New Fabric Technologies for Building a Better SAN

Robb Macomber

**Enterprise Storage Consultant
Hewlett-Packard Company**

Outline

- HP StorageWorks SAN & the Adaptive Enterprise

- Market Trends

- Customer Needs

- Infrastructure Portfolio

- Multi-protocol Technologies

- HP Multi-protocol Products

- Usage Scenarios

- Technical Summary

- Summary

- Q&A

The Adaptive Enterprise

Business and IT synchronized to capitalize on change

| Business strategy	
Business processes	Management
Applications	
Infrastructure	
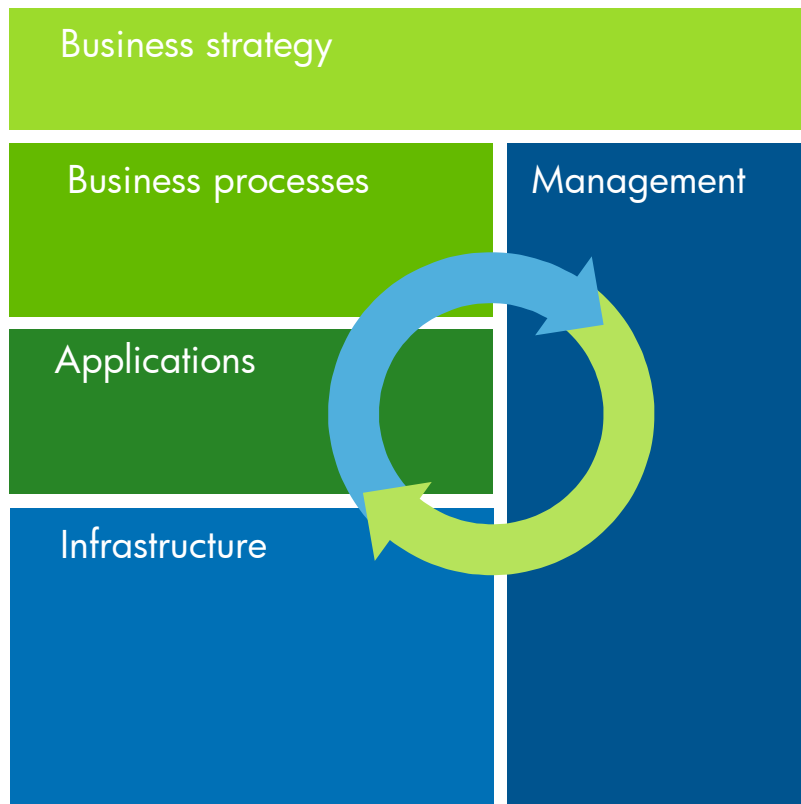
- Brings standardization to the entire IT environment

