CHAPTER 1

Interoperability Overview

This chapter provides an overview of interoperability and the Fibre Channel features that are affected by interoperability. It includes the following sections:

Understanding Interoperability

Interoperability is the facet of an implementation where multiple vendor products come in contact with each other. Fibre Channel standards have been put in place to guide vendors toward common external Fibre Channel interfaces. (For additional information about Fibre Channel standards that relate to interoperability, see Chapter 13, "Standards Perspectives.")

If all vendors followed the standards in the same manner, then interconnecting different products would become a trivial exercise; however, the Fibre Channel standards are open to interpretation and contain many optional areas. Vendors also have extended the features laid out in the standards documents to add advanced capabilities and functionality to their feature sets. Because these features are often proprietary, vendors have had to implement interoperability *modes* to accommodate these heterogeneous environments.

MDS 9000 Family Interoperability Modes

The MDS 9000 Family of multilayer directors and fabric switches supports various types of interoperability, depending on the release.

- **Default or Native Mode** —This is the default mode or behavior for a VSAN that is communicating between a SAN composed entirely of MDS 9000 switches.
- **Interop Mode 1**—This is the standard interoperability mode. It interoperates with Brocade and McData switches that have been configured for their own interoperability modes. Brocade and McData switches must be running in interop mode to work with this VSAN mode. See Chapter 6, "MDS 9000 Core with Brocade 3900/12000 Edge Topology".

- **Interop Mode 2** —This mode, also known as legacy switch interop mode 2, allows seamless integration with specific Brocade switches running in their own native mode of operation. Brocade switches must be configured with "core pid = 0" to work with this mode. See Chapter 7, "MDS 9000 Legacy Switch Interop Mode 2".
- **Interop Mode 3**—Similar to interop mode 2, interoperability mode 3 was introduced for Brocade switches that contained more than 16 ports. With this VSAN-based interop mode, Brocade switches will not have to be altered from their native mode (core pid = 1) and can be seamlessly added to a new or existing MDS SAN-OS VSAN. This mode is also known as legacy switch interop mode 3. See Chapter 8, "MDS 9000 Legacy Switch Interop Mode 3".
- **Interop Mode 4**— This mode, also known as legacy switch interop mode 4, provides seamless integration between MDS VSANs and McData switches running in McData Fabric 1.0 interop mode. See Chapter 9, "MDS 9000 Legacy Switch Interop Mode 4".

IVR

Inter-VSAN routing (IVR) allows a device that is located in one VSAN to communicate with a device that is located in another VSAN. IVR supports routing between all interop mode VSANs.

Firmware Version Requirements

The following switches have been tested with the Cisco MDS 9513, MDS 9509, MDS 9506, MDS 9216, MDS 9216i, MDS 9140, and MDS 9120 for interoperability:

- Brocade 2400, 2800, 3200, 3800, 3900, and 12000
- McData 3032 and 6064
- IBM BladeCenter

The following are minimum Cisco MDS SAN-OS versions for interop mode support:

- Release 1.0(1)+ (standard interop mode, 1)
- Release 1.2(1)+ (legacy switch interop mode 2)
- Release 1.3(2a)+ (legacy switch interop mode 3)
- Release 1.3(4a)+ (IVR with all interop modes)
- Release 2.1(2b) (MDS 9020 support)
- Release 3.0(1) (legacy switch interop mode 4)

Note Refer to the *Cisco MDS 9000 Family Interoperability Support Matrix* for current firmware version support.

Fibre Channel Features Affected by Interoperability

Each vendor (Cisco, McData, and Brocade) has its own *native* mode and an equivalent interoperability mode, which has the purpose of turning off specific advanced or proprietary features and providing the product with a more standards-compliant implementation.

