

HP Fibre Channel Fabric Migration Guide



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1 Fabric Migration Guide

This document describes the fabric feature for the Fibre Channel PCI Tachyon TL, HSC TL, PCI XL2 and PCI Universal host bus adapters. It lists the requirements you will need to take advantage of this feature along with any restrictions in using fabric.

Migrating to Fabric

A Fibre Channel fabric (one or more switches in a configuration) can provide multiple benefits including independent bandwidth per port, greater reliability, and increased performance.

Before you change your environment to a fabric supported environment, read the following sections carefully. They list the advantages and considerations of migrating to fabric, the requirements for fabric configurations, and examples of the configurations we support with the following host bus adapters:

- A5158A PCI Fibre Channel Tachyon TL Adapter
- A6684A HSC Fibre Channel Tachlite Adapter
- A6685A HSC Fibre Channel Tachlite Adapter
- A6795A PCI Fibre Channel Tachyon XL2 Adapter
- A6826A PCI-X Dual Port Fibre Channel Adapter

The configuration examples and some of the terminology we used are specific to the Brocade switch. We used this switch only as an example. HP also supports other switches. See the “Supported Platforms, Switches and Devices” link under Fibre Channel HBAs on our web site accessed through the ITRC. Log on to the ITRC web site (<http://itrc.hp.com>), and click on navigate knowledge trees and response center FAQs. In the Hardware area, navigate the links to networks/mass storage connectivity/fibre channel/technical support.

Important Considerations of Migrating to Fabric

When migrating from a private loop environment to a fabric environment, consider the following advantages.

Reliability

- Total removal of LIPs for N_Port (Direct Fabric Attach) devices results in the following:
 - No LIP storms.
 - No lost frames due to other devices going offline or coming online on the link.

This activity can cause long delays (approximately 10 sec) while the I/O is timed out and then retried for direct access devices. It can also cause a loss of position for sequential access devices, and the entire operation may need to be retried.

- Simpler link level protocol results in fewer chances of encountering hardware, firmware, or software defects in the HBAs.
- A fabric environment can provide multiple paths of communication between initiator and the target on the loop. If one path goes down because of loop port/link problems, the switch can determine an alternate path.

Manageability and Fault Isolation

- Switches contain management utilities which collect and present a broad range of statistical and error information. This information greatly assists in identifying specific components that are experiencing errors.
- Link level faults are isolated to a single link segment on a fabric.
- Target devices that are directly connected to the switch no longer need to have loop identifiers (Hard Physical Addresses) configured.

Performance

- Removal of FC-AL protocol for N_Port (DFA) devices.

FC-AL protocol overhead is related to frame size and the number of members on the loop. FC-AL protocol can be quite significant for larger loop configurations (loops with more than 30 active nodes). When you move to a Direct Fabric Attach topology, the AL level of protocol is no longer needed or present.

- Addition of fabric routing time.

Fabric routing times are generally less than 1 msec (one microsecond). For single switch fabrics or properly configured cascaded switches, the fabric will have no noticeable effect on latency.

- Parallel transfer of data.

Fabrics allow parallel transfers of data to and from multiple initiators on the fabric. They also allow parallel transfer of data to and from separate targets at the same time with a single initiator.

Scalability

- Fabrics allow you to expand beyond a single loop with a maximum of 126 loop ports to a SAN environment where it is possible to use multiple fabrics and attach virtually unlimited numbers of devices in several configurations.
- In addition to attaching devices directly to the fabric or having public loops in the SAN, you can attach an existing (but separate) private loop to the fabric, and have all of the devices managed by the fabric. This configuration creates a highly scalable and modular network of storage devices that you can extend as desired with minor effects to the existing network.

Sharing

Devices, such as tapes, that needed to be configured in a point-to-point configuration in a loop can now be shared with disk devices when they are in a fabric environment.

Device File Addressing Changes

Be aware of the following changes in your device files when you migrate to fabric:

- Device file names and iotree paths will change when you replace a private loop with a fabric switch.
- Device file names and iotree paths will change when you move a target device from one port on a fabric switch to another port on the switch.
- Device files and iotree nodes will change if the switch domain changes.

