinks. Optional alternate paths from multiple HBA non-clustered server to each SP. Clusters optional - MC/ServiceGuard. Access Logix, MirrorView, optional SnapView.	11 on page 104 12 on page 106

HP-UX Direct Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
Clustered Server Configuration Rules (page 14).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
1 per site per mirror configuration.

Server Connection: 1 to 2 local and remote fabrics.
See *Storage Area Network (SAN) Configuration Rules* (page 9) and
General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	Multiple	MirrorView - 1 I/O - multiple (CX600) or 1 (CX400, FC4700)	PVLinks. Optional alternate paths from multiple HBA-port non-clustered server to each SP. Clusters optional for multiple HBA-port servers - MC/ServiceGuard. Access Logix, MirrorView, optional SnapView.	13 on page 108

HP-UX Direct Remote Mirror with Direct Server Connections

See *General Configuration Rules* (page 6).

Servers: 1 per site.
See *Paths from a Server to an SP (*page 10*)*.

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
1 per site per mirror configuration.

Server Connection: Direct

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	1 per site	2	MirrorView - 1 I/O - multiple (CX600) or 1 (CX400, FC4700)	PVLinks. Clusters not applicable. Access Logix, MirrorView, optional SnapView.	14 on page 110

HP-UX Direct Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 4 depending on configuration.

                          See *Paths from a Server to an SP (*page 10*), Clustered Server Configuration Rules* (page 14).

Storage Systems: 1 CX400, CX600, FC4500, FC4700, FC5300, or FC5700.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4500 FC4700 FC5300 FC5700	1	1	1	No PVLinks. No non-disruptive software installation (NDU). Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	None
		2	1	PVLinks. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	15 on page 111
CX400 CX600 FC4700	1	Multiple	Multiple	PVLinks. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	16 on page 112
CX400 CX600 FC4500 FC4700 FC5300 FC5700	2	1	1	Both servers must run HP-UX. No failover. No non-disruptive software installation (NDU). Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	17 on page 113
CX400 CX600 FC4500 FC4700 FC5300	2	2	2	PVLinks. Clusters required for storage system *without* Access Logix; optional for storage system *with* Access Logix - MC/ServiceGuard. No Access Logix (FC4500, FC5300), optional Access Logix (CX400, CX600, FC4700), optional SnapView (CX400, CX600, FC47600), optional MirrorView (CX600).	18 on page 114
CX400 CX600 FC4700	Multiple	1	Multiple	No PVLinks. No non-disruptive software installation (NDU). Clusters not supported. Access Logix, optional SnapView, optional MirrorView (CX600).	19 on page 115

HP-UX Hub Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 2 with same operating system.
                        See *Paths from a Server to an SP (*page 10*), Clustered Server Configuration Rules* (page 14).

Storage Systems: 1 to 4 FC4500, FC5300, FC5700.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
FC4500 FC5300 FC5700	1	2	1	PVLinks. Clusters not applicable. No Access Logix.	20 on page 117
	2	2	1	PVLinks. Clusters required - MC/ServiceGuard. No Access Logix.	21 on page 118

IRIX Configurations

IRIX Single Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                        See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                        Clustered Server Configuration Rules (page 14).

Storage Systems: Multiple CX400, CX600, or FC4700.
                        See *Fan-In Rule* (page 9).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                        General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Single	Multiple	Multiple	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Clusters not applicable. No Access Logix except for optional SnapView.	1 on page 89
CX400 CX600 FC4700	Multiple	2	Multiple	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Clusters required. Access Logix required for optional SnapView **and optional MirrorView**.	2 on page 90
CX400 CX600 FC4700	Multiple	1	1	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Clusters optional - FailSafe. Access Logix, optional SnapView, **optional MirrorView.**	3 on page 91
			Multiple	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Clusters optional - FailSafe. Access Logix, optional SnapView, optional MirrorView.	4 on page 92
		Multiple	Multiple	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Clusters optional - FailSafe. Access Logix, optional SnapView, optional MirrorView.	5 on page 93
				Native IRIX failover requires that IRIX logical volume manager (**xlv**) manage all LUNs. Optional alternate paths from multiple HBA-port non-clustered server to each SP. Clusters optional - FailSafe Access Logix, optional SnapView, optional MirrorView.	6 on page 95

IRIX Dual Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                         See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*),*
                         Clustered Server Configuration Rules (page 14).

Storage Systems: Multiple CX400, CX600, or FC4700.
                         See *Fan-In Rule* (page 9).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                         General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple	Multiple	Multiple	Native IRIX failover requires that IRIX logical volume manager (**xlv**) manage all LUNs. Optional alternate paths from multiple HBA -port non-clustered server to each SP. Clusters optional - FailSafe. Access Logix, optional SnapView, optional MirrorView.	7 on page 96

IRIX Fabric Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                         See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*),*
                         Clustered Server Configuration Rules (page 14).

Storage Systems: 2 to 5 CX400, CX600, or FC4700 for remote mirroring.
                         1 per site per mirror configuration.
                         See *Fan-In Rule* (page 9).

Server Connection: 1 to 2 fabrics.
                         See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                         General Switch Topology Rules (page 20).

Mirror Connection: SPA port 3 (CX600) or SPA port 1 (CX400, FC4700) on local and remote storage systems connected
                         to one switch (single fabric) or one fabric (dual fabric), and SPB port 3 (CX600) or SP port 1
                         (CX400, FC4700) on local and remote storage systems connected to other switch (single fabric) or
                         other fabric (dual fabric).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	Multiple	Multiple	Native IRIX failover requires that IRIX logical volume manager (**xlv**) manage all LUNs. Optional alternate paths from multiple HBA -port non-clustered server to each SP. Clusters optional - FailSafe. Access Logix, MirrorView, optional SnapView.	8 on page 98 9 on page 100 10 on page 102

IRIX IP Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                          See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                          Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                          1 per site per mirror configuration.

Server Connection: 1 to 2 local and remote fabrics.
                          See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and
                          General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                          2 or 4 FC-to-IP devices required for Fibre Channel to IP network connection.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	Multiple	Multiple	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Optional alternate paths from multiple HBA -port non-clustered server to each SP. Clusters optional - FailSafe. Access Logix, MirrorView, optional SnapView.	11 on page 104 12 on page 106

IRIX Direct Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers:	Multiple with same or different operating systems.
	See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
	Clustered Server Configuration Rules (page 14).
Storage Systems:	2 CX400, CX600, or FC4700 for remote mirroring.
	1 per site per mirror configuration.
Server Connection:	1 to 2 local and remote fabrics.
	See *Storage Area Network (SAN) Configuration Rules* (page 9) and
	General Switch Topology Rules (page 20).
Mirror Connection:	SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
	Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	Multiple	MirrorView - 1 I/O - multiple (CX600) or 1 (CX400, FC4700)	Native IRIX failover requires that IRIX logical volume manager (**xlv**) manage all LUNs. Optional alternate paths from multiple HBA -port non-clustered server to each SP. Clusters optional - FailSafe. Access Logix, MirrorView, optional SnapView.	13 on page 108

IRIX Direct Remote Mirror with Direct Server Connections

See *General Configuration Rules* (page 6).

Servers:	1 per site.
	See *Paths from a Server to an SP (*page 10*)*.
Storage Systems:	2 CX400, CX600, or FC4700 for remote mirroring.
	1 per site per mirror configuration.
Server Connection:	Direct
Mirror Connection:	SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
	Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	1 per site	Multiple	MirrorView - 1 I/O - multiple (CX600) or 1 (CX400, FC4700)	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Clusters not applicable. Access Logix, MirrorView, optional SnapView.	14 on page 110

IRIX Direct Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 4 depending on configuration.
                      See *Paths from a Server to an SP (*page 10*), Clustered Server Configuration Rules* (page 14).

Storage Systems: 1 CX400, CX600, FC5500, or FC4700.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC5500 FC4700	1	1	1	No SP failover. No non-disruptive software installation (NDU). Clusters not applicable.	None
		2	1	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Clusters not applicable.	15 on page 111
CX400 CX600 FC4700	1	Multiple	Multiple	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	16 on page 112
CX400 CX600 FC5500 FC4700	2	1	1	No SP failover. No non-disruptive software installation (NDU). Clusters not supported.	17 on page 113
CX400 CX600 FC4700	2	2	2	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Clusters required for storage system *without* Access Logix; optional for storage system *with* Access Logix - FailSafe. Optional access Logix, optional SnapView, optional MirrorView (CX600).	18 on page 114
	Multiple	1	Multiple	No SP failover. No non-disruptive software installation (NDU). Clusters optional - FailSafe. Access Logix, optional SnapView, optional MirrorView (CX600).	19 on page 115

IRIX Hub Connections

See *General Configuration Rules* (page 6).

Servers: 1
                         See *Paths from a Server to an SP (*page 10*), Clustered Server Configuration Rules* (page 14).

Storage Systems: 1 to 4 FC5500.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
FC5500	1	2	1	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Clusters not applicable.	20 on page 117
	2	2	1	Native IRIX failover requires that IRIX logical volume manager (xlv) manage all LUNs. Clusters required - FailSafe. No Access Logix.	21 on page 118

Linux Configurations

Linux Single Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                       See *Fan-Out Rule* (page 9), *Clustered Server Configuration Rules* (page 14).

Storage Systems: Multiple CX200, CX400, CX600, FC4500, FC4700, or FC5300 (FC5300 configuration
                       available from selected channels; MIA required optical connect).
                       See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                       Failover Configuration Rules (page 15).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and
                       General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 FC4500 FC4700 FC5300	Single	Multiple	PowerPath - multiple except for 1 for CX200, FC4500 PowerPath Base - 1 FC5300 - 1	PowerPath, PowerPath Base except for FC5300. No SP failover for FC5300. Optional multiple paths from server to each SP (except for FC5300). Clusters not applicable. Access Logix required for CX200, FC4500, FC5300, and optional SnapView (CX600, FC4700).	1 on page 89
CX200 CX400 CX600 FC4700	Multiple	Multiple	1	No SP failover. Clusters required. Access Logix required for optional SnapView **(CX400, CX600, FC4700) and optional MirrorView (CX400, CX600, FC4700)**.	2 on page 90
CX200 CX400 CX600 FC4500 FC4700 FC5300	Multiple	1	1	PowerPath, PowerPath Base, Utility Kit PowerPath except for FC5300 or clustered server. No SP failover for FC5300 or clustered server. No non-disruptive software installation (NDU) for clustered server. Clusters optional for - Oracle9iRAC. Access Logix, optional SnapView (CX400, CX600, FC4700), **optional MirrorView (CX400, CX600, FC4700)**.	3 on page 91
CX400 CX600 FC4700	Multiple	1	PowerPath - multiple Utility Kit PowerPath - 1	PowerPath or Utility Kit PowerPath except for a clustered server. No SP failover or non-disruptive software installation (NDU) for clustered server. Clusters optional - Oracle9iRAC. No Access Logix, no SnapView, optional MirrorView.	4 on page 92
CX200 CX400 CX600 FC4500 FC4700 FC5300	Multiple	PowerPath - multiple PowerPath Base 1 or 2 Utility Kit PowerPath -1	PowerPath - multiple except 1 for CX200, FC4500, and FC5300 PowerPath Base, Utility Kit PowerPath - 1	PowerPath, PowerPath Base, or Utility Kit PowerPath except for FC5300 or clustered server. No SP failover for FC5300 or clustered server. No non-disruptive software installation (NDU) with clustered server. Clusters optional - Oracle9iRAC. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	5 on page 93

Linux Single Fabric Connections, continued

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple	PowerPath - multiple PowerPath Base 1 or 2 Utility Kit PowerPath -1	PowerPath - multiple PowerPath Base, Utility Kit PowerPath - 1	PowerPath, PowerPath Base, or Utility Kit PowerPath except for clustered server. No SP failover or non-disruptive software installation (NDU) for clustered server. Optional multiple paths from multiple HBA-port non-clustered server to each SP. Clusters optional - Oracle9iRAC. Access Logix, optional SnapView, optional MirrorView.	6 on page 95

Linux Dual Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Clustered Server Configuration Rules* (page 14).

Storage Systems: Multiple CX200, CX400, CX600, FC4500, FC4700, or FC5300 (FC5300 configuration available from selected channels; MIA required for optical connect).
See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and *General Switch Topology Rules* (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 FC4500 FC4700 FC5300	Multiple	**PowerPath - multiple PowerPath Base 1 or 2 Utility Kit PowerPath -1**	PowerPath - multiple except 1 for CX200, FC4500, and FC5300 PowerPath Base, Utility Kit PowerPath - 1	PowerPath, PowerPath Base, or Utility Kit PowerPath except for FC5300 or clustered server. No SP failover for FC5300 or clustered server. No non-disruptive software installation (NDU) for clustered server. Optional multiple paths from multiple HBA-port non-clustered server to each SP (except FC5300). Clusters optional - Oracle9iRAC. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	7 on page 96

Linux Fabric Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                        See *Fan-Out Rule* (page 9), *Clustered Server Configuration Rules* (page 14).

Storage Systems: 2 to 5 CX400, CX600, or FC4700 for remote mirroring.
                        1 per site per mirror configuration.
                        See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                        Failover Configuration Rules (page 15).

Server Connection: 1 to 2 fabrics.
                        See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and
                        General Switch Topology Rules (page 20).

Mirror Connection: SPA port 3 (CX600) or SPA port 1 (CX400, FC4700) on local and remote storage systems connected
                        to one switch (single fabric) or one fabric (dual fabric), and SPB port 3 (CX600) or SP port 1
                        (CX400, FC4700) on local and remote storage systems connected to other switch (single fabric) or
                        other fabric (dual fabric).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath - multiple **PowerPath Base - 1 or 2** Utility Kit PowerPath - 1	PowerPath - multiple **PowerPath Base,** Utility Kit PowerPath - 1	PowerPath, **PowerPath Base**, or Utility Kit PowerPath for non-clustered server. No SP failover for clustered server. No non-disruptive software installation (NDU) with clustered server. Optional multiple path from multiple-HBA-port non-cluster server to each SP. Clusters optional - Oracle9iRAC. Access Logix, MirrorView, optional SnapView.	8 on page 98 9 on page 100 10 on page 102

Linux IP Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                        See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                        Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                        1 per site per mirror configuration.
                        See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                        Failover Configuration Rules (page 15).

Server Connection: 1 to 2 local and remote fabrics.
                        See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and
                        General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                        2 or 4 FC-to-IP devices required for Fibre Channel to IP network connection.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath - multiple **PowerPath Base - 1 or 2** Utility Kit PowerPath - 1	PowerPath - multiple **PowerPath Base,** Utility Kit PowerPath - 1	PowerPath, **PowerPath Base**, or Utility Kit PowerPath for non-clustered server. No SP failover or non-disruptive software installation (NDU) for clustered server. Optional multiple path from multiple-HBA-port non-cluster server to each SP. Clusters optional - Oracle9iRAC. Access Logix, MirrorView, optional SnapView.	11 on page 104 12 on page 106

Linux Direct Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                            See *Fan-Out Rule* (page 9), *Clustered Server Configuration Rules* (page 14).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                            1 per site per mirror configuration.
                            See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                            Failover Configuration Rules (page 15).

Server Connection: 1 to 2 local and remote fabrics.
                            See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and
                            General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                            Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath - multiple **PowerPath Base - 1 or 2** Utility Kit PowerPath - 1	MirrorView - 1 PowerPath - multiple (CX600) or 1 (CX400, FC4700) **PowerPath Base,** Utility Kit PowerPath - 1	PowerPath, **PowerPath Base,** or Utility Kit PowerPath for non-clustered server. No SP failover or non-disruptive software installation (NDU) for clustered server. Optional multiple path from multiple HBA-port non-cluster server to each SP. Clusters optional - Oracle9iRAC. Access Logix, MirrorView, optional SnapView.	13 on page 108

Linux Direct Remote Mirror with Direct Server Connections

See *General Configuration Rules* (page 6).

Servers: 1 per site.

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                            1 per site per mirror configuration.
                            For the failover software supported for a storage system, see *Failover Configuration Rules*
                            (page 15).

Server Connection: Direct

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                            Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	1 per site	PowerPath - multiple **PowerPath Base 1 or 2**	MirrorView - 1 PowerPath - multiple (CX600) or 1 (CX400, FC4700) **PowerPath Base - 1**	PowerPath **or PowerPath Base.** Clusters not applicable. Access Logix, MirrorView, optional SnapView.	14 on page 110

Linux Direct Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 4 depending on configuration.

Storage Systems: 1 CX200, CX400, CX600, FC4500, FC4700, or FC5300.
For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 FC4500 FC4700 FC5300	1	1	1	No PowerPath, PowerPath Base, or Utility Kit PowerPath. No non-disruptive software installation (NDU). Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	None
		2	1	PowerPath or PowerPath Base, except for FC5300. No SP failover for FC5300. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	15 on page 111
CX400 CX600 FC4700	1	Multiple	Multiple	PowerPath. Optional multiple paths from multiple HBA-port non-clustered server to each SP. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	16 on page 112
CX200 CX400 CX600 FC4500 FC4700 FC5300	2	1	1	No PowerPath, PowerPath Base, or Utility Kit PowerPath. No non-disruptive software installation (NDU). Clusters not supported. No Access Logix, no SnapView, no MirrorView.	17 on page 113
	2	2	2	PowerPath except for FC5300 or clustered server. No SP failover for FC5300 or clustered server. No non-disruptive software installation for clustered server. Clusters required for storage system without Access Logix; optional for storage system with Access Logix - Oracle9iRAC. No Access Logix (CX200, FC4500, FC5300); optional Access Logix (CX400, CX600, FC4700); optional SnapView (CX400, CX600, FC4700); (optional MirrorView (CX600).	18 on page 114
CX400 CX600 FC4700	Multiple	1	Multiple	No PowerPath or Utility Kit PowerPath. No non-disruptive software installation (NDU). Clusters optional - Oracle9iRAC. Access Logix, optional SnapView, optional MirrorView (CX600).	19 on page 115

Linux Hub Connections

See *General Configuration Rules* (page 6).

Servers: 1.

Storage Systems: 1 to 4 FC4500, FC5300.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
FC4500 FC5300	1	2	1	No SP failover. No non-disruptive software installation (NDU). Clusters not applicable. No Access Logix.	20 on page 117

NetWare Configurations

NetWare Single Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9)*, Paths from a Server to an SP (*page 10*),
Clustered Server Configuration Rules* (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: Multiple CX200, CX400, CX600, FC4500, FC4700, or FC5300 (FC5300 configuration available from selected channels; MIA required for optical connect).
See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9) and *General Switch Topology Rules* (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 FC4500 FC4700 FC5300	Single	PowerPath - multiple PowerPath Base, ATF - 1 or 2	PowerPath - multiple, except 1 for CX200, FC4500, FC5300 PowerPath Base, ATF - 1	PowerPath, PowerPath Base, or ATF. Clusters not applicable. Access Logix required for CX200, FC4500, FC5300, and optional SnapView (CX600,FC4700).	1 on page 89
CX200 CX400 CX600 FC4700	Multiple	PowerPath - multiple ATF - 2	PowerPath - multiple, except 1 for CX200 PowerPath Base ATF - 1	PowerPath, PowerPath Base, or ATF. Clusters required. Access Logix required for optional SnapView **(CX400, CX600, FC4700) and optional MirrorView (CX400, CX600, FC4700).**	2 on page 90
CX200 CX400 CX600 FC4500 FC4700 FC5300	Multiple	1	1	PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, or CDE. Clusters optional - NetWare Cluster Service. Access Logix, optional SnapView (CX400, CX600, FC4700), **optional MirrorView (CX400, CX600, FC4700).**	3 on page 91
CX400 CX600 FC4700	Multiple	1	PowerPath - multiple PowerPath Base, Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Clusters optional - NetWare Cluster Service. Access Logix, optional SnapView, optional MirrorView.	4 on page 92
CX200 CX400 CX600 FC4500 FC4700 FC5300	Multiple	PowerPath - multiple PowerPath Base, ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath - multiple, except 1 for CX200, FC4500, FC5300 PowerPath Base, Utility Kit PowerPath, ATF, CDE - 1	PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, or CDE. Clusters optional - NetWare Cluster Service. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	5 on page 93
CX400 CX600 FC4700	Multiple	PowerPath - multiple **PowerPath Base,** ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	1	Powerpath, **PowerPath Base,** Utility Kit PowerPath, ATF, or CDE. Clusters optional - NetWare Cluster Service. Access Logix, optional SnapView, optional MirrorView.	6 on page 95

NetWare Dual Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: Multiple CX200, CX400, CX600, FC4500, FC4700, or FC5300 (FC5300 configuration available fro
selected channels; MIA required for optical connect).
See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
Failover Configuration Rules (page 15).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9) and
General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Servers	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 FC4500 FC4700 FC5300	Multiple	PowerPath - multiple PowerPath Base, ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath - multiple, except 1 for CX200, FC4500, FC5300 PowerPath Base, Utility Kit PowerPath, ATF, CDE - 1	PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, or CDE. Clusters optional - NetWare Cluster. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	7 on page 96

NetWare Fabric Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 to 5 CX400, CX600, or FC4700 for remote mirroring.
1 per site per mirror configuration.
See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
Failover Configuration Rules (page 15).

Server Connection: 1 to 2 fabrics.
See *Storage Area Network (SAN) Configuration Rules* (page 9) and
General Switch Topology Rules (page 20).

Mirror Connection: SPA port 3 (CX600) or SPA port 1 (CX400, FC4700) on local and remote storage systems connected
to one switch (single fabric) or one fabric (dual fabric), and SPB port 3 (CX600) or SP port 1
(CX400, FC4700) on local and remote storage systems connected to other switch (single fabric) or
other fabric (dual fabric).

Configurations:

Storage Systems	Servers	HBAs Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath - multiple PowerPath Base, ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath - multiple (CX600) or 1 (CX400, FC4700) PowerPath Base, Utility Kit PowerPath, ATF, CDE - 1	PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, or CDE. Clusters optional - NetWare Cluster Service. Access Logix, MirrorView, optional SnapView.	8 on page 98 9 on page 100 10 on page 102

NetWare IP Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
‘   *Clustered Server Configuration Rules* (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
1 per site per mirror configuration.
For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Server Connection: 1 to 2 local and remote fabrics.
See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and *General Switch Topology Rules* (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
2 or 4 FC-to-IP devices required for Fibre Channel to IP network connection.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath - multiple **PowerPath Base,** ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath - multiple (CX600) or 1 (CX400, FC4700) **PowerPath Base,** Utility Kit PowerPath, ATF, CDE - 1	PowerPath, **PowerPath Base,** Utility Kit PowerPath, ATF, or CDE. Clusters optional - NetWare Cluster Service. Access Logix, MirrorView, optional SnapView.	11 on page 104 12 on page 106

NetWare Direct Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                          See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                          Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                          1 per site per mirror configuration.
                          For the failover software supported for a storage system, see *Failover Configuration Rules*
                          (page 15).

Server Connection: 1 to 2 local and remote fabrics.
                          See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                          General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                          Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple1 per site	PowerPath - multiple **PowerPath Base,** ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	MirrorView - 1 PowerPath - multiple (CX600) or 1 (CX400, FC4700) **PowerPath Base,** Utility Kit PowerPath, ATF, CDE - 1	PowerPath, **PowerPath Base,** Utility Kit PowerPath, ATF, or CDE. Clusters optional - NetWare Cluster Service. Access Logix, MirrorView, optional SnapView.	13 on page 108

NetWare Direct Remote Mirror with Direct Server Connections

See *General Configuration Rules* (page 6).

Servers: 1 per site.
                          See *Paths from a Server to an SP (*page 10*)*, *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600,or FC4700 for remote mirroring.
                          1 per site per mirror configuration.
                          For the failover software supported for a storage system, see *Failover Configuration Rules*
                          (page 15).

Server Connection: Direct

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                          Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBAs Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	1 per site	PowerPath - multiple **ATF, PowerPath Base - 1 or 2**	MirrorView - 1 PowerPath - multiple (CX600) or 1 (CX400, FC4700) **PowerPath Base,** ATF - 1	PowerPath, **PowerPath Base,** or ATF. Clusters not applicable. Access Logix, MirrorView, optional SnapView.	14 on page 110

NetWare Direct Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 4 depending on configuration.
                      See *Paths from a Server to an SP (*page 10*), Clustered Server Configuration Rules* (page 14),
                      Failover Configuration Rules (page 15).

Storage Systems: 1 CX200, CX400, CX600, FC4500, FC4700, FC5300, or FC5700.
                      For the failover software supported for a storage system, see *Failover Configuration Rules*
                      (page 15).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 FC4500 FC4700 FC5300 FC5700	1	1	1	No PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, or CDE No non-disruptive software installation (NDU). Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	None
		2	1	PowerPath, PowerPath Base, or ATF. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	15 on page 111
CX400 CX600 FC4700	1	Multiple	Multiple	PowerPath. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	16 on page 112
CX200 CX400 CX600 FC4500 FC4700 FC5300 FC5700	2	1	1	No PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, or CDE. Clusters not supported. No Access Logix, no SnapView, no MirrorView.	17 on page 113
CX200 CX400 CX600 FC4500 FC4700 FC5300	2	2	2	PowerPath or ATF. Clusters required for storage system without Access Logix; optional for storage system with Access Logix - NetWare Cluster Service. No Access Logix (**CX200**, FC4500, FC5300), optional Access Logix (CX400, CX600, FC4700), optional SnapView (CX400, CX600, FC47600), optional MirrorView (CX600).	18 on page 114
CX400 CX600 FC4700	Multiple	1	Multiple	No PowerPath, Utility Kit PowerPath, ATF, or CDE. Cluster optional - NetWare Cluster Service. Access Logix, optional SnapView, optional MirrorView (CX600).	19 on page 115

NetWare Hub Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 2 with same operating system.
                        See *Paths from a Server to an SP* (page 10*), Clustered Server Configuration Rules* (page 14),
                        Failover Configuration Rules (page 15).

Storage Systems: 1 to 4 FC4500, FC5300, FC5700.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
FC4500 FC5300 FC5700	1	2	1	ATF. Clusters not applicable. No Access Logix.	20 on page 117
	2	2	1	ATF. Clusters required - NetWare Cluster Service. No Access Logix.	21 on page 118

Solaris Configurations

Solaris Single Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                      See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                      Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: Multiple CX400, CX600, FC4500, FC4700, or FC5300 (FC5300 configuration available from
                      selected channels; MIA required for optical connect).
                      See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                      Failover Configuration Rules (page 15).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                      General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4500 FC4700 FC5300	Single	PowerPath - multiple except for FC4500, FC5300 DMP - multiple ATF - 1 or 2	PowerPath, DMP - multiple ATF - 1	PowerPath, DMP, or ATF. Clusters not applicable. Access Logix required for FC4500, FC5300, and optional SnapView (CX600,FC4700).	1 on page 89
CX400 CX600 FC4700	Multiple	PowerPath, DMP - multiple ATF - 2	PowerPath, DMP - multiple ATF - 1	PowerPath, DMP, or ATF. Clusters required - SunCluster only if *not* using DMP, Veritas Cluster Server. Access Logix required for optional SnapView **and optional MirrorView**.	2 on page 90
CX400 CX600 FC4500 FC4700 FC5300	Multiple	1	1	PowerPath, Utility Kit PowerPath, DMP, ATF, or CDE. Clusters not supported. Access Logix, optional SnapView (CX400, CX600, FC4700), **optional MirrorView (CX400, CX600, FC4700).**	3 on page 91
CX400 CX600 FC4700	Multiple	1	PowerPath, DMP - multiple Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, DMP, ATF, or CDE. Clusters not supported. Access Logix, optional SnapView, optional MirrorView.	4 on page 92
CX400 CX600 FC4500 FC4700 FC5300	Multiple	PowerPath - multiple except for FC4500, FC5300 DMP - multiple ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath, DMP - multiple Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, DMP, ATF, or CDE. Clusters optional for multiple HBA-port servers *not* connected to FC5300 - SunCluster only if *not* using DMP, Veritas Cluster Server. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	5 on page 93
CX400 CX600 FC4700	Multiple	PowerPath, DMP - multiple ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	1	PowerPath, Utility Kit PowerPath, DMP, ATF, or CDE. Clusters optional for multiple HBA-port servers - SunCluster only if *not* using DMP, Veritas Cluster Server. Access Logix, optional SnapView, optional MirrorView.	6 on page 95

Solaris Dual Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                      See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*),*
                      Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: Multiple CX400, CX600, FC4500, FC4700,or FC5300 (FC5300 configuration available from selected
                      channels; MIA required for optical connect)
                      See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                      Failover Configuration Rules (page 15).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                      General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4500 FC4700 FC5300	Multiple	PowerPath - multiple except for FC4500, FC5300 DMP - multiple ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath, DMP - multiple Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, DMP, ATF, or CDE. Clusters optional for servers *not* connected to FC5300 - SunCluster only if *not* using DMP, Veritas Cluster Server. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	7 on page 96

Solaris Fabric Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                      See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*),*
                      Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 to 5 CX400, CX600, or FC4700 for remote mirroring.
                      1 per site per mirror configuration.
                      See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                      Failover Configuration Rules (page 15).