Various functions and parameters are affected by interoperating with other vendor switches. The following areas are affected:

- **Domain IDs**—The domain ID, which is part of the FC ID, may be limited to a range less than the full 239 values provided in the Fibre Channel standard. A switch may have to change its domain ID to the 97 to 127 range to accommodate the McData 31 domain address limitation. If a domain ID is changed (which can be a disruptive event to the switch), all devices attached to the switch will need to log into the switch again. When domain IDs are changed, the switch itself will need to reregister with the principal switch in the fabric to verify domain ID uniqueness.
  - **Disruptive**—The impact of this event is switch-wide. Brocade and McData require the entire switch to be taken offline and/or rebooted when changing domain IDs.
  - **Nondisruptive**—This event is limited to the VSAN where the event is taking place. The MDS 9000 switch can perform this action, as the domain manager process for this VSAN is restarted and not the entire switch. This event still requires any devices logged into the VSAN on that switch to log in again to obtain a new FC ID.
- **Fabric Shortest Path First (FSPF)**—The routing of frames within the fabric is not changed by the introduction of an interoperability mode. However, the MDS 9000 switch will continue to use the default src-id/dst-id/ox-id (or src-id/dst-id, if configured) to load balance across multiple Inter-Switch Links (ISLs), while Brocade and McData switches will use their default src-id/dst-id. When passing through an MDS 9000 switch, the return route may be different from the initial route.
- **Timers**—All Fibre Channel timers must be the same on all switches as these values are exchanged by E ports when establishing an ISL. The timers are:
  - F_S_TOV (fabric stability time out value)
  - D_S_TOV (distributed services time out value)
  - E_D_TOV (error detect time out value)
  - R_A_TOV (resource allocation time out value)
- **Trunking and PortChannels**—Trunking and PortChannels are not supported between two different vendor switches. However, some vendors can continue to use trunking and PortChannels between their own switches while in interop mode. This feature may be disabled on a per-port or per-switch basis, and continue to work as expected only if they are allowed by the interoperability mode of the vendor.
- **FC Aliases**—FC aliases are never propagated as part of an active zone set in any mode. FC aliases are propagated as part of the full database, if propagation of the full database is allowed in that specific mode.
- **Default Zone Behavior**—The default zone behavior of permit (all nodes can see all other nodes) or deny (all nodes are isolated when not explicitly placed in a zone) may change. The default zone parameter is restricted to the switch on which it is configured, and it is not propagated to other switches.
- **Zoning Membership**—Zones may be limited to the pWWN, while other proprietary zoning methods (physical port number) may be eliminated. Not all vendors can support the same number of zones. Determine which vendor is the lowest common denominator and limit the fabric to that value. The zoning methods are described in Table 1-1.

Table 1-1 Zoning Types in Interop Mode

Zoning Type	Allowed MDS 9000 Switch Interop Modes
Port WWN	All
FC ID	Non-interop mode only

Table 1-1 Zoning Types in Interop Mode

Zoning Type	Allowed MDS 9000 Switch Interop Modes
Fabric port WWN	Non-interop mode only
FC Alias	All
domain/port	Legacy switch interop modes 2, 3, 4
Symbolic node name	Non-interop mode only
<interface, switch wwn>	Non-interop mode only

- **Zone Propagation**—Some vendors only distribute the active zone set (configuration) while others continue to use a proprietary format to distribute the full zone set database (configuration). The behavior is described in Table 1-2.

Table 1-2 Full Zone Set Distribution

Mode	Default Behavior	Effect of "distribute full" Option
Non-interop mode	Full database is not distributed. It is always parsed if received from a remote switch.	Full database distribution can be turned on and off using this command.
Interop Mode 1	Full database is neither distributed nor parsed due to possible interoperability problems.	No effect.
Legacy switch mode (2,3)	Full database is distributed and parsed.	No effect.
Legacy switch mode 4	Full database is not distributed.	No effect.

See Chapter 13, "Standards Perspectives," for additional insight into the Fibre Channel standards with respect to interoperability.

Implementing an Interoperable Fabric

Before implementing an interoperable fabric, the following general steps should be taken:

Step 1 Verify zone compliance. All zones need to be made from pWWNs exclusively when using the standard interop mode (1). In legacy switch interop modes (domain/port), zoning should only be used on non-MDS switches.

Step 2 Verify FC timers. All timers need to match exactly including E_D_TOV and R_A_TOV.

Step 3 Assign domain IDs. Whether assigning them statically or restricting them to a specific range (97 to 127), these unique values should be planned or set up in advance of establishing the fabric.

Step 4 Enable interop mode. This action can be either a disruptive or nondisruptive process to the switch and can even result in the total reboot of the switch on which this mode is being enabled.

Step 5 Verify the name server. Verify that all switches have the correct values in their respective name server database.

Step 6 Verify zone propagation. Verify that the active zone set or zone configuration has correctly propagated to the other switches in the fabric.