For more information on device file addressing changes, see the section “Fabric Device Addressing Changes” on page 15.

Requirements for Arbitrated Loop and Fabric Support

- A5158A PCI Tachyon TL adapter
 - HP-UX 11.00 or 11i v1.0 for PA-RISC systems

- HP-UX 11i v1.6 or later for IPF systems
- A5158A HP-UX 11.00 or 11i v1.0 software driver for PA-RISC systems. The driver is available on the web at <http://www.software.hp.com> and on the HP-UX Application CD, AR0301 and later. The driver is always installed with the HP-UX 11i v1.0 Operating Environment.
- Tachyon patch PHKL_23939 or later for HP-UX 11.00
- Tachyon patch PHKL_23626 or later for HP-UX 11i v1.0
- A6684A and A6685A HSC Tachlite adapters
 - OS version HP-UX 10.20, 11.00 or 11i v1.0
 - A6684A/A6685A 10.20, 11.00 or 11i v1.0 software driver. The driver is available on the web at <http://www.software.hp.com> and on the HP-UX Application CD, AR0601 and later. The driver is always installed with the HP-UX 11i v1.0 Operating Environment.
 - J3630BA Fibre Channel Software Bundle (if not already installed, **for 10.20 only**)
 - PHSS_23581 or later for HP-UX 10.20
 - PHKL_17590 or later for HP-UX 10.20
 - PHKL_16751 or later for HP-UX 10.20
 - Tachyon patch PHKL_23939 or later for HP-UX 11.00
 - Tachyon patch PHKL_23626 or later for HP-UX 11i v1.0
- A6795A PCI Tachyon XL2 adapter
 - OS version HP-UX 11.00 and 11i v1.0
 - A6795A HP-UX 11.00 or 11i v1.0 software driver. The driver is available on the web at <http://www.software.hp.com> and on the HP-UX Application CD, AR1201 or later. The driver is always installed with the HP-UX 11i v1.0 Operating Environment.
 - Tachyon patch PHKL_23939 or later for HP-UX 11.00
 - Tachyon patch PHKL_23626 or later for HP-UX 11i v1.0
- A6826A PCI-X Dual Port adapter
 - OS version HP-UX 11i v1.0

- A6826A HP-UX 11i v1.0 software driver. The driver is available on the web at <http://www.software.hp.com>.
- PHKL_28801 or later for HP_UX 11i v1.0
- PHKL_23445 or later for HP-UX 11i v1.0
- Supported hardware

For the latest list of supported hardware and topologies, contact your HP representative, or visit the ITRC web site mentioned on page 6 in this manual.

Restrictions

- All target loop devices are required to continue using hard physical addresses.
- Remote device or LUN level scanning from IODC is not supported.
- `fcmsutil` option, `echo`, cannot be used in a fabric configuration.
- The maximum number of Tachyon TL hosts that HP recommends on an `FL_Port` is nine in non-HA configurations and four in HA configurations.

Supported Fabric Configurations

HP currently supports the following SAN configurations with the A5158A PCI Tachyon TL adapter, the A6684A and A6685A HSC Tachlite adapters, A6795A PCI 2Gb XL2 adapter and the A6826A PCI-X Dual Port adapter.

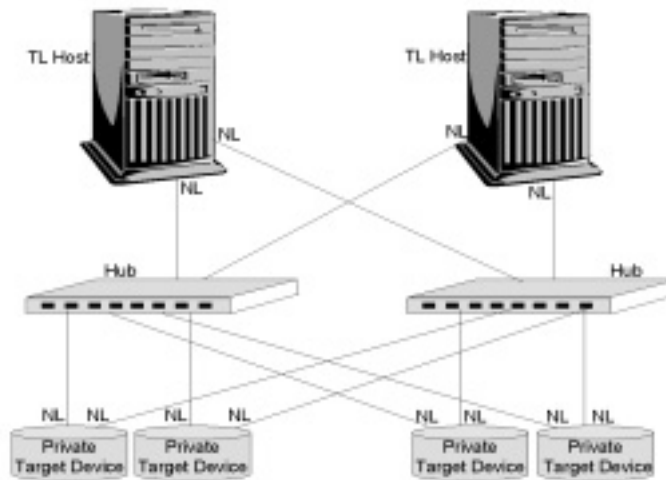
- Private Arbitrated Loop (with hubs)
- Direct Fabric Attachment
- Public Loop
- QuickLoop Fabric Attachment (with Brocade switches)
- QuickLoop Attachment for private devices (with Brocade switches)