- Eliminates vertical islands

- Embraces heterogeneity and legacy IT environments

- Uses automation to scale and reduce complexity

- Virtualizes all IT assets

- Helps convert fixed costs to variable costs

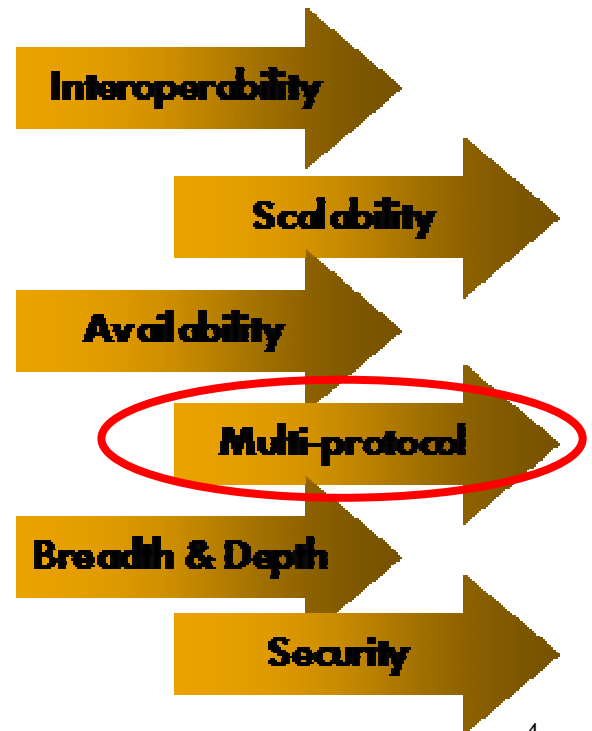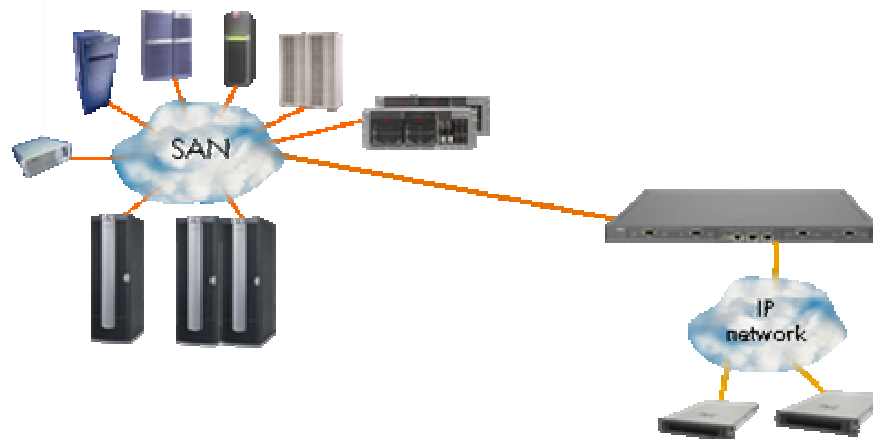Business benefits: *simplicity, agility, value*

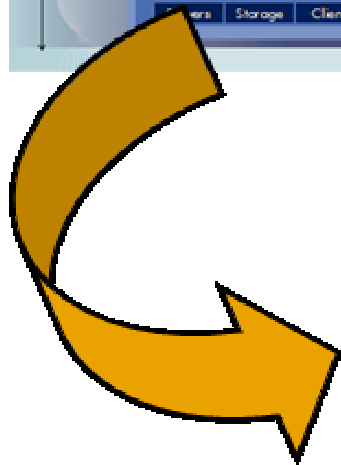# HP StorageWorks SAN

Darwin Architecture
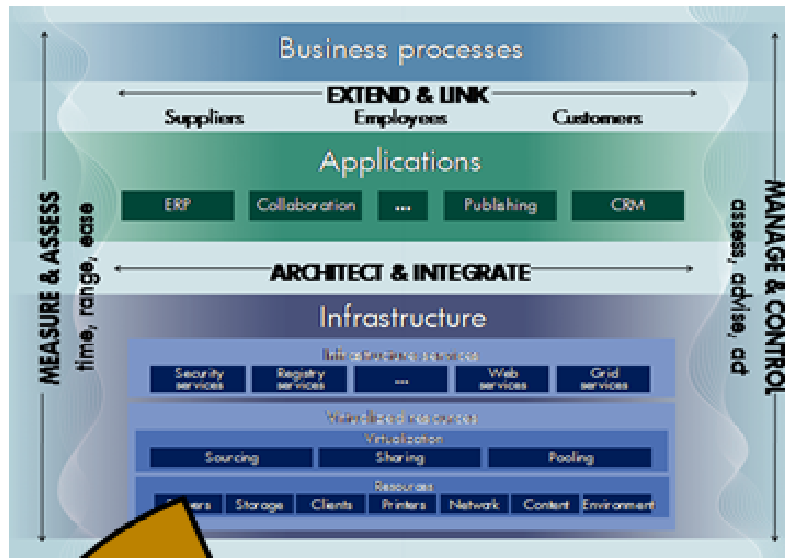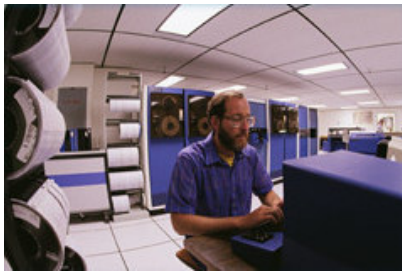

