Technical Session 3719:

Storage Solutions using FC Routing Technologies

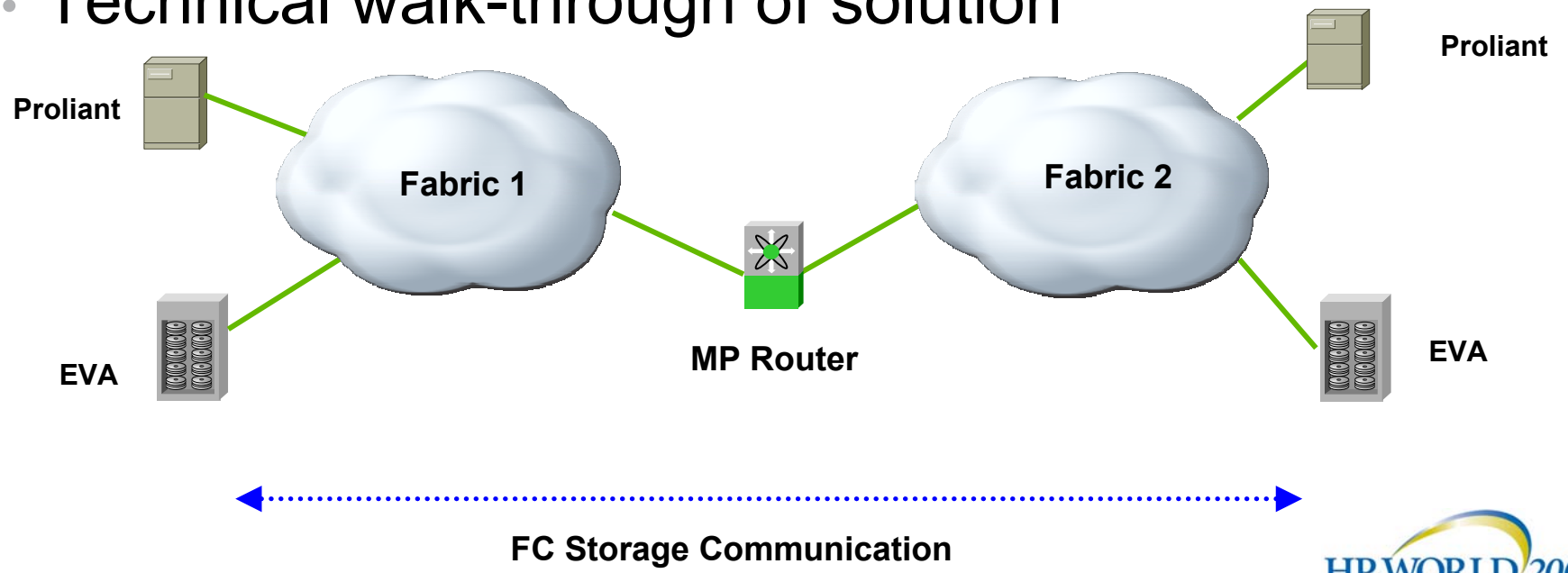
FIT Lab Team

Storage Services

Hewlett-Packard

Agenda

- Introduction
- Business Case
- Fundamental Technologies
- Technical walk-through of solution



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Storage / Fabric Consolidation

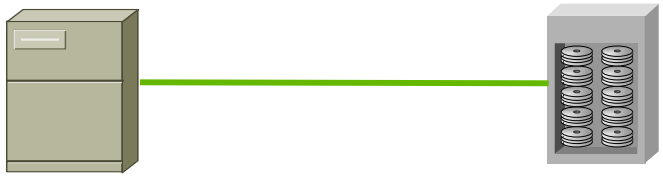
Business Case

Why the importance of Consolidation?

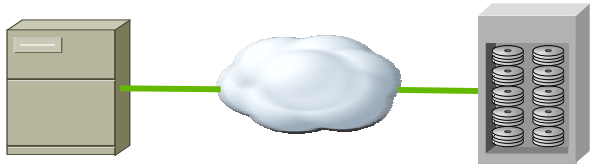
- Political / Management burden
- Management Costs
- Storage Capacity Utilization
- Sharing of Resources (Resource Utilization)
- Acquisitions, Departmental consolidation

Historical View of Storage Networks

Direct Attached

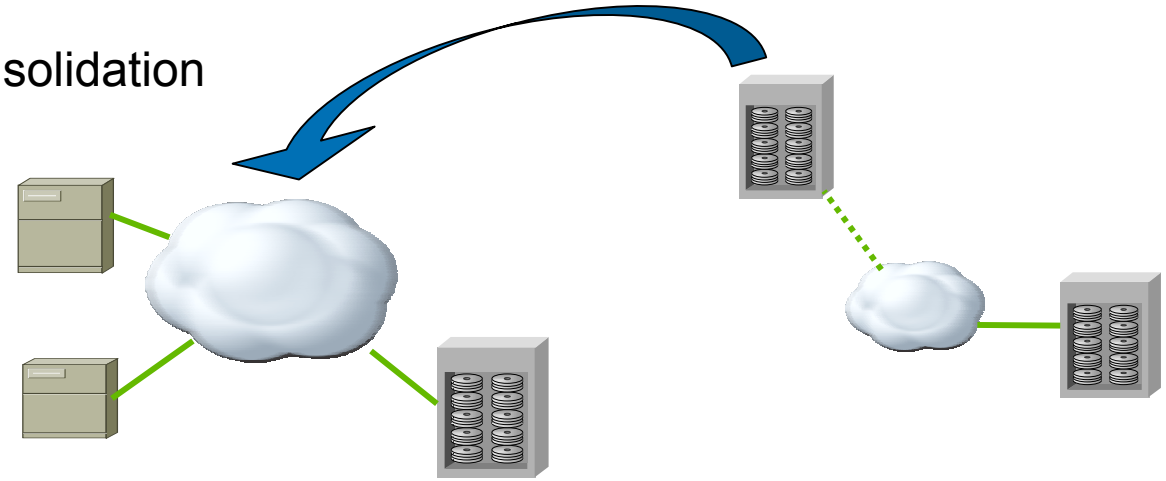


Small Islands

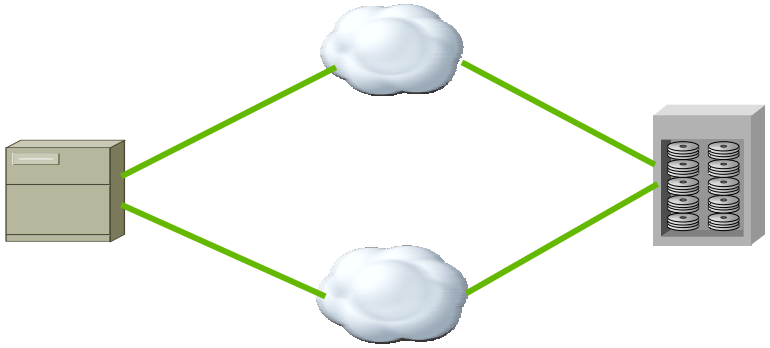


Historical View of Storage Networks

Consolidation



Redundancy / Resiliency



Consolidation

•During the tech boom, companies acquired storage resources by project need and departmental concern.

•Companies will increase spending on storage management seeking to increase capacity utilization.

•Some companies have utilization rates as low as 30% (IDC, 2003)

Tape Backup Consolidation

Value to the end-user

Assumptions

Medium customer with 8 SANs with 6-10TB FC disk storage
Mix of operating systems (WinXP, Linux, AIX) and applications (ERP & CRM)
Distributed backup support: 1.25 FTE per SAN (2 Tape Library mgrs FTE, 1 scheduling FTE per SAN)
Centralized backup support: 6 FTE (2 Tape Library mgrs FTE, 4 scheduling FTE)
3 year fully depreciated equipment model with yearly maintenance on tape frame & drives

Case #1 8 Separate SAN Segments

Item	Yearly Cost
STK-L180 Frame	$ 20,666.67
9 LTO Type II Drives	$ 18,000.00
Backup Server & SW	$ 11,666.67
Operations Expense	$ 117,187.50
Frame maintenance	$ 3,000.00
Drive maintenance	$ 9,900.00
Yearly Cost per SAN	$ 180,420.83
Distributed Total Cost	$ 1,443,366.67

Case #2: Centralized Backup

Item	Yearly Cost
2x STK-L700 Frames	$ 100,000.00
32 LTO II w special cabinets	$ 106,666.67
Backup Servers & S/W	$ 93,333.33
Operations Expense	$ 562,500.00
Frame maintenance	$ 6,000.00
Drive Maintenance	$ 33,000.00
2 FC-Routers + L2 Fanout	$ 58,333.33
Centralized Total Cost	$ 959,833.33

Total yearly savings	$ 483,533.33
Total savings over 3yr	$ 1,450,600.00

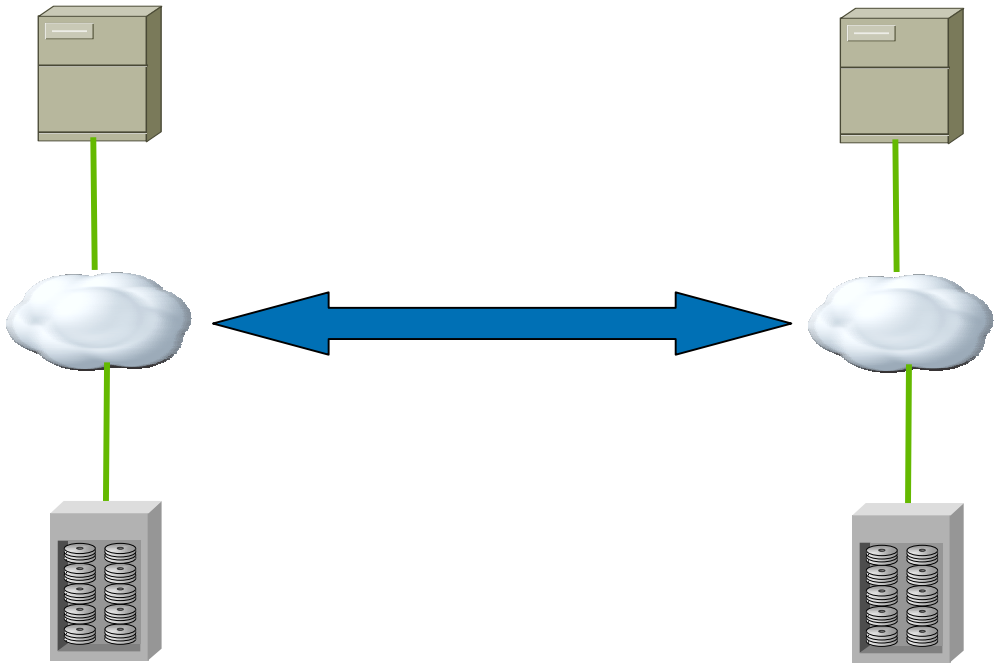
According to IDC

Storage Consolidation spending is increasing – while disk subsystem spending will plateau by 2006