For a list of supported platforms, switches and devices for these configurations, please contact your HP representative or visit the ITRC web site, mentioned on page 6, to access Fibre Channel HBA support information.

Isolated Private Arbitrated Loop

Figure 1-1 shows a typical Isolated Private Loop configuration without fabric. This is most likely your current configuration.

Figure 1-1 **Isolated Private Arbitrated Loop Configuration**



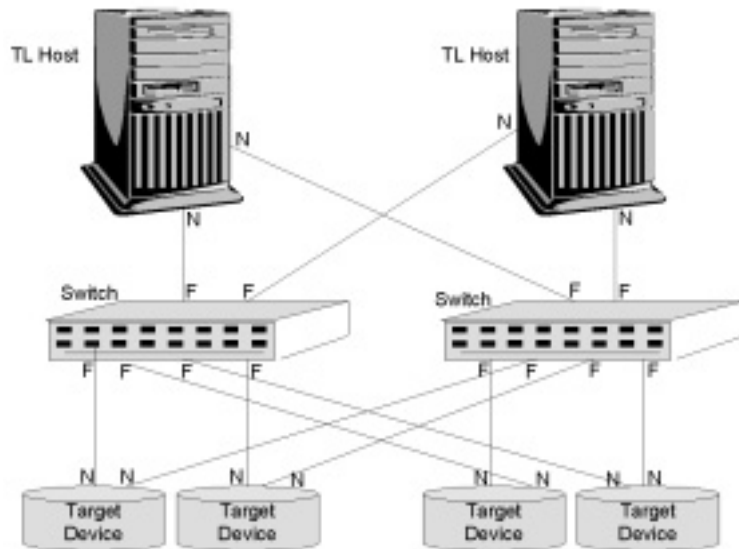
This isolated private loop is a typical configuration. It uses two hubs for some redundancy to the target devices. This configuration will continue to be supported.

Direct Fabric Attachment

A simple migration to a fabric configuration is to replace the two hubs with two Fibre Channel switches. Redundant paths to the targets are maintained while each link is isolated from each other providing better performance and reliability.

Figure 1-2 illustrates this fabric configuration.

Figure 1-2 Direct Fabric Attachment Configuration



The advantages of this configuration are:

- Additional cabling is unnecessary.
- All devices are isolated.
- Provides independent bandwidth for each device.

QuickLoop Attachment for Fabric

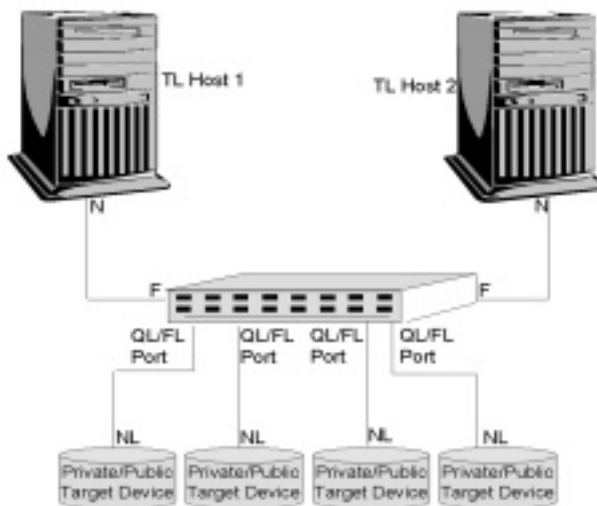
A migration path to a fabric configuration with devices that are not fabric capable is to use the QuickLoop fabric configuration. In this configuration, a host connected to a F_Port or FL_Port on the switch can communicate with private target devices connected to QL ports in the same or different loop. Through translative mode (a function of Brocade switch), the switch creates phantom loop addresses which allow private target devices to communicate with public hosts across the fabric. Translative mode allows private loop target devices to appear as public targets.