Server Connection: 1 to 2 fabrics.
                      See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                      General Switch Topology Rules (page 20).

Mirror Connection: SPA port 3 (CX600) or SPA port 1 (CX400, FC4700) on local and remote storage systems connected
                      to one switch (single fabric) or one fabric (dual fabric), and SPB port 3 (CX600) or SP port 1
                      (CX400, FC4700) on local and remote storage systems connected to other switch (single fabric) or
                      other fabric (dual fabric).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath, DMP - multiple ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath, DMP - multiple Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, DMP, ATF, or CDE. Clusters optional - SunCluster only if *not* using DMP, Veritas Cluster Server. Access Logix, MirrorView, optional SnapView.	8 on page 98 9 on page 100 10 on page 102

Solaris IP Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers:　　　　　　Multiple with same or different operating systems.
　　　　　　　　　　　See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
　　　　　　　　　　　Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems:　　2 CX400, CX600, or FC4700 for remote mirroring.
　　　　　　　　　　　1 per site per mirror configuration.
　　　　　　　　　　　For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Server Connection:　1 to 2 local and remote fabrics.
　　　　　　　　　　　See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and *General Switch Topology Rules* (page 20).

Mirror Connection:　SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
　　　　　　　　　　　2 or 4 FC-to-IP devices required for Fibre Channel to IP network connection.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath, DMP - multiple ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath, DMP - multiple Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, DMP, ATF, or CDE. Clusters optional - SunCluster only if *not* using DMP, Veritas Cluster Server. Access Logix, MirrorView, optional SnapView.	11 on page 104 12 on page 106

Solaris Direct Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
1 per site per mirror configuration.
For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Server Connection: 1 to 2 local and remote fabrics.
See *Storage Area Network (SAN) Configuration Rules* (page 9) and
General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBAs Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath, DMP - multiple ATF - 1 or 2 Utility Kit PowerPath, CDE - 1	MirrorView - 1 PowerPath, DMP - multiple (CX600) or 1 (CX400, FC4700) Utility Kit PowerPath, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, DMP, ATF, or CDE Clusters optional for multiple HBA-port servers - SunCluster only if *not* using DMP, Veritas Cluster Server. Access Logix, MirrorView, optional SnapView.	13 on page 108

Solaris Direct Remote Mirror with Direct Server Connections

See *General Configuration Rules* (page 6).

Servers: 1 per site.
See *Paths from a Server to an SP* (page 10), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
1 per site per mirror configuration.
For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Server Connection: Direct

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBAs Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 FC4700	1 per site	PowerPath, DMP - multiple ATF - 2	MirrorView - 1 PowerPath, DMP - multiple (CX600) or 1 (CX400, FC4700) ATF - 1	PowerPath, DMP, or ATF. Clusters not applicable. Access Logix, MirrorView, optional SnapView.	14 on page 110

Solaris Direct Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 4 depending on configuration.
See *Paths from a Server to an SP (*page 10*)*, *Clustered Server Configuration Rules* (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 1 CX400, CX600, FC4500, FC4700, FC5300, or FC5700.
For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 C4500 FC4700 FC5300 FC5700	1	1	1	clsp driver. PowerPath, Utility Kit PowerPath, ATF, or CDE. No non-disruptive software installation (NDU). Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	None
		2	1	PowerPath or ATF. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	15 on page 111
CX400 CX600 FC4700	1	Multiple	Multiple	PowerPath. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	16 on page 112
CX400 CX600 FC4500 FC4700 FC5300 FC5700	2	1	1	clsp driver for all but FC4700 with 8.45.xx or higher Base Software. No PowerPath, Utility Kit PowerPath, DMP, ATF, or CDE. No non-disruptive software installation (NDU). Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	17 on page 113
CX400 CX600 FC4500 FC4700 FC5300	2	2	2	PowerPath or ATF. Clusters required for storage system *without* Access Logix; optional for storage system *with* Access Logix - SunCluster only if *not* using DMP, Veritas Cluster Server. No Access Logix (FC4500, FC5300), optional Access Logix (CX400, CX600, FC4700), optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX600).	18 on page 114
CX400 CX600 FC4700	Multiple	1	Multiple	clsp driver. No PowerPath, Utility Kit PowerPath, DMP, ATF, or CDE. No non-disruptive software installation (NDU). Clusters not supported. Access Logix, optional SnapView, optional MirrorView (CX600).	19 on page 115

Solaris Hub Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 2 with same operating system.
                       See *Paths from a Server to an SP (*page 10*), Clustered Server Configuration Rules* (page 14),
                       Failover Configuration Rules (page 15).

Storage Systems: 1 to 4 FC4500, FC5300, FC5700.

Configurations:

Storage Systems	Servers	HBAs Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
FC4500 FC5300 FC5700	1	2	1	ATF. Clusters not applicable. No Access Logix.	20 on page 117
	2	2	1	ATF. Clusters required - SunCluster, Veritas Cluster Server. No Access Logix.	21 on page 118

Tru64 UNIX Configurations

Tru64 UNIX Single Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                        See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*),
                        Clustered Server Configuration Rules* (page 14).

Storage Systems: Multiple CX400, CX600, or FC4700.
                        See *Fan-In Rule* (page 9).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and
                        General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Single	Multiple	Multiple	Native Tru64 UNIX failover. Clusters not applicable. Access Logix **required for SnapView and optional MirrorView.**	1 on page 89
	Multiple	2	Multiple	Native Tru64 UNIX failover. Clusters required. Access Logix **required for optional SnapView and optional MirrorView.**	2 on page 90
		1	1	Native Tru64 UNIX failover. Clusters optional - TruCluster. Access Logix, **optional SnapView, and optional MirrorView.**	3 on page 91
			Multiple	Native Tru64 UNIX failover. Clusters optional - TruCluster. Access Logix, **optional SnapView, and optional MirrorView.**	4 on page 92
	Multiple	Multiple	Multiple	Native Tru64 UNIX failover. Clusters optional - TruCluster. Access Logix, optional SnapView, optional MirrorView.	5 on page 93
				Native Tru64 UNIX failover. Clusters optional - TruCluster. Access Logix, **optional SnapView, and optional MirrorView.**	6 on page 95

Tru64 UNIX Dual Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                         See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                         Clustered Server Configuration Rules (page 14).

Storage Systems: Multiple CX400, CX600, or FC4700.
                         See *Fan-In Rule* (page 9).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and
                         General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple	Multiple	Multiple	Native Tru64 UNIX failover. Clusters optional - TruCluster. Access Logix.	7 on page 96

Tru64 UNIX Fabric Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                         See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                         Clustered Server Configuration Rules (page 14).

Storage Systems: 2 to 5 CX400, CX600, or FC4700 for remote mirroring.
                         1 per site per mirror configuration.
                         See *Fan-In Rule* (page 9).

Server Connection: 1 to 2 fabrics.
                         See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                         General Switch Topology Rules (page 20).

Mirror Connection: SPA port 3 (CX600) or SPA port 1 (CX400, FC4700) on local and remote storage systems connected
                         to one switch (single fabric) or one fabric (dual fabric), and SPB port 3 (CX600) or SP port 1
                         (CX400, FC4700) on local and remote storage systems connected to other switch (single fabric) or
                         other fabric (dual fabric).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	1 to 2	2	Native Tru64 UNIX failover. Clusters optional - TruCluster. Access Logix, MirrorView, optional SnapView.	8 on page 98 9 on page 100 10 on page 102

Tru64 UNIX IP Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, FC4700 for remote mirroring.
1 per site per mirror configuration.

Server Connection: 1 to 2 local and remote fabrics.
See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and
General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
2 or 4 FC-to-IP devices required for Fibre Channel to IP network connection.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	1 to 2	2	Native Tru64 UNIX failover. Clusters optional - TruCluster. Access Logix, MirrorView, optional SnapView.	11 on page 104 12 on page 106

Tru64 UNIX Direct Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
Clustered Server Configuration Rules (page 14).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
1 per site per mirror configuration.

Server Connection: 1 to 2 local and remote fabrics.
See *Storage Area Network (SAN) Configuration Rules* (page 9) and
General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBAs Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	1 to 2	2	Native Tru64 UNIX failover. Clusters optional - TruCluster. Access Logix, MirrorView, optional SnapView.	13 on page 108

Windows 2000 Configurations

Windows 2000 Single Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers:	Multiple with same or different operating systems. See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*, *Clustered Server Configuration Rules* (page 14), *Failover Configuration Rules* (page 15).
Storage Systems:	Multiple CX200, CX400, CX600, FC4500, FC4700, or FC5300 (FC5300 configuration available from selected channels; MIA required for optical connect). See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).
Fabric:	See *Storage Area Network (SAN) Configuration Rules* (page 9) and *General Switch Topology Rules* (page 20).

Configurations:

Storage Systems	Servers	HBAs Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 FC4500 FC4700 FC5300	Single	Multiple	PowerPath - multiple, except for CX200, FC4500, FC5300 ATF- multiple (FC4700) or 1 (FC4500, FC5300) PowerPath Base - 1	PowerPath, PowerPath Base, or ATF. Optional multiple paths from server to each SP. Clusters not applicable. Access Logix required for CX200, FC4500, FC5300, and optional SnapView (CX400, CX600, FC4700).	1 on page 89
CX200 CX400 CX600 FC4700	Multiple	Multiple	PowerPath - multiple except for CX200 ATF- multiple PowerPath Base - 1	PowerPath, PowerPath Base, or ATF. Clusters required. Access Logix required for optional SnapView **(CX400, CX600, FC4700) and optional MirrorView (CX400, CX600, FC4700).**	2 on page 90
CX200 CX400 CX600 FC4500 FC4700 FC5300	Multiple	1	1	PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, or CDE. Clusters optional for servers - Microsoft Cluster Server or Oracle9iRAC. Access Logix, optional SnapView (CX400, CX600, FC4700), **optional MirrorView (CX400, CX600, FC4700)**.	3 on page 91
CX400 CX600 FC4700	Multiple	1	PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Clusters optional - Microsoft Cluster Server or Oracle9iRAC. Access Logix, optional SnapView, optional MirrorView.	4 on page 92
CX200 CX400 CX600 FC4500 FC4700 FC5300	Multiple	PowerPath, ATF - multiple PowerPath Base - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath - multiple except for CX200, FC4500, FC5300 ATF- multiple (FC4700) or 1 (FC4500, FC5300) PowerPath Base, Utility Kit PowerPath, CDE - 1	PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, or CDE. Clusters optional for servers - Microsoft Cluster Server or Oracle9iRAC. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	5 on page 93
CX400 CX600 FC4700	Multiple	PowerPath, ATF - multiple **PowerPath Base - 1 or 2** Utility Kit PowerPath, CDE - 1	PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	PowerPath, **PowerPath Base**, Utility Kit PowerPath, ATF, or CDE. Optional multiple paths from multiple HBA-port non-clustered server to each SP. Clusters optional - Microsoft Cluster Server or Oracle9iRAC. Access Logix, optional SnapView, optional MirrorView.	6 on page 95

Windows 2000 Dual Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                        See *Fan-Out Rule* (page 9), *Paths from a Server to an SP* (page 10),
                        Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: Multiple CX200, CX400, CX600, FC4500, FC4700, or FC5300 (FC5300 configuration available from
                        selected channels; MIA required for optical connect).
                        See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                        Failover Configuration Rules (page 15).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                        General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 FC4500 FC4700 FC5300	Multiple	PowerPath, ATF - multiple PowerPath Base - 1 or 2 Utility Kit PowerPath, CDE - 1	PowerPath - multiple except for CX200, FC4500, FC5300 ATF- multiple (FC4700) or 1 (FC4500, FC5300) PowerPath Base, Utility Kit PowerPath, CDE - 1	PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, or CDE. Optional multiple paths from multiple HBA-port non-clustered server to each SP (except FC5300). Clusters optional - Microsoft Cluster Server or Oracle9iRAC. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	7 on page 96

Windows 2000 Fabric Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 to 5 CX400, CX600, FC4700 for remote mirroring.
1 per site per mirror configuration.
See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
Failover Configuration Rules (page 15).

Server Connection: 1 to 2 fabrics.
See *Storage Area Network (SAN) Configuration Rules* (page 9) and
General Switch Topology Rules (page 20).

Mirror Connection: SPA port 3 (CX600) or SPA port 1 (CX400, FC4700) on local and remote storage systems connected to one switch (single fabric) or one fabric (dual fabric), and SPB port 3 (CX600) or SP port 1 (CX400, FC4700) on local and remote storage systems connected to other switch (single fabric) o other fabric (dual fabric).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath, ATF - multiple **PowerPath Base - 1 or 2** Utility Kit PowerPath, CDE - 1	PowerPath, ATF - multiple **PowerPath Base,** Utility Kit PowerPath, CDE - 1	PowerPath, **PowerPath Base,** Utility Kit PowerPath, ATF, or CDE. Optional multiple paths from multiple HBA-port non-clustered server to each SP. Clusters optional - Microsoft Cluster Server or Oracle9iRAC. Access Logix, MirrorView, optional SnapView.	8 on page 98 9 on page 100 10 on page 102

Windows 2000 IP Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9)*, Paths from a Server to an SP (*page 10*)*,
Clustered Server Configuration Rules (page 14)*, Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
1 per site per mirror configuration.
For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Server Connection: 1 to 2 local and remote fabrics.
See *Storage Area Network (SAN) Configuration Rules* (page 9)*, Port Speed Rules* (page 14), and *General Switch Topology Rules* (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
2 or 4 FC-to-IP devices required for Fibre Channel to IP network connection.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath, ATF - multiple **PowerPath Base - 2** Utility Kit PowerPath, CDE - 1	PowerPath, ATF - multiple **PowerPath Base,** Utility Kit PowerPath, CDE - 1	PowerPath, **PowerPath Base,** Utility Kit PowerPath, ATF, or CDE. Optional multiple paths from multiple HBA-port non-clustered server to each SP. Clusters optional - Microsoft Cluster Server or Oracle9iRAC. Access Logix, MirrorView, optional SnapView.	11 on page 104 12 on page 106

Windows 2000 Direct Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                          See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                          Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                          1 per site per mirror configuration.
                          For the failover software supported for a storage system, see *Failover Configuration Rules*
                          (page 15).

Server Connection: 1 to 2 local and remote fabrics.
                          See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                          General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                          Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath, ATF - multiple **PowerPath Base - 1 or 2** Utility Kit PowerPath, CDE - 1	MirrorView - 1 PowerPath - multiple (CX600) or 1 (CX400, FC4700) **PowerPath Base,** Utility Kit PowerPath, ATF, CDE - 1	PowerPath, **Power Path Base,** Utility Kit PowerPath, ATF, or CDE. Optional multiple paths from multiple HBA-port non-clustered server to each SP. Clusters optional - Microsoft Cluster Server or Oracle9iRAC. Access Logix, MirrorView, optional SnapView.	13 on page 108

Windows 2000 Direct Remote Mirror with Direct Server Connections

See *General Configuration Rules* (page 6).

Servers: 1 per site.
                          See *Paths from a Server to an SP* (page 10), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                          1 per site per mirror configuration.
                          For the failover software supported for a storage system, see *Failover Configuration Rules*
                          (page 15).

Server Connection: Direct

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                          Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBAs Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	1 per site	PowerPath or ATF - multiple **PowerPath Base - 1 or 2**	MirrorView - 1 PowerPath - multiple (CX600) or 1 (CX400, FC4700) **PowerPath Base,** ATF - 1	PowerPath, **PowerPath Base,** or ATF. Clusters not applicable. Access Logix, MirrorView, optional SnapView.	14 on page 110

Windows 2000 Direct Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 4 depending on configuration.
See *Paths from a Server to an SP (*page 10*), Clustered Server Configuration Rules* (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 1 CX200, CX400, CX600, FC4500, FC4700, FC5300, or FC5700.
For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 FC4500 FC4700 FC5300 FC5700	1	1	1	No PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, or CDE. No non-disruptive software installation (NDU). Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	None
		2	1	PowerPath, PowerPath Base, or ATF. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	15 on page 111
CX400 CX600 FC4700	1	Multiple	Multiple	PowerPath or ATF. Optional multiple paths from multiple HBA-port non-clustered server to each SP. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	16 on page 112
CX200 CX400 CX600 FC4500 FC4700 FC5300 FC5700	2	1	1	No PowerPath, PowerPath Base, Utility Kit PowerPath, ATF, or CDE. No non-disruptive software installation (NDU). Clusters not supported. No Access Logix, no SnapView, no MirrorView.	17 on page 113
CX200 CX400 CX600 FC4500 FC4700 FC5300	2	2	2	PowerPath or ATF. Clusters required for storage system without Access Logix; optional for storage system with Access Logix - Microsoft Cluster Server or Oracle9iRAC. No Access Logix (CX200, FC4500, FC5300), optional Access Logix (CX400, CX600, FC4700), optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX600).	18 on page 114
CX400 CX600 FC4700	Multiple	1	Multiple	No PowerPath, Utility Kit PowerPath, ATF, or CDE. No non-disruptive software installation (NDU). Clusters optional - Microsoft Cluster Server or Oracle9iRAC. Access Logix, optional SnapView, optional MirrorView (CX600).	19 on page 115

Windows 2000 Hub Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 2 with same operating system.
                      See *Paths from a Server to an SP (*page 10*)*, *Clustered Server Configuration Rules* (page 14),
                      Failover Configuration Rules (page 15).

Storage Systems: 1 to 4 FC4500, FC5300, FC5700.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
FC4500 FC5300 FC5700	1	2	1	ATF. Clusters not applicable. No Access Logix.	20 on page 117
	2	2	1	ATF. Clusters required - Microsoft Cluster Server or Oracle9iRAC. No Access Logix.	21 on page 118

Windows NT Configurations

Windows NT Single Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
See *Fan-Out Rule* (page 9), *Paths from a Server to an SP* (page 10),
Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: Multiple CX200, CX400, CX600, FC4500, FC4700, or FC5300 (FC5300 configuration available from selected channels; MIA required for optical connect).
See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9) and *General Switch Topology Rules* (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 FC4500 FC4700 FC5300	Single	Multiple	PowerPath - multiple except for CX200, FC4500, FC5300 ATF- multiple (FC4700) or 1 (FC4500, FC5300)	PowerPath or ATF. Optional multiple paths from server to each SP. Clusters not applicable. Access Logix required for CX200, FC4500, and FC5300, optional SnapView (CX400, CX600, FC4700).	1 on page 89
CX200 CX400 CX600 FC4700	Multiple	Multiple	Multiple	PowerPath or ATF. Clusters required. Access Logix required for optional SnapView **(CX400, CX600, FC4700) and optional MirrorView (CX400, CX600, FC4700).**	2 on page 90
CX200 CX400 CX600 FC4500 FC4700 FC5300	Multiple	1	1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Clusters optional - Microsoft Cluster Server. Access Logix, optional SnapView (CX400, CX600, FC4700), **optional MirrorView (CX400, CX600, FC4700)**.	3 on page 91
CX400 CX600 FC4700	Multiple	1	PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Clusters optional - Microsoft Cluster Server. Access Logix, optional SnapView, optional MirrorView.	4 on page 92
CX200 CX400 CX600 FC4500 FC4700 FC5300	Multiple	PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	PowerPath - multiple except for CX200, FC4500, FC5300 ATF- multiple (FC4700) or 1 (FC4500, FC5300) Utility Kit PowerPath, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Clusters optional for servers - Microsoft Cluster Server. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	5 on page 93
CX400 CX600 FC4700	Multiple	PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Optional multiple paths from multiple HBA-port non-clustered server to each SP. Clusters optional - Microsoft Cluster Server. Access Logix, optional SnapView, optional MirrorView.	6 on page 95

Windows NT Dual Fabric Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                        See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                        Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: Multiple CX200, CX400, CX600, FC4500, FC4700, or FC5300 (FC5300 configuration available from
                        selected channels; MIA required for optical connect).
                        See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                        Failover Configuration Rules (page 15).

Fabric: See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                        General Switch Topology Rules (page 20).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 C4500 FC4700 FC5300	Multiple	PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	PowerPath - multiple except for CX200, FC4500, FC5300 ATF- multiple (FC4700) or 1 (FC4500, FC5300) Utility Kit PowerPath, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Optional multiple paths from multiple HBA-port non-clustered server to each SP (except FC5300). Clusters optional - Microsoft Cluster Server. Access Logix, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX400, CX600, FC4700).	7 on page 96

Windows NT Fabric Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                            See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                            Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 to 5 CX400, CX600, or FC4700 for remote mirroring.
                            1 per site per mirror configuration.
                            See *Fan-In Rule* (page 9). For the failover software supported for a storage system, see
                            Failover Configuration Rules (page 15).

Server Connection: 1 to 2 fabrics.
                            See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                            General Switch Topology Rules (page 20).

Mirror Connection: SPA port 3 (CX600) or SPA port 1 (CX400, FC4700) on local and remote storage systems connected
                            to one switch (single fabric) or one fabric (dual fabric), and SPB port 3 (CX600) or SP port 1
                            (CX400, FC4700) on local and remote storage systems connected to other switch (single fabric) or
                            other fabric (dual fabric).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	MirrorView - 1 PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Optional multiple paths from multiple HBA-port non-clustered server to each SP. Clusters optional - Microsoft Cluster Server. Access Logix, MirrorView, optional SnapView.	8 on page 98 9 on page 100 10 on page 102

Windows NT IP Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                        See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                        Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                        1 per site per mirror configuration.
                        For the failover software supported for a storage system, see *Failover Configuration Rules*
                        (page 15).

Server Connection: 1 to 2 local and remote fabrics.
                        See *Storage Area Network (SAN) Configuration Rules* (page 9), *Port Speed Rules* (page 14), and
                        General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                        2 or 4 FC-to-IP devices required for Fibre Channel to IP network connection.

Configurations:

Storage Systems	Servers	HBA ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	MirrorView - 1 PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Optional multiple paths from multiple HBA-port non-clustered server to each SP. Clusters optional - Microsoft Cluster Server. Access Logix, MirrorView, optional SnapView.	11 on page 104 12 on page 106

Windows NT Direct Remote Mirror with Fabric Server Connections

See *General Configuration Rules* (page 6) and *Switch Topology Rules* (page 20).

Servers: Multiple with same or different operating systems.
                      See *Fan-Out Rule* (page 9), *Paths from a Server to an SP (*page 10*)*,
                      Clustered Server Configuration Rules (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                      1 per site per mirror configuration.
                      For the failover software supported for a storage system, see *Failover Configuration Rules*
                      (page 15).

Server Connection: 1 to 2 local and remote fabrics.
                      See *Storage Area Network (SAN) Configuration Rules* (page 9) and
                      General Switch Topology Rules (page 20).

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                      Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	Multiple per site	PowerPath, ATF - multiple Utility Kit PowerPath, CDE - 1	MirrorView - 1 PowerPath - multiple (CX600) or 1 (CX400, FC4700) Power, ATF, CDE - 1	PowerPath, Utility Kit PowerPath, ATF, or CDE. Optional multiple paths from multiple HBA-port non-clustered server to each SP. Clusters optional - Microsoft Cluster Server. Access Logix, MirrorView, optional SnapView.	13 on page 108

Windows NT Direct Remote Mirror with Direct Server Connections

See *General Configuration Rules* (page 6).

Servers: 1 per site.
                      See *Paths from a Server to an SP* (page 10), *Failover Configuration Rules* (page 15).

Storage Systems: 2 CX400, CX600, or FC4700 for remote mirroring.
                      1 per site per mirror configuration.
                      For the failover software supported for a storage system, see *Failover Configuration Rules*
                      (page 15).

Server Connection: Direct

Mirror Connection: SP port 3 (CX600) or SP port 1 (CX400, FC4700) for dedicated point-to-point mirroring.
                      Extenders required for over 500 meters.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX400 CX600 FC4700	1 per site	Multiple	MirrorView - 1 PowerPath - multiple (CX600) or 1 (CX400, FC4700) ATF - 1	PowerPath or ATF. Clusters not applicable. Access Logix, MirrorView, optional SnapView.	14 on page 110

Windows NT Direct Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 4 depending on configuration.
See *Paths from a Server to an SP (*page 10*)*, *Clustered Server Configuration Rules* (page 14), *Failover Configuration Rules* (page 15).

Storage Systems: 1 CX200, CX400, CX600, FC4500, FC4700, FC5300, or FC5700.
For the failover software supported for a storage system, see *Failover Configuration Rules* (page 15).

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
CX200 CX400 CX600 FC4500 FC4700 FC5300 FC5700	1	1	1	No PowerPath, Utility Kit PowerPath, ATF, or CDE. No non-disruptive software installation (NDU). Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	None
		2	1	PowerPath or ATF. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	15 on page 111
CX400 CX600 FC4700	1	Multiple	Multiple	PowerPath or ATF. Clusters not applicable. No Access Logix, no SnapView, no MirrorView.	16 on page 112
CX200 CX400 CX600 FC4500 FC4700 FC5300 FC5700	2	1	1	No PowerPath, Utility Kit PowerPath, ATF, or CDE. No non-disruptive software installation (NDU). Clusters not supported. No Access Logix, no SnapView, no MirrorView.	17 on page 113
CX200 CX400 CX600 FC4500 FC4700 FC5300	2	2	2	PowerPath or ATF. Clusters required for storage system without Access Logix; optional for storage system with Access Logix - Microsoft Cluster Server. No Access Logix (CX200, FC4500, FC5300), optional Access Logix (CX400, CX600, FC4700), optional SnapView (CX400, CX600, FC47600), optional MirrorView (CX600).	18 on page 114
CX400 CX600 FC4700	Multiple	1	Multiple	No PowerPath, Utility Kit PowerPath, ATF, or CDE. No non-disruptive software installation (NDU). Clusters optional - Microsoft Cluster Server. Access Logix, optional SnapView, optional MirrorView (CX600).	19 on page 115

Windows NT Hub Connections

See *General Configuration Rules* (page 6).

Servers: 1 to 2 with same operating system.
                      See *Paths from a Server to an SP (*page 10*), Clustered Server Configuration Rules* page 14),
                      Failover Configuration Rules (page 15).

Storage Systems: 1 to 4 FC4500, FC5300, FC5700.

Configurations:

Storage Systems	Servers	HBA Ports per Server	Ports Used per SP	Requirements/Comments	Diagrams
FC4500 FC5300 FC5700	1	2	1	ATF. Clusters not applicable. No Access Logix.	20 on page 117
	2	2	1	ATF. Clusters required - Microsoft Cluster Server. No Access Logix.	21 on page 118

Sample Configuration Diagrams

This section provides diagrams of *sample* configurations. A diagram may not show the best configuration for a specific environment.

Sample Single Fabric Connections

1. **Single Fabric - Single Host and Multiple Storage Systems (CX200, CX400, CX600, FC4500, FC4700, FC5300)**

CX200, FC4500, or FC5300   CX600   CX400 or FC4700   CX200, FC4500, or FC5300

NOTE: See *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 15), and *Switch Topology Rules* (page 20).