Source: "Disruptive Innovation in Enterprise Computing: Storage"
IDC, 2003

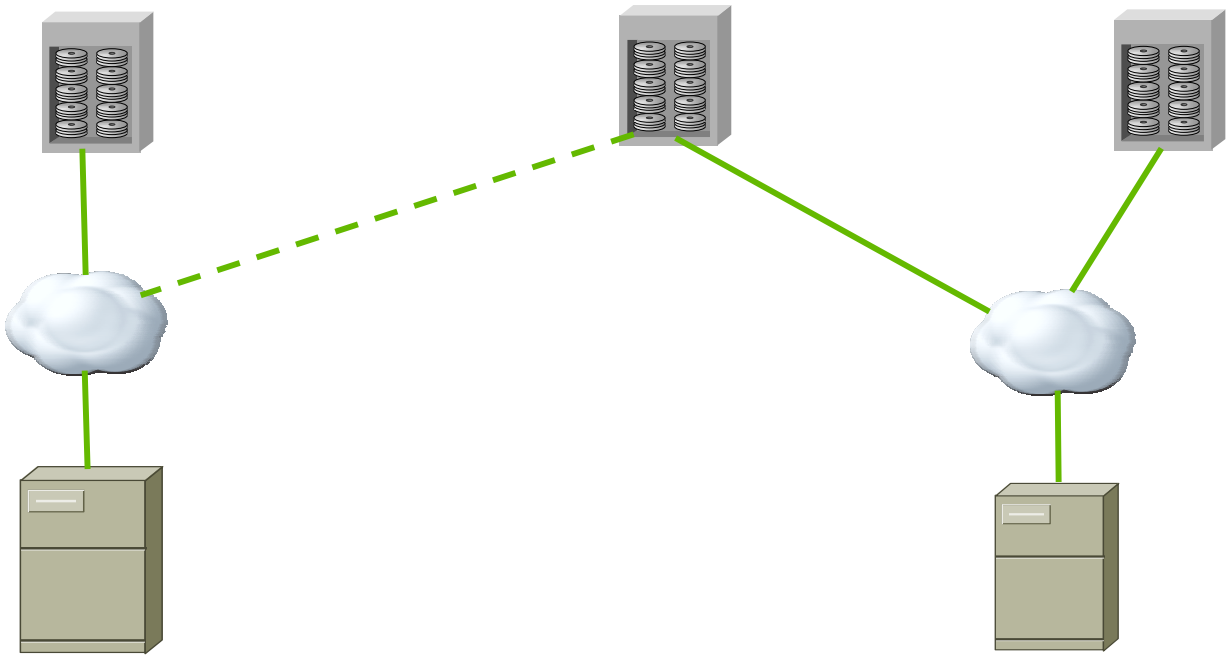
Potential Solution

Fibre Channel Merge



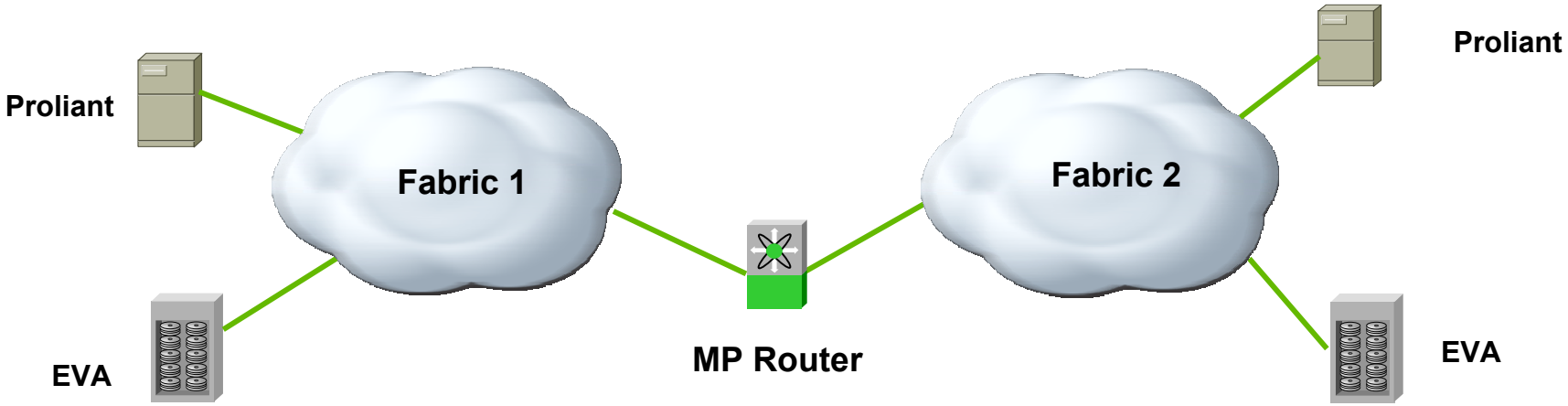
Potential Solution

Resource Mobility



Potential Solution

FC Routing Technologies



Fundamental Technologies

Fibre Channel

- Fibre Channel is the solution for IT professionals who need reliable, cost-effective information storage and delivery at blazing speeds. With development started in 1988 and ANSI standard approval in 1994, Fibre Channel is the mature, safe solution for gigabit communications.

- Fibre Channel, a powerful ANSI standard, economically and practically meets the challenge with these advantages:
  - Price Performance Leadership - Fibre Channel delivers cost-effective solutions for storage and networks.
  - Solutions Leadership - Fibre Channel provides versatile connectivity with scalable performance.
  - Reliable - Fibre Channel, a most reliable form of communications, sustains an enterprise with assured information delivery.
  - Gigabit Bandwidth Now – 2 Gigabit solutions are in place today! On the horizon is ten gigabit-per-second data delivery.
  - Multiple Topologies - Dedicated point-to-point, shared loops, and scaled switched topologies meet application requirements.
  - Multiple Protocols - Fibre Channel delivers data. SCSI, TCP/IP, video, or raw data can all take advantage of high-performance, reliable Fibre Channel technology.
  - Scalable - From single point-to-point gigabit links to integrated enterprises with hundreds of servers, Fibre Channel delivers unmatched performance.
  - Congestion Free - Fibre Channel's credit-based flow control delivers data as fast as the destination buffer is able to receive it.
  - High Efficiency - Real price performance is directly correlated to the efficiency of the technology. Fibre Channel has very little transmission overhead. Most important, the Fibre Channel protocol, is specifically designed for highly efficient operation using hardware.

FC-FC ROUTING

Hierarchical Routing for Fibre Channel

- Many customers have isolated SAN islands:
  - Difficult or not possible to merge
  - IP routers solved similar problems for data networks
- Provides connectivity between fabrics without merging them:
  - Services and management remain separate
  - Separate fabrics have independent scalability
  - Selective connectivity configured with LSANs
  - Provides interoperability benefits
  - Eliminates the need to resolve conflicts:
    - Domain ID, zoning, TOV, etc.
- An FC router allows the creation of Logical Storage Area Networks, or LSANs, which provide connectivity that can span fabrics
- Simplifies SAN design, implementation and management
- Creates a more unified SAN environment with easier interconnection and support
- Can be combined with FCIP service or third-party distance extension products:
  - Isolates sites from failures in the WAN or at other sites
  - Allows each site to be managed independently

FC-FC Router Usage

- Larger configurations than flat FC fabrics could scale to
- Connecting SAN islands without changing domain IDs and other fabric-wide parameters
- Less complex data migration procedures
- Improved solutions for backup/restore and disaster recovery
- Separate administrative domains with selective connectivity
- Simplified interoperability between different Fibre Channel switch vendors' products
- Fault containment between networked fabrics

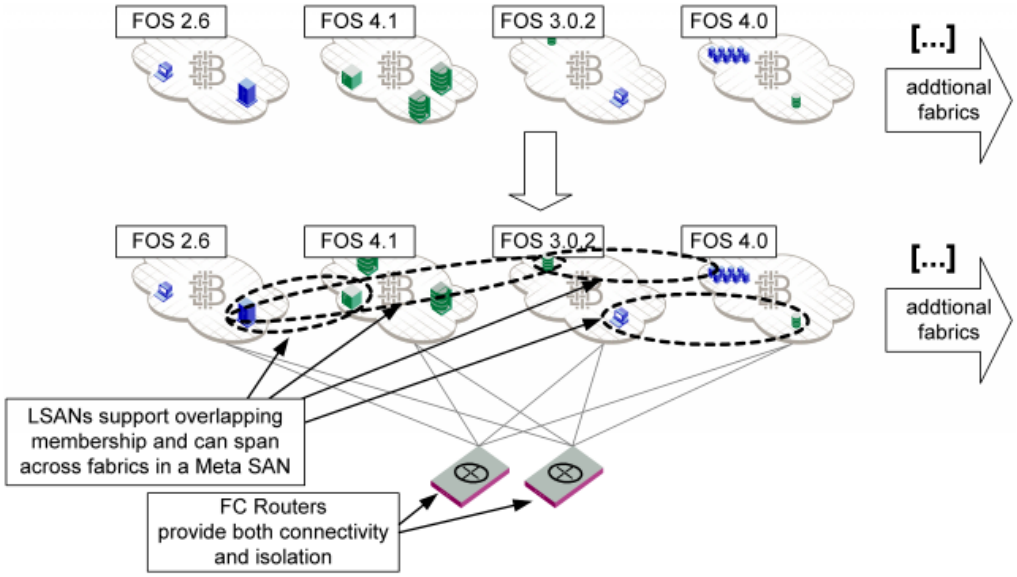
A New Market for Extending SANs

SAN Connectivity Opportunities are Vast!

- **Data Migration**
  - Data Migration between different vendor SANs
  - Migration to new 2G storage on 2G SAN from old 1G storage & SAN
  - Storage and/or application rebalancing between fabrics
- **Resource Optimization**
  - Increased utilization of storage, sharing not possible before
  - Creation of a shared tape service for the enterprise
  - Sharing of distance connectivity resources for DR / backup
- **Consolidation**
  - Datacenter consolidation, facilitating moving data to new location
  - Tape consolidation of multiple backup activities
  - New SAN designs with central pools and hosts on edge fabrics
- **Isolation**
  - Isolation of vendor equipment or business units
  - Moving production data to development / test SAN
  - Test Lab automation, easy selective sharing of resources

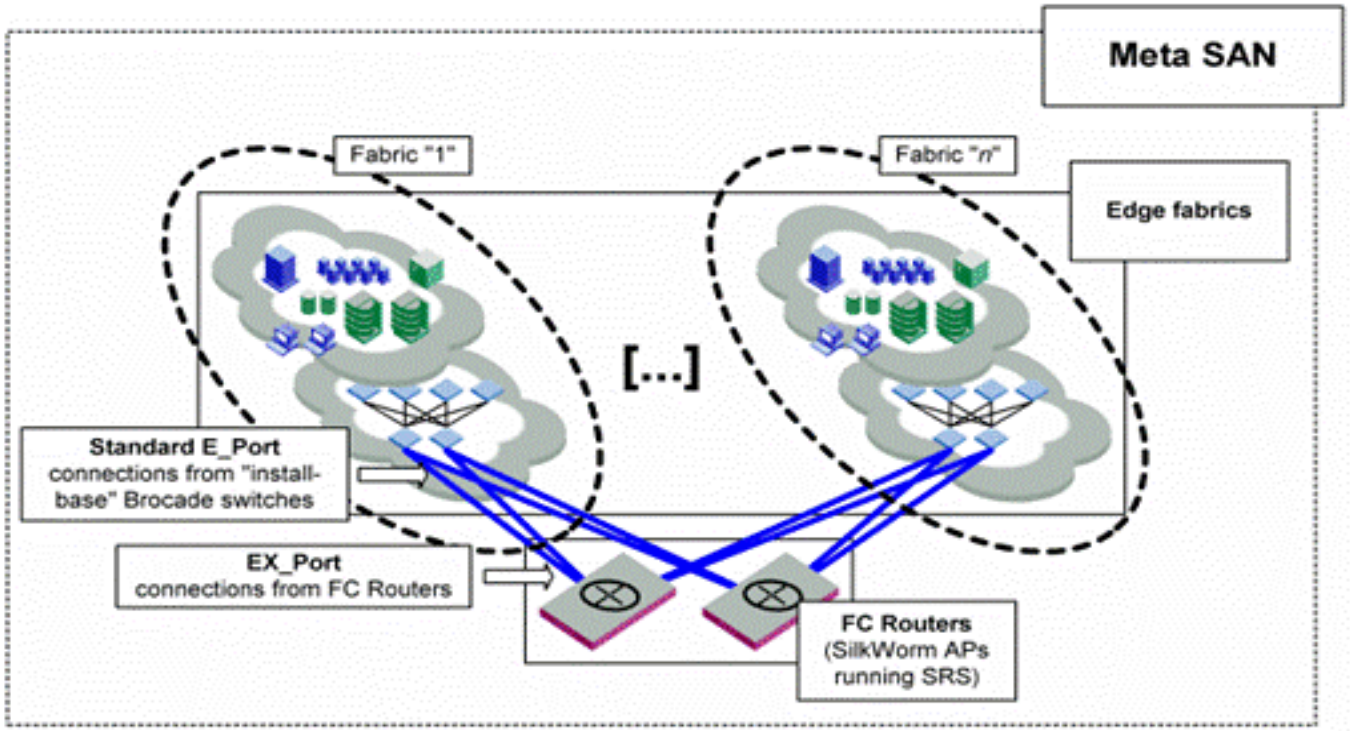
Island to Continent Migration

- **Consider 32 fabrics averaging 10 switches**
  - overlapping Domains
  - incompatible zoning
  - different OEM-supported FOS versions
  - different fabric-wide parameters like PID format and TOVs
- **Impossible to merge fabrics**
  - Administrative nightmare
  - FC cannot support 320 domains
- **FC Routing is the solution**
  - Each edge fabric sees 31 virtual domains,
  - Fabrics are not merged: no zoning conflicts
  - Any device on any fabric may access any other through zoning

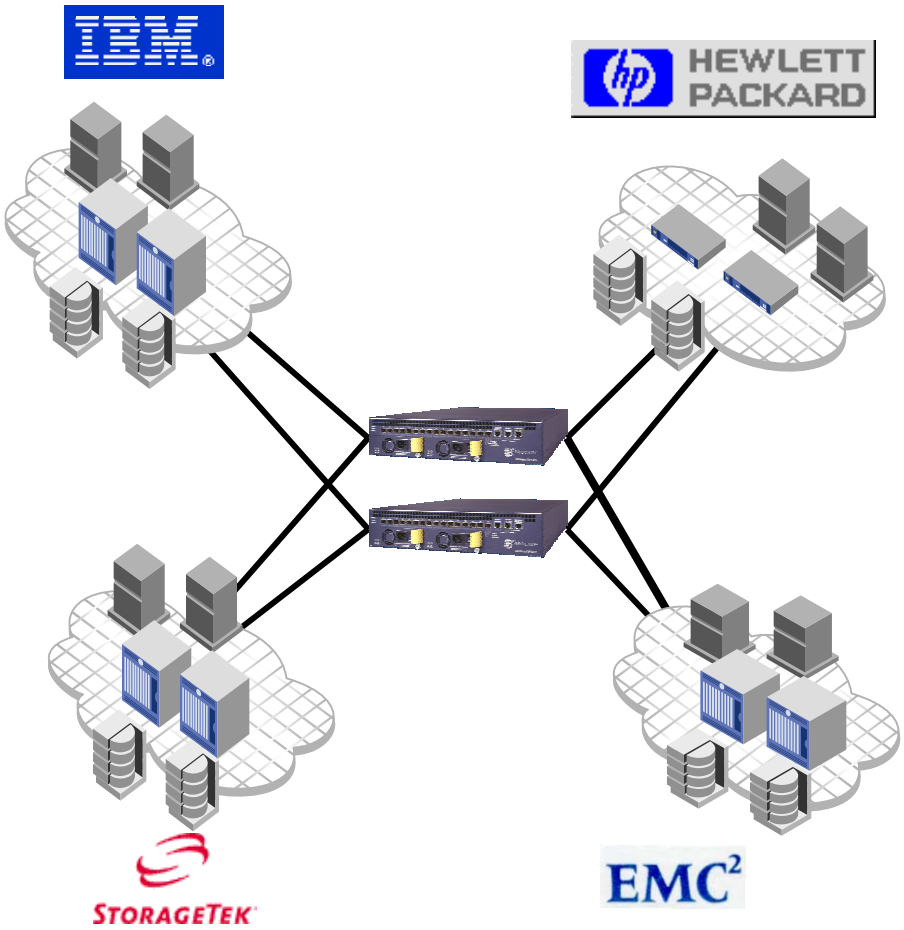


Meta SANs and EX_Ports

- Includes all devices and software that make up an FC routed SAN
- Above (greater than) “traditional” SAN fabric
- “Meta SAN” is to “edge fabric” as “internetwork” is to “subnet”
- Fabrics in a Meta SAN are connected via Inter-Fabric Links (IFLs):
  - IFLs connect EX_ports on routers to E_Ports on switches
  - EX_Ports are E_Ports with enhancements