NOTE Translative mode does not allow private hosts to communicate with public devices on the switch.

An example of a QuickLoop fabric configuration is to replace the two hubs shown in the previous illustration with a single Fibre Channel switch. You can connect Host 1 and Host 2 to F_Ports on the switch, and connect each private target device to a QuickLoop port.

Figure 1-3 shows that Host 1 and Host 2 are now public hosts, each having access to any of the QuickLoop target devices through the translative mode function.

Figure 1-3 QuickLoop Fabric Configuration



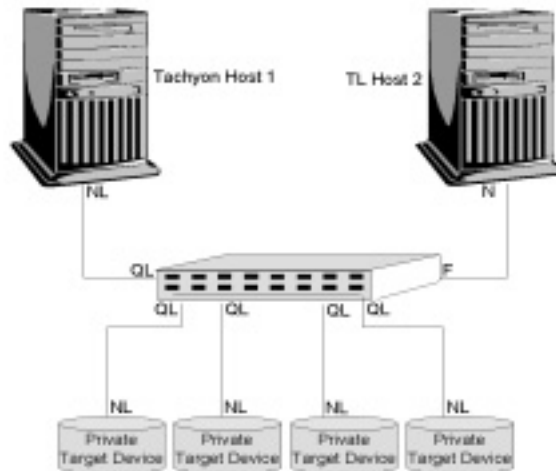
QuickLoop Attachment for Private Devices

NOTE The following configuration can be used when you are in the process of migrating to fabric but your fabric environment is not yet fully functional.

In a private loop environment, a QuickLoop configuration can allow private hosts with a Tachyon adapter attached to a QL_Port to access private devices on the loop by using the switch as a hub.

Figure 1-4 shows that Tachyon Host 1 is a private host which has access to the private target devices connected to a QuickLoop port. TL Host 2, a public host connected to a fabric port, also has access to the private devices and any future public devices.

Figure 1-4 QuickLoop Attachment for Private Devices



For Tachlite hosts:

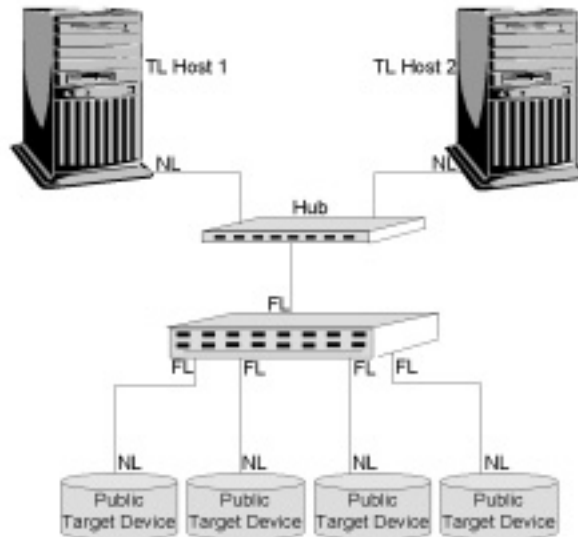
- Public hosts/devices cannot exist on a QL loop.
- Private QL hosts cannot connect to fabric devices.
- Public hosts connected to a QuickLoop port will behave as private hosts and therefore is not recommended or supported.

Public Loop

A public loop is an arbitrated loop where at least one of the ports on the loop is a switch port (FL_Port), which allows hosts or devices on the loop to communicate with hosts or devices attached to other FL_Ports.

Figure 1-5 shows that Host 1 and Host 2 are public hosts connected through a hub to an FL_Port on the switch. The target devices are public devices (NL_Ports) connected to other FL_Ports. Host 1 and 2 have access to any of the public devices.

Figure 1-5 Public Loop Attachment



To use this or any other configuration shown in this guide, check to see if your devices support the configuration. For a list of HP supported topologies and devices, visit the ITRC web site, mentioned on page 6, to access Fibre Channel HBA support information.