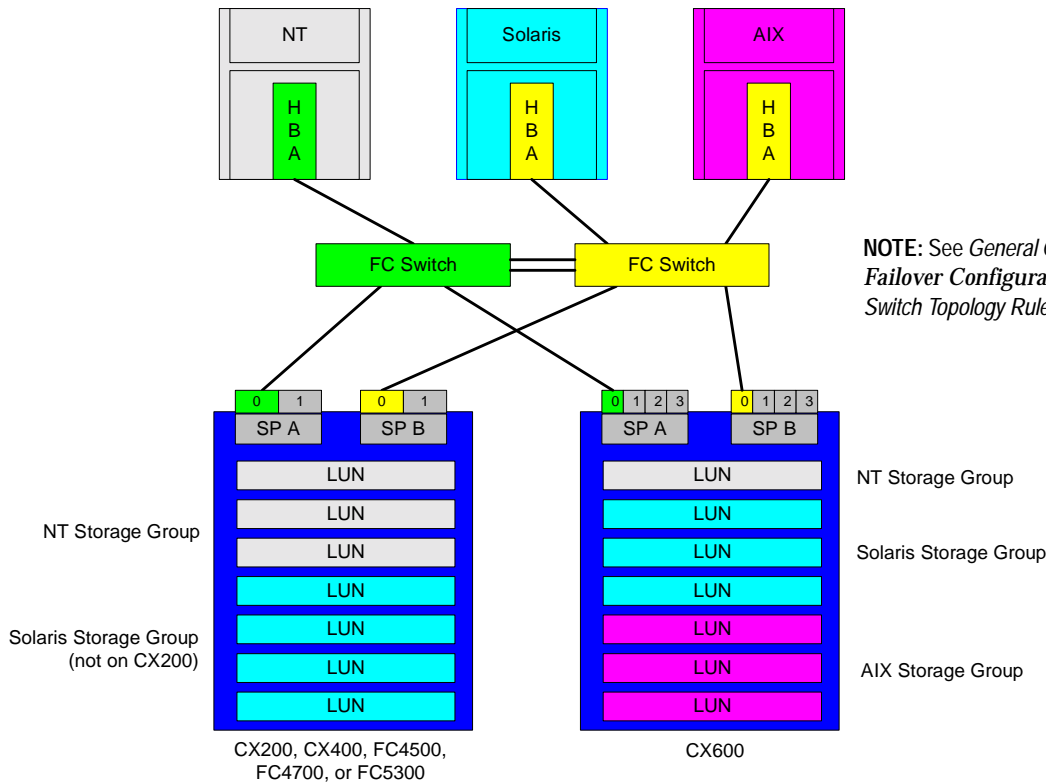|	
Benefits	Low cost, highly-available, switch connect for single server to multiple storage systems.
Hardware	Single server with multiple HBAs. 1 fabric.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath for AIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT. **PowerPath Base for Linux without clustering, NetWare, and Windows 2000.** DMP for Solaris. ATF for AIX, NetWare, Solaris, Windows 2000, and Windows NT PVLinks for HP-UX. Native failover for IRIX and Tru64 UNIX. No SP failover **or non-disruptive software installation (NDU)** for Linux with FC5300. Optional multiple/alternate paths to each SP for AIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, for Windows 2000 and Windows NT with ATF, and for HP-UX, IRIX, and Tru64 UNIX.
Clusters	Not applicable.
Storage Systems	For AIX, HP-UX, and Solaris: CX400, CX600, FC4500, FC4700, and FC5300. For IRIX and Tru64 UNIX: CX400, CX600, and FC4700. For Linux, NetWare, Windows 2000, and Windows NT: CX200, CX400, CX600, FC4500, FC4700, and FC5300. FC5300 available from selected channels; FC5300 optical connections require MIAs on SP ports.
Storage-System Software	Access Logix required for CX200, FC4500, FC5300, Tru64 Unix, and optional SnapView.

2. Single Fabric - Clustered Hosts and Single Storage System (CX200, CX400, CX600, FC4700)

NT Cluster

NOTE: See *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 15), and *Switch Topology Rules* (page 20)

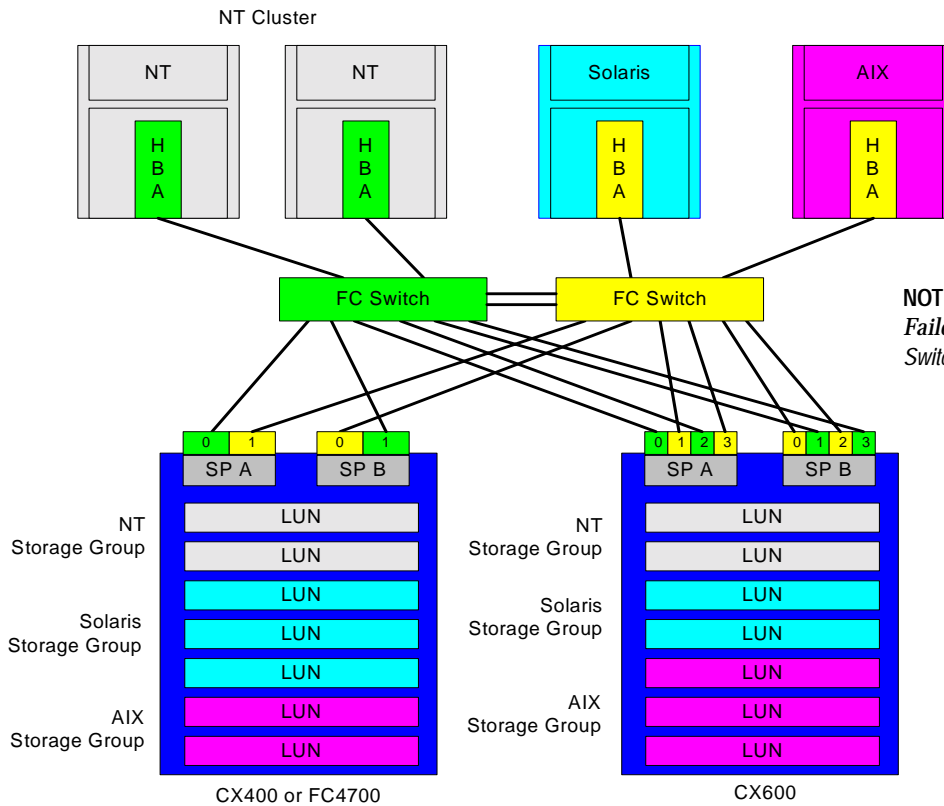| Benefits	Low cost, highly-available, switch connect for clustered servers to single or multiple storage systems.
Hardware	Servers with multiple HBAs. 1 fabric.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PowerPath Base for NetWare, and Windows 2000. DMP for Solaris. ATF for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. No SP failover **or non-disruptive software installation (NDU)** for Linux. Native failover for IRIX and Tru64 UNIX. Optional multiple/alternate paths to each SP for AIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, for Windows 2000 and Windows NT with ATF, and for HP-UX, IRIX, and Tru64 UNIX.

Clusters	Required:
	  AIX (HACMP, HACMP/ES)
	  HP-UX (MC/ServiceGuard)
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server)
	  Tru64 UNIX (TruCluster)
	  Windows 2000 (Microsoft Cluster Server or Oracle9iRAC)
	  Windows NT (Microsoft Cluster Server).

Storage Systems	For AIX, HP-UX, IRIX, Solaris, and Tru64 UNIX,: CX400, CX600, and FC4700. For Linux, NetWare, Windows 2000, and Windows NT: CX200, CX400, CX600, and FC4700.
Storage-System Software	Access Logix required for Tru64 UNIX, optional SnapView (CX400, CX600, FC4700), **optional MirrorView (CX400, CX600, FC4700)**

3. Single Fabric - Single HBA Port/Single Port Per SP (CX200, CX400, CX600, FC4500, FC4700, FC5300)

NOTE: See *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 15), and *Switch Topology Rules* (page 20).

| Benefits	Low cost, partial-highly-available, switch connect for multiple servers to storage systems.
Hardware	Servers each with single HBA. 1 fabric.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath or Utility Kit PowerPath for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT. PowerPath Base for Linux without clustering, NetWare, and Windows 2000. DMP for Solaris. ATF or CDE for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX and Tru64 UNIX. No SP failover **or non-disruptive software installation (NDU)** for Linux with FC5300 or clustering.

Clusters	Optional:
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Tru64 UNIX (TruCluster)
	  Windows 2000 (Microsoft Cluster Server or Oracle9iRAC)
	  Windows NT (Microsoft Cluster Server).
	Not supported for other operating systems.

Storage Systems	For AIX, HP-UX, and Solaris: CX400, CX600, FC4500, FC4700, and FC5300. For IRIX and Tru64 UNIX: CX400, CX600, and FC4700. For Linux, NetWare, Windows 2000, and Windows NT: CX200, CX400, CX600, FC4500, FC4700, and FC5300. FC5300 optical connections require MIAs on SP ports.
Storage-System Software	Access Logix; optional SnapView for CX400, CX600, and FC4700, **optional MirrorView (CX400, CX600, FC4700)**.

4. Single Fabric - Single HBA Port/Multiple Ports per SP (CX400, CX600, FC4700)

NOTE: See *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 15), and *Switch Topology Rules* (page 20).

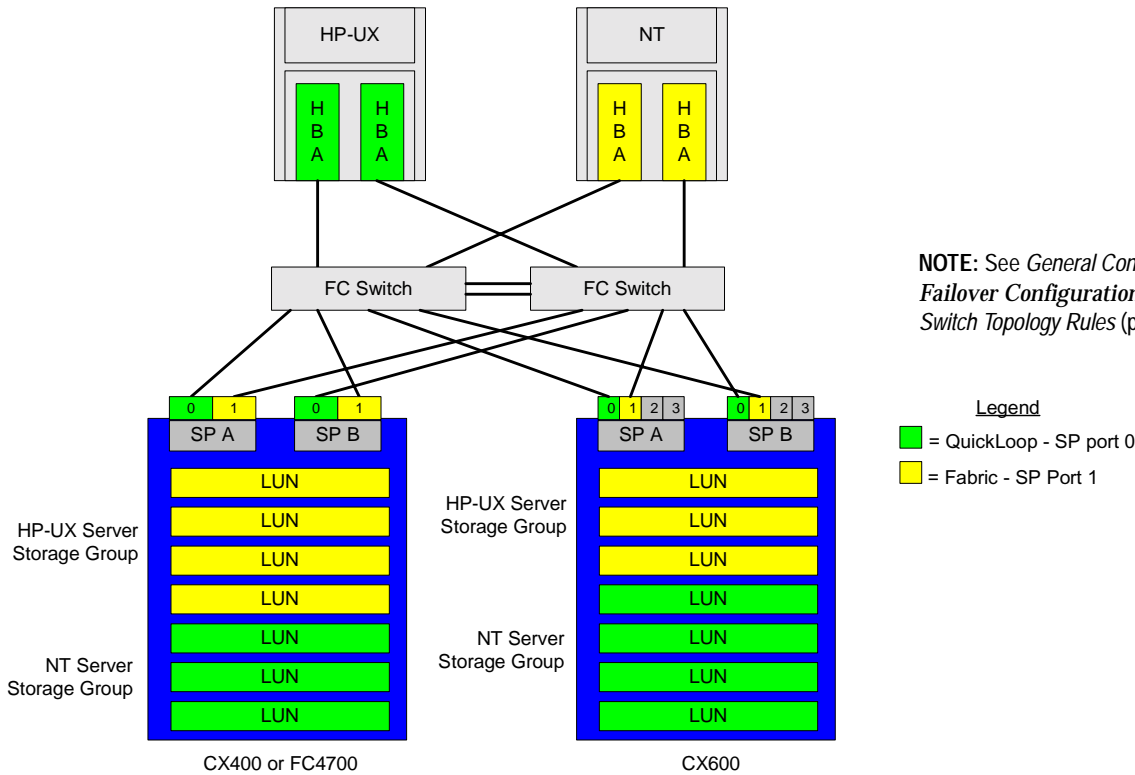|	
Benefits	Low cost, partial-highly-available, switch connect for multiple servers to CX600 and FC4700 storage systems. Higher throughput than configuration 3.
Hardware	Servers each with single HBA. 1 fabric.
Server Operating Systems	AIX, HP-UX, Linux, IRIX, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath or Utility Kit PowerPath for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT. DMP for Solaris. ATF or CDE for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX and Tru64 UNIX. No SP failover or non-disruptive software installation (NDU) for Linux with clustering. Optional multiple/alternate paths to each SP for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, and for Windows 2000 and Windows NT with ATF and without clusters.

Clusters	Optional:
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Solaris (Veritas Cluster Server only if using DMP)
	  Tru64 UNIX (TruCluster)
	  Windows 2000 (Microsoft Cluster Server or Oracle9iRAC)
	  Windows NT (Microsoft Cluster Server).
	Not supported for other operating systems.

Storage Systems	CX400, CX600, and FC4700.
Storage-System Software	Access Logix; optional SnapView and optional MirrorView, **optional MirrorView.**

5. Single Fabric - Mixed Single and Multiple HBA Ports Accessing Same CX200, FC4500, or FC5300 and CX400, CX600, or FC4700
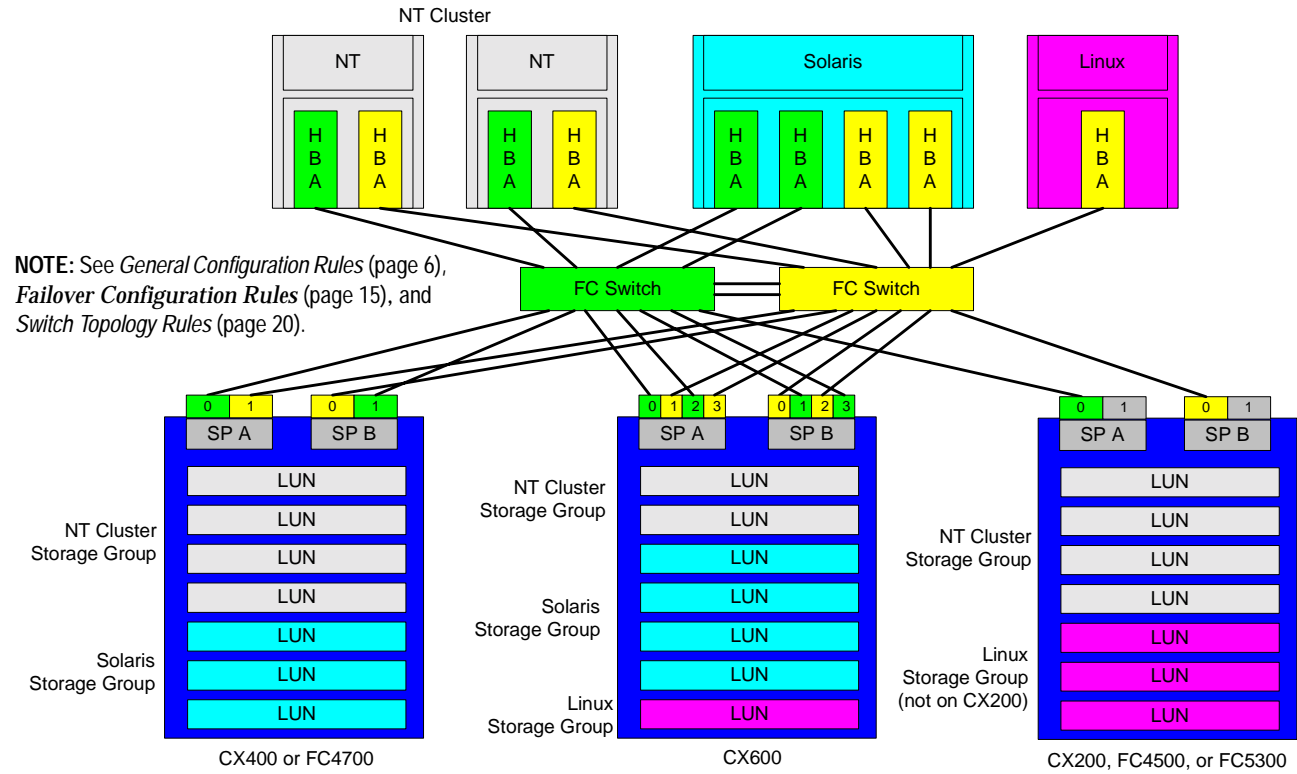
5. Single Fabric - Mixed Single and Multiple HBA Ports Accessing Same CX200, FC4500, or FC5300 and CX400, CX600, or FC4700, continued

Benefits	Partial-highly available (single HBA) and highly-available (multiple HBAs), switch connect for multiple servers using same storage systems.
Hardware	Servers, some with single HBA, some with multiple HBAs. 1 fabric.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath or Utility Kit PowerPath for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, Windows NT. PowerPath Base for Linux without clustering, NetWare, and Windows 2000. DMP for Solaris. ATF or CDE for AIX, NetWare, Solaris, Windows 2000, Windows NT. PVLinks for HP-UX. Native failover for IRIX and Tru64 UNIX. No SP failover or non-disruptive software installation (NDU) **for Linux with FC5300 or clustering.** Optional multiple/alternate paths to each SP for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, for Windows 2000 and Windows with ATF and without clusters, and for non-clustered, multiple-HBA HP-UX, IRIX, and Tru64 UNIX servers.

Clusters	Optional:
	  AIX (HACMP, HACMP/ES)
	  HP-UX (MC/ServiceGuard)
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server)
	  Tru64 UNIX (TruCluster)
	  Windows 2000 (Microsoft Cluster Server or Oracle9iRAC)
	  Windows NT (Microsoft Cluster Server)
	Not supported for any server connected to FC5300 except Netware, Windows 2000, or Windows NT server.

Storage Systems	For AIX, HP-UX, and Solaris: CX400, CX600, FC4500, FC4700, and FC5300. For IRIX and Tru64 UNIX: CX400, CX600, and FC4700. For Linux, NetWare, Windows 2000, and Windows NT: CX200, CX400, CX600, FC4500, FC4700, and FC5300. FC5300 available from selected channels; FC5300 optical connections require MIAs on SP ports.
Storage-System Software	Access Logix; optional SnapView (**CX400**, CX600, FC4700), optional MirrorView (**CX400**, CX600, FC4700)

6. Single Fabric - QuickLoop and Fabric/Multiple HBA Ports /Multiple Ports per SP (CX400, CX600, FC4700)
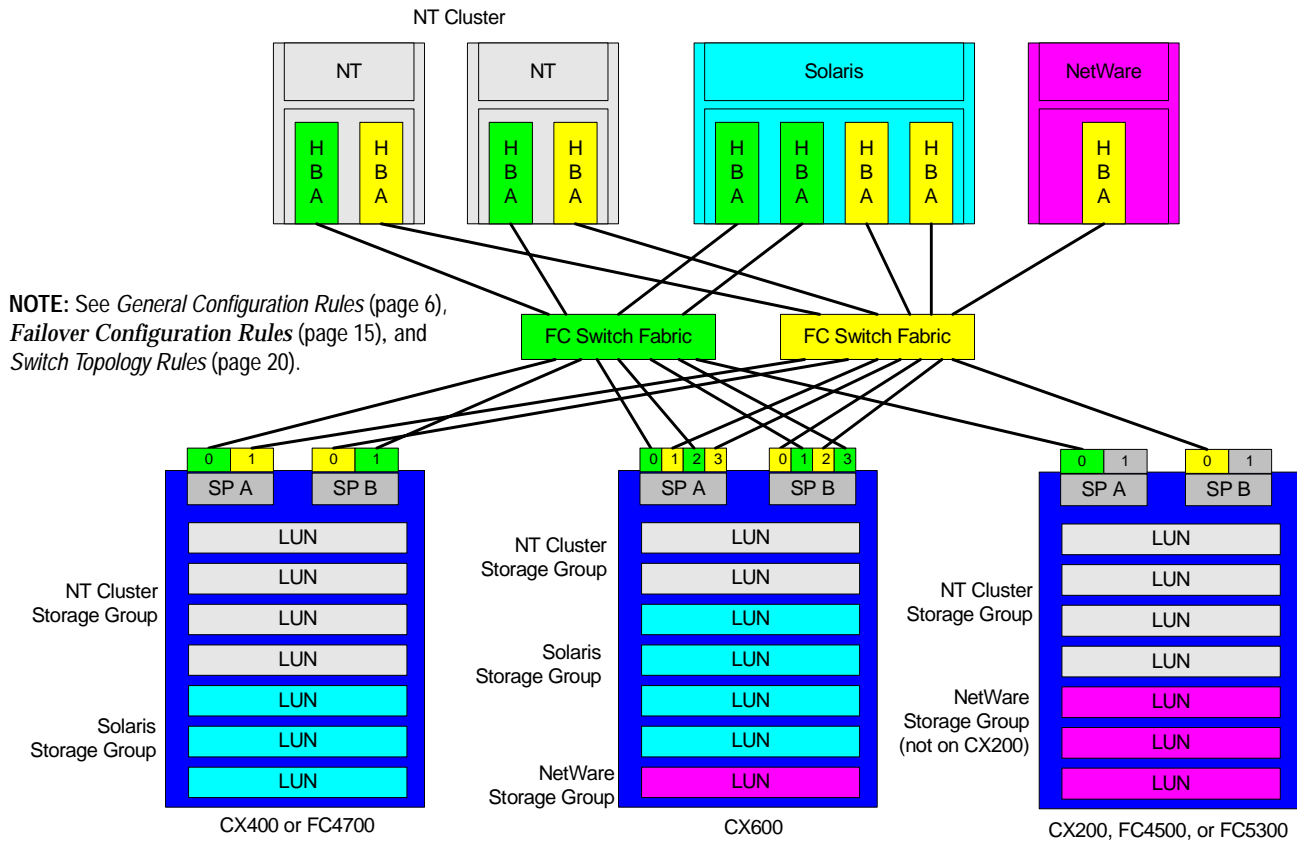

NOTE: See *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 15), and *Switch Topology Rules* (page 20).

Legend

🟩 = QuickLoop - SP port 0

🟨 = Fabric - SP Port 1

Benefits	Highly-available, QuickLoop and fabric switch connect to CX600 and FC4700 storage systems.
Hardware	HP-UX (QuickLoop or fabric) servers and non-HP-UX servers (fabric) with single or multiple HBAs. SP port 0 for QuickLoop; SP port 1 for fabric. 1 fabric.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath or Utility Kit PowerPath for AIX, Linux **without clustering**, NetWare, Solaris, Windows 2000, and Windows NT. **PowerPath Base for Linux without clustering, NetWare, and Windows 2000.** DMP for Solaris. ATF or CDE for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX and Tru64 UNIX. No SP failover or non-disruptive software installation (NDU) **for Linux with clustering.** Optional multiple/alternate paths to each SP for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, for Windows 2000 and Windows with ATF and without clusters, and for non-clustered, multiple-HBA HP-UX, IRIX, and Tru64 UNIX servers.

Clusters	Optional:
	  AIX (HACMP, HACMP/ES)
	  HP-UX (MC/ServiceGuard)
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server)
	  Tru64 UNIX (TruCluster)
	  Windows 2000 (Microsoft Cluster Server or Oracle9iRAC)
	  Windows NT (Microsoft Cluster Server).

Storage Systems	CX400, CX600, and FC4700.
Storage-System Software	Access Logix; optional SnapView, optional MirrorView.

Sample Dual Fabric Connections

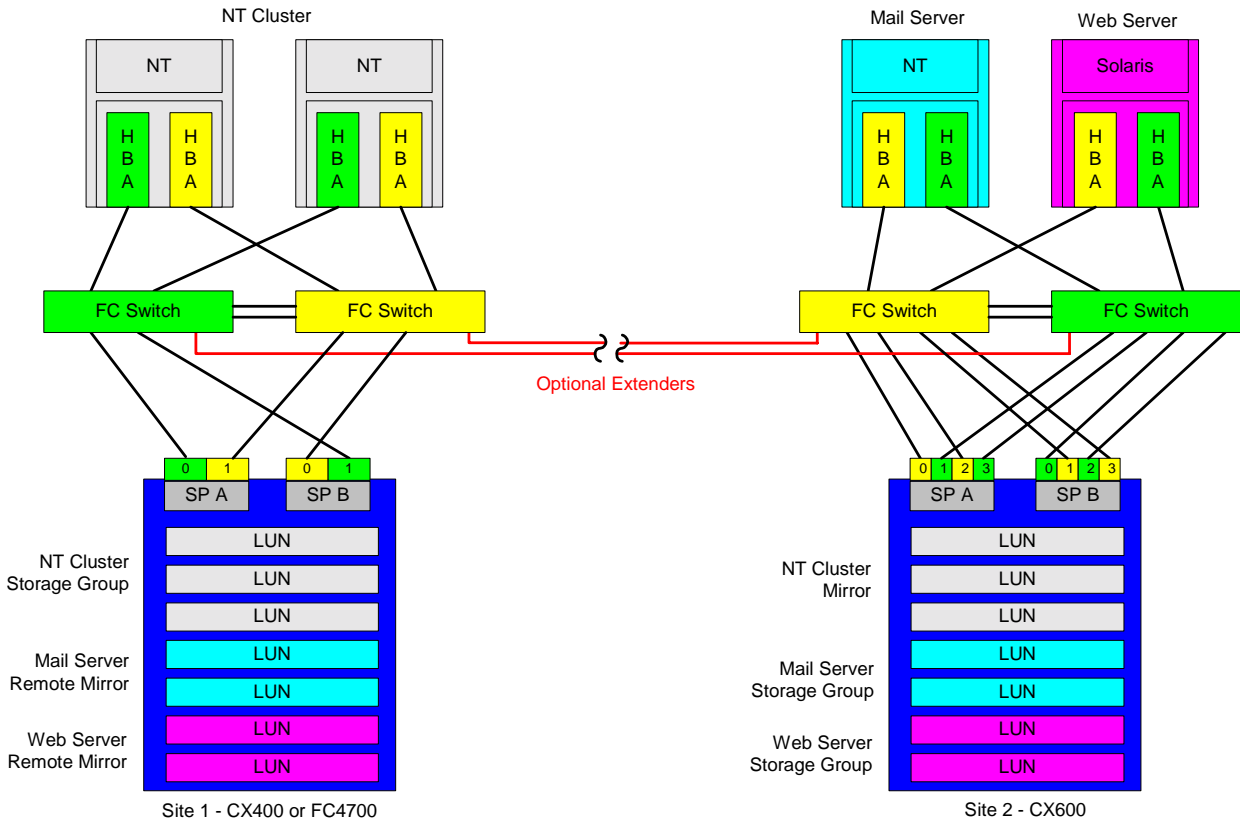7. Dual Fabric - Mixed Multiple and Single HBA Ports (CX200, CX400, CX600, FC4500, FC4700, FC5300)

NOTE: See *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 15), and *Switch Topology Rules* (page 20).