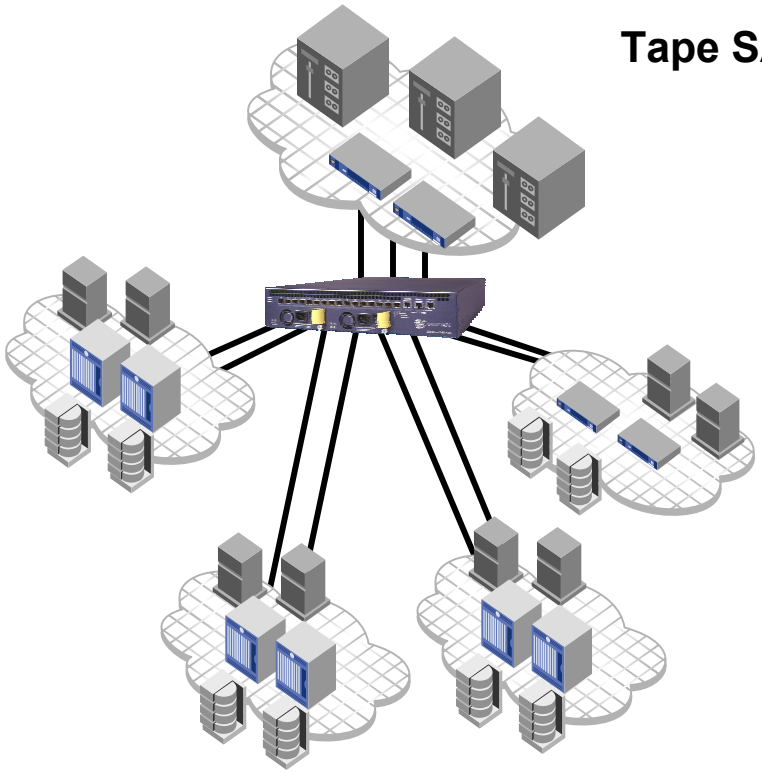


Vendor Island Connectivity



- Simplified scalability of SANs by interconnecting islands using routing
- Connect and organize heterogeneous resources
- Selective sharing or full consolidation across multiple SANs
- Ease of implementation and management using existing skill sets and practices

Backup Consolidation

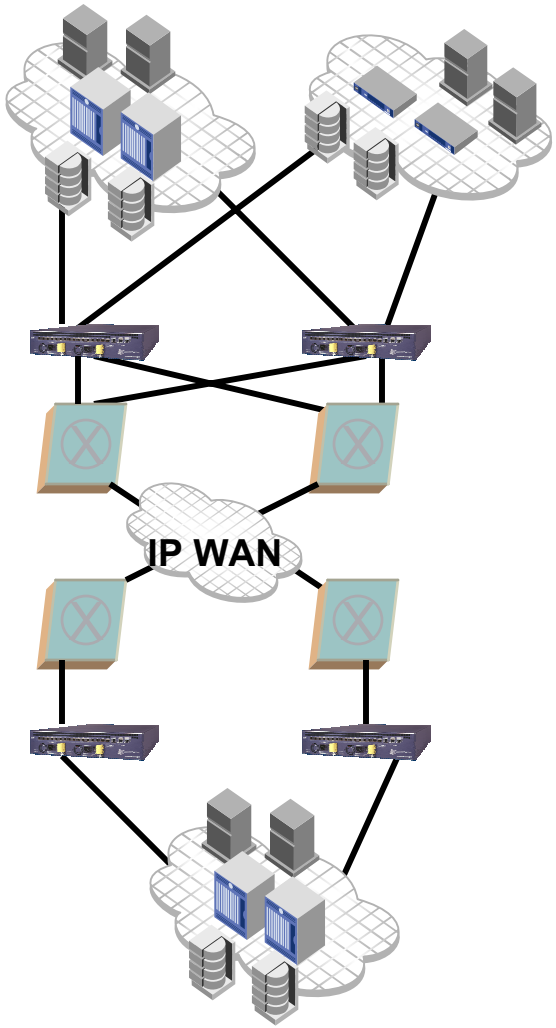


- Share Tape Library fabric without forcing merge of disk fabrics
- Independent management of backup fabric reduces management overhead and improves quality of backup function
- Eliminate need for separate HBA in every backup server on every fabric
- Increased asset utilization

Multi-Protocol Router FCIP Service Overview

- Implemented as “Virtual E_Port” or VE_Port
- Multiple Links Permitted and use FSPF DLS (dynamic load sharing)
- Two TCP Connections per Tunnel
  - Enables *Double TOE:* two ARMs on each port process TCP
- Initiator-Listener Architecture
  - WWN authentication option for initiator or listener
- Wide Area Network Time Out Value (WAN_TOV)
  - Times link for discard using FCIP time stamps
  - Uses NTP-based Time Server for clock synchronization
- CRC32 protects data on the FCIP link

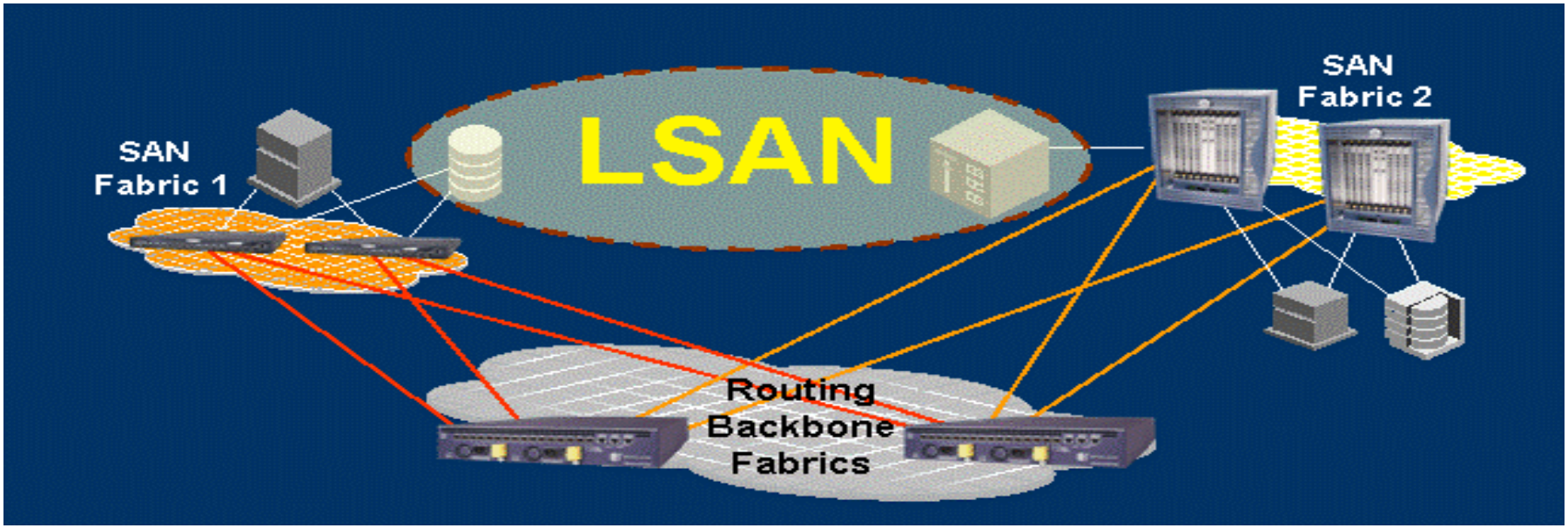
FCIP+Routing for HA Business Continuity



- Provide ability to share resources and move data between geographies
- Foundation for Business Continuity solutions such as remote replication and remote backup over IP
- Integrated within Brocade framework
- Simple, cost effective foundation for utility computing

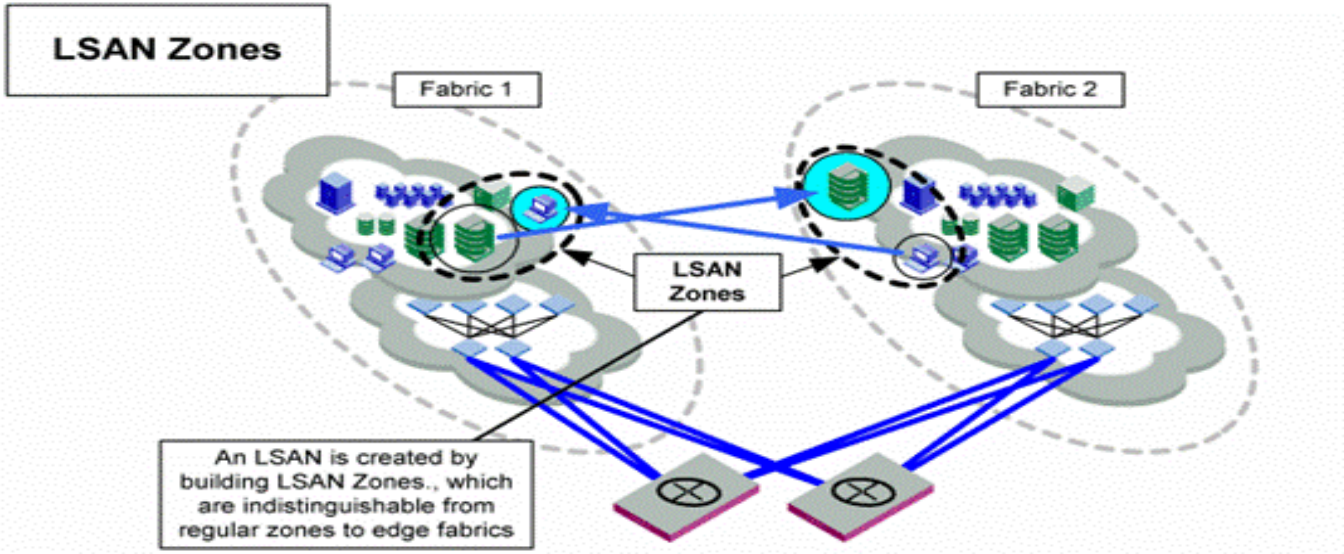
Introducing Logical Private SAN (LSAN)

- SAN Router allows creation of a Logical Private SAN (LSAN)
- Think of LSAN as a new type of Zone that can exist in multiple fabrics (in the past, each zone can only live in its own fabric)
- LSAN allows secure way of sharing resources across fabrics (devices export /import from one fabric to another fabric