Fabric Device Addressing Changes

When you migrate from an existing Fibre Channel private loop configuration to a switched Fibre Channel fabric configuration, the hardware path to the attached target devices will change to reflect the presence of a fabric/switch in the route from the host initiator to the target device. When the I/O path information to a given disk changes, a new device file is created for this device.

Your system administrator will need to change the appropriate configuration files to allow the correct devices to be used by the file system or application that accesses these disk device files.

NOTE

Device file names and iotree paths will change when a fabric switch replaces a loop.

Device file names and iotree paths will change when you move a target from one port on a fabric switch to another port on the switch.

Device files and iotree nodes will change if the switch domain changes.

How to Make Configuration Changes

Check all references to device files. The two most common files to check are:

- `/etc/lvmtab`
- `/etc/fstab`

In all cases where you move an LVM device, you can use the `vgexport` and `vgimport` commands to easily migrate existing volume groups. Use `vgexport` to export your volume groups *before* changing your SAN configuration or installing the switch. Then use `vgimport` to import your volume groups using the new device files.

Please refer to the `vgexport` and `vgimport` man pages and to the LVM portions of your administrator's guides for details.

Device Addressing in a Fabric Environment

HP's current model of addressing associates devices with their hardware path information. In the case of Fibre Channel disk devices, the device file names are little more than tags that are associated with a node in the system iotree. Using the `ioscan` command, `ioscan -kfn -C disk`, you can obtain this association.

During the kernel initialization phase of the boot process, `ioscan` scans the hardware I/O subsystem for attached devices, and builds an iotree. Any new devices that are found during this scan process will have new device files created for them.

The current Fibre Channel implementation over a Private Arbitrated Loop uses the Hard Address (HPA) of the FC target to generate a portion of the hardware path to the Fibre Channel port. Behind this port, virtual SCSI buses, targets and LUNs will exist.

In a fabric environment, the N_Port address is used to generate this portion of the hardware path to the Fibre Channel port. Behind this port, virtual SCSI buses, targets, and LUNs exist in the same manner as the existing configurations. The fabric/switch is responsible for the generation of the N_Port address. Three fields comprise this address:

Domain	Generally associated with the physical instance of a switch. (To determine how the domain is assigned on a particular switch, refer to that switch vendor's documentation.)
Area	Generally associated with a port on the switch.
Port	Set to 0 for direct fabric attached devices (N_Port to F_Port). Set to the AL_PA associated with the Hard Physical Address or loop identifier of a Fibre Channel target for public loop devices. (See the FC-AL-2 annex K for this mapping. Figure 1-6 shows an example of the annex K table). For private loop devices, the port field(s) in the HW path in an <code>ioscan</code> output contains the Hard Physical Address or loop identifier of the target device.