7. Dual Fabric - Mixed Multiple and Single HBA Ports (CX200, CX400, CX600, FC4500, FC4700, FC5300), continued

Benefits	Highly-available (multiple HBA servers) and partial-highly available (single HBA server), switch connect for multiple servers and storage systems.
Hardware	Servers with single or multiple HBAs.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath or Utility Kit PowerPath for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT. PowerPath Base for Linux without clustering, NetWare, and Windows 2000. DMP for Solaris. ATF or CDE for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PowerPath for Linux. PVLinks for HP-UX Native failover for IRIX and Tru64 UNIX. No SP failover for Linux with FC5300 or clustering. Optional multiple/alternate paths to each SP for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, for Windows 2000 and Windows with ATF and without clusters, and for non-clustered, multiple-HBA HP-UX, IRIX, and Tru64 UNIX servers.
Clusters	Optional: AIX (HACMP, HACMP/ES) HP-UX (MC/ServiceGuard) IRIX (FailSafe) Linux (Oracle9iRAC) NetWare (NetWare Cluster Service) Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server) Tru64 UNIX (TruCluster) Windows 2000 (Microsoft Cluster Server or Oracle9iRAC) Windows NT (Microsoft Cluster Server). Not supported for any server connected to FC5300 except Netware, Windows 2000, or Windows NT server.
Storage Systems	For AIX, HP-UX, and Solaris: CX400, CX600, FC4500, FC4700, and FC5300. For IRIX and Tru64 UNIX: CX400, CX600, and FC4700. For Linux, NetWare, Windows 2000, and Windows NT: CX200, CX400, CX600, FC4500, FC4700, and FC5300. FC5300 available from selected channels; FC5300 optical connections require MIAs on SP ports.
Storage-System Software	Access Logix; optional SnapView (CX400, CX600, **FC4700**), **optional MirrorView (CX400, CX600, FC4700).**

Sample Fabric Remote Mirror Connections

8. Single Fabric Remote Mirror - Fabric Servers (CX400, CX600, FC4700)
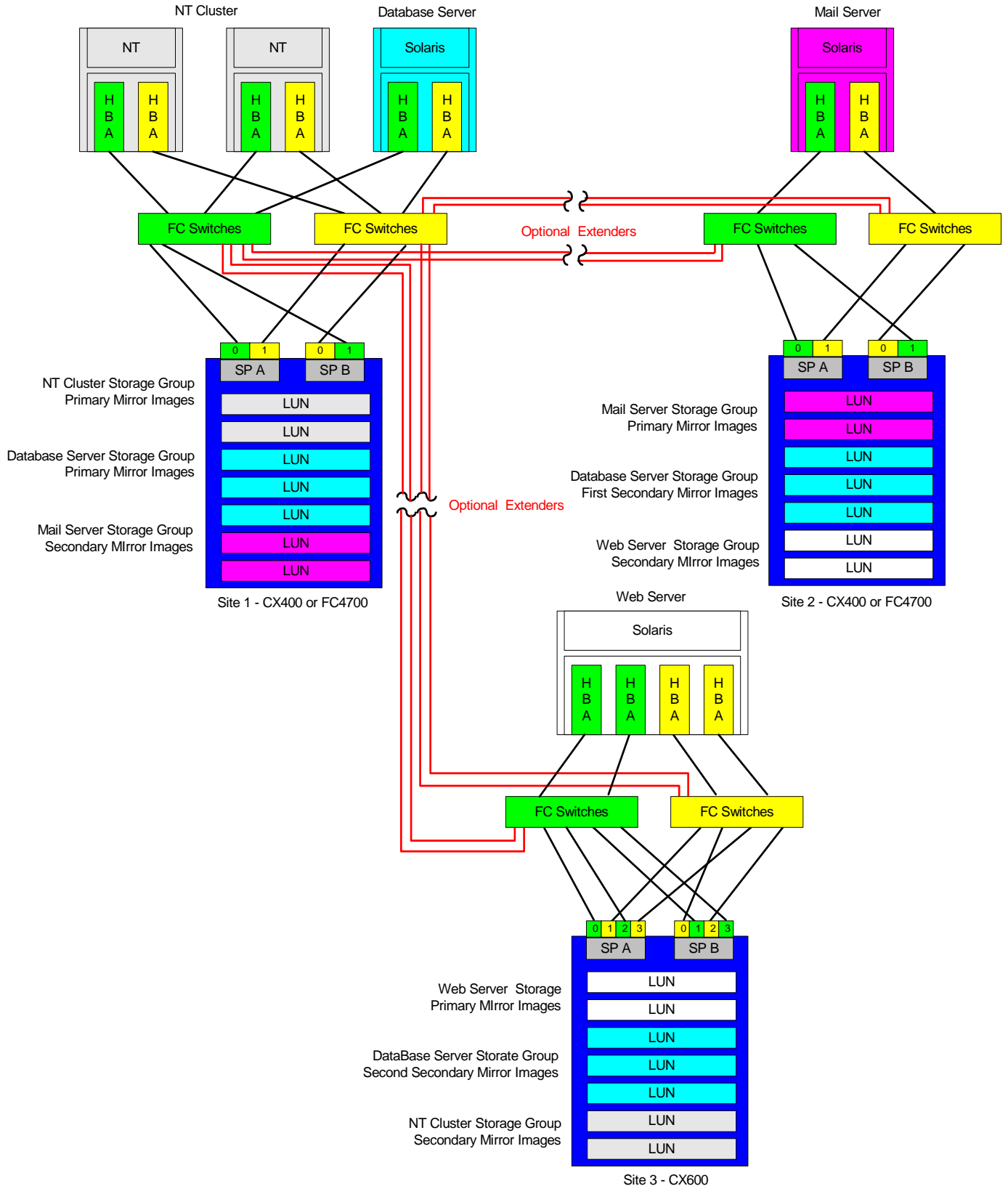

NOTE: See *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 15), and *Switch Topology Rules* (page 20).

8.   Single Fabric Remote Mirror - Fabric Servers (CX400, CX600, FC4700), continued

Benefits	Partially highly-available, remote mirroring with fabric connections connection for multiple servers.
Hardware	Servers with single or multiple HBAs. 1 fabric with 2 switches max, 1 at local site and 1 at remote site. Two ISLs or DWDMs required. CX400 or FC4700 - SP port 0 for server I/O; SP port 1 for mirroring. CX600 - SP ports 0, 1, 2 for server I/O; SP port 3 for mirroring.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath or Utility Kit PowerPath for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT. **PowerPath Base for Linux without clustering, NetWare, and Windows 2000.** DMP for Solaris. ATF or CDE for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX andTru64 UNIX. No SP failover or non-disruptive software installation (NDU) for Linux. Optional multiple/alternate paths to each SP for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, for Windows 2000 and Windows with ATF and without clusters, and for non-clustered, multiple-HBA HP-UX, IRIX, and Tru64 UNIX servers.

Clusters	Optional:
	  HP-UX (MC/ServiceGuard)
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server.)
	  Tru64 UNIX (TruCluster)
	  Windows 2000 (Microsoft Cluster Server or Oracle9iRAC)
	  Windows NT (Microsoft Cluster Server).
	Not supported for AIX.

Storage Systems	CX400, CX600, and FC4700.
Storage-System Software	Access Logix, MirrorView, and optional SnapView.

9. Dual Fabric Remote Mirror (one primary image, one or more secondary images) - Fabric Servers (CX400, CX600, FC4700)
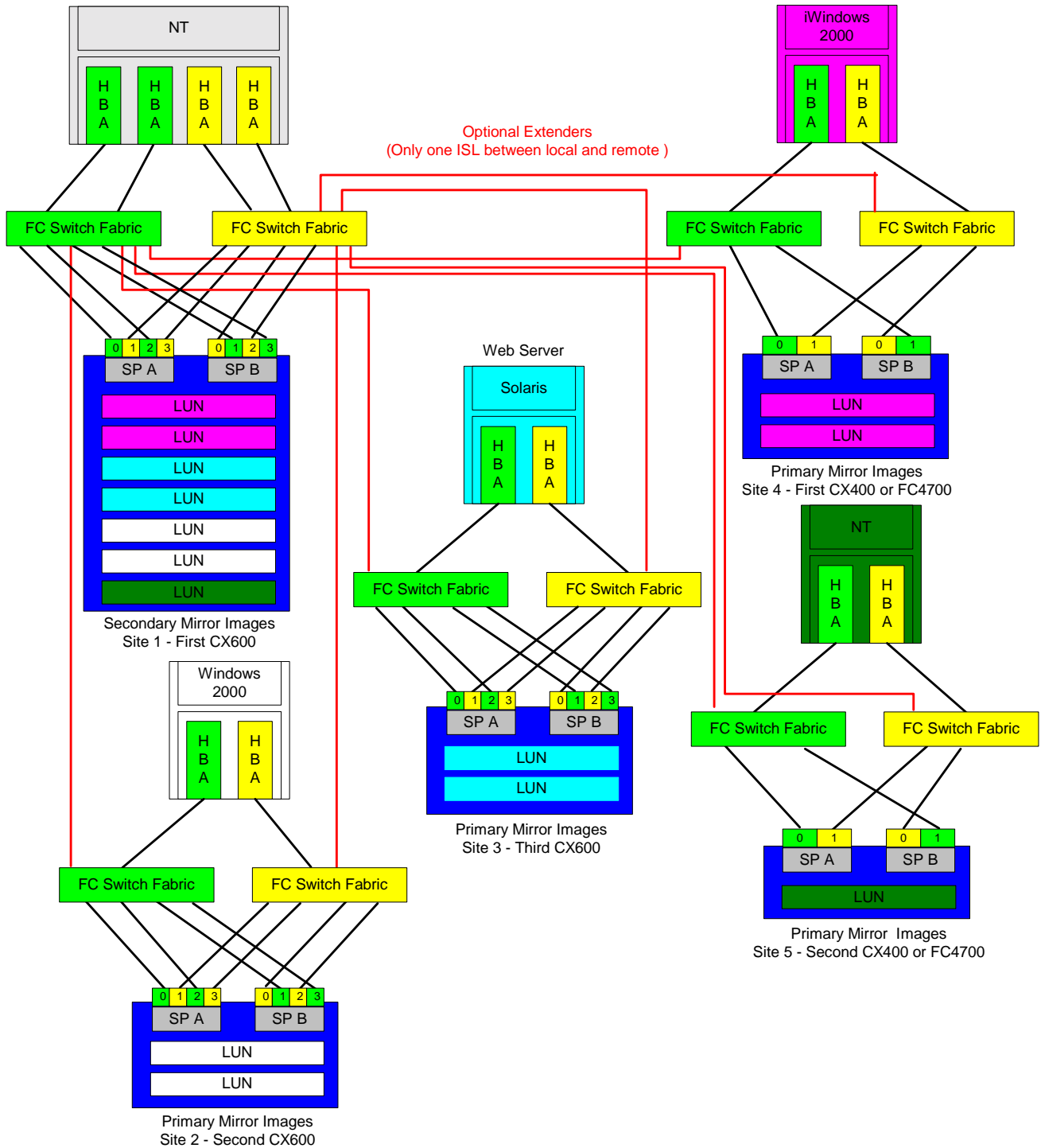

NOTE: See *General Configuration Rules* (page 6), ***Failover Configuration Rules*** (page 15), and *Switch Topology Rules* (page 20).

9. Dual Fabric Remote Mirror (one primary image, one or more secondary images on) - Fabric Servers (CX400, CX600, FC4700), continued

Benefits	Maximum highly-available, high-throughput, remote mirroring with fabric connections for multiple servers.
Hardware	Servers with single or multiple HBAs. 2 fabrics extended to 2 remote site. Two ISLs or DWDMs recommended. CX400 or FC4700 - SP port 0 for server I/O; SP port 1 for mirroring. CX600 - SP ports 0, 1, 2 for server I/O; SP port 3 for mirroring.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, Windows NT.
Other Server Software	PowerPath or Utility Kit PowerPath for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT. **PowerPath Base for Linux without clustering, NetWare, and Windows 2000.** DMP for Solaris. ATF or CDE for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX and Tru64 UNIX. No SP failover or non-disruptive software installation (NDU) for Linux with clustering. Optional multiple/alternate paths to each SP for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, for Windows 2000 and Windows with ATF and without clusters, and for non-clustered, multiple-HBA HP-UX, IRIX, and Tru64 UNIX servers.

Clusters	Optional:
	  HP-UX (MC/ServiceGuard)
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server.)
	  Tru64 UNIX (TruCluster)
	  Windows 2000 (Microsoft Cluster Server or Oracle9iRAC)
	  Windows NT (Microsoft Cluster Server).
	Not supported for AIX.

Storage Systems	CX400, CX600, and FC4700.
Storage-System Software	Access Logix, MirrorView, and optional SnapView.

10. Multiple Fabric Remote Mirror (primary images on multiple CX600s and CX400s or FC4700s, secondary images on one CX600) - Fabric Servers
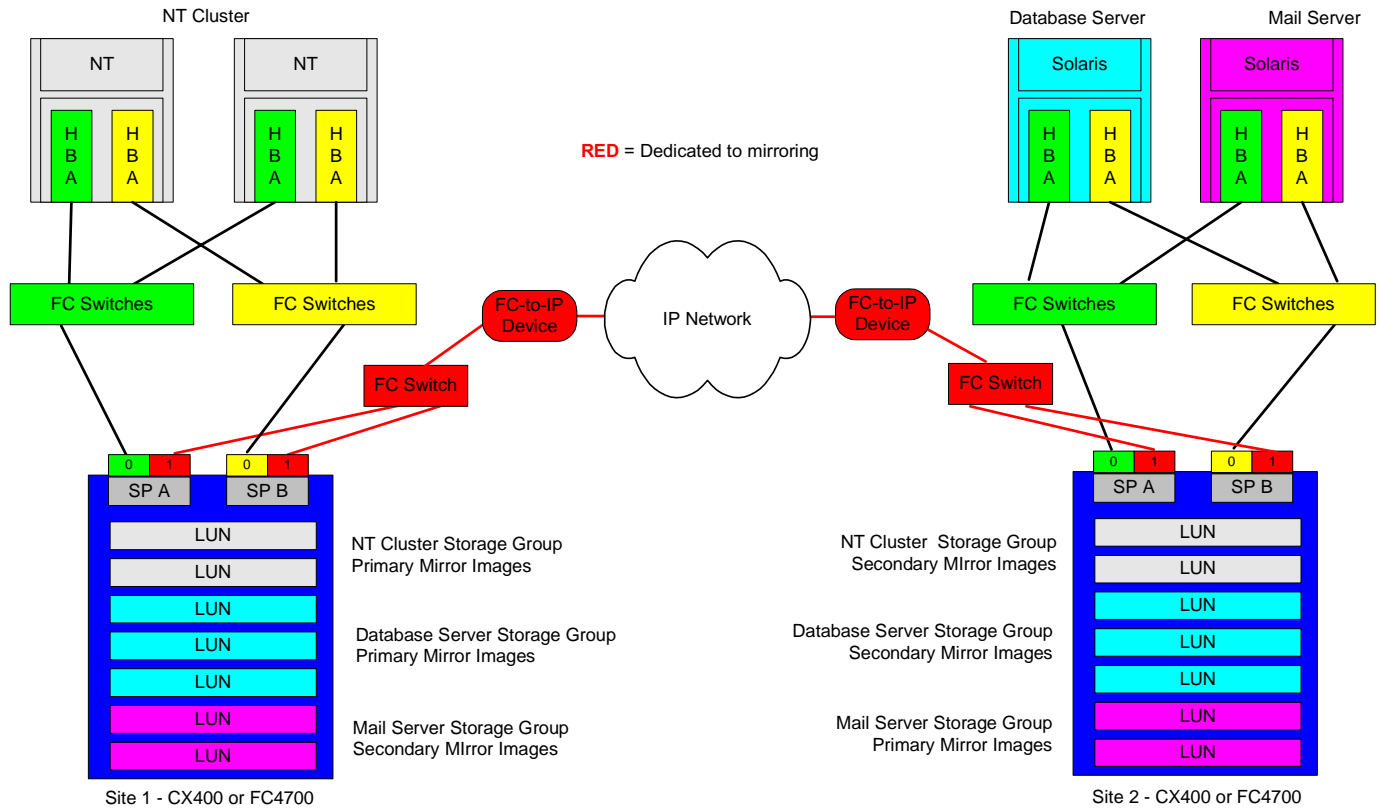

NOTE: See *General Configuration Rules* (page 6), ***Failover Configuration Rules*** (page 15), and *Switch Topology Rules* (page 20).

10. Multiple Fabric Remote Mirror (primary images on multiple CX600s and FC4700s, secondary images on one CX600 - Fabric Servers, continued

Benefits	Maximum highly-available, high-throughput, remote mirroring with fabric connections for multiple servers.
Hardware	Servers with single or multiple HBAs. 2 fabrics extended to 4 remote sites. Two ISLs or DWDMs recommended. CX400 or FC4700 - SP port 0 for server I/O; SP port 1 for mirroring. CX600 - SP ports 0, 1, 2 for server I/O; SP port 3 for mirroring.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath or Utility Kit PowerPath for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT. **PowerPath Base for Linux without clustering, NetWare, and Windows 2000.** DMP for Solaris. ATF or CDE for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX and Tru64 UNIX. No SP failover or non-disruptive software installation (NDU) for Linux with clustering. Optional multiple/alternate paths to each SP for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, for Windows 2000 and Windows with ATF and without clusters, and for non-clustered, multiple-HBA HP-UX, IRIX, and Tru64 UNIX servers.

Clusters	Optional:
	  HP-UX (MC/ServiceGuard)
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server.)
	  Tru64 UNIX (TruCluster)
	  Windows 2000 (Microsoft Cluster Server or Oracle9iRAC)
	  Windows NT (Microsoft Cluster Server).
	Not supported for AIX.

Storage Systems	CX400, CX600, and FC4700.
Storage-System Software	Access Logix, MirrorView, and optional SnapView.

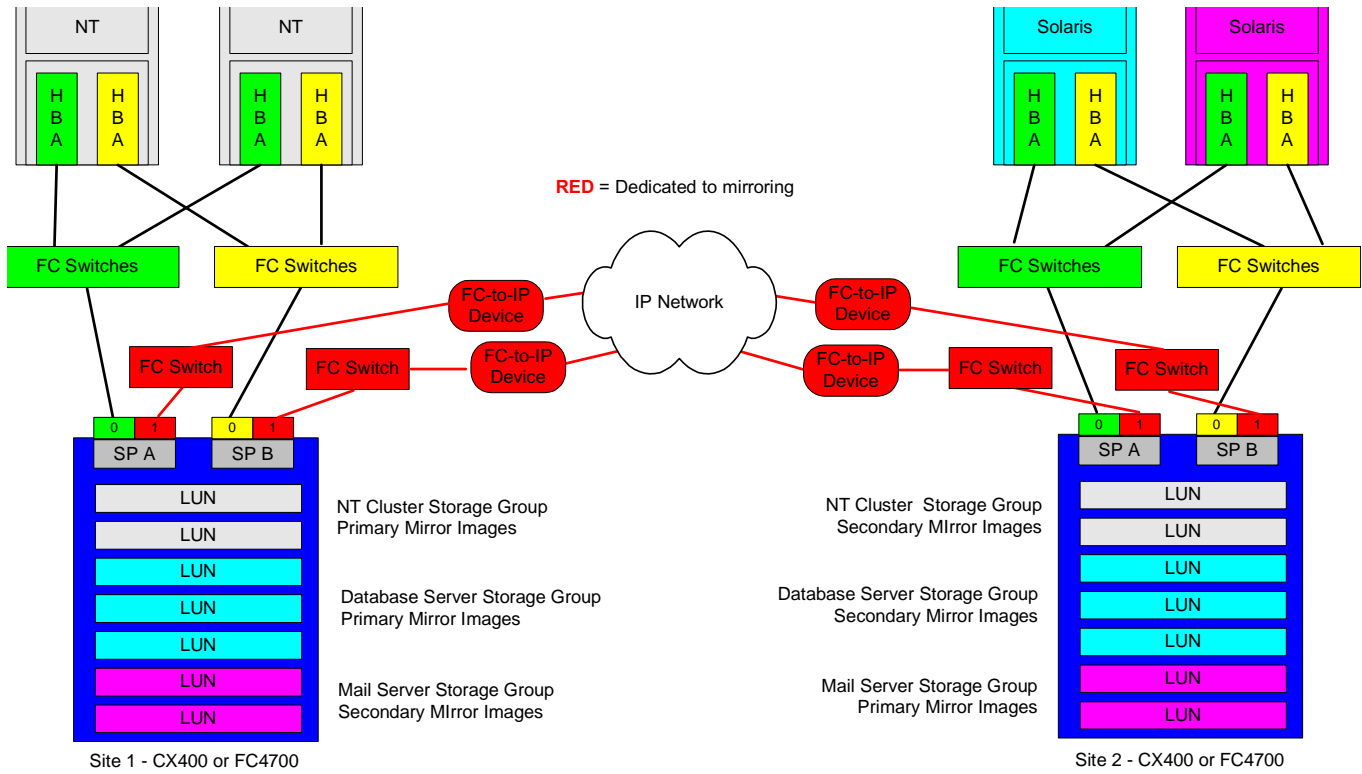## 11. IP Remote Mirror Single IP - Fabric Servers (CX400, CX600, FC4700)

NOTE: See *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 15), and *Switch Topology Rules* (page 20).

11. IP Remote Mirror Single IP - Fabric Servers (CX400, CX600, FC4700), continued

Benefits	Partially-available, remote mirroring with IP network connection for multiple servers.
Hardware	Servers with single or multiple HBAs. 1 or 2 fabrics, 1 or 2 at local site and 1 or 2 at remote site for SAN. For mirror over IP, two dedicated switches and two FC-to-IP devices. CX400 or FC4700 - SP port 0 for server I/O; SP port 1 for mirroring. CX600 - SP ports 0, 1, 2 for server I/O; SP port 3 for mirroring.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath or Utility Kit PowerPath for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT. **PowerPath Base for Linux without clustering, NetWare, or Windows 2000.** DMP for Solaris. ATF or CDE for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX andTru64 UNIX. No SP failover or non-disruptive software installation (NDU) for Linux with clustering. Optional multiple/alternate paths to each SP for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, for Windows 2000 and Windows with ATF and without clusters, and for non-clustered, multiple-HBA HP-UX, IRIX, and Tru64 UNIX servers.

Clusters	Optional:
	  HP-UX (MC/ServiceGuard)
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server.)
	  Tru64 UNIX (TruCluster)
	  Windows 2000 (Microsoft Cluster Server or Oracle9iRAC)
	  Windows NT (Microsoft Cluster Server).
	Not supported for AIX.

Storage Systems	CX400, CX600, and FC4700.
Storage-System Software	Access Logix, MirrorView, and optional SnapView.

12. IP Remote Mirror Dual IP - Fabric Servers (CX400, CX600, FC4700)

RED = Dedicated to mirroring

NT Cluster Storage Group
Primary Mirror Images

Database Server Storage Group
Primary Mirror Images

Mail Server Storage Group
Secondary MIrror Images

NT Cluster Storage Group
Secondary MIrror Images

Database Server Storage Group
Secondary Mirror Images

Mail Server Storage Group
Primary Mirror Images

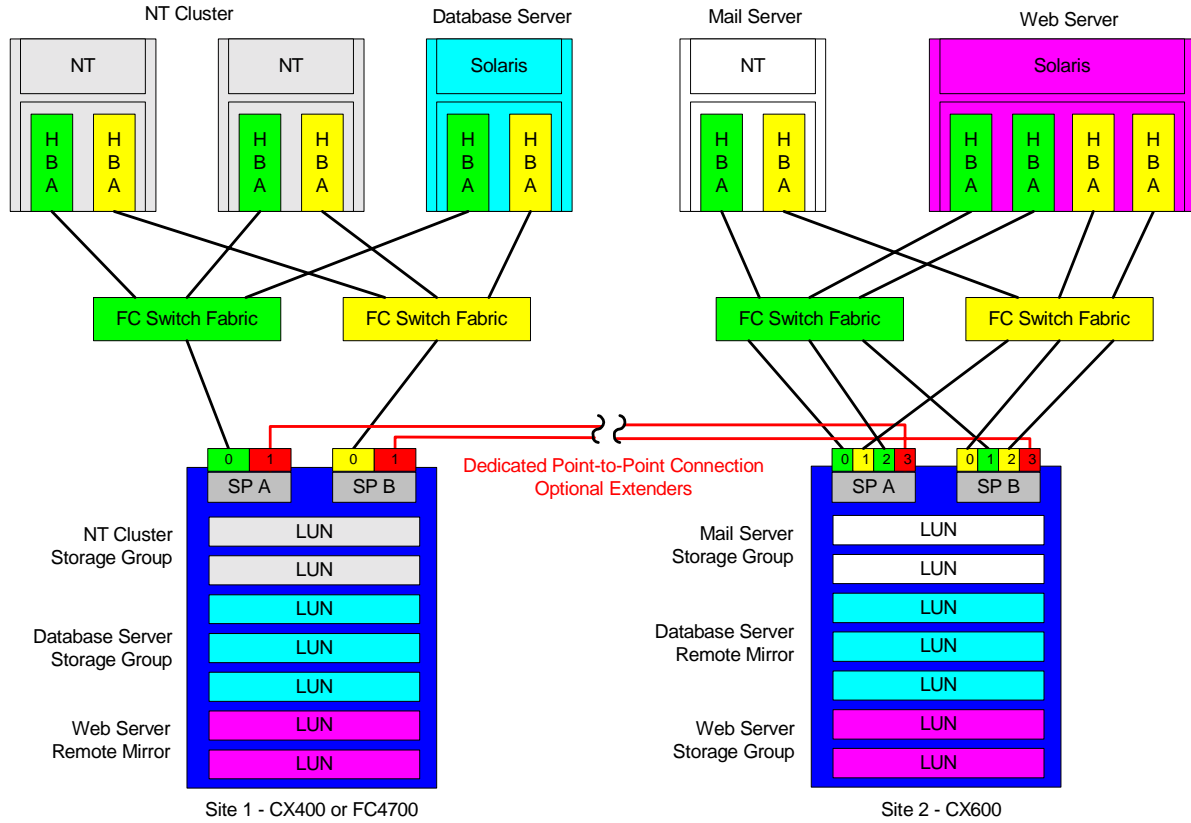Site 1 - CX400 or FC4700

Site 2 - CX400 or FC4700

NOTE: See *General Configuration Rules* (page 6)*, **Failover Configuration Rules** (page 15), and *Switch Topology Rules* (page 20).

12. IP Remote Mirror Dual IP - Fabric Servers (CX400, CX600, FC4700), continued

Benefits	Highly-available, remote mirroring with IP network connections for multiple servers.
Hardware	Servers with single or multiple HBAs. 4 fabrics, 2 at local site and 2 at remote site for SAN. For mirror over IP, four dedicated switches and four FC-to-IP devices. CX400 or FC4700 - SP port 0 for server I/O; SP port 1 for mirroring. CX600 - SP ports 0, 1, 2 for server I/O; SP port 3 for mirroring.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath or Utility Kit PowerPath for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT. **PowerPath Base for Linux without clustering, NetWare, or Windows 2000l.** DMP for Solaris. ATF or CDE for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX andTru64 UNIX. No SP failover or non-disruptive software installation (NDU) for Linux with clustering. Optional multiple/alternate paths to each SP for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, for Windows 2000 and Windows with ATF and without clusters, and for non-clustered, multiple-HBA HP-UX, IRIX, and Tru64 UNIX servers.

Clusters	Optional:
	  HP-UX (MC/ServiceGuard)
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server.)
	  Tru64 UNIX (TruCluster)
	  Windows 2000 (Microsoft Cluster Server or Oracle9iRAC)
	  Windows NT (Microsoft Cluster Server)
	Not supported for AIX.

Storage Systems	CX400, CX600, and FC4700.
Storage-System Software	Access Logix, MirrorView, and optional SnapView.

Sample Direct Remote Mirror Connections

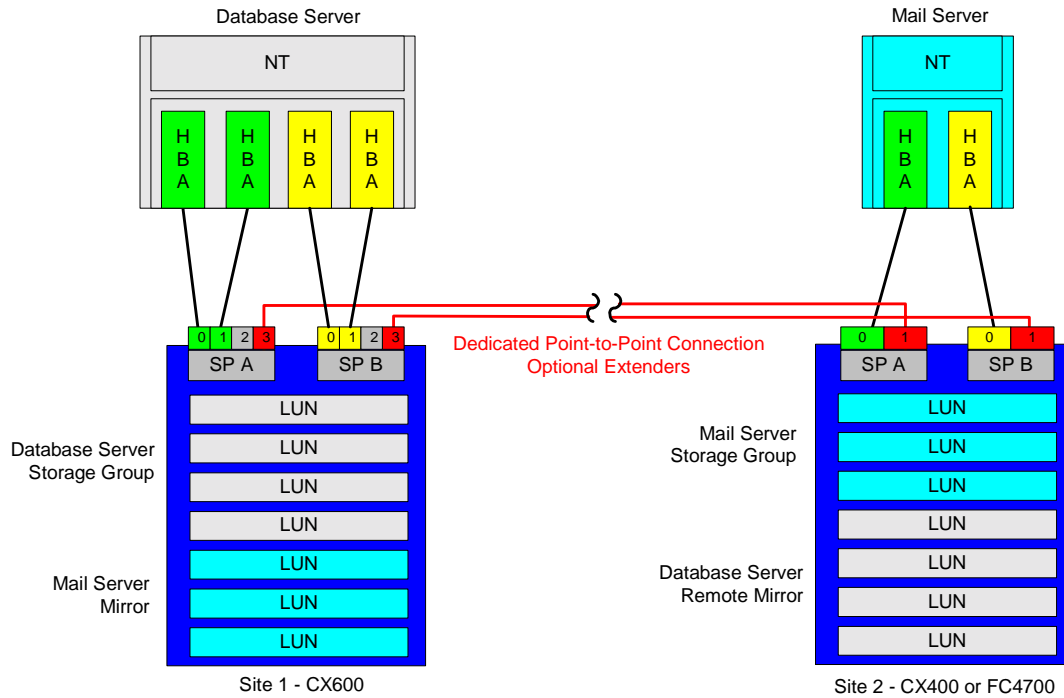## 13. Direct Remote Mirror - Fabric Servers (CX400, CX600, FC4700)

NOTE: See *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 15), and *Switch Topology Rules* (page 20).