LSAN Zones: Managing LSANS

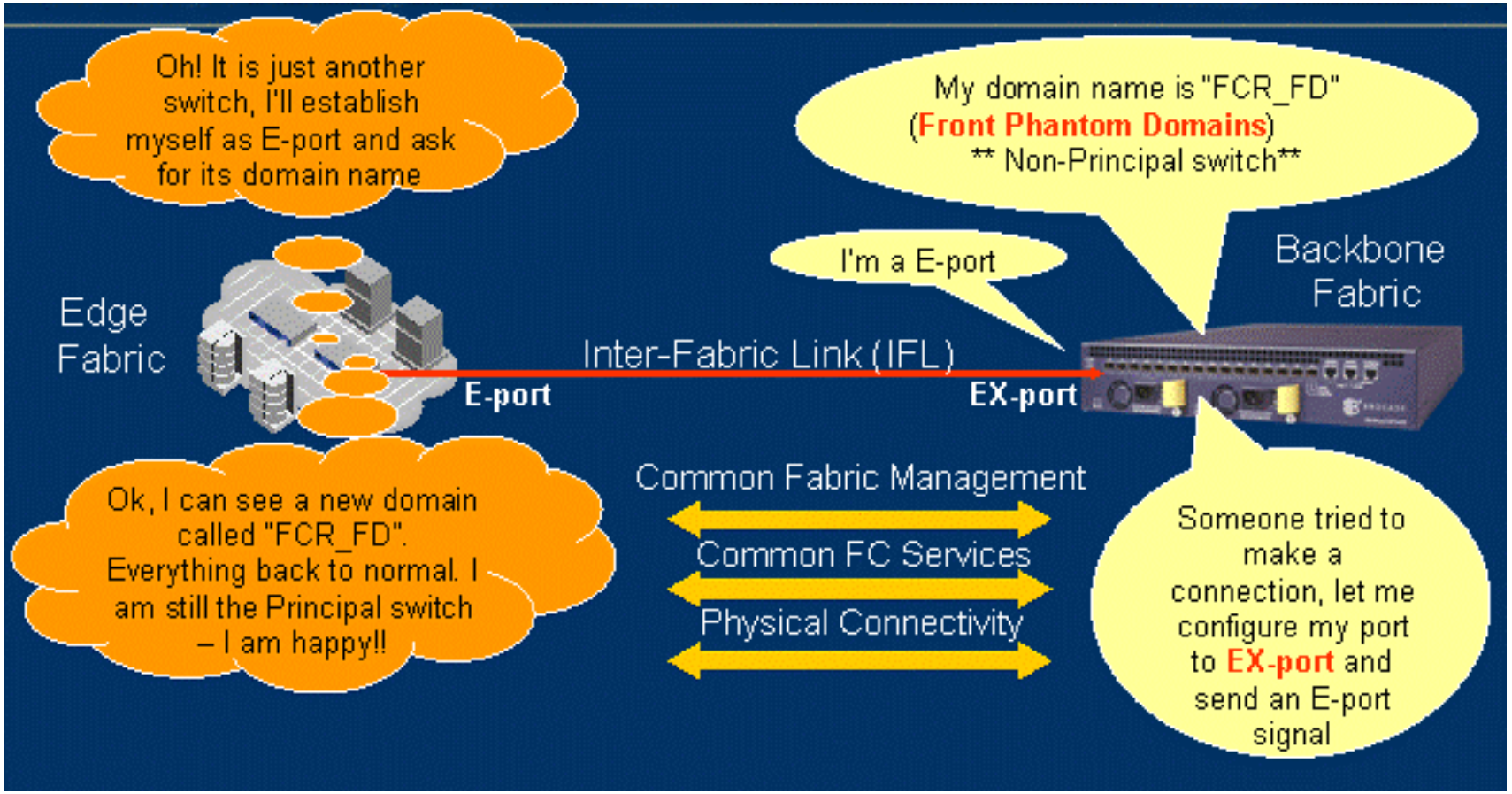
- An LSAN is a zone that spans fabrics
- There are just two distinguishing features of an LSAN zone:
  - First, they must begin with the prefix “LSAN_” so that routers will recognize them
  - Second, they must contain only port WWNs or aliases of devices intended for inter-fabric sharing
- LSANs are created and managed with standard FC zoning
- Admin(s) create “Lsan_xxx” port WWN or alias zones on each fabric, router automatically creates appropriate LSAN



“Services Lite” and FC-NAT

- EX_Ports use a lightweight version of fabric services:
  - Simplifies compatibility
  - Enhances scalability
  - Allows different fabric-wide parameters on each fabric:
    - TOV, PID format, zoning database
- Fibre Channel Network Address Translation (FC-NAT) allows different edge fabrics to be autonomous:
  - Can have the same domain ID in connected fabrics
  - Not allowed if fabrics were merged
  - Means that PIDs are no longer guaranteed to be unique:
    - Use port WWN zoning

When an existing Fabric connects to the Router



Multi-Protocol Router Hardware Overview 1

Data Path

- 16 Multi-Protocol Ports
  - 2/1Gbps Auto-negotiated FC
  - 1Gbps Ethernet
  - User-selectable on port basis
- Port Subsystem
  - 3 ARM Processors/port with over 500KB on-chip
  - Frame-manipulation accelerators on-chip
  - 2x2MB SSRAM per port
  - 2x16MB SDRAM per port
- 1Gbps link to Control Path
- 34Gbps internal switching fabric

Control Path

- Processor Complex
  - PPC 7445gx+Marvell GT-64260B System Controller, 800Mhz
  - 1GB Central Memory
  - ECC Memory and Parity-protected data paths
  - Dual 10/100BT Mgmt Ports
  - Serial Mgmt Port
  - Gigabit Ethernet GMII link to data path
- 256MB Compact Flash
- 64MB Code Flash
- 16MB Boot Flash

- Chassis
  - 2U x 25” x 19” rack
  - Dual Redundant Hot-swap FR Power Supplies
  - Dual Hot-swap FR Fan trays
  - Brocade-standard Rail kit
  - 35 lbs (1PS); 40 lbs (2PS

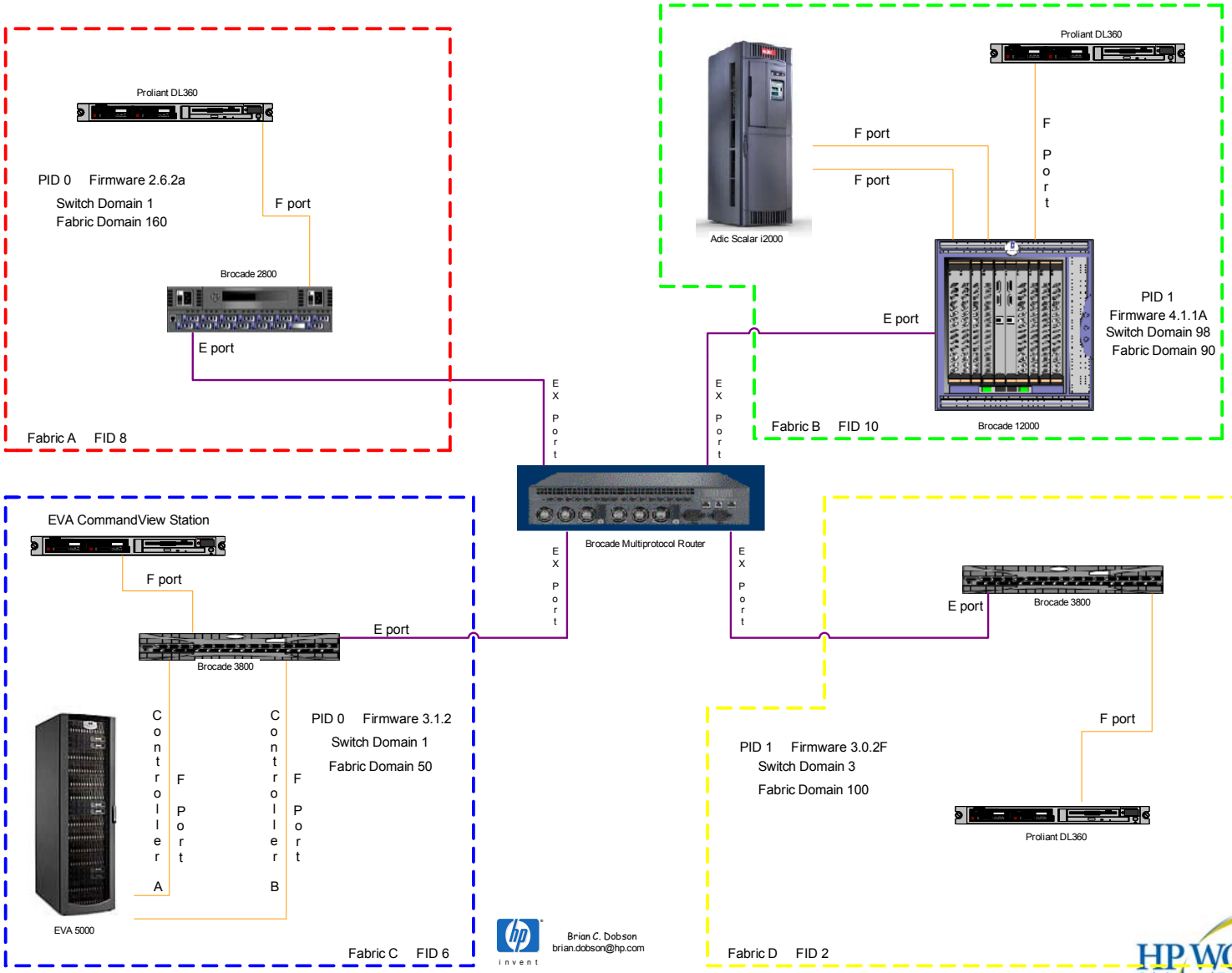
SilkWorm AP7420 SFP Media Support List		
Vendor	**Type**	**Model**
Finisar	**SWL**	**FTRJ8519P1BNL-B1**
Finisar	SWL	FTRJ8519-7D-2.5
Agilent	SWL	HFBR-5720L
Infineon	**SWL**	**V23848-M305-C56**
Finisar	**LWL**	**FTRJ1319P1BTL-B1**
Infineon	**LWL**	**V23848-M15-C56**
Finisar	ELWL	FTRJ1419P1BTL-B1

Bold Rows indicate

- Same media as SilkWorm 24000/3250/3850
- Media supports GbE and Fibre Channel

Technical walk-through of Solution

Device Sharing Across Fabrics



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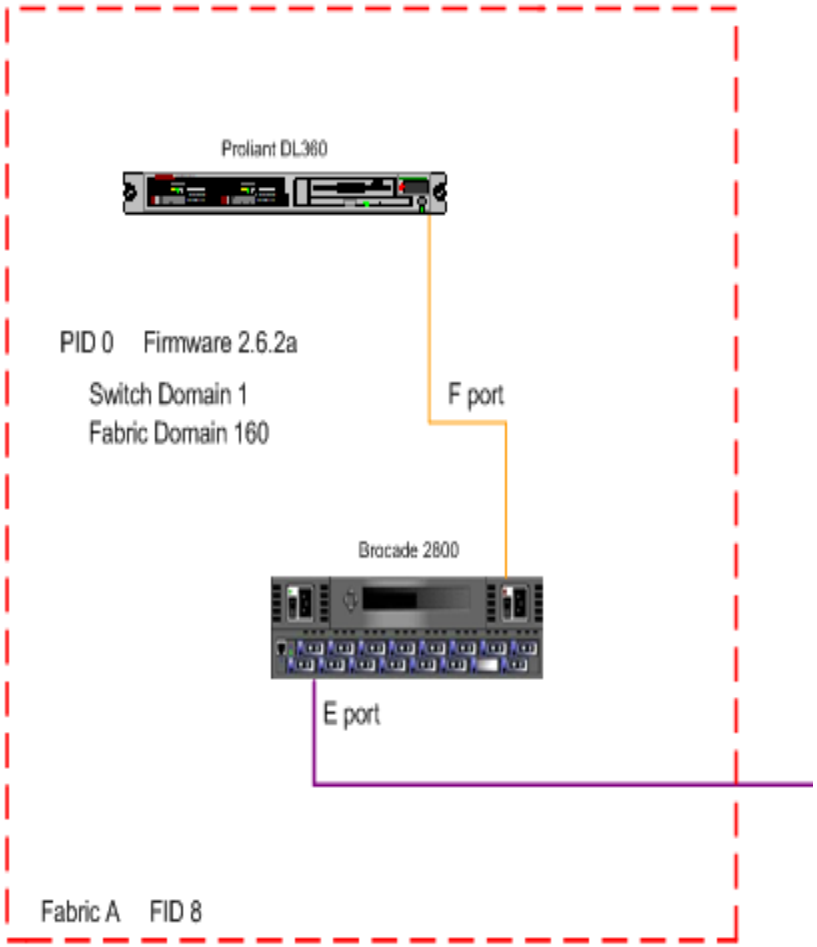
Fabric A Breakdown

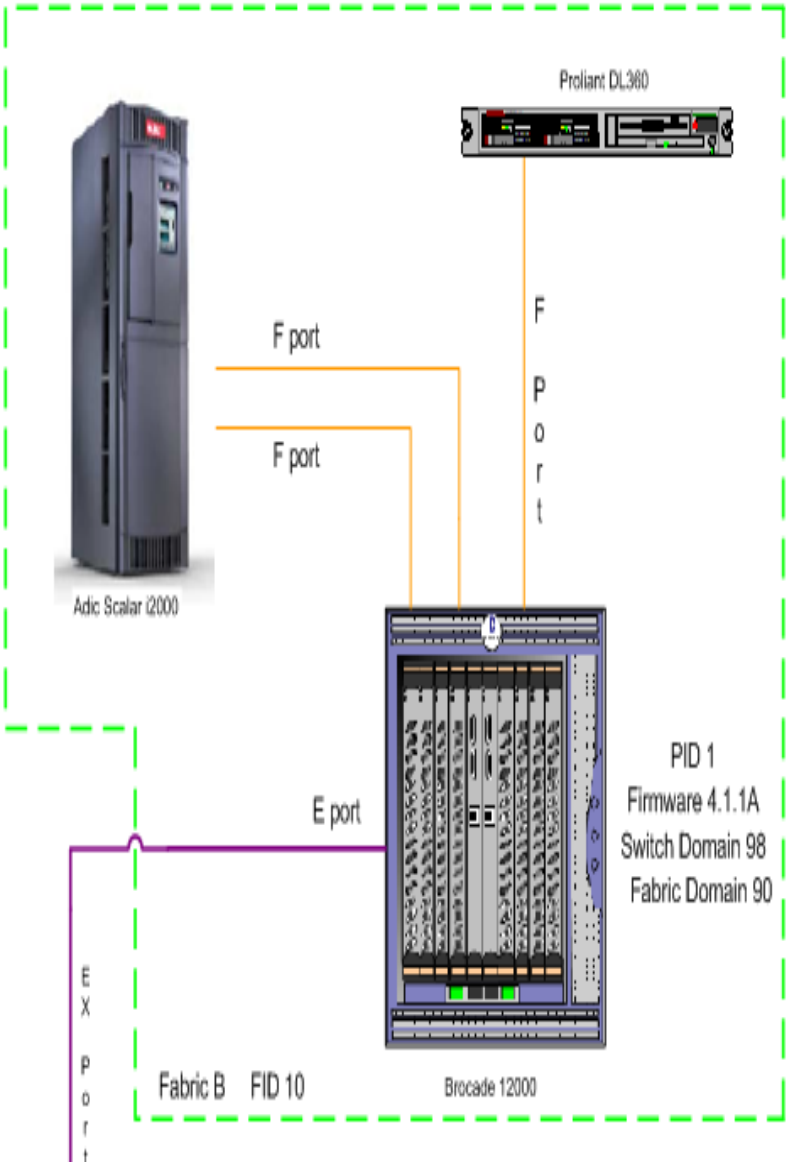



```
Fabric_A_2800:admin> switchshow
switchName:     Fabric_A_2800
switchType:     2.4
switchState:    Online
switchMode:     Native
switchRole:     Principal
switchDomain:   1
switchId:       fffc01
switchWwn:      10:00:00:60:69:10:28:36
switchBeacon:   OFF
Zoning:         OFF
port  0: --  No_Module
port  1: id  Online       E-Port  50:00:51:e1:62:06:ce:08 "fcr_fd_160_8" (downstream)
port  2: id  Online       F-Port  21:00:00:e0:8b:05:83:d7
port  3: sw  No_Light
port  4: sw  No_Light
port  5: id  No_Light
port  6: id  No_Light
port  7: --  No_Module
port  8: --  No_Module
port  9: --  No_Module
port 10: --  No_Module
port 11: sw  No_Light
port 12: --  No_Module
port 13: --  No_Module
port 14: --  No_Module
port 15: --  No_Module
Fabric_A_2800:admin>
```