Figure 1-6 Annex-K - Assigned Loop Identifier

AL_PA		Switch Setting		AL_PA		Switch Setting		AL_PA		Switch Setting		AL_PA		Switch Setting	
Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec
FF	239	00	0	B2	178	20	32	72	114	40	64	3A	58	60	96
E8	232	01	1	B1	177	21	33	71	113	41	65	39	57	61	97
E4	228	02	2	AE	174	22	34	6E	110	42	66	36	54	62	98
E2	226	03	3	AD	173	23	35	6D	109	43	67	35	53	63	99
E1	225	04	4	AC	172	24	36	6C	108	44	68	34	52	64	100
E0	224	05	5	AB	171	25	37	6B	107	45	69	33	51	65	101
DC	220	06	6	AA	170	26	38	6A	106	46	70	32	50	66	102
DA	218	07	7	A9	169	27	39	69	105	47	71	31	49	67	103
D9	217	08	8	A7	167	28	40	67	103	48	72	2E	46	68	104
D6	214	09	9	A6	166	29	41	66	102	49	73	2D	45	69	105
D5	213	0A	10	A5	165	2A	42	65	101	4A	74	2C	44	6A	106
D4	212	0B	11	A3	163	2B	43	63	99	4B	75	2B	43	6B	107
D3	211	0C	12	9F	159	2C	44	5C	92	4C	76	2A	42	6C	108
D2	210	0D	13	9E	158	2D	45	5A	90	4D	77	29	41	6D	109
D1	209	0E	14	9D	157	2E	46	59	89	4E	78	27	39	6E	110
CE	206	0F	15	9B	155	2F	47	56	86	4F	79	26	38	6F	111
CD	205	10	16	98	152	30	48	55	85	50	80	25	37	70	112
CC	204	11	17	97	151	31	49	54	84	51	81	23	35	71	113
CB	203	12	18	90	144	32	50	53	83	52	82	1F	31	72	114
CA	202	13	19	8F	143	33	51	52	82	53	83	1E	30	73	115
C9	201	14	20	88	136	34	52	51	81	54	84	1D	29	74	116
C7	199	15	21	84	132	35	53	4E	78	55	85	1B	27	75	117
C6	198	16	22	82	130	36	54	4D	77	56	86	18	24	76	118
C5	197	17	23	81	129	37	55	4C	76	57	87	17	22	77	119
C3	195	18	24	80	128	38	56	4B	75	58	88	10	16	78	120
BC	188	19	25	7C	124	39	57	4A	74	59	89	0F	15	79	121
BA	186	1A	26	7A	122	3A	58	49	73	5A	90	08	8	7A	122
B9	185	1B	27	79	121	3B	59	47	71	5B	91	04	4	7B	123
B6	182	1C	28	76	118	3C	60	46	70	5C	92	02	2	7C	124
B5	181	1D	29	75	117	3D	61	45	69	5D	93	01	1	7D	125
B4	180	1E	30	74	116	3E	62	43	67	5E	94				
B3	179	1F	31	73	115	3F	63	3C	60	5F	95				
Reserved addresses:															
00	0	7E	126												
-	-	7F	127												

Note that the values are from lowest to highest priority. AL_PA=00 is reserved for an FL_Port; “-” is not available.

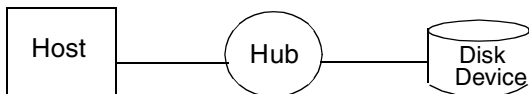
Because HP continues to use Physical Path addressing, loop devices (public and private) will be required to continue using Hard Physical Addresses.

Private Loop to Fabric Example

Following is a simple example of migrating an HP disk device from a private loop configuration to a fabric topology.

Figure 1-7 shows a private loop configuration.

Figure 1-7 Private Loop Configuration

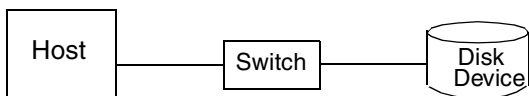


The ioscan output for a Private Loop Configuration could be as follows:

Class	I	H/W Path	Driver	S/W State	H/W Type	Description
fc	0	0/1/2/0	td	CLAIMED	INTERFACE	HP Tachyon TL/TS Fibre Channel Mass Storage Adapter
fc	1	0/1/2/0.8	fc	CLAIMED	INTERFACE	FCP Protocol Adapter
ext_bus	3	0/1/2/0.8.0.11.0	fcarray	CLAIMED	INTERFACE	FCP Array Interface
target	6	0/1/2/0.8.0.11.0.0	tgt	CLAIMED	DEVICE	
disk	3	0/1/2/0.8.0.11.0.0.0	sdisk	CLAIMED	DEVICE	HP OPEN-8 /dev/dsk/c3t0d0 /dev/rdisk/c3t0d0
disk	10	0/1/2/0.8.0.11.0.0.7	sdisk	CLAIMED	DEVICE	HP OPEN-8 /dev/dsk/c3t0d7 /dev/rdisk/c3t0d7
target	7	0/1/2/0.8.0.11.0.1	tgt	CLAIMED	DEVICE	
disk	18	0/1/2/0.8.0.11.0.1.7	sdisk	CLAIMED	DEVICE	HP OPEN-9 /dev/dsk/c3t1d7 /dev/rdisk/c3t1d7

Figure 1-8 shows a Direct Fabric Attachment configuration.