13. Direct Remote Mirror - Fabric Servers (CX400, CX600, FC4700), continued

Benefits	Highly-available, direct remote mirroring connect for multiple servers.
Hardware	Servers with single or multiple HBAs. 2 local and 2 remote fabrics. Extenders required for over 500 meters. See CLARiiON sections *EMC Support Matrix*. CX400 or FC4700 - SP port 0 for server I/O; SP port 1 for mirroring. CX600 - SP ports 0, 1, 2 for server I/O; SP port 3 for mirroring.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Tru64 UNIX, Windows 2000, and Windows NT.
Other Server Software	PowerPath or Utility Kit PowerPath for AIX, Linux without clustering, NetWare, Solaris, Windows 2000, and Windows NT. DMP for Solaris. ATF or CDE for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX.Native failover for IRIX and Tru64 UNIX. No SP failover or non-disruptive software installation (NDU) for Linux with clustering. Optional multiple/alternate paths to each SP for AIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT with PowerPath, for Solaris with DMP, for Windows 2000 and Windows with ATF and without clusters, and for non-clustered, multiple-HBA HP-UX, IRIX, and Tru64 UNIX servers.

Clusters	Optional:
	  HP-UX (MC/ServiceGuard)
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server)
	  Tru64 UNIX (TruCluster)
	  Windows 2000 (Microsoft Cluster Server or Oracle9iRAC)
	  Windows NT (Microsoft Cluster Server).
	Not supported for AIX.

Storage Systems	CX400, CX600, and C4700.
Storage-System Software	Access Logix, MirrorView, and optional SnapView.

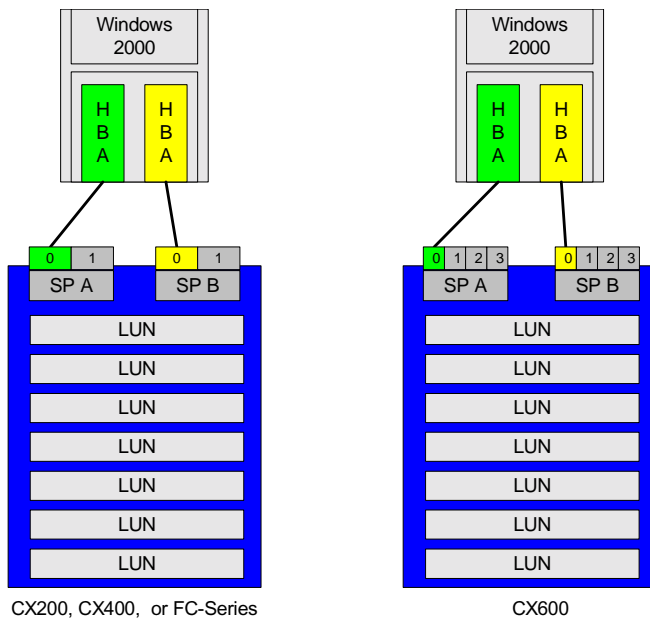## 14. Direct Mirror - Direct Server (CX400, CX600, FC4700)

NOTE: See *General Configuration Rules* (page 6) and *Failover Configuration Rules* (page 15).

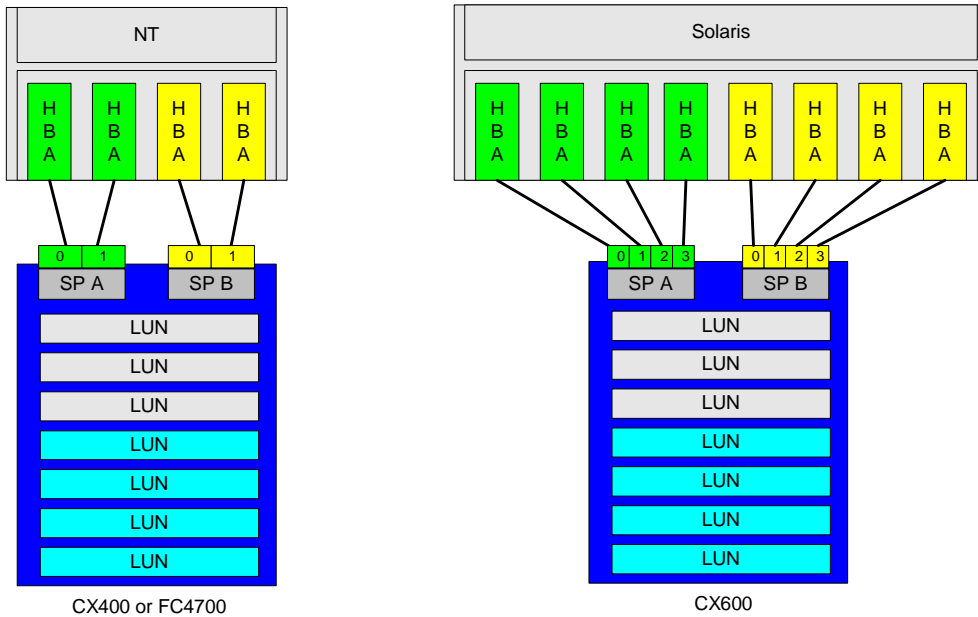| Benefits	Low cost highly-available, direct remote mirroring connect.
Hardware	1 server with dual HBAs per site. CX400 or FC4700 - SP port 0 for server I/O; SP port 1 for mirroring. CX600 - SP ports 0, 1, 2 for server I/O; SP port 3 for mirroring. Extenders required for over 500 meters. See CLARiiON sections of *EMC Support Matrix*.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Windows 2000, Windows NT.
Other Server Software	PowerPath for AIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT. **PowerPath Base for Linux without clustering, NetWare, and Windows 2000.** DMP for Solaris. ATF for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX.
Clusters	Not applicable.
Storage Systems	CX400, CX600, and FC4700.
Storage-System Software	Access Logix, MirrorView, and optional SnapView.

Sample Single Server Direct Connections

15. Single Server - Dual HBA Ports (CX200, CX400, CX600, FC4500, FC4700, FC5300, FC5500, FC5700)

NOTE: See *General Configuration Rules* (page 6) and *Failover Configuration Rules* (page 15).

CX200, CX400, or FC-Series

CX600

Benefits	Low cost, highly-available, direct connect for 1 server to 1 storage system.
Hardware	1 server with dual HBAs per storage system.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT. DMP for Solaris.
Clusters	Not applicable.
Server Software	PowerPath AIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT. PowerPath Base for Linux, NetWare, and Windows 2000. ATF for AIX, NetWare, Solaris, Windows 2000, and Windows NT PVLinks for HP-UX. Native failover for IRIX. No SP failover for Linux with FC5300.
Storage Systems	For AIX, HP-UX, NetWare, Solaris, Tru64 UNIX: CX400, CX600, FC4500, FC4700, and FC5300. For IRIX: CX400, CX600, FC4700, and FC5500. For Linux, Windows 2000, and Windows NT: CX200, CX400, CX600, FC4500, FC4700, and FC5300. FC5300 optical connections require MIAs on SP ports.
Storage-System Software	No Access Logix, no SnapView, and no MirrorView.

16. Single Server - Multiple HBA Ports /Multiple Ports Per SP (CX400, CX600, FC4700)
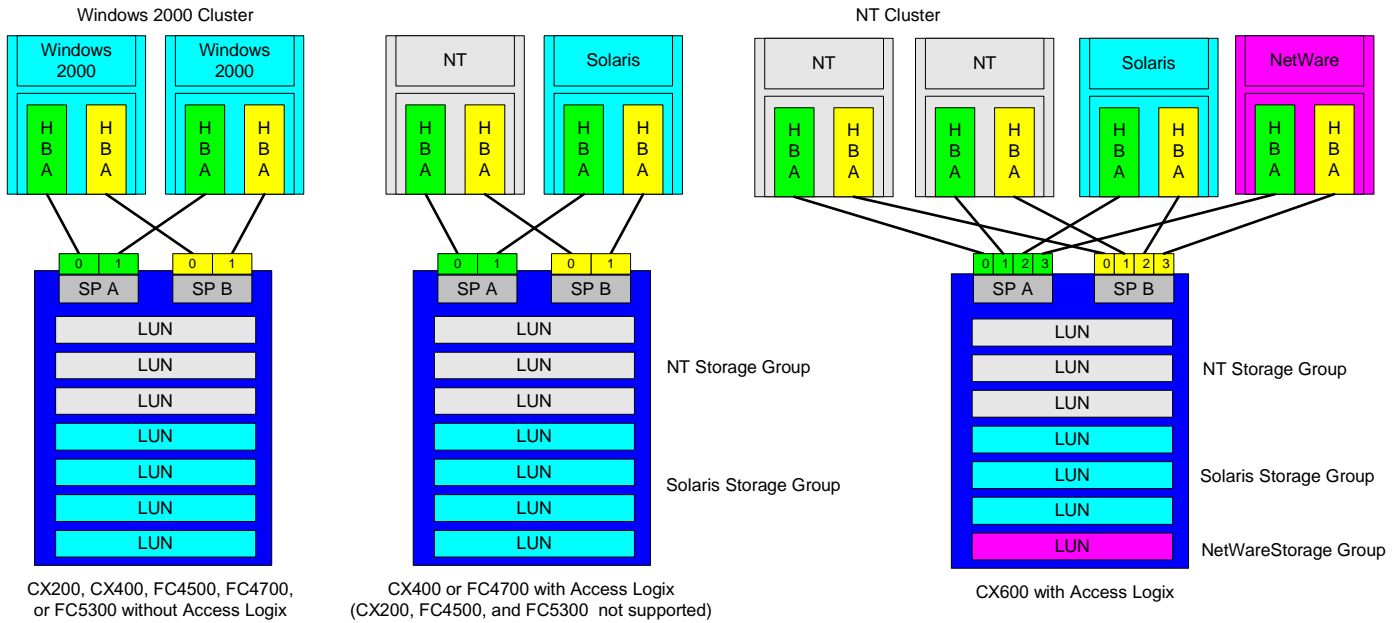

CX400 or FC4700   CX600

NOTE: See *General Configuration Rules* (page 6) and *Failover Configuration Rules* (page 15).

Benefits	Low cost, highly-available, maximum throughput direct connect for 1 server to 1 storage system.
Hardware	1 server with 4 HBAs per storage system.
Server Operating Systems	AIX, Linux, NetWare, HP-UX, IRIX, Solaris, Windows 2000, and Windows NT.
Clusters	Not applicable.
Server Software	PowerPath for AIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT. DMP for Solaris. ATF for Windows NT and Windows 2000. PVLinks for HP-UX. Native failover for IRIX.
Storage Systems	CX400, CX600, and FC4700.
Storage-System Software	No Access Logix, no SnapView, and no MirrorView.

Sample Multiple Server Direct Connections

17. Dual Server Direct - Single HBA Port (Split-Bus) (CX200, CX400, CX600, FC4500, FC4700, FC5300, FC5500, FC5700)

| Linux | Windows 2000 | Linux | Windows 2000 |

HBA (green)   HBA (yellow)   HBA (green)   HBA (yellow)

| 0 | 1 | | 0 | 1 | | 0 | 1 | 2 | 3 | | 0 | 1 | 2 | 3 |
| SP A | | SP B | | SP A | | SP B |

LUN	LUN	LUN	LUN
LUN	LUN	LUN	LUN
LUN	LUN	LUN	LUN
LUN	LUN	LUN	LUN
	LUN		LUN
	LUN		LUN
	LUN		LUN

CX200, CX400, or FC-Series   CX600

NOTE: See *General Configuration Rules* (page 6).

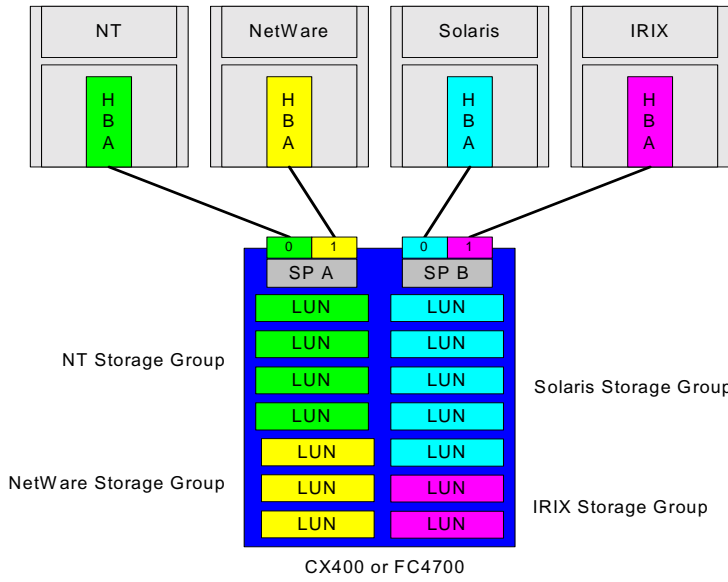|	
Benefits	Low cost, non-highly-available, direct connect for 2 servers to 1 storage system.
Hardware	2 independent servers each with single HBA per storage system.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT. For HP-UX and IRIX, same operating system on both servers.
Other Server Software	clsp driver for Solaris. No PowerPath, PowerPath Base, Utility Kit PowerPath, DMP, ATF, or CDE. No non-disruptive software installation (NDU).
Clusters	Not supported.
Storage Systems	For AIX, HP-UX, and Solaris: CX400, CX600, FC4500, FC4700, FC5300, and FC5700. For IRIX: CX400, CX600, FC4700, and FC5500. For Linux: CX200, CX400, CX600, FC4500, FC4700, and FC5300. For NetWare, Windows 2000, and Windows NT: CX200, CX400, CX600, FC4500, FC4700, FC5300, and FC5700. FC5300 optical connections require MIAs on SP ports.
Storage-System Software	No Access Logix, no SnapView, and no MirrorView.

18. Dual Server Direct - Dual HBA Ports /Dual Ports Per SP (CX200, CX400, CX600, FC4500, FC4700, FC5300)
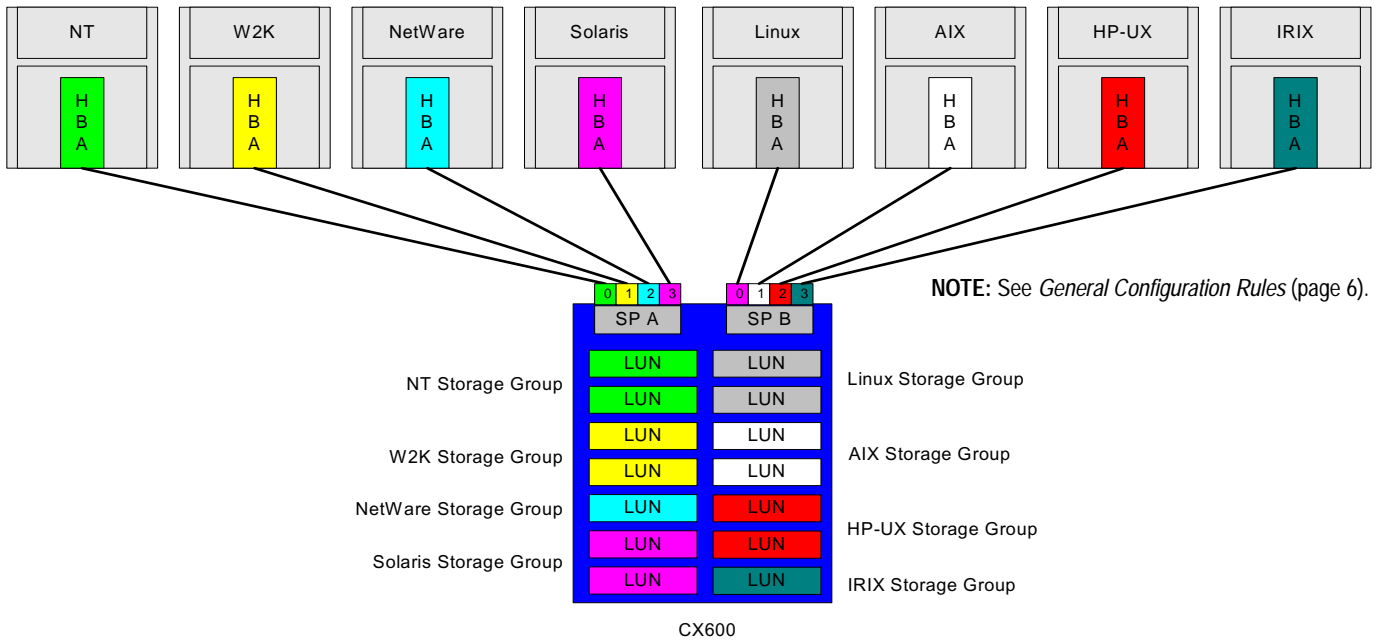

OTE: See *General Configuration Rules* (page 6) and *Failover Configuration Rules* (page 15).

Benefits	Low cost, highly-available, direct connect for 2 servers to 1 storage system.
Hardware	2 servers each with dual HBAs per storage system.
Server Operating Systems	AIX, HP-UX, IRIX, NetWare, Linux, Solaris, Windows 2000, and Windows NT. Both servers connected to a storage system without Access Logix must run same operating system.
Other Server Software	PowerPath for AIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT. **PowerPath Base for Linux without clustering, NetWare and Windows 2000**. DMP for Solaris. ATF for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX. No SP failover **or non-disruptive software installation (NDU)** for Linux with FC5300 or clustering.
Clusters	Required for servers without Access Logix or servers connected to **CX200**, FC4500, and FC5300. AIX (HACMP, HACMP/ES) HP-UX (MC/ServiceGuard) IRIX (FailSafe) Linux (Oracle9iRAC) NetWare (NetWare Cluster Service) Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server) Windows 2000 (Microsoft Cluster Server or Oracle9iRAC) Windows NT (Microsoft Cluster Server). Clusters not supported for AIX, HP-UX, IRIX, and Solaris connected to an FC5300 without Access Logix **or Linux connected to a CX200.**
Storage Systems	For AIX, HP-UX, and Solaris: CX400, CX600, FC4500, FC4700, and FC5300. For IRIX: CX400, CX600, and FC4700. For Linux, **NetWare**, Windows 2000, and Windows NT: CX200, CX400, CX600, FC4500, FC4700, and FC5300. FC5300 optical connections require MIAs on SP ports.
Storage-System Software	No Access Logix (**CX200,** FC4500, FC5300), optional Access Logix (CX600, FC4700) except required for Linux, optional SnapView (CX400, CX600, FC4700), optional MirrorView (CX600).

19. Multiple Server Direct - Single HBA Port/Multiple Ports Per SP (CX400, CX600, FC4700)
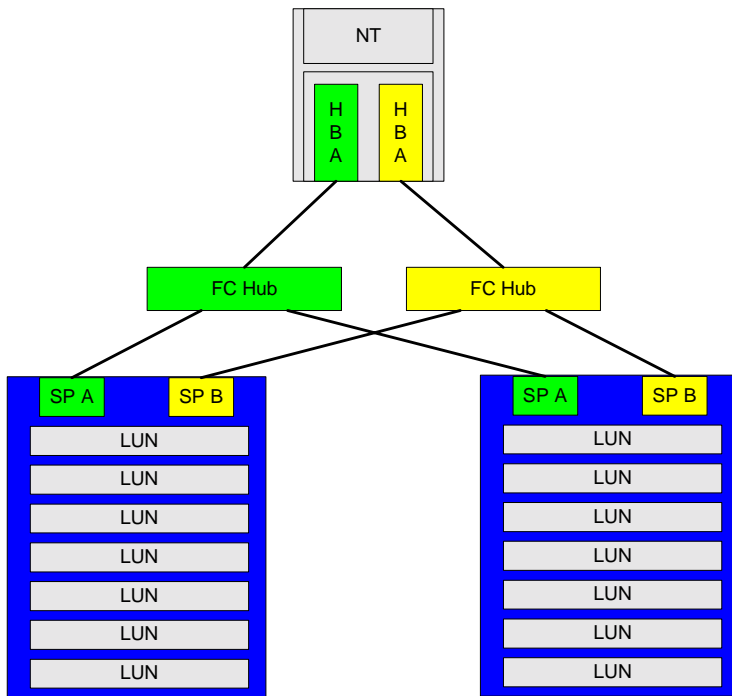

NOTE: See *General Configuration Rules* (page 6).

CX400 or FC4700

NOTE: See *General Configuration Rules* (page 6).

CX600

19. Multiple Server Direct - Single HBA Port/Multiple Ports Per SP (CX400, CX600, FC4700) (continued)

Benefits	Low cost, highly-available, direct connect for more than 2 servers to 1 CX600 or FC4700 storage system.
Hardware	4 independent servers, each with single HBA.
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT.
Other Server Software	clsp driver for Solaris if FC4700 is running Access Logix 8.44.xx or lower. No PowerPath, Utility Kit PowerPath, DMP, ATF, or CDE. No non-disruptive software installation (NDU).

Clusters	Optional:
	  IRIX (FailSafe)
	  Linux (Oracle9iRAC)
	  NetWare (NetWare Cluster Service)
	  Windows 2000 (Microsoft Cluster Server)
	  Windows NT (Microsoft Cluster Server).
	Not supported for AIX, HP-UX, or Solaris.

Storage Systems	CX400, CX600, and FC4700.
Storage-System Software	Access Logix, optional SnapView, optional MirrorView (CX600).

Sample Hub Connections

20. Hub - Single Server (FC4500, FC5300, FC5500, FC5700)

NOTE: See *General Configuration Rules* (page 6) and *Failover Configuration Rules* (page 15).

Benefits	Low cost, highly-available, hub connect of 1 server to multiple storage systems.
Hardware	1 server with dual copper HBAs. 2 to 4 storage systems. 2 hubs (with MIAs for FC4500 connections).
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT.
Other Server Software	ATF for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX or NetWare with ATF or CDE. No SP failover **or non-disruptive software installation (NDU)** for Linux.
Clusters	Not applicable.
Storage Systems	For all except IRIX and Linux: FC4500, FC5300, and FC5700. For IRIX: FC5500. For Linux: FC4500 and FC5300.
Storage-System Software	No Access Logix.

21. Hub - Clustered Servers (FC4500, FC5300, FC5700)

NT Cluster

OTE: See *General Configuration Rules* (page 6) and *Failover Configuration Rules* (page 15).

Benefits	Low cost, highly-available, hub connect of multiple servers to one or more storage systems.
Hardware	Servers each with dual copper HBAs. 1 to 4 storage systems. Total number of servers and storage systems cannot exceed 6. 2 hubs (with MIAs for FC4500 connections).
Server Operating Systems	AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT. Same operating system on both servers.
Other Server Software	ATF for AIX, NetWare, Solaris, Windows 2000, and Windows NT. PVLinks for HP-UX. Native failover for IRIX. No SP failover **or non-disruptive software installation (NDU)** for Linux.

Clusters	Required:
	  AIX (HACMP, HACMP/ES)
	  HP-UX (MC/ServiceGuard)
	  IRIX (FailSafe)
	  NetWare (NetWare Cluster Service)
	  Solaris (SunCluster only if *not* using DMP, Veritas Cluster Server)
	  Windows 2000 (Microsoft Cluster Server and Windows NT (Microsoft Cluster Server)
	Clusters not supported for AIX, HP-UX, IRIX, and Solaris connected to an FC5300.

Storage Systems	FC4500, FC5300, and FC5700.
Storage-System Software	No Access Logix.

Switch Zoning

Zoning spans the entire fabric. EMC requires single-initiator zoning using the World Wide Port Name (WWPN) of the HBA port and the WWPNs of the SP ports. One server can have only one path to each SP, unless the server is running software that supports multi-path or alternate path access to the storage-system SP (see *Paths from a Server to an SP* (page 10). For information on configuring zones, refer to the switch manuals and release notes.

IMPORTANT: Be sure to document all zoning parameters, including the WWPNs of HBA port and SP ports, for future reference.

Remote Mirror Zoning

See Fan-In Rule and Fan-Out Rule, "Storage Area Network (SAN) Configuration Rules" on page 9. If an HB A is using one or more SP ports for normal I/O and SP port 3 (CX600) or SP port 1 (CX400, FC4700) for normal I/O and remote mirror data, have one switch zone for the HBA port and the normal I/O ports and one zone for the HBA port and the remote mirror data ports.

QuickLoops

QuickLoop emulates Arbitrated Loop in a Fabric.

- QuickLoop is supported only on DS-8B, DS-16B, and DS-16B2 switches.
- One QuickLoop can be present on each switch or can span two switches.
- Servers and storage systems within a QuickLoop must be configured for arbitrated loop.

Zoning Examples

Example 1   Single-Initiator Zoning with Multiple HBA-Port Servers
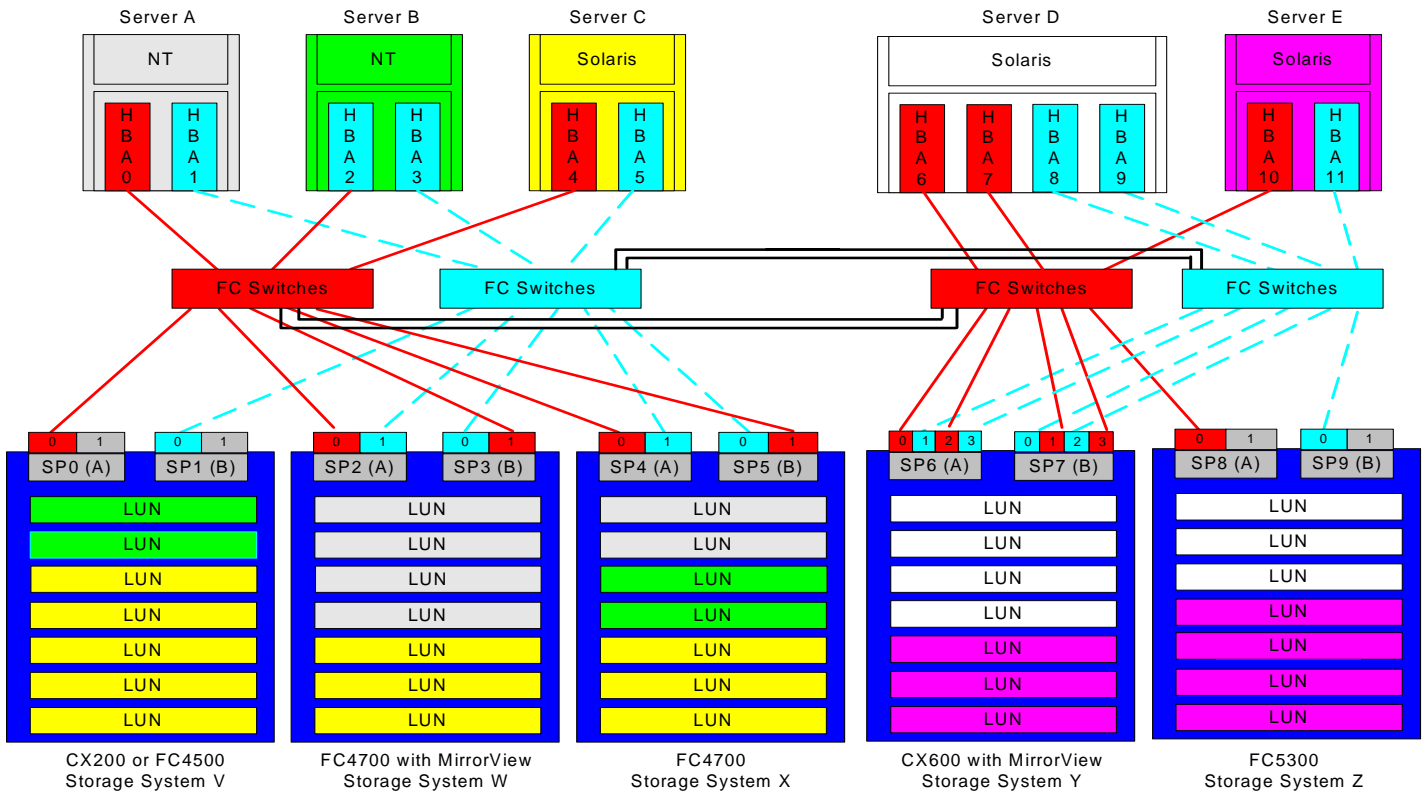
Legend: (A) = SP A and (B) = SP B

If a component failure in the solid line (red) path prevents I/O from any server. PowerPath, DMP, or ATF on that server allows all access via the dashed line (blue) path.