E_Port connection into Multi-Protocol Router

F_Port Connection From Proliant Host

Fabric B Breakdown




```
Fabric_B_12000:admin> switchshow
switchName:     Fabric_B_12000
switchType:     10.0
switchState:    Online
switchMode:     Native
switchRole:     Principal
switchDomain:   98
switchId:       fffc62
switchWwn:      10:00:00:60:69:80:40:5b
zoning:         OFF
switchBeacon:   OFF
blade8 Beacon:  OFF

Area Slot Port Media Speed State
==================================
 16    8    0   --    N2   No_Module
 17    8    1   id    N2   Online    F-Port  50:03:08:c0:01:43:58:07
 18    8    2   --    N2   No_Module
 19    8    3   --    N2   No_Module
 20    8    4   --    N2   No_Module
 21    8    5   --    N2   No_Module
 22    8    6   id    N2   Online    F-Port  50:03:08:c0:01:43:58:08
 23    8    7   --    N2   No_Module
 24    8    8   --    N2   No_Module
 25    8    9   --    N2   No_Module
 26    8   10   id    N2   Online    F-Port  21:00:00:e0:8b:06:26:85
 27    8   11   --    N2   No_Module
 28    8   12   --    N2   No_Module
 29    8   13   --    N2   No_Module
 30    8   14   id    N2   Online    E-Port  50:00:51:e1:62:06:ce:0a "fcr_fd_160_10" (downstream)
 31    8   15   --    N2   No_Module
Fabric_B_12000:admin>
```

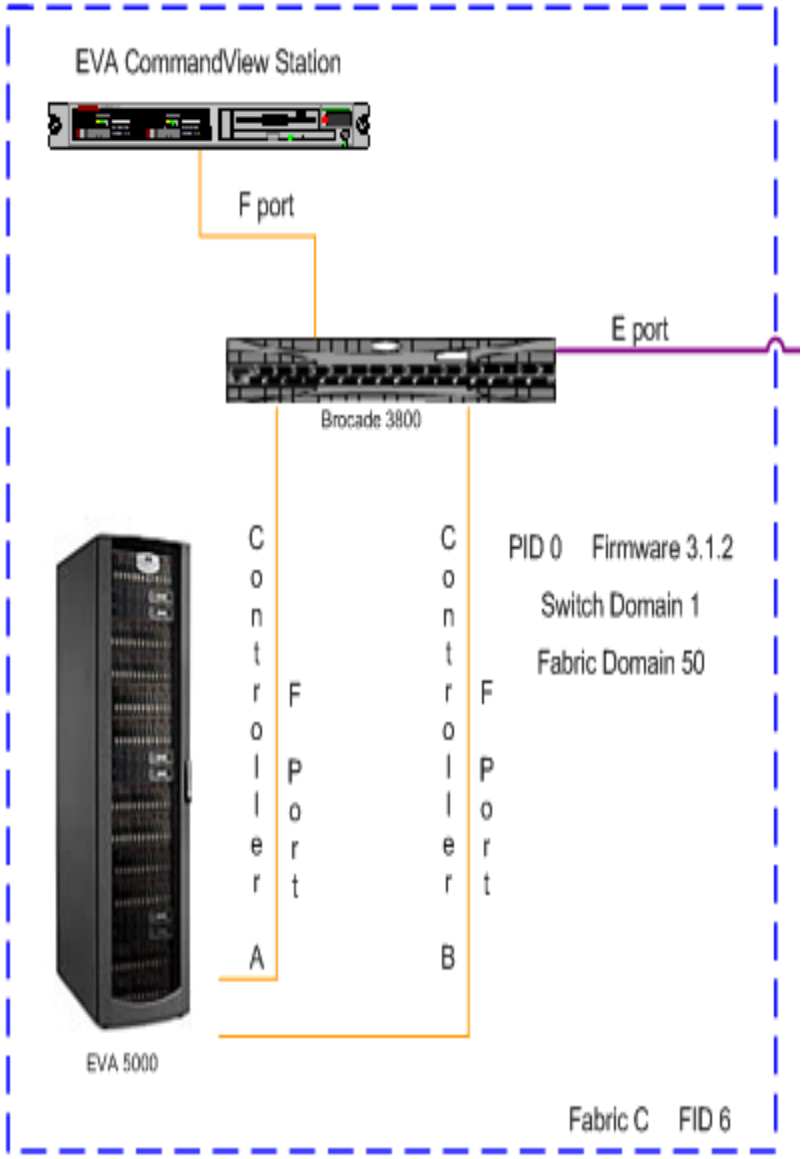
Scalar I2000 Connection A

Scalar I2000 Connection B

Connection to Proliant Host

Connection to Multi-Protocol Router

Fabric C Breakdown




```
Fabric_C_3800:admin> switchshow
switchName:     Fabric_C_3800
switchType:     9.2
switchState:    Online
switchMode:     Native
switchRole:     Principal
switchDomain:   1
switchId:       fffc01
switchWwn:      10:00:00:60:69:51:72:3a
switchBeacon:   OFF
Zoning:         OFF
port  0: id N1 Online        F-Port 10:00:00:00:c9:2f:7d:be
port  1: id N2 No_Light
port  2: -- N2 No_Module
port  3: -- N2 No_Module
port  4: id N2 Online        F-Port 50:00:1f:e1:50:01:01:98
port  5: id N2 No_Light
port  6: -- N2 No_Module
port  7: -- N2 No_Module
port  8: id N2 Online        F-Port 50:00:1f:e1:50:01:01:9d
port  9: id N2 No_Light
port 10: -- N2 No_Module
port 11: -- N2 No_Module
port 12: id N2 No_Light
port 13: id N2 No_Light
port 14: -- N2 No_Module
port 15: id N2 Online        E-Port 50:00:51:e1:62:06:ce:02 "fcr_fd_50_2" (downstream)
Fabric_C_3800:admin>
```

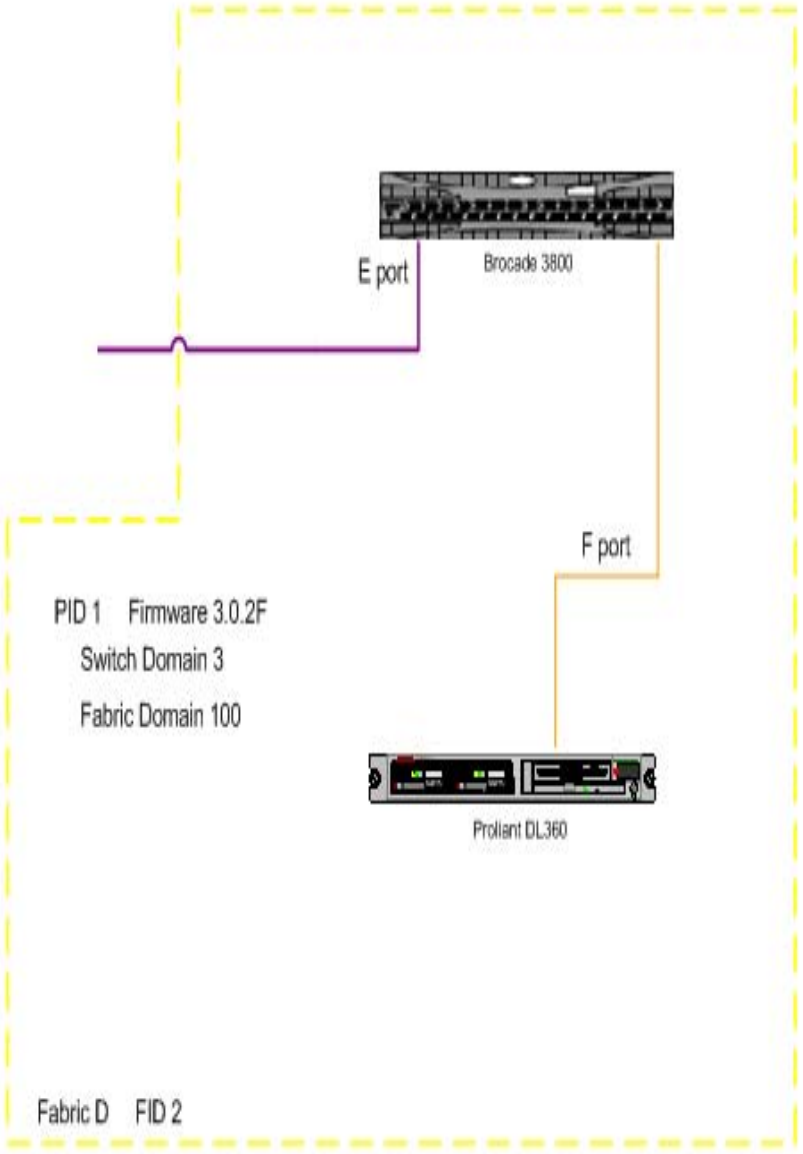
EVA CommandView Management Connection

EVA Controller A

EVA Controller B

Connection into Multi-Protocol Router

Fabric D Breakdown




```
Fabric_D_3800:admin> switchshow
switchName:     Fabric_D_3800
switchType:     9.2
switchState:    Online
switchMode:     Native
switchRole:     Principal
switchDomain:   3
switchId:       fffc03
switchWwn:      10:00:00:60:69:51:22:72
switchBeacon:   OFF
Zoning:         OFF
port  0: id N1 Online      F-Port 21:01:00:e0:8b:25:ef:d3
port  1: id N2 Online      E-Port 50:00:51:e1:62:06:ce:00 "fcr_fd_100_0" (downstream)
port  2: -- N2 No_Module
port  3: -- N2 No_Module
port  4: -- N2 No_Module
port  5: -- N2 No_Module
port  6: -- N2 No_Module
port  7: -- N2 No_Module
port  8: -- N2 No_Module
port  9: -- N2 No_Module
port 10: -- N2 No_Module
port 11: -- N2 No_Module
port 12: -- N2 No_Module
port 13: -- N2 No_Module
port 14: -- N2 No_Module
port 15: -- N2 No_Module
Fabric_D_3800:admin>
```

Connection to Proliant Host

Connection into Multi-Protocol Router

Initial Setup and Login

- The initial communication to the Multi-Protocol Router requires a serial connection. Follow these steps to establish a serial connection and log in to the Multi-Protocol Router :

1. Verify that the Multi-Protocol Router is powered on and that POST is complete by verifying that all power LED indicators are displaying a steady green light
2. Use the serial cable provided with the Multi-Protocol Router to connect the console port on the chassis to an RS-232 port on the computer workstation.
3. Access the Multi-Protocol Router using a terminal emulator application (such as HyperTerminal on Windows 95, 2000, or NT, or TERM in a UNIX environment).
4. Open the terminal emulator application and configure it as follows.

For most Windows systems	Parameter	Value
	Bits per second	9600
	Databits	8
	Parity	None
	Stop bits	1
	Flow control	None
For most UNIX systems	Enter the following string at the prompt: **tip /dev/ttyb -9600**	

Initial Setup and Login

5. When the terminal emulator application stops reporting information, press **Enter**.
6. Log in to the Multi-Protocol Router as admin. The default password is “password”. At the initial login, you are prompted to enter new admin and user passwords.
7. Modify passwords, if desired. Passwords can be 8 to 40 characters and should include a combination of numbers and upper/lowercase letters. To skip modifying the password, press **Ctrl-C**.

```
XPath OS

APswitch login: admin
Password:
Please change your passwords now.
Use Control-C to exit or press 'Enter' key to proceed.

Password was not changed. Will prompt again at next login
until password is changed.
APswitch:admin>
```

Setting the IP Address

- After establishing a serial connection follow these steps to set the IP address:

1. Log in as admin.
2. Enter the **ipaddrset** command with the following syntax:

```
APswitch:admin> ipaddrset
usage: ipaddrset <mgmt interface num> [-i ipAddress] [-n netmask]
[-g gateway] [-a action] [-s] [-r]
where mgmt interface num is either 1 or 2, action is either "cfgnow" or
"cfgafterreboot,",
-s option sets the switch virtual IP as same as the IP of the management
interface,
and -r option resets IP configuration of the management interface
APswitch 1:admin>
```

Variable	Description
mgmt interface num	Specifies the management Ethernet port number (either 1 or 2)
-i	Sets the IP address*
-n	Sets the netmask*
-g	Sets the gateway*
-a	Specifies if the change is to take place immediately (using the **cfgnow** command) or after the next reboot (using the **cfgafterreboot** command)
-s	Specifies if you want to set the virtual IP address and netmask to be the same as the new IP address and netmask
-r	Specifies if you want to reset the IP configuration of the management interface
***NOTE**: These variables use the standard aa.bb.cc.dd format.	