Figure 1-8 Direct Fabric Attachment Configuration



The ioscan output for this configuration could be as follows:

Class	I	H/W Path	Driver	S/W State	H/W Type	Description
fc	0	0/1/2/0	td	CLAIMED	INTERFACE	HP Tachyon
TL/TS Fibre Channel Mass Storage Adapter						
fc	1	0/1/2/0.1	fc	CLAIMED	INTERFACE	FCP Domain
ext_bus	3	0/1/2/0.1.19.0.0	fcarray	CLAIMED	INTERFACE	FCP Array
Interface						
target	6	0/1/2/0.1.19.0.0.0	tgt	CLAIMED	DEVICE	
disk	3	0/1/2/0.1.19.0.0.0.0	sdisk	CLAIMED	DEVICE	HP OPEN-8
			/dev/dsk/c4t0d0		/dev/rdisk/c4t0d0	
disk	10	0/1/2/0.1.19.0.0.0.7	sdisk	CLAIMED	DEVICE	HP OPEN-8
			/dev/dsk/c4t0d7		/dev/rdisk/c4t0d7	
target	7	0/1/2/0.1.19.0.0.1	tgt	CLAIMED	DEVICE	
disk	18	0/1/2/0.1.19.0.0.1.7	sdisk	CLAIMED	DEVICE	HP OPEN-9
			/dev/dsk/c4t1d7		/dev/rdisk/c4t1d7	

Looking at the iotree examples, you can see the following:

- There has been no change to the adapter path or the associated device file which is used for the fcmsutil diagnostic tool.
- The node 0/1/2/0.8, FCP Protocol Adapter, is in the first ioscan output file. In a private loop configuration, the interface and target devices will reside behind this node. In a fabric environment, this node may be created as a dummy node generated by the scan logic if the HBA is scanned when it cannot see the fabric (for example, no cable attached, switch down, etc.).

In the original Private Loop implementation of the Fibre Channel driver, this node of the iotree was used to indicate the Fibre Channel FC4 “TYPE”. A type of “8” denotes that the FCP protocol is being used to encapsulate the SCSI protocol. With the introduction of fabric, this node contains the domain portion of the N_Port address. To maintain backward compatibility, the domain of 8 is reserved for use with Private Loop devices.

CAUTION

Do not configure switches with a domain of 8. This configuration is unsupported and will not work. HP systems reserve domain 8 for Private Loop devices.

- The fabric configuration now contains an iotree node of 0/1/2/0.1 described as FCP Domain. A node of this type will be built for each domain the fabric contains. (Domains generally correspond one to one with a physical instance of a switch).
- The FCP Array Interface iotree node has changed from 0/1/2/0.8.0.11.0 to 0/1/2/0.1.19.0.0. The address is still at hardware path 0/1/2/0, but the next three elements of the path, which represent the N_Port ID, have changed. The old N_Port ID of 8.0.11 uses the reserved domain of 8 and area of 0. In this case, the HPA or Port portion of the N_Port ID is 11. In the fabric iotree, the new N_Port ID is 1.19.0. This N_Port ID corresponds to the following:
 - domain ID of 1 = Brocade switch #1
 - area ID of 19 = port 3
 - port ID of 0 = Direct Fabric Attach

In the ioscan example, the area ID is 19. The switch will show a hexadecimal value of “1x” because it has a fixed “1” in the upper four bits of the area field (0001xxxx). However, ioscan shows a decimal value for this field. Therefore, you must subtract decimal 16 from the number 19 to get the actual port number, which is 3.

For most switches, the domain ID generally will map to a switch. An area ID will map to a physical connector on the switch. This mapping may not be a direct numerical correlation; that is, physical port “3” may map to an area ID other than “3,” depending on the decimal value shown in this field.

If the switch port is an F_Port (Direct Fabric Attach), the port ID is set to 0. If the switch port is an FL_Port, the port ID is set to the AL_PA associated with the Hard Physical Address or loop identifier of a Fibre Channel target for public loop devices. The AL_PA is then used as the Port portion of the iotree address.

- New device files will be generated for the new iotree nodes. The old device files will continue to exist until they are removed with the `rmsf` command or a system reboot.