<u>Storage Group assumptions</u>
Server A has a Storage Group on storage systems W and X
Server B has a Storage Group on storage systems V and X.
Server C has a Storage Group on storage systems V, W, and X.
Servers D and E have a Storage Group on storage systems Y and Z.

<u>MirrorView assumptions</u>
Storage systems W and Y are running MirrorView.

<u>SP Ports used for Host I/O</u>
Server A uses all SP ports to which it is connected on storage systems W and X for host I/O.
Server B uses all SP ports to which it is connected on storage systems V and X for host I/O.
Server C uses SP port 0 for storage systems V, W, X for host I/O.
Server D uses all SP ports which it is connected on storage system Y and SP port 0 on storage system Z for host I/O.
Server E uses all SP ports which it is connected on storage systems Y and Z for host I/O.

**Example 1   Single-Initiator Zoning with Dual HBA-Port Servers (continued)**

Zone contents for Storage-System Mirror Ports

SP	Switch Zone	Participants in Zone by WWPN	Connections
SP A	1	SP2 port 1, SP6 port 3	SP A mirror ports on storage systems W and Y
SP B	2	SP3 port 1, SP7 port 3	SP B mirror ports on storage systems W and Y

Zone contents for Server HBAs

Server	Switch Zone	Participants in Zone by WWPN	Connections
Server A	3	HBA0, SP2 port 0, SP4 port 0, SP5 port 1	HBA0 and SP non-mirror ports
	4	HBA0, SP3 port 1	HBA0 and SP mirror port
	5	HBA1, SP3 port 0, SP4 port 1, SP5 port 0	HBA1 and SP non-mirror ports
	6	HBA1, SP2 port 1	HBA1 and SP mirror port
Server B	7	HBA2, SP0 port 0, SP1 port 1, SP4 port 0, SP5 port 1	HBA2 and SP non-mirror ports
	8	HBA3, SP0 port 1, SP1 port 0, SP4 port 1, SP5 port 0	HBA 3 and SP non-mirror ports3
Server C	9	HBA4, SP0 port 0, SP2 port 0, SP4 port 0	HBA4 and SP non-mirror ports
	10	HBA4, SP3 port 1	HBA4 and SP mirror port
	11	HBA5, SP1 port 0, SP3 port 0, SP5 port 0	HBA5 and SP non-mirror ports
	12	HBA5, SP2 port 1	HBA5 and SP mirror port
Server D	13	HBA6, SP6 port 0, SP6 port 2, SP7 port 1, SP7 port 3, SP8 port 0	HBA6 and SP non-mirror ports
	14	HBA6, SP7 port 3	HBA6 and SP mirror port
	15	HBA7, SP6 port 0, SP6 port 2, SP7 port 1, SP7 port 3, SP8 port 0	HBA7 and SP non-mirror ports
	16	HBA7, SP7 port 3	HBA7 and SP mirror port
	17	HBA8, SP6 port 1, SP6 port 3, SP7 port 0, SP7 port 2, SP9 port 0	HBA8 and SP non-mirror ports
	18	HBA8, SP6 port 3	HBA8 and SP mirror port
	19	HBA9, SP6 port 1, SP6 port 3, SP7 port 0, SP7 port 2, SP9 port 0	HBA9 and SP non-mirror ports
	20	HBA9, SP6 port 3	HBA9 and SP mirror port
Server E	21	HBA10, SP6 port 0, SP6 port 2, SP7 port 1, SP7 port 3, SP8 port 0, SP9 port 1	HBA10 and SP non-mirror ports
	22	HBA10, SP7 port 3	HBA10 and SP mirror port
	23	HBA11, SP6 port 1, SP6 port 3, SP7 port 0, SP7 port 2, SP8 port 1, SP9 port 0	HBA11 and SP non-mirror ports
	24	HBA11, SP 6 port 3	HBA11 and SP mirror port

Example 2   Single-Initiator Zoning with Dual HBA-Port and Single HBA-Port Servers Connected to a CX400 or FC4700
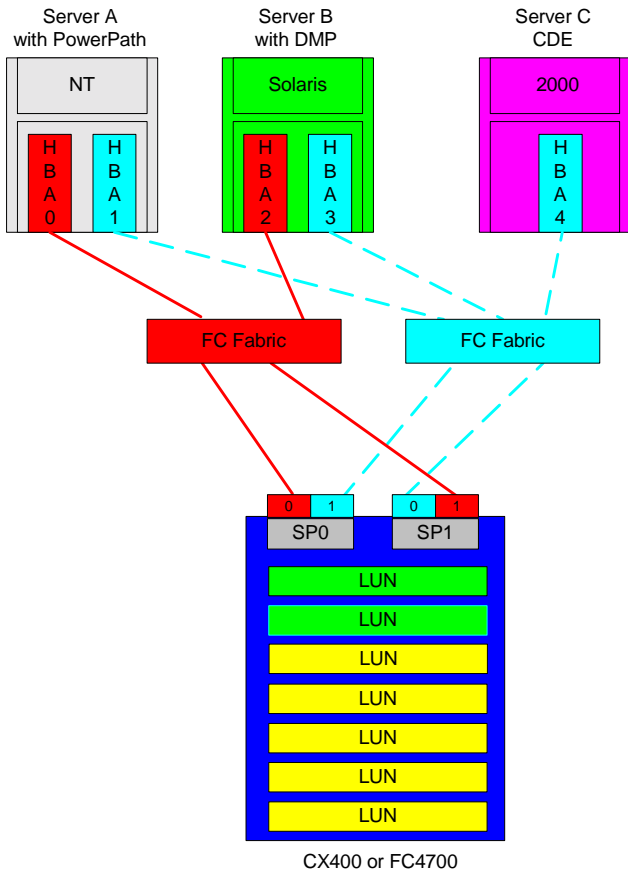
Configuration Goals

- Connect both ports of SPs so different servers can use the SP front end ports.
- Cross port 1 on each SP to the other fabric so the configuration is ready for future use of multi-path PowerPath, alternate-path DMP, or multi-path ATF.
- Use switch zoning to ensure that each server can see only one path to an SP.

Zone Contents

Switch Zone Number	Participants in Zone by WWPN	Server
1	HBA0, SPA0	Server A has a Storage Group on the CX400 or FC4700
2	HBA1, SPB0	
3	HBA2, SPB1	Server B has a Storage Group on the CX400 or FC4700
4	HBA3, SPA1	
5	HBA4, SPA1, SPB0	Server C has a Storage Group on the CX400 or FC4700

Cable Selection for CLARiiON Switch Models

EMC sells only 50um multi-mode cabling, and does not recommend mixing 62.5 micron and 50 micron optical cable in the same link. In certain situations, you can add a 50 micron adapter cable to the end of an already installed 62.5 micron cable plant. Contact your customer service representative for details.

EMC recommends a 3M or 5M multi-mode cable for intra-cabinet cabling servers to SPs in DPEs.

To select cables:

1. Determine devices to be connected and associated connector types.
1. Using Table 3 below, determine the cable length.
1. Using Tables 4 and 5 below, select cables based on device connector type, connection quantity and distance required for each connection.

Table 3: Fibre Optic Cable Parameters

Optical Modes	Wavelength	Cable Type	Max Length	
			1Gbit	2Gbit
Multi-mode	850 nm	50 um	500 meters	300 meters
Single mode	1300 nm	9 um	10 kilometers	10 kilometers

Table 4: Devices and Connectors

Device	FC Speed	Number of Connectors	Connector Type[a]	Mode	Comments
Storage Systems					
CX200	2 Gbit	4	LC	Multi-mode	2 connects per SP
CX400	2 Gbit	4	LC	Multi-mode	2 connects per SP
CX600	2 Gbit	8	LC	Multi-mode	4 connects per SP
FC4700-2	1 or 2 Gbit	4	LC	Multi-mode	2 connects per SP
FC4700	1 Gbit	4	SC	Multi-mode	2 connects per SP
FC4500	1 Gbit	4	SC	Multi-mode	2 connects per SP
FC5300	1 Gbit	4	SC	Multi-mode	2 connects per SP; requires a MIA for each connect
FC Switches					
DS-16B-00D	1 Gbit	16	SC	Multi-mode	None
DS-16B2-0D	1 or 2 Gbit	16	LC	Multi-mode	None
DS-16M-0D	1 Gbit	16	LC	Multi-mode	None
DS-16M2-0D	1 or 2 Gbit	16	LC	Multi-mode	None
DS-24M2-08C	1 or 2 Gbit	8, 16, or 24	LC	Multi-mode	None
DS-32B2-0D	1 or 2 Gbit	32	LC	Multi-mode	None
DS-32M-0D	1 Gbit	32	LC	Multi-mode	None
DS-32M2-0D	1 or 2 Gbit	32	LC	Multi-mode	None
Host Bus Adapters					
HBAGL-xxxx	1 Gbit	1	SC	Multi-mode	xxxx = server operating system type
HBAE2-xxxx	2 Gbit	1	LC	Multi-mode	xxxx = server operating system type
HBAQ2-xxxx	2 Gbit	1	LC	Multi-mode	xxxx = server operating system type

a. SC = Standard connector
   LC = Lucent™ connector (latest small-form-factor connector)

Table 5: Fibre Optic Cables

Cable Length	Cable Model for Multi-mode Connector Type		
	SC-to-SC	SC-to-LC or LC-to-SC	LC -to-LC
1 meter[a]	n/a	FM-LS1MD	FM-LL1MD
3 meters[a]	n/a	FM-LS3MD	FM-LL3MD
5 meters	FC-OPT5M	FM-LS5MD	FM-LL5MD
10 meters	FC-OPT10M	FM-LS10MD	FM-LL10MD
30 meters	n/a	FM-LS30MD	FM-LL30MD
50 meters	FC-OPT50M	FM-LS50MD	FM-LL50MD
100 meters	FC-OPT100M	FM-LS100MD	FM-LL100MD
250 meters	FC-OPT250M	n/a	n/a
500 meters	FC-OPT500M	n/a	n/a

a. Ships with SC male-to-female adapter.

Backup Configurations (CX200[1], CX400, CX600, FC4500, FC4700, FC5300[2], FC5700)

This section describes the topologies that EMC currently supports for backup and restore of EMC CLARiiON storage systems in the configurations described in the previous sections of this document. For supported tape libraries and drives, see the *Tape to ESN Connectivity* section of the *EMC Support Matrix.* For definitions of backup terms, see page 144.

Backup Configuration Rules

Use the following rules when configuring local, LAN-based and private LAN topologies and SAN-connected servers that are backed up by a local, LAN-based or private LAN topology (that is, topologies where the backup data does not flow over the SAN):

- Any backup server or client server that connects to EMC CLARiiON storage systems (CX200, CX400, CX600, FC4500, FC4700, FC5300, or FC5700) must adhere to the attach requirements specified in the CLARiiON sections of *EMC Support Matrix.*
- EMC places no restrictions on any backup server or client server that is not connected to EMC CLARiiON storage systems.
- Consult the backup software supplier's support matrix for component compatibility (server platform, operating systems, HBAs, tape driver, and tape libraries).

Topologies

---

1. CX200 storage systems available from selected channels only.
2. FC5300 SAN configuration available from selected channels only; MIA required for optical connect.

Local Tape Backup

A local backup topology has only one server that is both the backup client and the backup server. In this topology, backup data flows from the EMC CLARiiON storage system into the server, and then from the server out to the tape library.
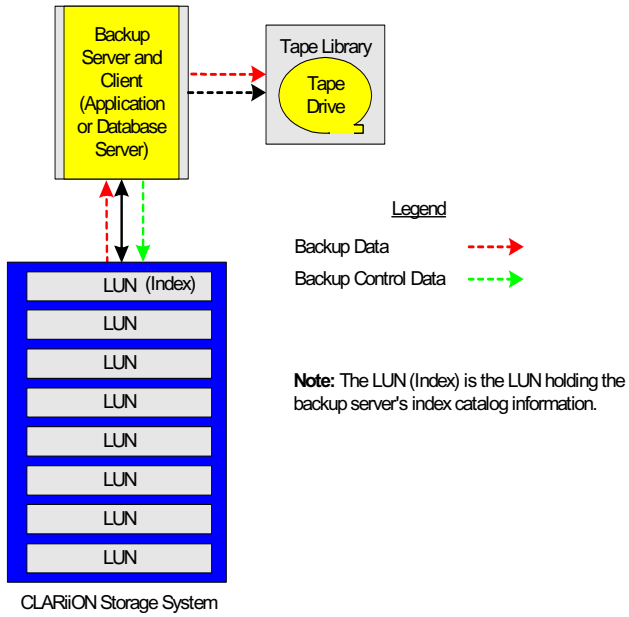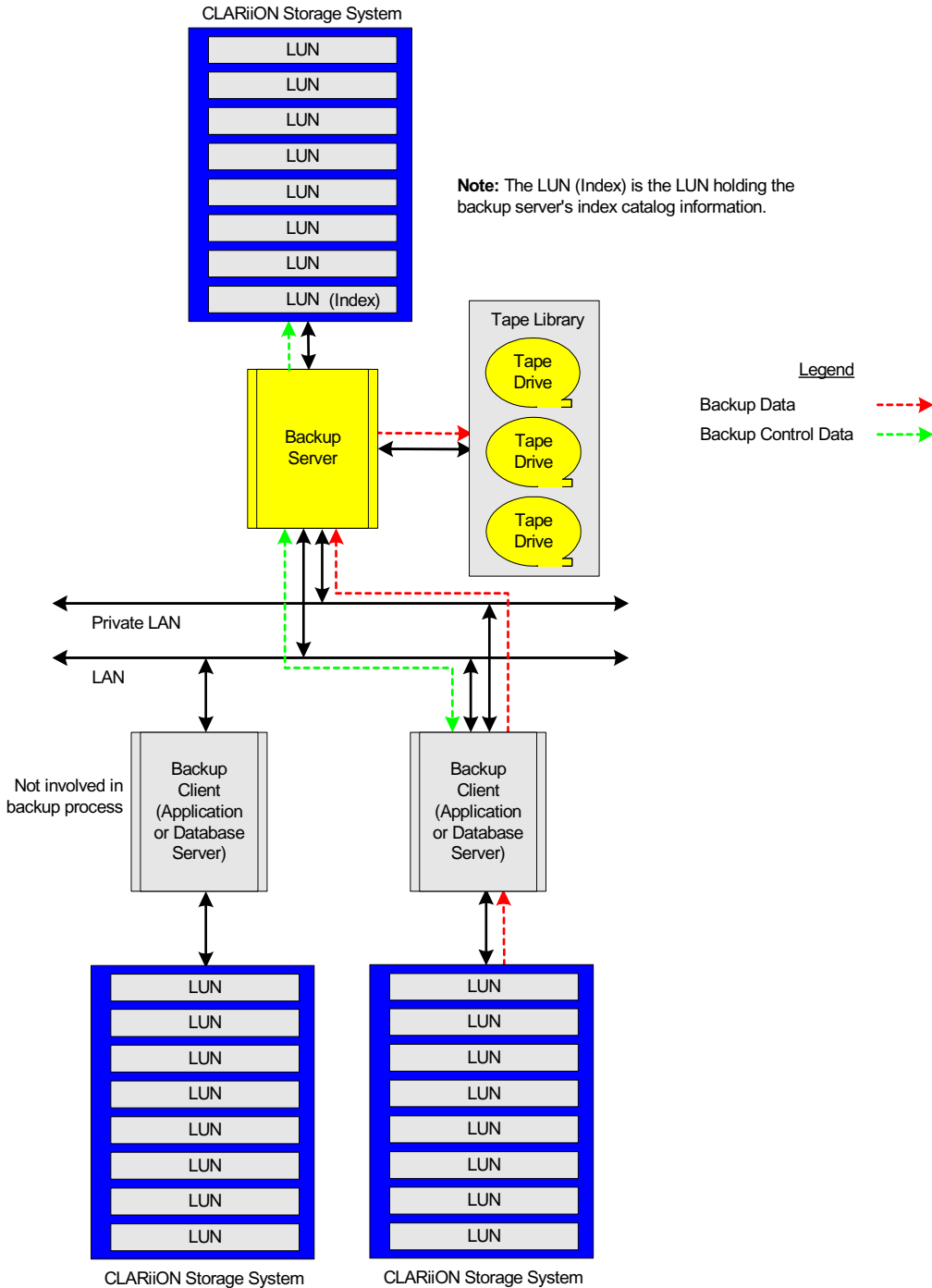
LAN-Based Backup

In this topology, backup data flows from the storage systems into the client servers, across the LAN to the backup server, and then from the backup server out to the tape library. In this case, EMC places no restrictions on the backup server or its components. Consult the backup software supplier for information on compatible backup server components such as the server and its operating system, HBAs, and tape libraries.
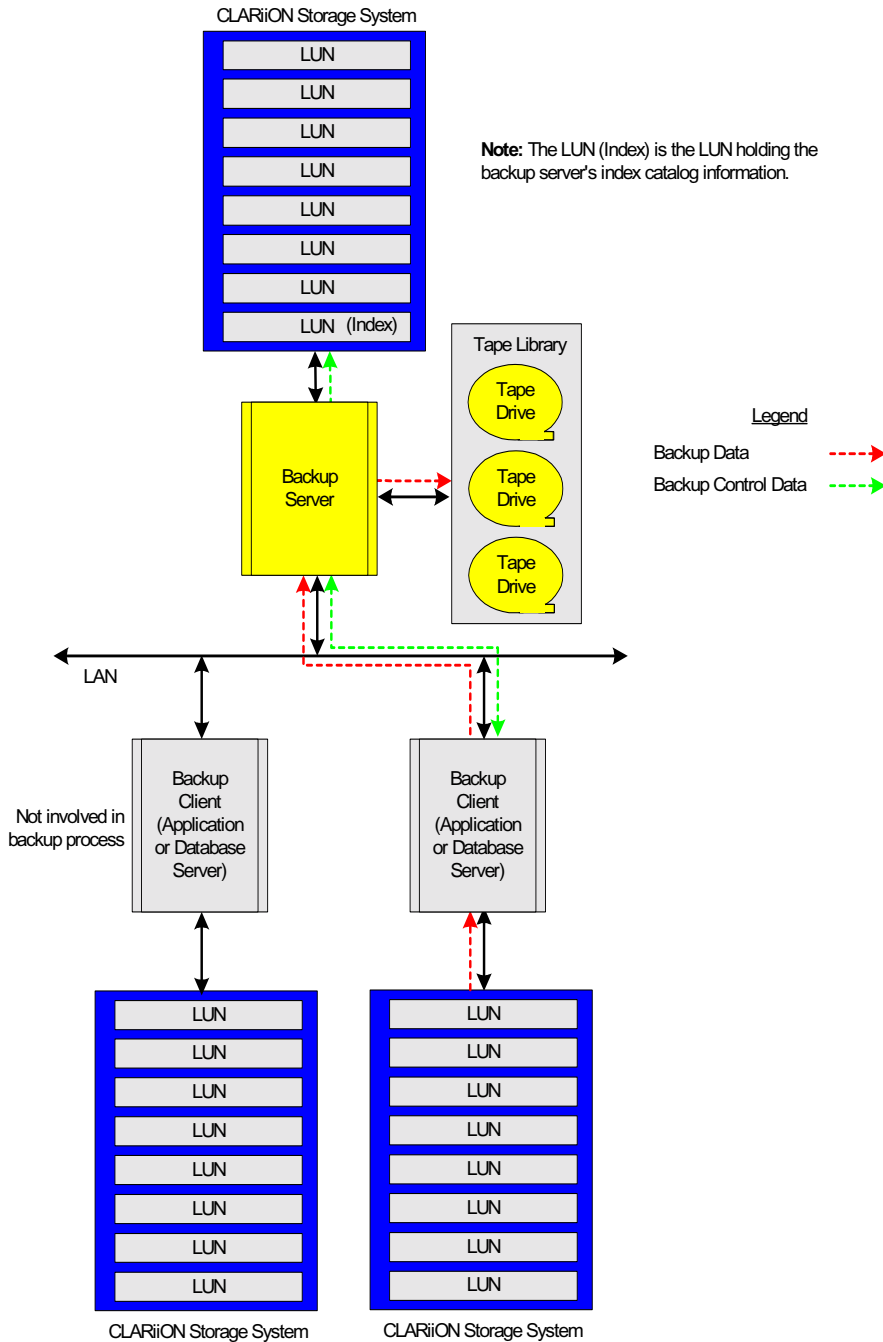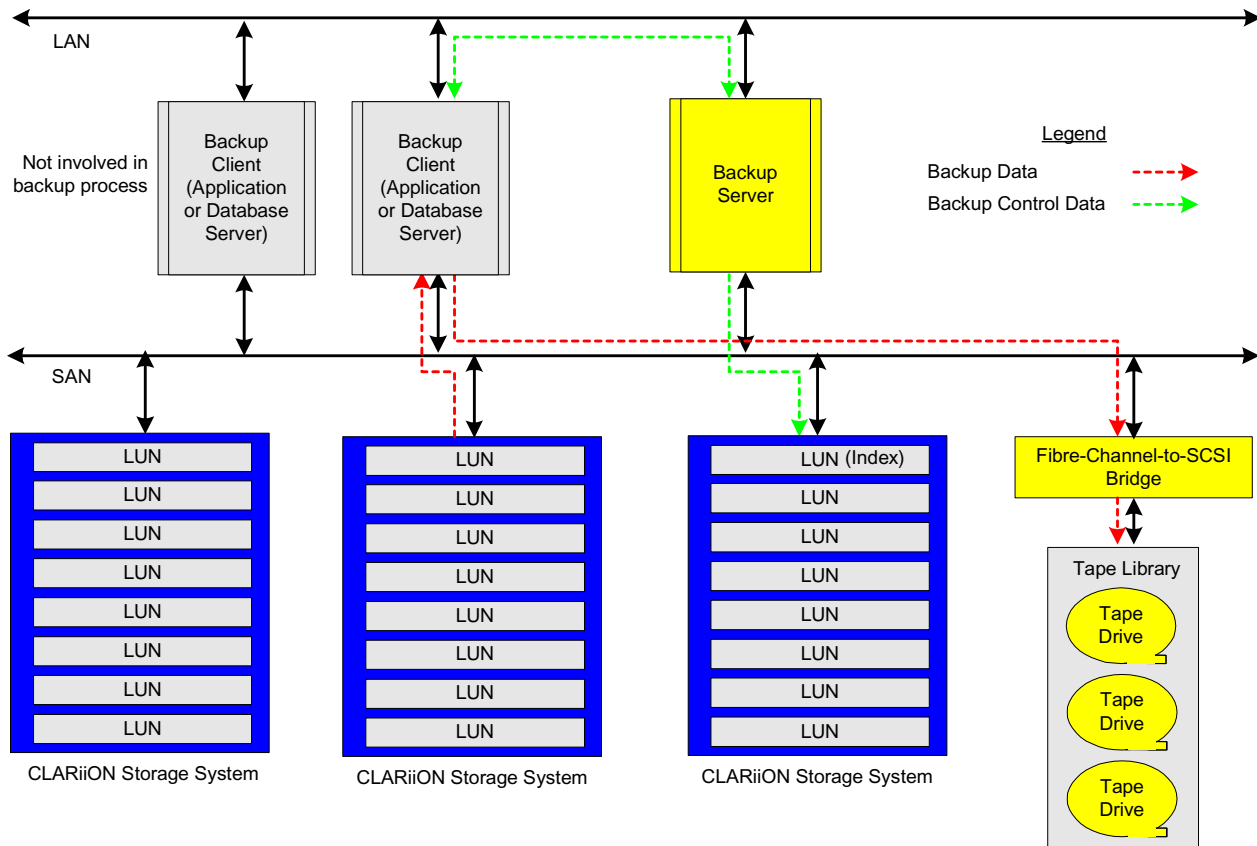
Private LAN

In a LAN free, private LAN topology, a separate LAN is implemented solely for the purposes of backup data traffic. In this topology, backup data flows from the EMC CLARiiON storage systems into the client servers, across the private LAN to the backup server, and then from the backup server out to the tape library. Consult the backup software supplier for information on compatible backup components such as the server and its operating system, HBAs, and tape libraries.

Note: The LUN (Index) is the LUN holding the backup server's index catalog information.

Legend

Backup Data   - - - - →

Backup Control Data - - - - →

SAN with Dedicated Tape Drives

A dedicated tape drive is a drive within a library that is statically and permanently associated with one backup client.

In a LAN free, SAN topology, the backup server is connected through the SAN to EMC CLARiiON storage systems. In this configuration, client backup data flows from the EMC CLARiiON storage system through the SAN, into the clients, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. Backup data owned by the backup server flows from the EMC CLARiiON storage system, through the SAN into the backup server, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. For this topology, additional requirements are found in the associated table in the CLARiiON Backup Solutions section of the *EMC Support Matrix*.
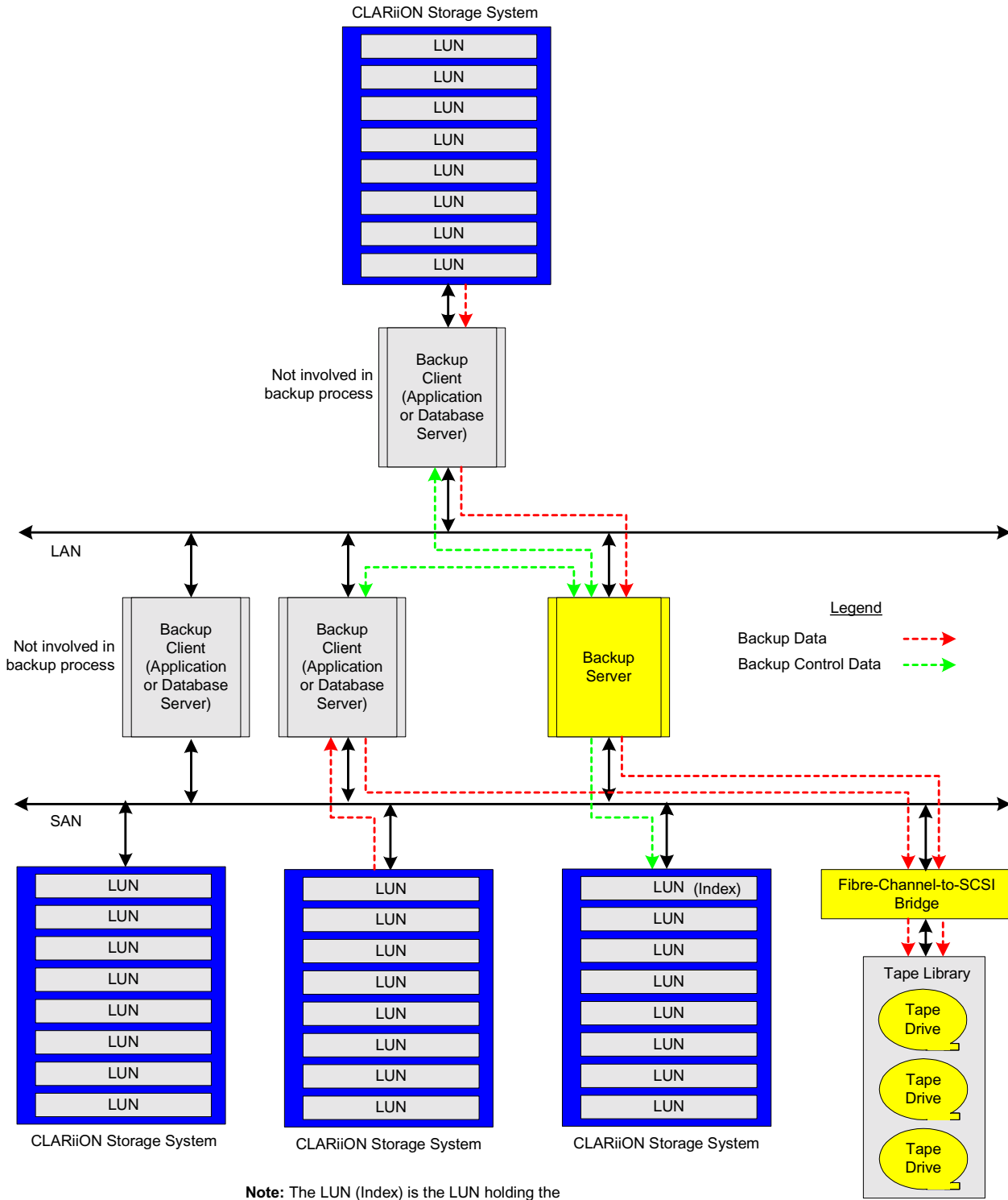
Note: The LUN (Index) is the LUN holding the backup server's index catalog information.