To set the IP address as 192.168.10.1, netmask 255.255.255.0, and gateway 192.168.10.2 of the management interface 1; the switch virtual IP address; and the netmask:

```
APswitch:admin> ipaddrset 1 -i 192.168.10.1 -n 255.255.255.0 -g 192.168.10.2 -a cfgnow -s
```

3. Enter the **ipaddrshow** command to verify that the IP address was set correctly.

Establishing an Ethernet Connection

- After using a serial connection to configure the IP address for the Multi-Protocol Router, you can connect the Multi-Protocol Router to the local area network (LAN) if desired.
  - Connecting the Multi-Protocol Router to a private network/VLAN is recommended.
- By establishing an Ethernet connection, you can complete the Multi-Protocol Router configuration using either the serial session or a telnet session. However, you must ensure that the Multi-Protocol Router is not modified from other connections at the same time.
- To establish an Ethernet connection to the Multi-Protocol Router, follow these steps:

1. Insert one end of an Ethernet cable into one of the management ports
2. Connect the other end to the workstation (or to an Ethernet network containing the workstation). As a result, the Multi-Protocol Router can be accessed by remote connection using any of the available management tools, such as telnet or Advanced Web Tools—AP Edition. Ensure that the switch is not being modified from any other connections during the configuration process.
3. Complete any additional Multi-Protocol Router configuration procedures through a telnet session. Log in to the switch by telnet, using the admin login. The default password is "password".

Configuring the Multi-Protocol Router for FC-FC Routing

- Configuring a Multi-Protocol Router is a six-phase process:

1. Use **portstop** to stop all FCR ports
2. Connect the Multi-Protocol Router (s) to the edge fabrics and backbone fabrics, if used.
3. Install or verify the FCR license
4. Configure EX_Ports
5. Establish LSAN zones
6. Use **portstart** to start all FCR ports

Viewing Current Licenses

- To view the licenses that are currently enabled on the Multi-Protocol Router:

1. Log in to the Multi-Protocol Router as admin.
2. Enter the **licenseshow** command. A list of the enabled licenses and their features is displayed:

```
APswitch:admin> licenseshow
License Key: bQebzeRdScRfc0iK
        Web

License Key: SybbzQQ9edTzcd0X
        Zoning

License Key: SybbzQQ9edTzcc0X
        Trunking

License Key: cSzbbcdyQbdb0csv
        FCIP

APswitch:admin>
```

Adding a License

- To add a license to the Multi-Protocol Router:

1. Log in to the Multi-Protocol Router as admin.
2. Enter the **switchshow** command to obtain the WWN of your Multi-Protocol Router . You will need to supply the switch vendor with the WWN to obtain a license key. A license key is a string of approximately 16 uppercase and lowercase letters and digits. Case is significant. The key is an encrypted form of the system WWN and the products licensed to run on this system.
3. Enter the **licenseadd** command, followed by the license key enclosed in quotation marks:

```
APswitch:admin> licenseadd "bQebzbRdScRfc0iK"
License key bQebzbRdScRfc0iK added
```

   Enter the license key into the system exactly as issued. If you enter it incorrectly, the license might be accepted, but it will not function.
4. After entering the license key, use the **licenseshow** command to check to see if it is valid. If a licensed product is not displayed, the license is invalid.

Note
After you enter a license, the licensed product is available immediately; the system does not need to be rebooted.

Note
After installing the "Ports on Demand" license, you must use the **portstart 8-15** command to enable all 16 switch ports.

Port Status

- To view the status of a port:

1. Log in to the Multi-Protocol Router as admin.
2. Type the **portshow** command, followed by the number that corresponds to the port you are troubleshooting:

Port 0 on the Multi-Protocol Router

```
Fabric AP:admin> portshow 0
        port   0  info
                  Configuration   Current
Name :            port 0
State:            STARTED         UP

Type :            FC              FC
Link Status:      ENABLED         UP
Topology:         P-P             P-P
Speed:            AN              N2
LinkCost:         N/A             N/A
WWN:              20:00:00:05:1e:16:20:6c

EX_Port Mode:     Enabled
Fabric ID:        2
Front Phantom:    State: OK       Cur Dom ID: 100 WWN: 50:00:51:e1:62:06:ce:00
Pr Switch Info:   Dom ID: 3       WWN: 10:00:00:60:69:51:22:72
Fabric params:    R_A_TOV: 10000  E_D_TOV: 2000   PID fmt: core

Licensed          : YES

Diag result       : PASSED

inFrames:         65697
outFrames:        73601
inOctets:         62065072
outOctets:        64387544
discards:         0

Fabric AP:admin>
```

Port 2 on the Multi-Protocol Router

```
Fabric AP:admin> portshow 2
        port    2   info
                  Configuration    Current
Name :            port 2
State:            STARTED          UP

Type :            FC               FC
Link Status:      ENABLED          UP
Topology:         P-P              P-P
Speed:            AN               N2
LinkCost:         N/A              N/A
WWN:              20:02:00:05:1e:16:20:6c

EX_Port Mode:     Enabled
Fabric ID:        6
Front Phantom:    State: OK        Cur Dom ID: 50  WWN: 50:00:51:e1:62:06:ce:02
Pr Switch Info:   Dom ID: 1        WWN: 10:00:00:60:69:51:72:3a
Fabric params:    R_A_TOV: 10000   E_D_TOV: 2000    PID fmt: native

Licensed          : YES

Diag result       : PASSED

inFrames:         216929
outFrames:        202787
inOctets:         147310352
outOctets:        150178152
discards:         0

Fabric AP:admin> _
```

Port Status Cont.

Port 8 on the Multi-Protocol Router

```
Fabric AP:admin> portshow 8
        port    8   info
                    Configuration    Current
Name :              port 8
State:              STARTED          UP

Type :              FC               FC
Link Status:        ENABLED          UP
Topology:           P-P              P-P
Speed:              AN               N1
LinkCost:           N/A              N/A
WWN:                20:08:00:05:1e:16:20:6c

EX_Port Mode:       Enabled
Fabric ID:          8
Front Phantom:      State: OK        Cur Dom ID: 160 WWN: 50:00:51:e1:62:06:ce:08
Pr Switch Info:     Dom ID: 1        WWN: 10:00:00:60:69:10:28:36
Fabric params:      R_A_TOV: 10000   E_D_TOV: 2000    PID fmt: native

Licensed            : YES

Diag result         : PASSED

inFrames:           65350
outFrames:          67798
inOctets:           70889300
outOctets:          70707116
discards:           0

Fabric AP:admin> _
```

Port 10 on the Multi-Protocol Router

```
Fabric AP:admin> portshow 10
        port   10   info
                    Configuration    Current
Name :              port 10
State:              STARTED          UP

Type :              FC               FC
Link Status:        ENABLED          UP
Topology:           P-P              P-P
Speed:              AN               N2
LinkCost:           N/A              N/A
WWN:                20:0a:00:05:1e:16:20:6c

EX_Port Mode:       Enabled
Fabric ID:          10
Front Phantom:      State: OK        Cur Dom ID: 160 WWN: 50:00:51:e1:62:06:ce:0a
Pr Switch Info:     Dom ID: 98       WWN: 10:00:00:60:69:80:40:5b
Fabric params:      R_A_TOV: 10000   E_D_TOV: 2000    PID fmt: core

Licensed            : YES

Diag result         : PASSED

inFrames:           110882
outFrames:          109230
inOctets:           20520776
outOctets:          5026272
discards:           0

Fabric AP:admin>
```

Stopping FCR Ports

- Use the **portstop** command to stop all FCR ports.

```
switch:admin> portstop 1
port  1 stopped.
```

- If the FCR ports are not stopped when cabled into a fabric, the port becomes part of the fabric and backbone fabrics might merge with edge fabrics. The first example stops port 1 on the FCR. The second example stops ports 1 through 8.
- You can also enter a range of ports:

```
switch:admin> portstop 1-8
port  1 stopped.
port  2 stopped.
port  3 stopped.
port  4 stopped.
port  5 stopped.
port  6 stopped.
port  7 stopped.
port  8 stopped.
```

Starting FCR Ports

- Use the portstart command, followed by the number of the port you want to start.
- To start the port:

```
switch:admin> portstart 1
port  1 started
```

- Run the **portshow** command, followed by a port number to verify that the port is configured as you want it to be.

Verifying Switch Information

- You can use the **switchshow** command to display the following switch information:
  - symbolic name
  - state (online or offline)
  - type
  - role (principal or subordinate)
  - domain ID
  - embedded port D_ID
  - World Wide Name (WWN)
  - zoning status
- **To use the switchshow command**
  1. Log in to the switch as admin.
  2. Enter **switchshow** at the command line:

```
Fabric AP:admin> switchshow
Switch Name  :  Fabric AP
Switch State :  Online
Switch Type  :  38.0
Switch Role  :  Principal
Switch Domain:  100
Switch ID    :  FFFC64
Switch WWN   :  10:00:00:05:1e:16:20:6c
beacon status:  OFF
zoning       :  OFF

FC router BB Fabric ID: 1
```

```
Port Media Speed State     Info
====================================
 0    id    N2   Online    EX_PORT 10:00:00:60:69:51:22:72 "Fabric_D_3800" (fabr
ic id = 2)
 1    --    AN   No_Module
 2    id    N2   Online    EX_PORT 10:00:00:60:69:51:72:3a "Fabric_C_3800" (fabr
ic id = 6)
 3    --    AN   No_Module
 4    --    AN   No_Module stopped
 5    --    AN   No_Module stopped
 6    --    AN   No_Module stopped
 7    --    AN   No_Module stopped
 8    id    N1   Online    EX_PORT 10:00:00:60:69:10:28:36 "Fabric_A_2800" (fabr
ic id = 8)
 9    --    AN   No_Module stopped
10    id    N2   Online    EX_PORT 10:00:00:60:69:80:40:5b "Fabric_B_12000" (fab
ric id = 10)
11    --    AN   No_Module stopped
12    --    AN   No_Module stopped
13    --    AN   No_Module stopped
14    --    AN   No_Module stopped
15    --    AN   No_Module stopped
Fabric AP:admin>
```

Configuring EX_Ports

- Use this procedure to configure each FCR port connecting to an edge fabric (that is, each EX_Port). Ports connecting the FCR to a backbone fabric are standard FC E_Ports. The ports must be stopped before running this procedure.
- **To configure EX_Ports**

  Use **portcfgexport** to set the admin mode to 1 (enabled) and the fabric ID for port 1:

```
switch:admin> portcfgexport 1 -a 1 -f 1
```

- The PID mode for the fabric application platform running FCRS and the edge fabric do not need to match, but the PID mode for an EX_Port and the edge fabric to which it is attached must. You can set the PID mode for the EX_Port at the same time you configure the port, using the **-p** option. Repeat this procedure for each EX_Port.
- **Note** The FID for all EX_Ports attached to the same fabric must be the same. EX_Ports attached to different edge fabrics must configure different FIDs for each.

Configuring EX_Ports Cont.

EX_Port Configuration of Port 0

```
Fabric AP:admin> portstop 0
port  0 stopped.
Fabric AP:admin> portcfgexport
Usage: portcfgexport plist [-a 1/2(enable/disable)] [-f fid(1..128)]
                           [-r r_a_tov] [-e e_d_tov] [-d domain]
                           [-p 1-core 2-extended edge 3-native]
Fabric AP:admin> portcfgexport 0 -a 1 -f 2 -p 1
Fabric AP:admin> portstart 0
port  0 started
Fabric AP:admin> switchshow
Switch Name  :  Fabric AP
Switch State :  Online
Switch Type  :  38.0
Switch Role  :  Principal
Switch Domain:  100
Switch ID    :  FFFC64
Switch WWN   :  10:00:00:05:1e:16:20:6c
beacon status:  OFF
```

```
zoning       :  OFF

FC router BB Fabric ID: 1

Port Media Speed State     Info
========================================
 0    id    N2   Online    EX_PORT 10:00:00:60:69:51:22:72 "Fabric_D_3800" (fabr
ic id = 2)
 1    --    AN   No_Module
 2    --    AN   No_Module
```

Configuring Zones

- The following procedure outlines basic zone configuration and includes an example of configuration zones on multiple fabrics for an LSAN zone.
- The Multi-Protocol Router can be included in zones using either "domain, port" or WWN naming and both Fabric OS switches and XPath OS switches enforce hard zoning on both WWN and "domain, port" zone object naming. However, note that if a zone configuration on one switch uses WWN and an identical zone configuration on another switch uses "domain, port" naming, the configurations will not merge, and the fabric will segment.
- **Note:** Zones used with a Fibre Channel router have additional member-naming requirements. Use port WWNs for FC-attached nodes with FCR LSAN zones.
- If you use "domain, port" naming, use the Insistent Domain ID flag under the Fabric OS **configure** command so that the domain ID assignments for the fabric are insistent over reboots, power cycles, failovers, and fabric reconfigurations.