Glossary

A

AL Boot - the process of booting from a device that is on the same arbitrated loop as the host adapter. No switch is required.

Arbitrated Loop - a Fibre Channel topology where information is routed around the loop from port to port until it arrives at its destination. This is a private loop configuration.

Area - the second field of the 3-byte address assigned to an attached N_Port in a Fabric configuration. The Area is generally associated with an F/FL port on a switch.

C

Cascading - an interconnection of individual switches used to create larger Fabric configurations.

D

DFA (Direct Fabric Attachment) - a configuration in which both the host initiator and the target device are attached to the same switch (N_Port to F_Port).

Domain - the first field of the 3-byte address assigned to an attached N_Port in a Fabric configuration. The domain is generally associated with an instance of the switch.

F

Fabric - a term used to describe an interconnection of Fibre Channel host ports, device ports and switch ports where frames

from a source N_Port are routed through a switch (Fabric) to a destination N_Port based on the frame's destination address.

Fabric Boot - the process of booting from a device that is accessed by a Fibre Channel switch.

Fabric Device Addressing - the assigning of addresses to attached N_Ports in the Fabric. The address is determined by the switch and is comprised of three fields: Domain, Area, and Port.

FC-FLA (Fibre Channel Fabric Loop Attach) - the ANSI technical report that describes the rules by which NL_Ports and FL_Ports communicate with each other.

FC-AL - (Fibre Channel Arbitrated Loop) - the ANSI standard that describes how several Fibre Channel ports can share a single communication ring.

F_Port (Fabric Port) - a port within the Fabric used to route frames from N_Port to N_Port. The F_Port is the access point to a Fibre Channel switch.

FC-SW (Fibre Channel Switch Fabric) - the standard that describes how Fibre Channel switches are required to behave.

FC-GS - (Fibre Channel Generic Service) - the ANSI standard that describes such services as the directory service that allows a host to identify which storage devices are available and their addresses.

FL_Port - an F_Port that is attached to the Fabric in a loop configuration.

I

IODC (Input/Output Dependent Code) - firmware that implements a simplified driver for an adapter card. It is analogous to card BIOS in a PC. IODC is included in the PDC (Processor Dependent Code). *See also See also PDC..*

L

LIP (Loop Initialization Primitive) used to initiate a procedure on the loop. This initialization state usually causes activity on the loop to suspend briefly. It can be caused by new devices being added or moved on the loop, arbitrated loop address assignment, recovery from loop failure, or resetting a node.

N

N_Port - a node port (or device port) used to route information to or from other nodes or to devices. The N_Port is the access point to a Fibre Channel adapter.

NL_Port - an N_Port that is attached to the Fabric in a loop configuration.

P

PDC (Processor Dependent Code) - firmware that hides machine differences and integrates and calls IODC to allow the system to boot. It is analogous to system BIOS in a PC. *See also See also IODC..*

Port - the third field of the 3-byte address assigned to an attached N_Port in a Fabric configuration. The port is generally associated with the Hard Physical Address (HPA) of a Fibre Channel target device.

Private Loop - an arbitrated loop that has no attached switch port. Private loop devices can only communicate with other devices on the same loop (except in translative mode).

See also See also Translative Mode and Arbitrated Loop..

Public Loop - a topology in which an arbitrated loop is connected to a switch through an FL_Port which allows hosts or devices on the loop to communicate with hosts or devices attached to other FL_Ports.

Q

QL_Port - a Fabric port in a QuickLoop configuration that routes information from a QuickLoop switch to a target device connected to an NL_Port.

QuickLoop Configuration - an emulated private loop configuration that allows private hosts on Fabric-attached loops to access private target devices across the switch. This configuration can consist of multiple private Arbitrated Loops that are interconnected and may be isolated by the switch (this is a feature of the Brocade switches).

T

TMWQL Translative Mode with QuickLoop

Translative Mode - a technique by which a switch allows public hosts on a private loop connected to a fabric to communicate with private target devices. In translative mode, these private target devices operate as public devices.

Z

Zoning - a logical grouping of Fabric-attached devices that are isolated from other devices and other zones by the switch.