SAN and LAN with Dedicated Tape Drives

A dedicated tape drive is a drive within a library that is statically and permanently associated with one backup client.

In a SAN and LAN topology, the backup server is connected through the SAN to an EMC CLARiiON storage systems. In this configuration, SAN client backup data flows from the EMC CLARiiON storage systems through the SAN into the clients, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. Backup data owned by the backup server flows from the EMC CLARiiON storage system through the SAN into the Backup Server, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. LAN client backup data flows from the EMC CLARiiON storage systems into the client servers, across the LAN to the Backup Server, out through the SAN, through a Fibre-Channel-to-SCSI Bridge, and out to the tape library. For this topology, additional requirements are found in the associated table in the CLARiiON Backup Solutions section of the *EMC Support Matrix.*
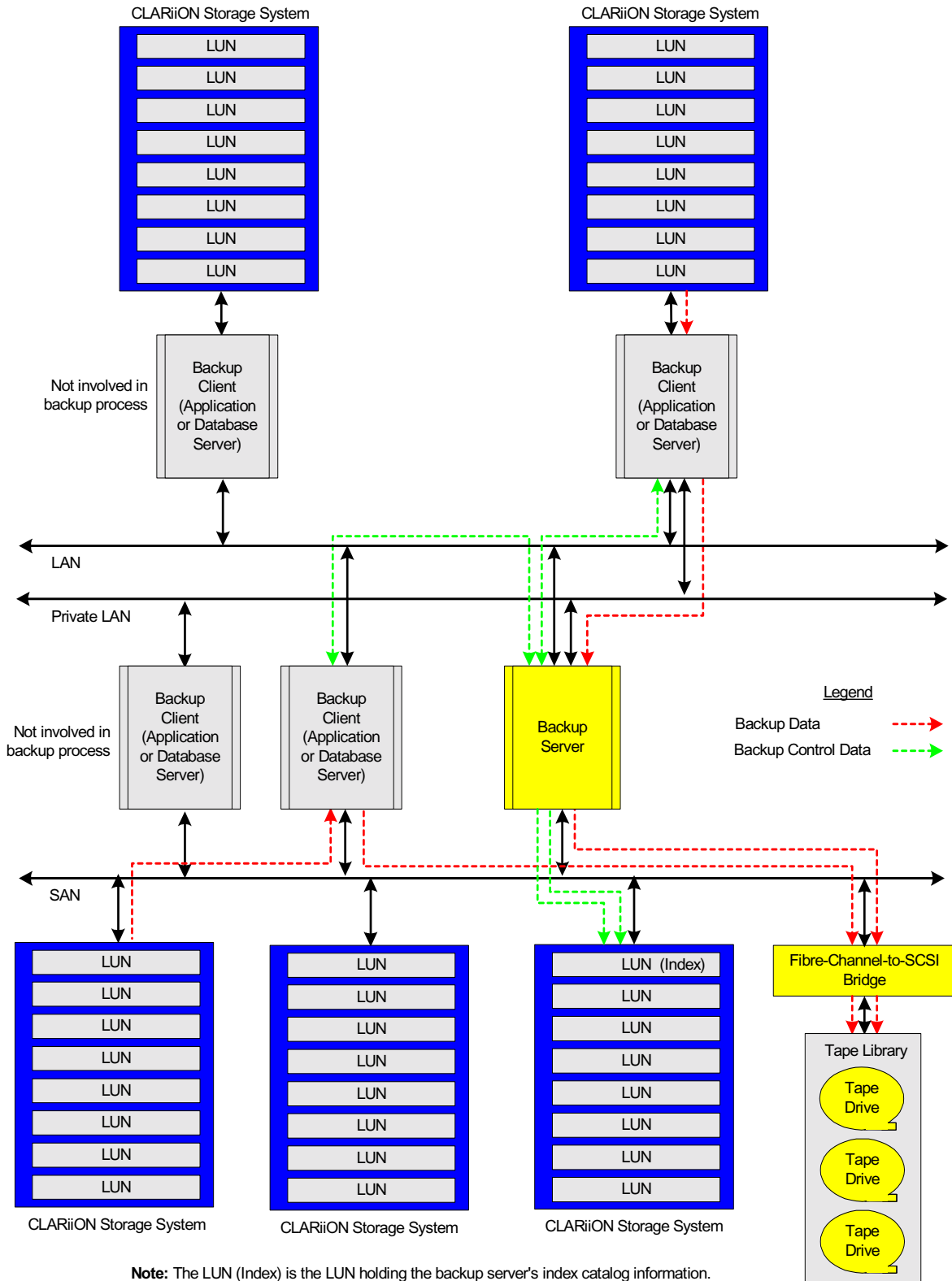
SAN and LAN with Dedicated Tape Drives, continued

CLARiiON Storage System

| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |

Not involved in backup process

Backup Client (Application or Database Server)

LAN

Not involved in backup process

Backup Client (Application or Database Server)

Backup Client (Application or Database Server)

Backup Server

Legend

Backup Data -------->

Backup Control Data -------->

SAN

| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |

CLARiiON Storage System

| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |

CLARiiON Storage System

| LUN (Index) |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |

CLARiiON Storage System

Fibre-Channel-to-SCSI Bridge

Tape Library

Tape Drive

Tape Drive

Tape Drive

Note: The LUN (Index) is the LUN holding the backup server's index catalog information.

SAN and Private LAN with Dedicated Tape Drives

A dedicated tape drive is a drive within a library that is statically and permanently associated with one backup client.

In a LAN free, SAN and private LAN topology, the backup server is connected through the SAN to EMC CLARiiON storage systems. Additionally, a separate, private LAN is implemented solely for the purposes of backing up clients not part of the SAN. In this configuration, SAN client backup data flows from the EMC CLARiiON storage systems through the SAN into the clients, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. Backup data owned by the backup server flows from the EMC CLARiiON storage systems through the SAN into the backup server, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. LAN client backup data flows from the EMC CLARiiON storage systems into the client servers, across the private LAN to the Backup Server, out through the SAN, through a Fibre-Channel-to-SCSI Bridge, and out to the tape library. For this topology, additional requirements are found in the associated table in the CLARiiON Backup Solutions section of the *EMC Support Matrix.*
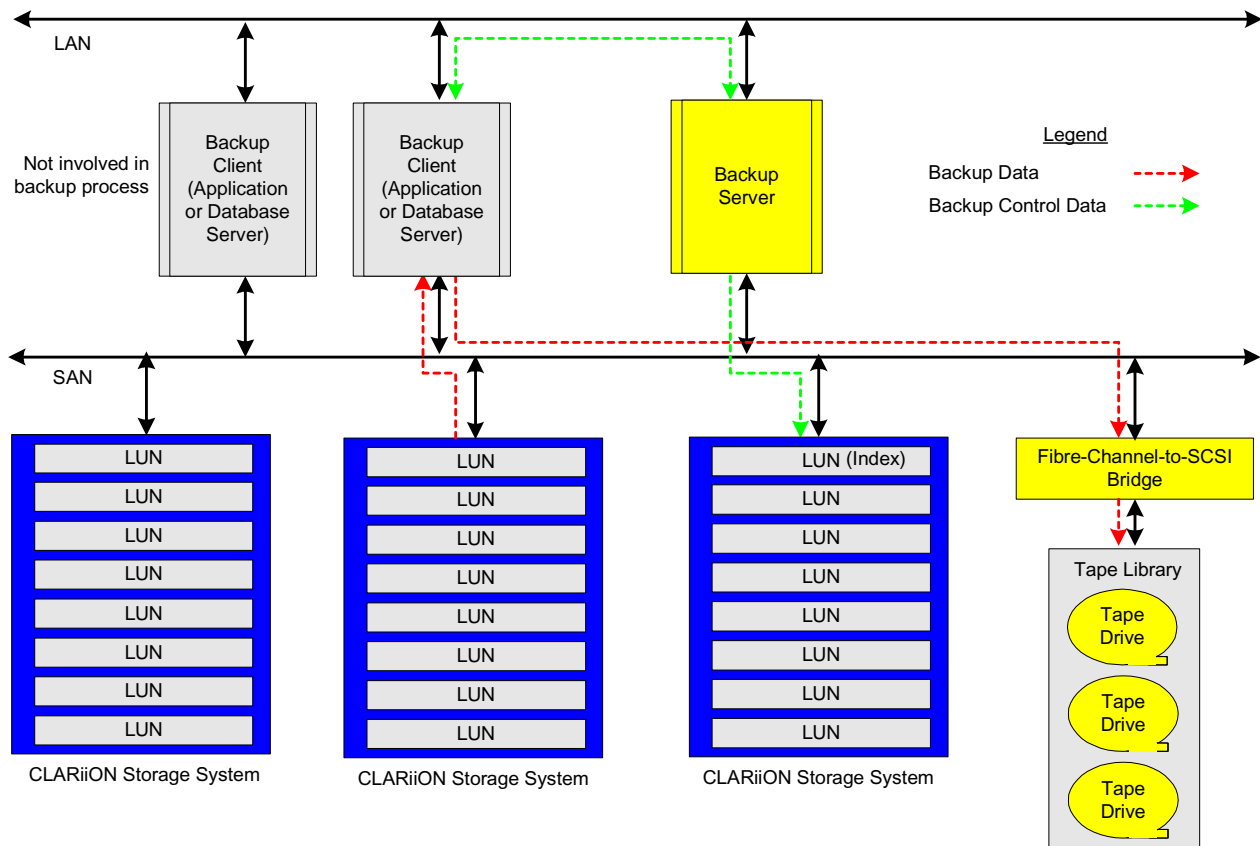
SAN and Private LAN with Dedicated Tape Drives, continued

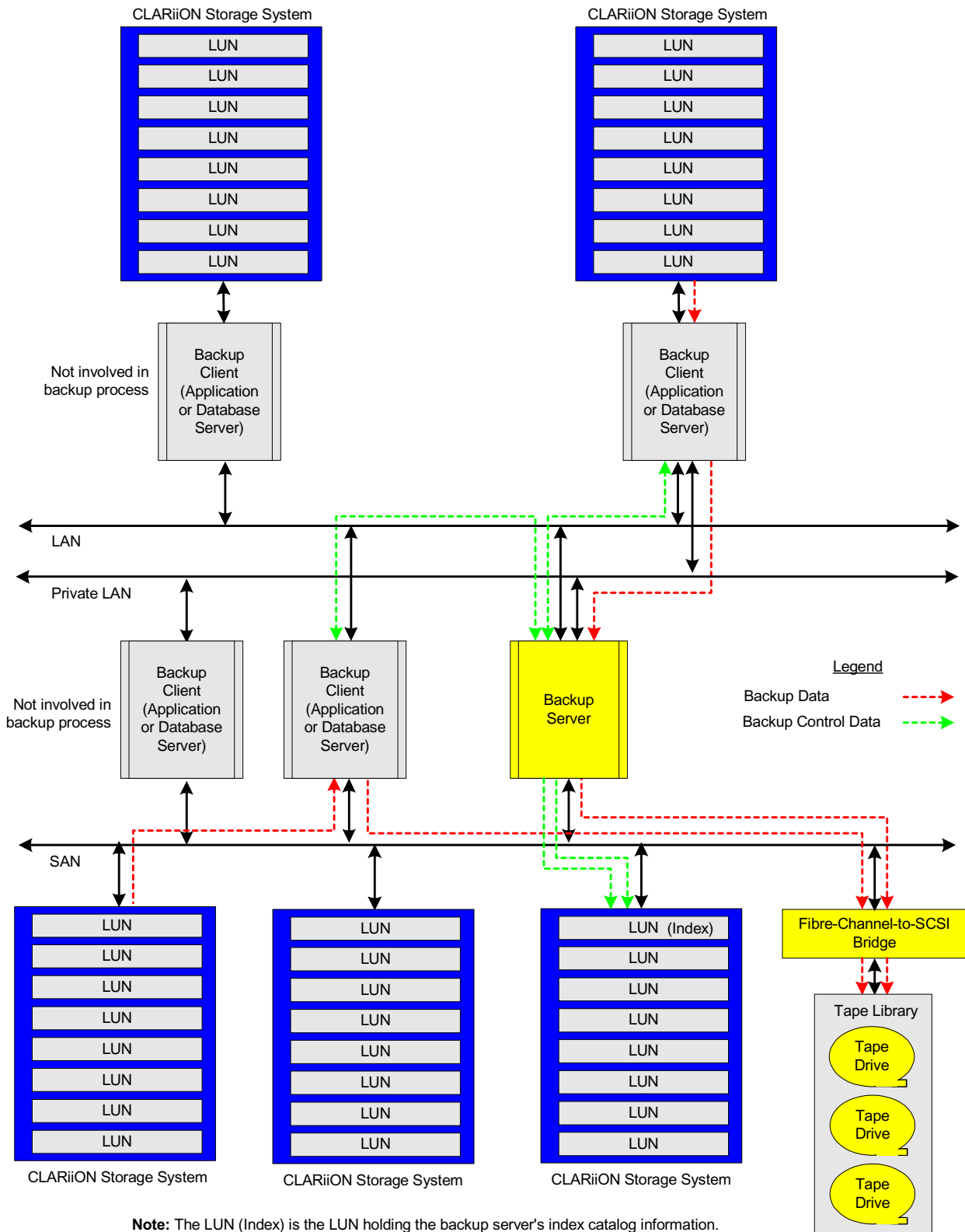**Note:** The LUN (Index) is the LUN holding the backup server's index catalog information.

SAN with Shared Tape Drives

A shared tape drive is a drive within a library that is dynamically and temporarily associated with a backup client. An option module is usually required from the backup software supplier to implement shared tape drives.

In a LAN free, SAN topology, the backup server is connected through the SAN to EMC CLARiiON storage systems. In this configuration, client backup data flows from the EMC CLARiiON storage systems through the SAN into the clients, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. Backup data owned by the backup server flows from the EMC CLARiiON storage systems through the SAN into the backup server, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library.

Note: The LUN (Index) is the LUN holding the backup server's index catalog information.

SAN and LAN with Shared Tape Drives

A shared tape drive is a drive within a library that is dynamically and temporarily associated with a backup client. An option module is usually required from the backup software supplier to implement shared tape drives.

In a SAN and LAN topology, the backup server is connected through the SAN to EMC CLARiiON storage systems. In this configuration, SAN client backup data flows from the EMC CLARiiON storage systems through the SAN into the clients, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. Backup data owned by the backup server flows from the EMC CLARiiON storage systems through the SAN into the Backup Server, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. LAN client backup data flows from the EMC CLARiiON storage systems into the client servers across the LAN to the backup server, out through the SAN, through a Fibre-Channel-to SCSI bridge, and out to the tape library. For this topology, additional requirements are found in the associated table in the CLARiiON Backup Solutions section of the *EMC Support Matrix*.

SAN and LAN with Shared Tape Drives, continued

CLARiiON Storage System

| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |

CLARiiON Storage System

| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |

Not involved in backup process

Backup Client (Application or Database Server)

Backup Client (Application or Database Server)

LAN

Private LAN

Not involved in backup process

Backup Client (Application or Database Server)

Backup Client (Application or Database Server)

Backup Server

SAN

Legend

Backup Data

Backup Control Data

CLARiiON Storage System

| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |

CLARiiON Storage System

| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |

CLARiiON Storage System

| LUN (Index) |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |
| LUN |

Fibre-Channel-to-SCSI Bridge

Tape Library

Tape Drive

Tape Drive

Tape Drive

Note: The LUN (Index) is the LUN holding the backup server's index catalog information.

SAN and Private LAN with Shared Tape Drives

A shared tape drive is a drive within a library that is dynamically and temporarily associated with a backup client. An option module is usually required from the backup software supplier to implement shared tape drives.

In a LAN free, SAN and private LAN topology, the backup server is connected through the SAN to EMC CLARiiON storage systems. Additionally, a separate, private LAN is implemented solely for the purposes of backing up clients not part of the SAN. In this configuration, SAN client backup data flows from the EMC CLARiiON storage system through the SAN into the clients, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. Backup data owned by the backup server flows from the EMC CLARiiON storage systems through the SAN into the backup server, and then back out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. LAN client backup data flows from the EMC CLARiiON storage systems into the client servers, across the private LAN to the backup server, out through the SAN, through a Fibre-Channel-to-SCSI bridge, and out to the tape library. For this topology, additional requirements are found in the associated table in the CLARiiON Backup Solutions section of the *EMC Support Matrix*.

Note: For Solaris PCI, Windows NT, Windows 2000 systems, AIX and HP-UX an additional FC HBA (in addition to the ones used for EMC CLARiiON attach) is not required for accessing the tape library. For Solaris SBus servers, an additional HBA is required for accessing the tape library. This HBA uses a different driver than the one used for the EMC CLARiiON storage system attach.

SAN and Private LAN with Shared Tape Drives, continued

Note: The LUN (Index) is the LUN holding the backup server's index catalog information.
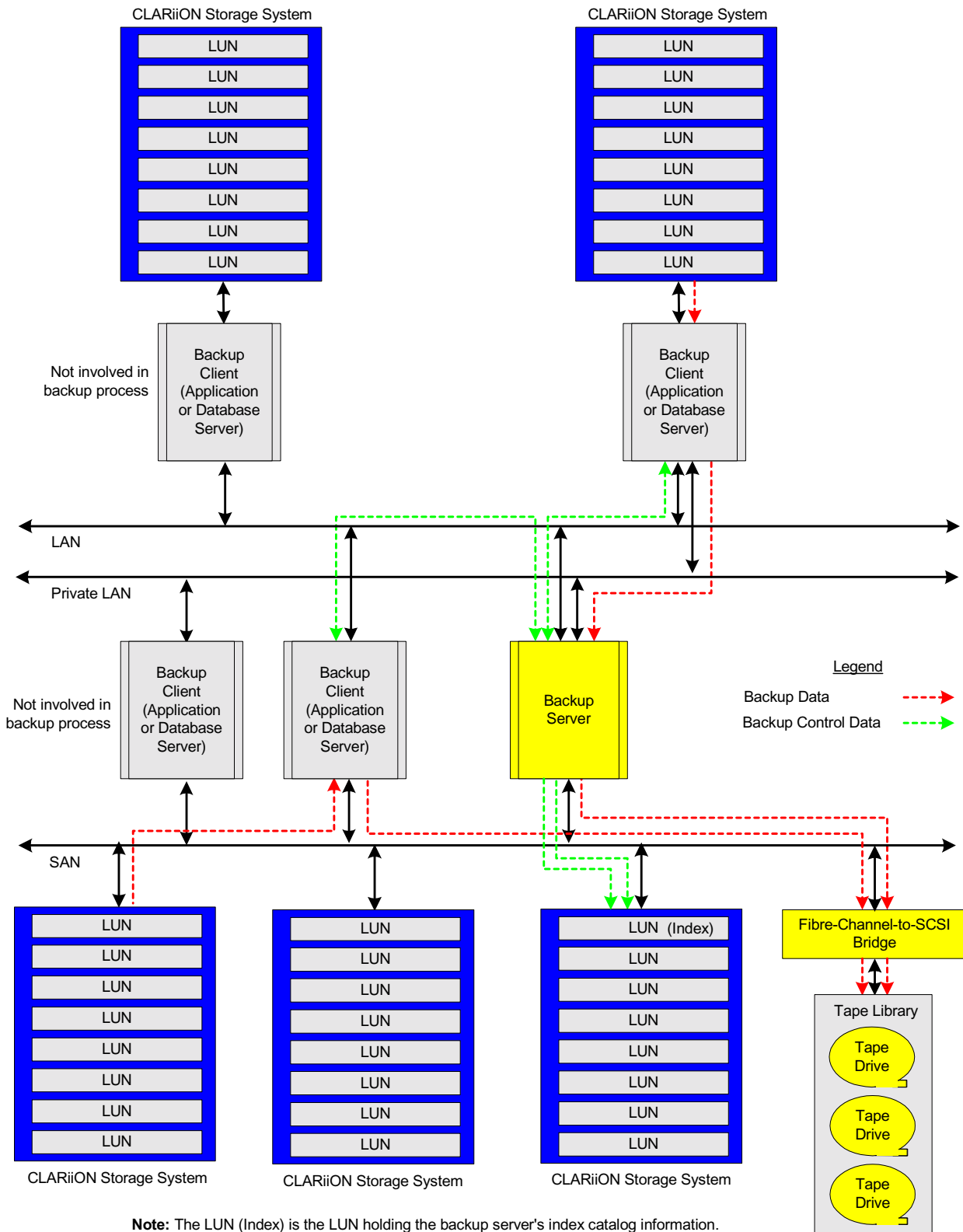
Local Disk Backup with Remote Archive

This topology uses disk-to-disk backups at the production site, as well as a remote tape library upstream at a regional or central data center. This upstream site is reached via a narrow WAN IP circuit, possibly using DSL or broadband cable.

Data is backed up to disk at the local site. Data is restored rapidly from the same local site disk. In the event of a local site disaster or data corruption, data can be restored from the remote archive. Some or all of the backup data is archived from the local site backup media to a remote location, reducing IT costs while providing centralized management. This topology does not use local tape drives. Distance are not limited and low speed links can be utilized. This topology is useful in a remote branch office environment.

Local Disk Backup with Remote Archive, continued
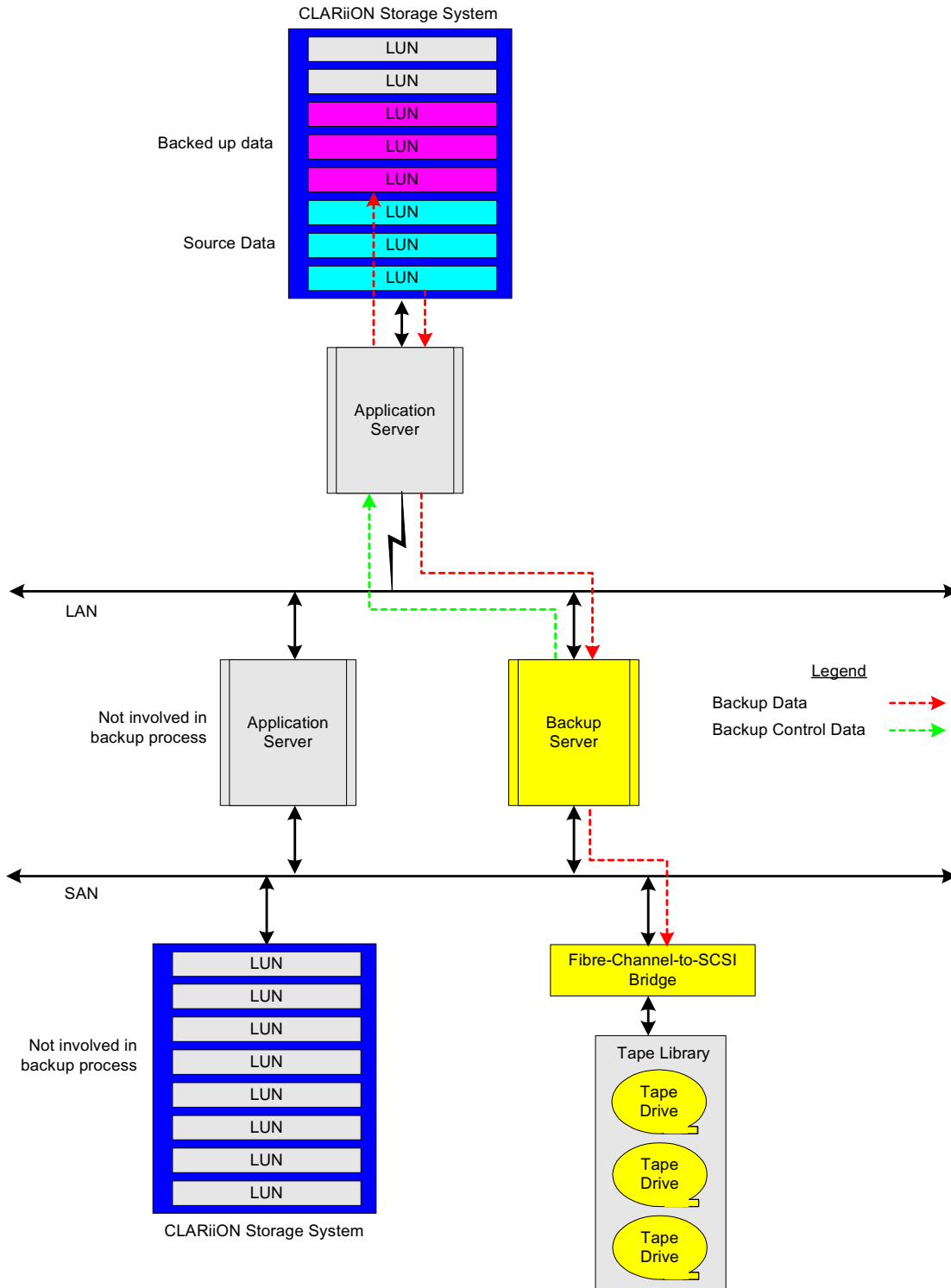
Local Backup to Remote Tape Drive Using DWDM

This topology uses disk-to-tape backups over a DWDM-based extended Fibre Channel SAN. Local disks are backed up to a tape drive at the remote facility. This type of backup accomplishes the dual-purpose of backing up the disks and placing the backup in a remote location for disaster recovery. It also centralizes tape media handling to one site. A DWDM provides a very high bandwidth, short-distance solution, though it is expensive.