LSAN Zone Between Fabric_A and Fabric_C

Storage Device Sharing

```
Fabric_A_2800:admin> zonecreate "Lsan_Fabric_A", "21:00:00:e0:8b:05:83:d7;50:00:1f:e1:50:01:01:98;50:00:1f:e1:50:01:01:9d"
Fabric_A_2800:admin> cfgcreate "Fabric_A", "Lsan_Fabric_A"
Fabric_A_2800:admin> cfgenable "Fabric_A"
0x102a1070 (tRtwr): Jul  1 11:14:33
    INFO ZONE-MSGSAVE, 4, cfgSave completes successfully.

cfgEnable successfully completed
Fabric_A_2800:admin> cfgshow
Defined configuration:
 cfg:    Fabric_A
                 Lsan_Fabric_A
 zone:  Lsan_Fabric_A
                 21:00:00:e0:8b:05:83:d7; 50:00:1f:e1:50:01:01:98;
                 50:00:1f:e1:50:01:01:9d

Effective configuration:
 cfg:    Fabric_A
 zone:  Lsan_Fabric_A
                         Protocol:ALL
                 21:00:00:e0:8b:05:83:d7
                 50:00:1f:e1:50:01:01:98
                 50:00:1f:e1:50:01:01:9d

Fabric_A_2800:admin> cfgsave
cfgSave successfully completed
Fabric_A_2800:admin> _
```

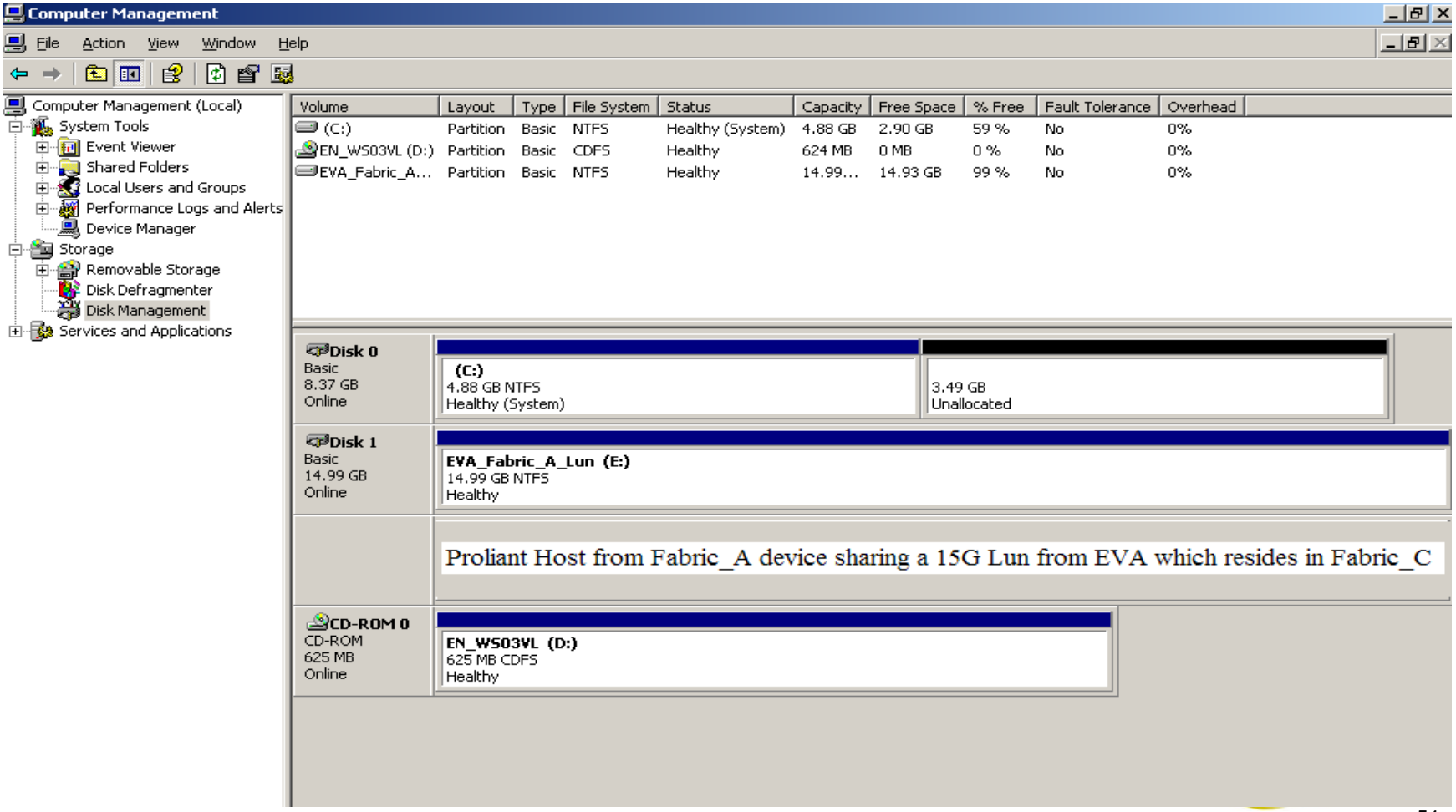
Proliant Host which resides in Fabric_A

EVA Controllers which reside in Fabric_C

```
Fabric_C_3800:admin> zonecreate "Lsan_Fabric_C_1", "21:00:00:e0:8b:05:83:d7;50:00:1f:e1:50:01:01:98;50:00:1f:e1:50:01:01:9d"
Fabric_C_3800:admin> cfgcreate "Fabric_C", "Lsan_Fabric_C_1"
Fabric_C_3800:admin> cfgenable "Fabric_C"
Starting the Commit operation...
0x10282970 (tRtwr): Jul  1 14:25:12
    INFO ZONE-MSGSAVE, 4, cfgSave completes successfully.

cfgEnable successfully completed


Fabric_C_3800:admin> cfgshow
Defined configuration:
 cfg:    Fabric_C
                 Lsan_Fabric_C_1
 zone:  Lsan_Fabric_C_1
                 21:00:00:e0:8b:05:83:d7; 50:00:1f:e1:50:01:01:98;
                 50:00:1f:e1:50:01:01:9d

Effective configuration:
 cfg:    Fabric_C
 zone:  Lsan_Fabric_C_1
                 21:00:00:e0:8b:05:83:d7
                 50:00:1f:e1:50:01:01:98
                 50:00:1f:e1:50:01:01:9d
```

LSAN Zone Between Fabric_A and Fabric_C Results

- Create a 15G Lun from the EVA in Fabric_C and Present it to the Proliant Host in Fabric_A



LSAN Zone Between Fabric_D and Fabric_C
Storage Device Sharing

```
Fabric_D_3800:admin> zonecreate "Lsan_Fabric_D" ," 21:01:00:e0:8b:25:ef:d3;50:00:1f:e1:50:01:01:98;50:00:1f:e1:50:01:01:9d"
Fabric_D_3800:admin> cfgcreate "Fabric_D","Lsan_Fabric_D"
Fabric_D_3800:admin> cfgenable "Fabric_D"
zone config "Fabric_D" is in effect
Updating flash ...
Fabric_D_3800:admin> cfgshow
Defined configuration:
 cfg:   Fabric_D
                Lsan_Fabric_D
 zone:  Lsan_Fabric_D
                21:01:00:e0:8b:25:ef:d3; 50:00:1f:e1:50:01:01:98;
                50:00:1f:e1:50:01:01:9d

Effective configuration:
 cfg:   Fabric_D
 zone:  Lsan_Fabric_D
                21:01:00:e0:8b:25:ef:d3
                50:00:1f:e1:50:01:01:98
                50:00:1f:e1:50:01:01:9d
```

Proliant Host which resides in Fabric_D

EVA Storage Controllers which reside in Fabric_C

```
Fabric_C_3800:admin> zonecreate "Lsan_Fabric_C_2","21:01:00:e0:8b:25:ef:d3;50:00:1f:e1:50:01:01:98;50:00:1f:e1:50:01:01:9d"
Fabric_C_3800:admin> cfgadd "Fabric_C", "Lsan_Fabric_C_2"
Fabric_C_3800:admin> cfgenable "Fabric_C"
Starting the Commit operation...
cfgEnable successfully completed
Fabric_C_3800:admin> cfgshow
Defined configuration:
 cfg:   Fabric_C
                Lsan_Fabric_C_1; CommandView; Lsan_Fabric_C_2
 zone:  CommandView
                10:00:00:00:c9:2f:7d:be; 50:00:1f:e1:50:01:01:98;
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Fabric_C_1
                21:00:00:e0:8b:05:83:d7; 50:00:1f:e1:50:01:01:98;
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Fabric_C_2
                21:01:00:e0:8b:25:ef:d3; 50:00:1f:e1:50:01:01:98;
                50:00:1f:e1:50:01:01:9d


Type <CR> to continue, Q<CR> to stop:
Effective configuration:
 cfg:   Fabric_C
 zone:  CommandView
                10:00:00:00:c9:2f:7d:be
                50:00:1f:e1:50:01:01:98
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Fabric_C_1
                21:00:00:e0:8b:05:83:d7
                50:00:1f:e1:50:01:01:98
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Fabric_C_2
                21:01:00:e0:8b:25:ef:d3
                50:00:1f:e1:50:01:01:98
                50:00:1f:e1:50:01:01:9d
```

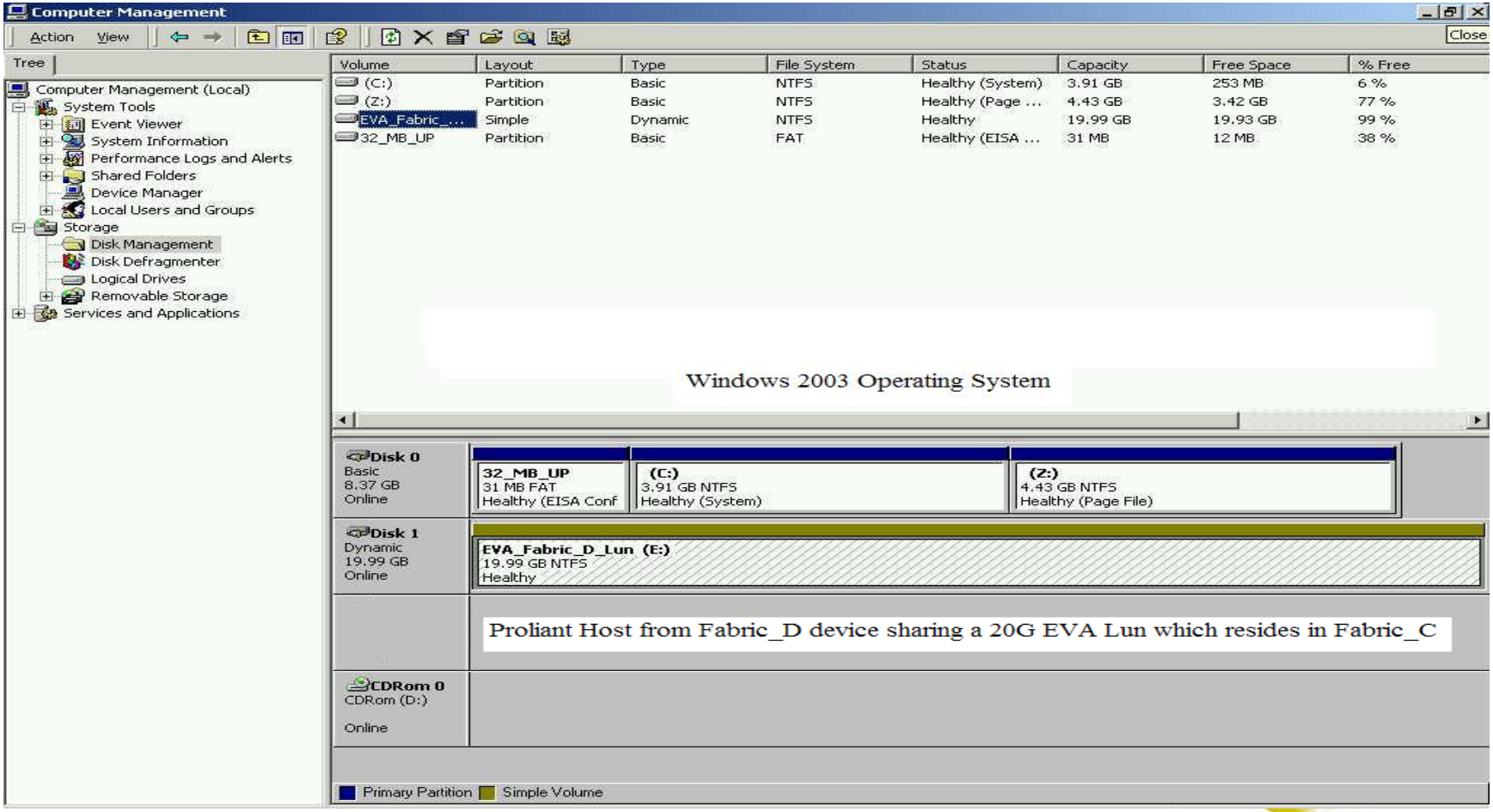
EVA CommandView Management Zone

LSAN Zone Between Fabric_A and Fabric_C

LSAN Zone Between Fabric_D and Fabric_C

LSAN Zone Between Fabric_D and Fabric_C Results

- Create a 20G Lun from the EVA in Fabric_C and Present it to the Proliant Host in Fabric_D