This topology is appropriate for organizations that have or will deploy a DWDM-extended SAN to solve data replication challenges. Since DWDM has the same bandwidth as a Fibre Channel, a DWDM-extended SAN is functionally a single FC SAN. By utilizing a fully capable SAN, full backup capabilities are available. Backup and restore servers are more available, duplicate copies of data are available for use, SnapView and MirrorView can be utilized fully, and backup and restores are easily scheduled.
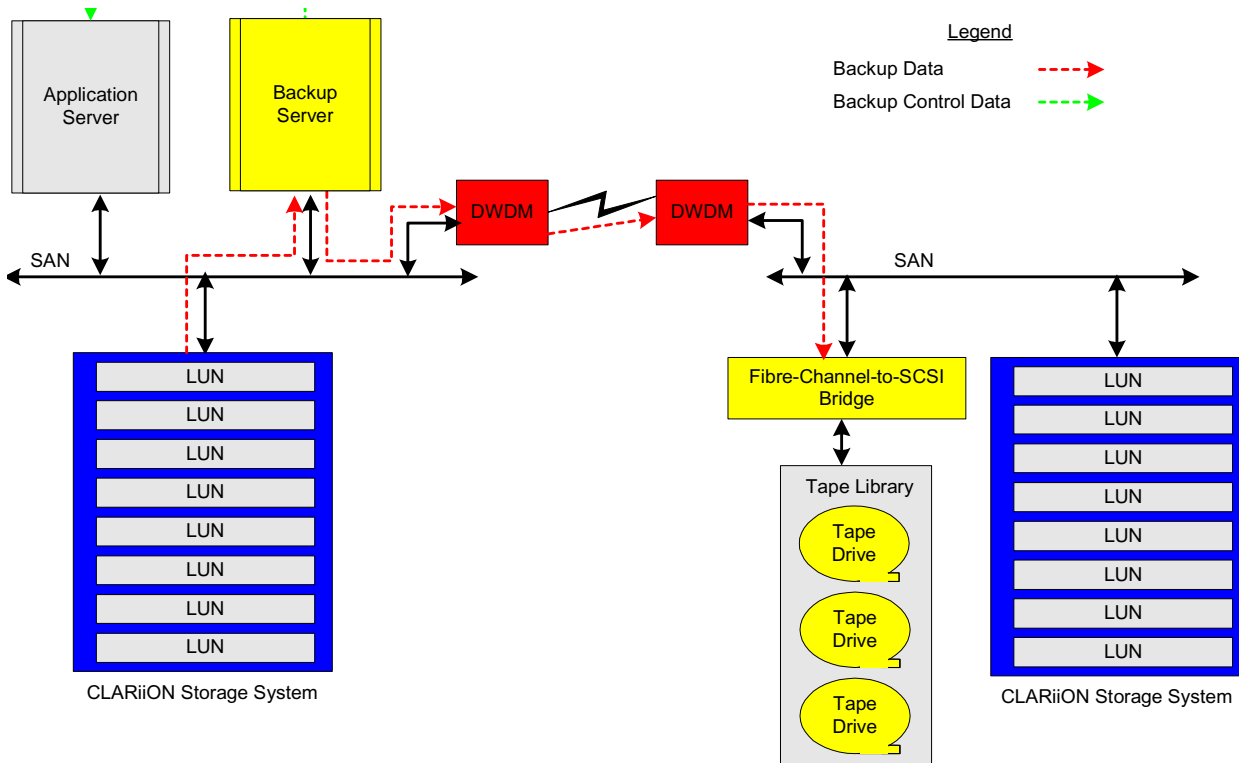
Remote Backup of Snapped, Mirrored Disk Using FC/IP

This topology makes use of disk-to-tape backups of a snapshot of a mirror maintained over a extended Fibre Channel SAN. Backup is done from the remote mirror of the local data. No bulk data transfer is needed between the remote sites (once the mirrors are synchronized). Bulk backup occurs only between the disk mirror at the remote site and a disk or tape at the remote site. MirrorView provides the mechanism for backup, expanding on its usefulness beyond disaster recovery.

This backup topology uses a replication infrastructure in conjunction with the MirrorView application and a technique for controlled splitting of the mirrors. This technique involves

- Using EMC MirrorView to establish or synchronize a mirror of the production data

- Intentionally splitting that mirror at a desired point in time

- Using SnapView to create from the mirror a source for the backup process

- Re-synchronizing the mirror in preparation for the next backup
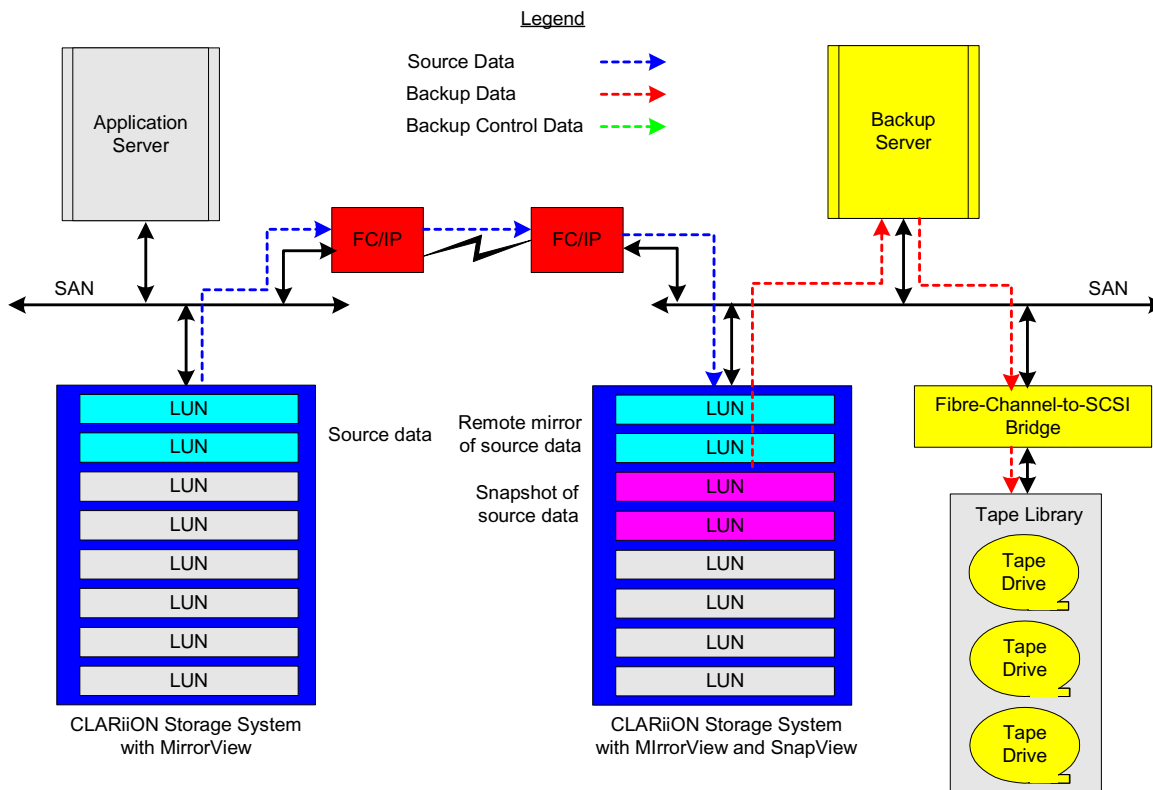
Remote Backup of Snapped, Mirrored Disk Using DWDM

This topology makes use of disk-to-tape backups of a snapshot of a mirror maintained over a DWDM-based extended Fibre Channel SAN. Backups are done using the remote mirror of the local data. No bulk data transfer is needed between the remote sites (once the mirrors are synchronized). Bulk backup occurs only between the disk mirror at the remote site, and the backup destination device at the remote site. MirrorView provides the mechanism for backup, expanding on its usefulness beyond disaster recovery.

This backup topology uses a replication infrastructure in conjunction with MirrorView and a technique for controlled splitting of the mirrors. This technique involves

- Using EMC MirrorView to establish or synchronize a mirror of the production data

- Intentionally splitting that mirror at a desired point in time

- Using SnapView to create from the mirror a source for the backup process

- Re-synchronizing the mirror in preparation for the next backup
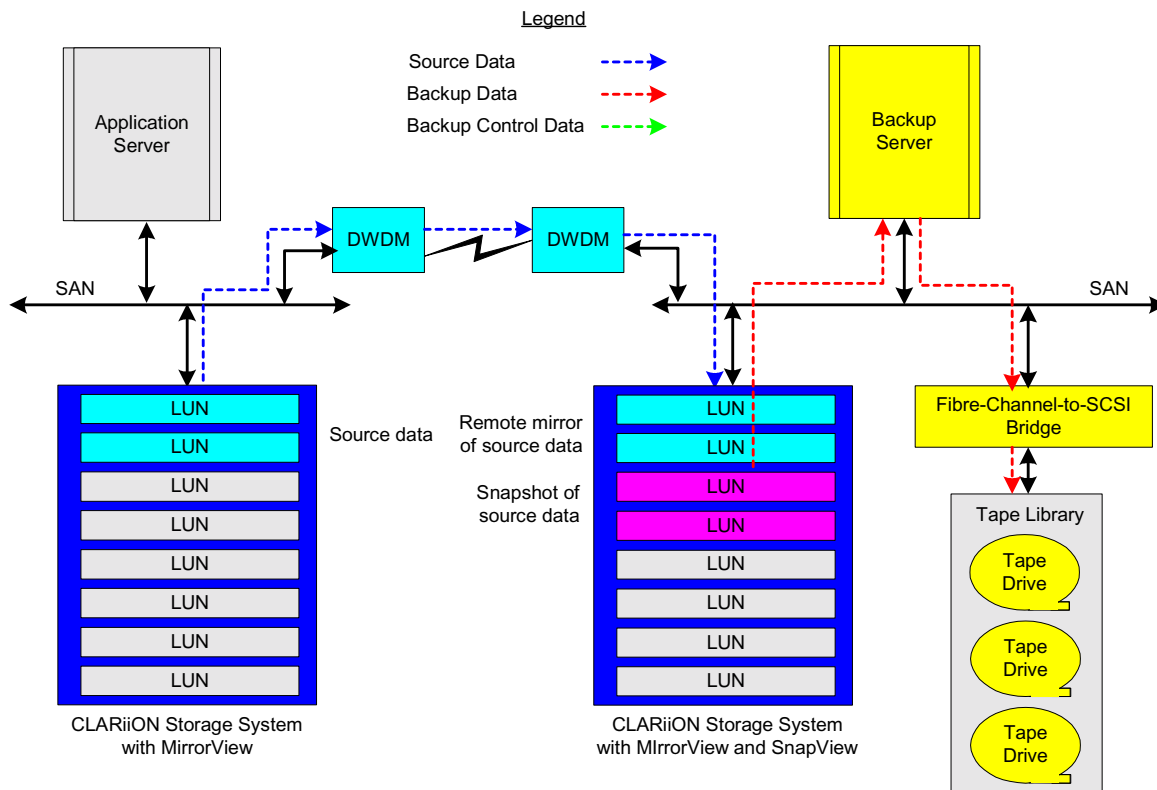
Backup Terminology

Backup Client: A computer system that owns data that must be backed up, such as an application or database server. Note that computer systems typically referred to as servers (e.g., application servers, or database servers) are referred to as clients when discussing backup.

Backup Control Data: Two types of data - (1) communications between the backup server and the backup client used to manage the backup process, and (2) catalog or index data that is written to disk.

Backup Data: Data, owned by backup clients, which must be copied to backup media for the purposes of data protection. Backup data may be files, file systems, or databases.

Backup Media: Storage media, typically magnetic tape, that holds backup data.

Backup Server: A server running backup software, which controls the flow of backup data from backup clients to the backup media. In some topologies, the backup data may flow through the backup server.

Backup Software: Software running on the backup server that controls the flow of backup data from backup clients to the backup media. Additionally, there is usually backup agent software running on the backup clients.

Catalog: A collection of metadata that identifies the details of a backup, e.g., the names of the clients backed up, the names, files sizes, and dates of the data backed up, the location of the files on the backup media, etc. The catalogs are used to restore files. Also known as an index.

Dedicated Tape Drive: A tape drive within a library that is statically and permanently associated with one backup client. A shared tape drive is one that is dynamically and temporarily associated to a backup client.

Fibre-Channel-to SCSI bridge: A device that connects one or more Fibre Channel (FC) links to one or more SCSI buses. The primary purpose of a FC Bridge is to connect a tape library to a FC SAN.

Index: A collection of metadata that identifies the details of a backup, e.g., the names of the clients backed up, the names, files sizes, and dates of the data backed up, the location of the files on the backup media, etc. The indices are used to restore files. Also known as a catalog.

Library Changer: A robotic mechanism within a tape library that moves tape cartridges between storage shelves and tape drives.

NIC: Network Interface Card. Note that EMC CLARiiON places no restrictions on the NICs used in backup servers or clients.

Restore: The act of replacing lost or corrupt data on a client with the data that was backed up.

Shared Tape Drive: A tape drive within a library that is dynamically and temporarily associated with a backup client. A dedicated tape drive is one that is statically and permanently associated with a backup client.

Tape Library or Library: A device that houses one or more tape drives, a changer, and tape cartridges.

Revision History

Revision	Effective Date	Changes
18	January 6,2003	Adds a *LUN Counts* section (page 8) to the *General Configuration Rules.* Adds a definition of path to *Switch Terminology* (page 9), and clarifies the definition of a path from an initiator (such as an HBA port) to an SP port in the following sections: - *Fan_Out Rule* (page 9) - *Path Rules* (page 11) Adds CX200 examples to *Path Rules* (page 13). Continues RPQ support for Linux PowerPath and Linux PowerPath Base in the *Path Rules* (page 11), *Failover Configuration Rules* (page 15), *Linux Configurations* (page 46), and the *Sample Configuration Drawings* (page 87). Note that PowerPath for Linux is currently only supported on non-clustered servers. Adds Linux cluster support to *Linux Direct Connections* (page 52) and the following configuration drawings: - *18. Dual Server Direct - Dual HBA Ports /Dual Ports Per SP (CX200, CX400, CX600, FC4500, FC4700, FC5300)* (page 113) - *19. Multiple Server Direct - Single HBA Port/Multiple Ports Per SP (CX400, CX600, FC4700)* (page 114). Adds NetWare support for the CX200 to the following configuration tables: - *NetWare Single Fabric Connections* (page 55) - *NetWare Dual Fabric Connections* (page 56) - *NetWare Direct Connections* (page 59) Adds NetWare support for the CX200 to the **Sample Configuration Diagrams (page 87).** Removes the *For information on switch fabric configurations, also refer to EMC Networked Storage Topology Guide.* (page 20) and adds a reference to the *EMC Networked Storage Topology Guide* for switch topology information to the beginning of *General Switch Topology Rules* (page 20). Updated the information in the *Switch Topology Rules* (page 20) and the *Cable Selection for CLARiiON Switch Models* (page 122).
17	December 6, 2002	Clarifies CX200 direct attach configurations in *Mixing Configurations* (page 7), *Access Logix Configuration Rules* (page 16), and configuration drawing 18 (page 107). Adds support for PowerPath for Linux (RPQ only) to the *Path Rules* (page 11), *Failover Configuration Rules* (page 14), *Linux Configurations* (page 46*),* and the *Configuration Diagrams* (page 86). Adds support for the DS-32B2 and DS-24M2 switches and the ED-140M enterprise director to the *General Switch Topology Rules* (page 20).
16	November 4, 2002	Adds support for CX200 storage system to the *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 13), *Switch Topology Rules* (page 19), Linux, Windows 2000, and Windows NT server configurations, the *Configuration Diagrams* (page 83), *Cable Selection for CLARiion Switch Models* (page 114), and the *Backup Configurations (CX200, CX400, CX600, FC4500, FC4700, FC5300, FC5700)* (page 116).
15	October 7, 2002	Adds support for CX400 storage system to the *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 13), *Switch Topology Rules* (page 18), server configurations, the *Configuration Diagrams* (page 82), and *Cable Selection for CLARiiON Switch Models* section (page 112). Adds SnapView clones to the *SnapView Configuration Rules* (page 15).
14	September 20, 2002	Adds support for PowerPath, PowerPath Base, and Utility Kit Power Path for FC4500 and FC5300 storage systems to the - *Failover Configuration Rules* (page 13) - tables for NetWare (page 49), Solaris (page 56), Windows 2000 (page 68), and Windows NT (page 75) - configuration drawings applicable to the FC4500 and FC5300 storage systems. Adds PowerPath Base, Utility Kit PowerPath, and CDE to the *Path Rules* table (page 10.)

Revision	Effective Date	Changes

13	September 13, 2002	Updates the *Access Logix Configuration Rules* section (page 14)
		
		Adds full support for CX600 storage systems connected to AIX servers and for PowerPath for AIX.
		
		Adds support for remote mirroring with MirrorView over an IP network to the *MirrorView Configuration Rules* (page 16), the *General Switch Topology Rules* (page 17), and the operating system configuration tables, and to the *Configuration Diagrams* section with the following new diagrams:
		- *IP Remote Mirror Single IP - Fabric Servers (CX600, FC4700)* (page 95)
		- *IP Remote Mirror Dual IP - Fabric Servers (CX600, FC4700)* (page 96)
		
		Adds support for the following remote backup configurations:
		  Local Disk Backup with Remote Archive (page 128)
		  Local Backup to Remote Tape Drive Using DWDM (page 130)
		  Remote Backup of Snapped, Mirrored Disk Using FC/IP (page 131)
		  Remote Backup of Snapped, Mirrored Disk Using DWDM (page 132)

12	August 6, 2002	Adds support for CX600 storage system to the *General Configuration Rules* (page 6), *Failover Configuration Rules* (page 13,) *Switch Topology Rules* (page 17), server configurations, the *Configuration Diagrams* (page 64), and *Cable Selection* section (page 92). Adds the DS-16M2 and DS-32M2 switches to the *Switch Topology Rules* (page 17). Adds support for PowerPath for AIX (RPQ only) and NetWare to the - *Paths from a Server to an SP* section (page 9) - *Failover Configuration Rules* section (page 13 - Configuration tables for AIX (page 22) and NetWare (page 41) - Configuration diagrams (page 64). Adds support of Veritas DMP to the *Failover Configuration Rules* (page 13), *Solaris Configurations* (page 46), and the *Configuration diagrams* (page 64)
11	June 10, 2002	Replaces the CDE and ATF Configuration Rules section in General Configuration Rules with a Failover Configuration Rules section (page 11), which covers configuration rules for PowerPath, PowerPath Basic, ATF, and CDE. IMPORTANT: This document used the term "PowerPath Basic" to refer to the PowerPath functionality that ships with the CLARiiON server utility kits. PowerPath Basic is a replacement for CDE. Adds support for PowerPath for Solaris, Windows 2000, and Windows NT to the - Paths from a Server to an SP section (page 9) - Configuration tables for Solaris (page 39), Windows 2000 (page 47), and Windows NT (page 52) - Configuration diagrams (page 57). Adds support for Linux clusters for single HBA servers in a SAN with Oracle9iRAC to the configuration table for Linux (page 31)and the configuration diagrams (page 57). Updates the number of paths for Windows 2000 and Windows NT multi-path ATF in the Path Rules (page 9). Adds the ED-12000B switch to the Switch Topology Rules (page 15). Adds configuration 14 Single Server - Quad HBA Ports/Dual Port Per SP (FC4700) for Solaris with PowerPath. Supports Tru64 UNIX configurations for general availability.

Revision	Effective Date	Changes

10	April 15, 2002	Removes support for multi-path NetWare from the Path Rules (page 9), the NetWare Configuration tables, and the configuration drawings.
		 Increases the number of paths supported for Tru64 UNIX native failover software in Path Rules (page 9).
		 Adds support for Tru64 UNIX servers for the following to the General Configuration Rules, the Tru64 UNIX Configurations section (pages 44 and 46), and the configuration drawings:
		    Clusters with Tru64Cluster
		    Non-disruptive software installation (NDU) and SP failover with native Tru64 UNIX failover
		    SnapView and MirrorView.
		 Adds support for multiple SnapView sessions and the following sections to the SnapView Configuration Rules (page 12):
		    Snapshot Cache LUNs
		    Snapshot LUNs
		    Snapshot Sessions
		 Adds the Mirror Images section (page 14) to the MirrorView Configuration Rules (page 14).
		 Adds a zoning information for a remote mirror configuration to the MirrorView Configuration Rules (page 14) and the Remote Mirror Zoning (page 77).
		 Adds support for host I/O over SP port 1 in the MirrorView Configuration Rules (page 14), the remote mirror configuration drawings 8 through 12, and example 1 of switch zoning (page 78).
		 Adds support for two secondary mirror images per primary image in the MirrorView Configuration Rules (page 14) and the configuration 9, Dual Fabric Remote Mirror (one primary image, one or more secondary images) - Fabric Servers (FC4700.)
		 Adds support for primary mirror images on four different FC4700s and secondaries on a fifth FC4700 in the MirrorView Configuration Rules (page 14) and the new configuration drawing Multiple Fabric Remote Mirror (primary images on multiple FC4700s, secondary images on one FC4700).
		 Clarifies Access Logix as an option for an FC4700 in a SAN by adding a new configuration for clustered server connections through a single switch to an FC4700 (Figure 1 on page 55).

9	February 8, 2002	Changes HBA to HBA port where applicable to support future qualification of multi-port HBAs. Adds a restriction for the number of paths to an SP supported for NetWare multi-path access (Path Rules table on page 9). Clarifies that Access Logix is supported on FC4500 and FC5300 storage systems in a storage area network (SAN) only (pAGE 12). Clarifies the use of clustered servers in SnapView configurations, and adds a drawing of a Windows cluster in a SnapView configuration with tape backup (page 13). Updates the information in the Switch Zoning section (page 72) for multi-path and alternate path access from a server to a storage-system SP.

Revision	Effective Date	Changes
8	January 7, 2002	Adds the following drawing to the Mixing Configurations section: *Example of a Solaris Server in Both SAN and DIrect Attach Configurations.* Revises the paths information and adds support for 8 paths from an HP-UX server to an FC4700 storage system (page 9 Adds CDE or ATF as a software requirement to the *Access Logix Configuration Rules* ()page 12 Adds support for Microsoft Cluster Server for Windows 2000 and Windows NT servers connected to an FC5300 in a SAN configuration. Adds support for a single-server single-fabric connection to multiple storage systems in the single fabric connection tables for all operating systems, and adds the following new configuration drawing: *Single Fabric - Single Host and Multiple Storage Systems (FC4500, FC4700, FC5300)* (configuration 1) Combined the following three configuration drawings from the previous revision into one drawing: *Dual Fabric - Multiple HBAs* (configuration 5), *Dual Fabric - Mixed Multiple and Single HBA (FC4700)* (configuration 6), and *Dual Fabric - Mixed Multiple HBA (4700)* (configuration 7). The new drawing is *Dual Fabric - Mixed Multiple and Single HBAs (FC4500, FC4700, FC5300)* (configuration 6) Removes the configuration 11 because it is unnecessary: *Direct Remote Mirror - Fabric Servers Multiple/Single HBAs and Optional Extenders (FC4700).* Adds support for direct optical connection to FC5300 to the direct connection tables for all operating systems except IRIX, and to the following configuration drawings: - *Single Server - Dual HBA (FC4500, FC4700, FC5300, FC5500, FC5700)* (configuration 11 on page 63) - *Dual Server Direct - Single HBA (Split-Bus) (FC4500, FC4700, FC5300, FC5500, FC5700)* (configuration 13 on page 64) - *Dual Server Direct - Dual HBA/Dual Ports Per SP (FC4500, FC4700, FC5300)* (Configuration 14 on page 65) Adds the FC5300 to and removes single mode cables from the *Devices and Connectors* table (page 74).

7	December 3, 2001	Adds the information from the EMC CLARiiON Switch Topology Rules P/N 0850090540-A08 and obsoletes the topology rules document:
		- Switch and fibre connectivity information to *Storage Area NetWork (SAN) Configuration Rules* (page 7)
		- *Switch Topology Rules* section (page 12)
		- Following configurations:
		  - *Sample DS-16B Switch Configurations* (configuration 21)
		  - *Typical Fan-out Configuration Using Two 16-Port Switches* (configuration 22)
		- *Switch Zoning* section (page 76)
		Adds support for NetWare CDE and/or ATF to all the NetWare configuration tables (pages 32 through 35) and to all configuration drawings except configuration *16 Dual Server Direct - Single HBA (Split-Bus).*
		Adds support for multi-path NetWare servers to the "Multi-path Support (FC4700 only)" information (page 8) and to the following NetWare configuration tables and configuration drawings:
		- *NetWare Single Fabric Connections*
		- *NetWare Dual Fabric Connections*
		- *NetWare Switch Remote Mirror and Fabric Server Connections*
		- *NetWare Direct Remote Mirror with Fabric Server Connections*
		- *NetWare Direct Connections*
		- *Single Fabric - QuickLoop and Fabric/Multiple HBA/Dual Ports per SP (FC4700)* (configuration 4)
		- *Dual Fabric - Multiple HBA* (configuration 6 on page 57)
		- *Dual Fabric - Mixed Multiple and Single HBA (FC4700)* (configuration 7)
		- *Dual Fabric - Mixed Multiple HBA (FC4700)* (configuration 8)
		- *Single Fabric Remote MIrror - Fabric Servers (FC4700)* (configuration 9)
		- *Dual Fabric Remote Mirror - Fabric Servers (FC4700)* (configuration 10)
		- *Direct Remote Mirror - Fabric Servers and Optional Extenders (FC4700)* (configuration 11)
		- *Direct Remote Mirror - Fabric Servers Multiple/Single HBAs and Optional Extenders (FC4700)* (configuration 12)
		- *Single Server - Quad HBA/Dual Port Per SP (FC4700) Single Server (configuration 15).*

6	November 15, 2001	Adds support for the FC5300 in SAN configurations (requires Access Logix, which is available from selected channels).

Revision	Effective Date	Changes
5	November 5, 2001	Adds support for the FC4700 series model FC4700-2.
		Adds a section on port speeds to *General Configuration Rules* (page 8).
		Adds a section for the Compaq Tru64™ UNIX® operating system in single and dual fabric configurations with Access Logix and no clusters, no SP failover, no SnapView, and no MirrorView. The section consists of the following tables:
		Single Fabric Connections
		Dual Fabric Connections
		Adds Tru64 UNIX to the following configuration drawings:
		Single Fabric - Single HBA/Single Port Per SP (configuration 1
		Single Fabric - Single HBA/Dual Port per SP (FC4700) (configuration 2)
		Single Fabric - QuickLoop and Fabric/Multiple HBA/Dual Ports per SP (FC4700) (configuration 4)
		Dual Fabric - Multiple HBA (configuration 5)
		Dual Fabric - Mixed Multiple and Single HBA (FC4700) (configuration 6)
		Dual Fabric - Mixed Multiple HBA (FC4700) (configuration 7)
		Single Fabric Remote Mirror - Fabric Servers (FC4700) (configuration 8)
		Dual Fabric Remote Mirror - Fabric Servers (FC4700) (configuration 9)
		Direct Remote Mirror - Fabric Servers and Optional Extenders (FC4700) (configuration 10)
		Direct Remote Mirror - Fabric Servers Multiple/Single HBAs and Optional Extenders (FC4700) (configuration 11)
		Adds the FC4700-2, the 2Gbit switch (DS-16B2-0D), and the 2Gbit QLogic HBAs (HBAQ2-xxxx) to Table 2 in the *Cable Selectio*n section.
4	October 9, 2001	Adds information on dual configurations for a single storage system to the Mixing Configurations section (page 6)
		Adds a *Cable Selection* section
3	September 1, 2001	Adds remote mirroring over switches
		Adds multiple path or alternate path support for FC4700s connected to HP-UX, IRIX, Windows 2000, and Windows NT servers
		Adds FC4700 and cluster configurations for IRIX
		Adds direct attach cluster support for FC4700
		Combines configuration 16 (Dual Clustered Server Direct - Dual HBA/Dual Ports Per SP) and configuration 18 (Server Direct - Dual HBA/Dual Ports Per SP (FC4700) into a new configuration 16 (Dual Server Direct - Dual HBA/Dual Ports Per SP) for both FC4500 and FC4700.
		Adds the following configurations:
		Single Fabric - QuickLoop and Fabric/Dual HBA/Dual Ports Per SP (FC4700) for HP-UX with QuickLoop and IRIX, NetWare, Windows 2000, and Windows NT with Fabric (configuration 4)
		Dual Fabric - Mixed Multiple HBAs (FC4700) for AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT (configuration 7)
		Single Fabric Remote Mirror - Fabric Servers (FC4700) for AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT (configuration 8)
		Dual Fabric Remote Mirror - Fabric Servers (FC4700) for AIX, HP-UX, IRIX, Linux, NetWare, Solaris, Windows 2000, and Windows NT (configuration 9)
		Single Server - Quad HBA/Dual Port Per SP (FC4700) for HP-UX, NetWare, Windows 2000, and Windows NT (configuration 14)
		Multiple Server Direct - Single HBA/Dual Ports Per SP (FC4700) for AIX, NetWare, HP-UX, IRIX, Solaris, Windows 2000, and Windows NT (configuration 17)
		Adds backup configuration sections with information from the *EMC Midrange Backup Topology Matrix*. Remaining information from this matrix is now in the *EMC Open Systems Support Matrix*. The *EMC Midrange Backup Topology Matrix* is no longer published as a separate document.
		Adds revision history.
2	June 7, 2001	Added EMC Policies and Requirements for Open Systems Server Support
		Added Revision History
1	May 7, 2001	N/A