LSAN Zone Between Fabric_B and Fabric_C

Storage Device Sharing

```
Fabric_B_12000:admin> zonecreate "Lsan_Fabric_B", "50:00:1f:e1:50:01:01:98;50:00:1f:e1:50:01:01:9d;21:00:00:e0:8b:06:26:85"
Fabric_B_12000:admin> cfgcreate "Fabric_B","Lsan_Fabric_B"
Fabric_B_12000:admin> cfgenable "Fabric_B"
zone config "Fabric_B" is in effect
Updating flash ...
Fabric_B_12000:admin> cfgshow
Defined configuration:
 cfg:   Fabric_B
                Lsan_Fabric_B
 zone:  Lsan_Fabric_B
                50:00:1f:e1:50:01:01:98; 50:00:1f:e1:50:01:01:9d;
                21:00:00:e0:8b:06:26:85

Effective configuration:
 cfg:   Fabric_B
 zone:  Lsan_Fabric_B
                50:00:1f:e1:50:01:01:98
                50:00:1f:e1:50:01:01:9d
                21:00:00:e0:8b:06:26:85

Fabric_B_12000:admin>
```

Proliant Host which resides in Fabric_B

EVA Storage Controllers which reside in Fabric-C

LSAN Zone Between Fabric_B and Fabric_C (Cont.)

```
Fabric_C_3800:admin> zonecreate "Lsan_Fabric_C_3"," 50:00:1f:e1:50:01:01:98;50:00:1f:e1:50:01:01:9d;21:00:00:e0:8b:06:26:85"
Fabric_C_3800:admin> cfgadd "Fabric_C","Lsan_Fabric_C_3"
Fabric_C_3800:admin> cfgenable "Fabric_C"
Starting the Commit operation...
cfgEnable successfully completed
Fabric_C_3800:admin> cfgshow
Defined configuration:
 cfg:    Fabric_C
                Lsan_Fabric_C_1; CommandView; Lsan_Fabric_C_2;
                Lsan_Fabric_C_3
 zone:  CommandView
                10:00:00:00:c9:2f:7d:be; 50:00:1f:e1:50:01:01:98;
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Fabric_C_1
                21:00:00:e0:8b:05:83:d7; 50:00:1f:e1:50:01:01:98;
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Fabric_C_2
                21:01:00:e0:8b:25:ef:d3; 50:00:1f:e1:50:01:01:98;
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Fabric_C_3
                50:00:1f:e1:50:01:01:98; 50:00:1f:e1:50:01:01:9d;
                21:00:00:e0:8b:06:26:85


Type <CR> to continue, Q<CR> to stop:
Effective configuration:
 cfg:    Fabric_C
 zone:  CommandView
                10:00:00:00:c9:2f:7d:be
                50:00:1f:e1:50:01:01:98
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Fabric_C_1
                21:00:00:e0:8b:05:83:d7
                50:00:1f:e1:50:01:01:98
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Fabric_C_2
                21:01:00:e0:8b:25:ef:d3
                50:00:1f:e1:50:01:01:98
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Fabric_C_3
                50:00:1f:e1:50:01:01:98
                50:00:1f:e1:50:01:01:9d
                21:00:00:e0:8b:06:26:85

Fabric_C_3800:admin>
```

EVA CommandView Management Zone

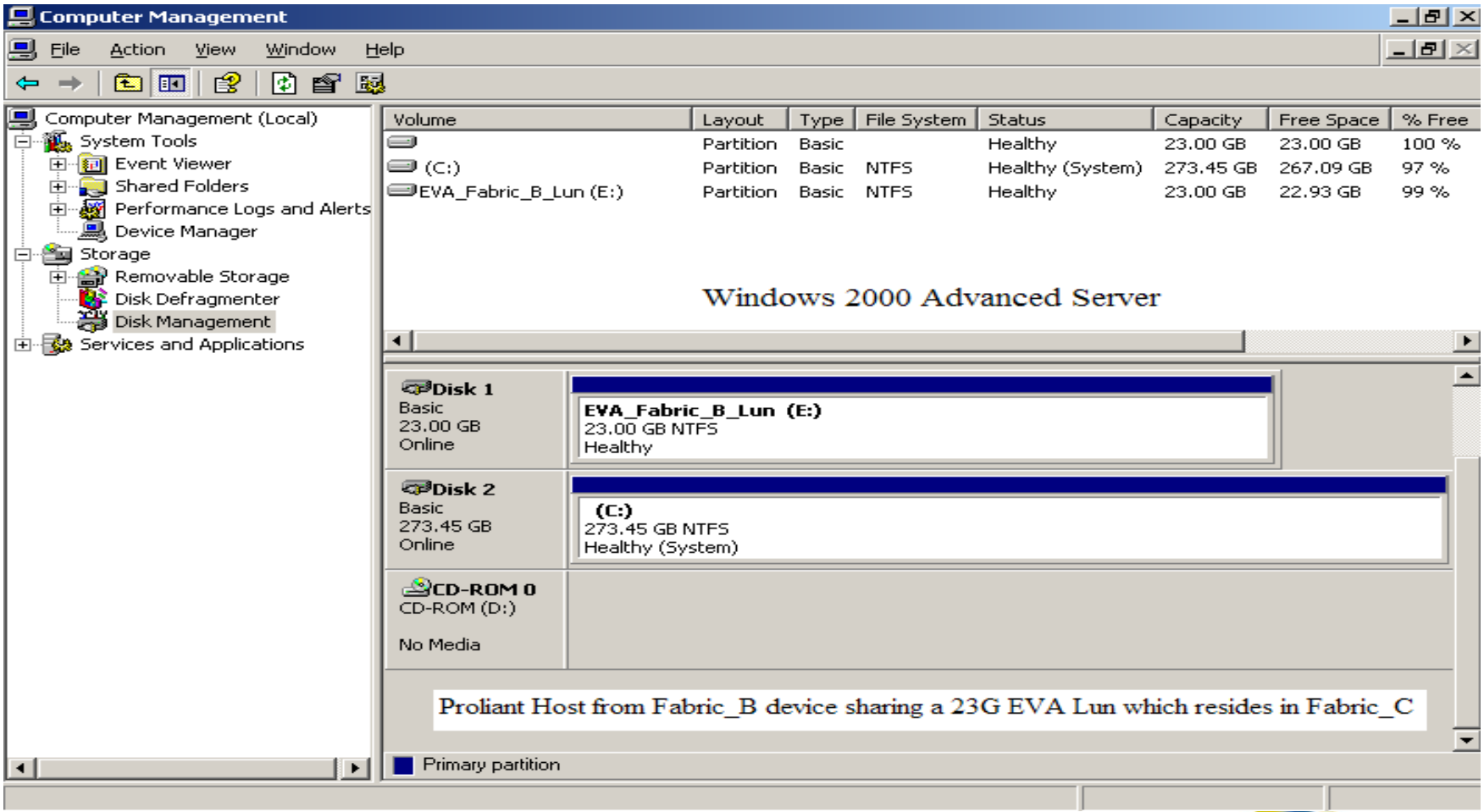
LSAN Zone Between Fabric_A and Fabric_C

LSAN Zone Between Fabric_D and Fabric_C

LSAN Zone Between Fabric_B and Fabric_C

LSAN Zone Between Fabric_B and Fabric_C Results

- Create a 20G Lun from the EVA in Fabric_C and Present it to the Proliant Host in Fabric_B



LSAN Zone Between Fabric_B and Fabric_D

Tape Device Sharing

LSAN Zone Between Fabric_B and Fabric_D

Tape Device Sharing (Cont.)

```
Fabric_D_3800:admin> zonecreate "Lsan_Tape_Fabric","50:03:08:c0:01:43:58:07;50:03:08:c0:01:43:58:08;21:01:00:e0:8b:25:ef:d3"
Fabric_D_3800:admin> cfgadd "Fabric_D","Lsan_Tape_Fabric"
Fabric_D_3800:admin> cfgenable "Fabric_D"
zone config "Fabric_D" is in effect
Updating flash ...
Fabric_D_3800:admin> cfgshow
Defined configuration:
 cfg:   Fabric_D
                Lsan_Fabric_D; Lsan_Tape_Fabric
 zone:  Lsan_Fabric_D
                21:01:00:e0:8b:25:ef:d3; 50:00:1f:e1:50:01:01:98;
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Tape_Fabric
                50:03:08:c0:01:43:58:07; 50:03:08:c0:01:43:58:08;
                21:01:00:e0:8b:25:ef:d3

Effective configuration:
 cfg:   Fabric_D
 zone:  Lsan_Fabric_D
                21:01:00:e0:8b:25:ef:d3
                50:00:1f:e1:50:01:01:98
                50:00:1f:e1:50:01:01:9d
 zone:  Lsan_Tape_Fabric
                50:03:08:c0:01:43:58:07
                50:03:08:c0:01:43:58:08
                21:01:00:e0:8b:25:ef:d3

Fabric_D_3800:admin>
```

Proliant Host which resides in Fabric_D

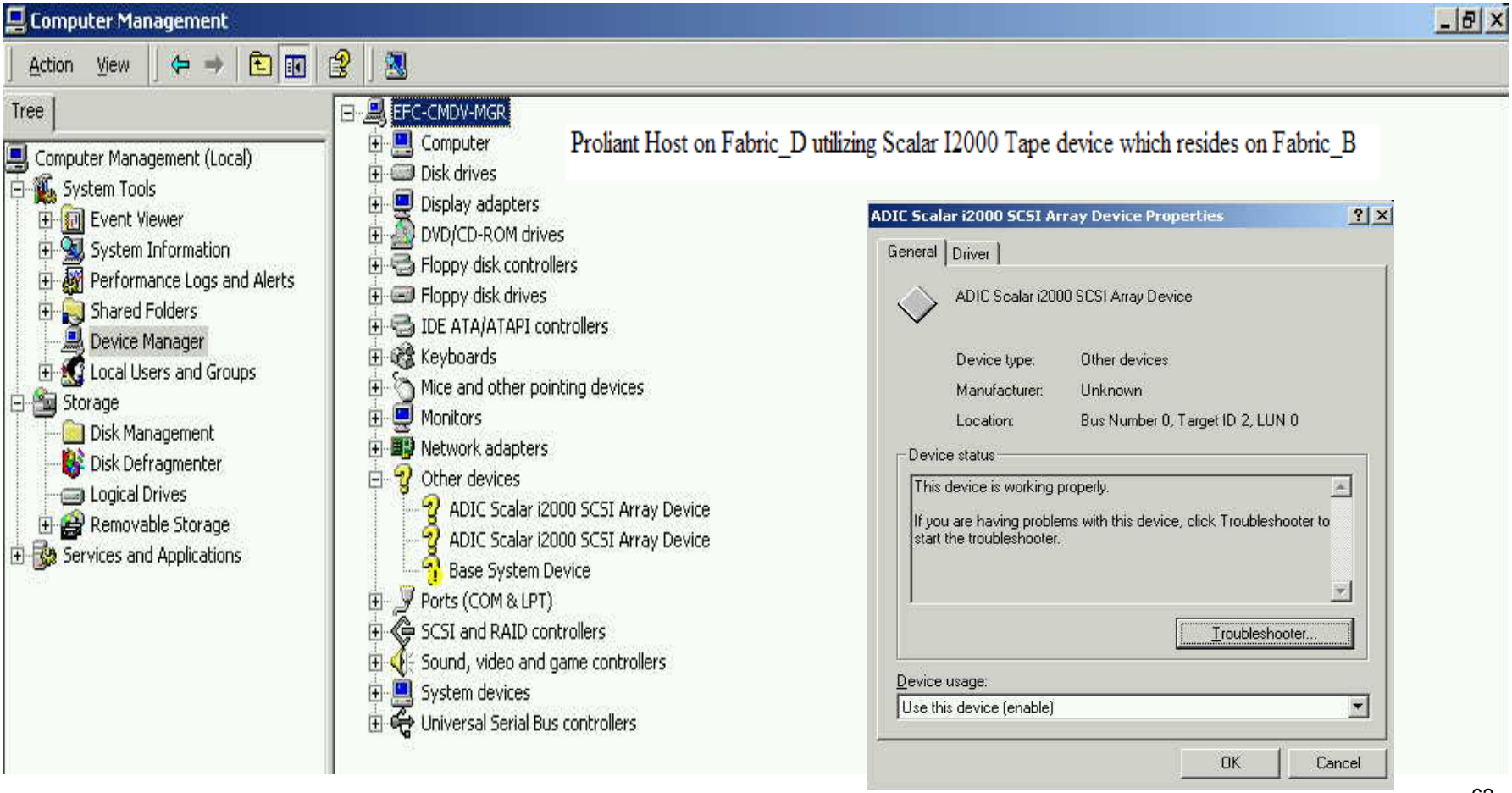
Adic Scalar I2000 Controllers which reside in Fabric_B

LSAN Storage Zone between Fabric_D and Fabric_C

LSAN Tape Zone between Fabric_D and Fabric_B

LSAN Zone Between Fabric_B and Fabric_D Results

- Ability to share high cost investment of Enterprise Tape Device throughout MetaSAN



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