- An open network platform for end-to-end network storage solutions

- HP partners with the "best in class" storage networking component providers in the ecosystem, to provide complete, integrated, end-to-end, open network storage solutions focused on:

Interoperability

Scalability

Availability

Multi-protocol

Breadth & Depth

Security

Evolution of Computing
The Next Wave

Disk Scaling

SAN Scaling

Network Scaling

Data growth

Complexity

DAS centric

Fibre Channel centric

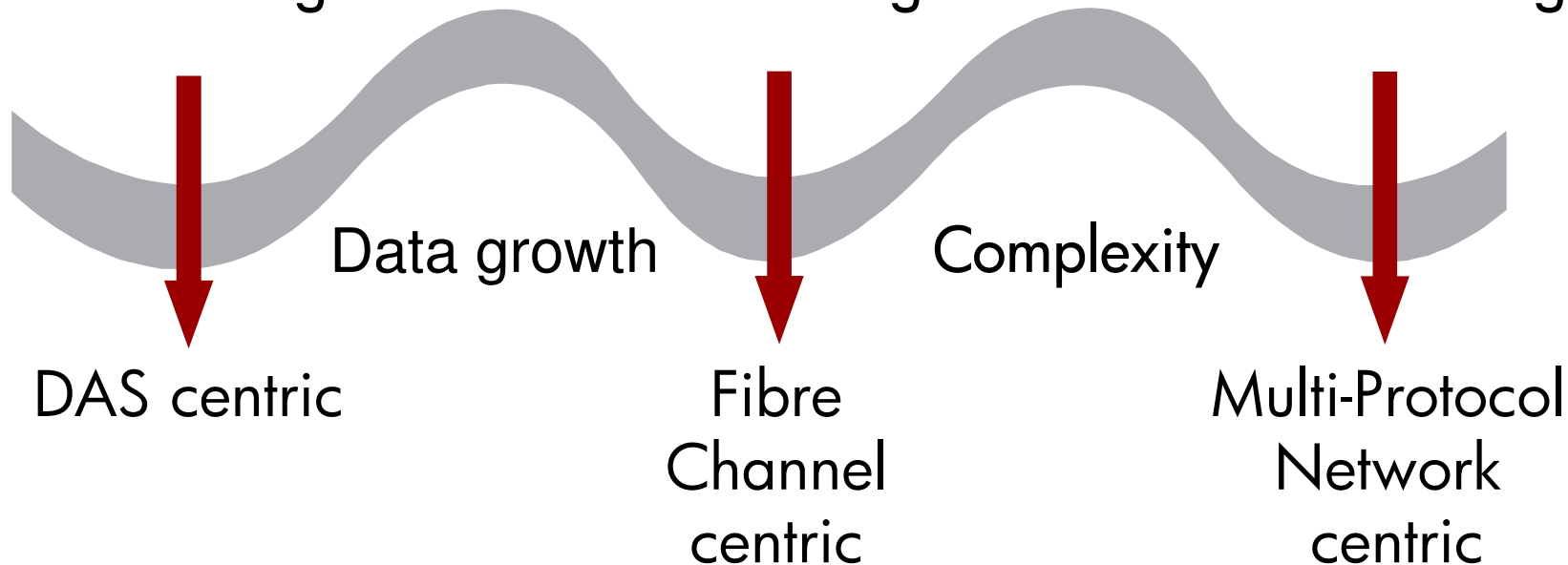Multi-Protocol Network centric

s t a n d a r d i z a t i o n   w a v e s

Delivering on the value promise

HP StorageWorks SANs deliver the storage networking for the Adaptive Enterprise:

Simplification
- Central Management
- Integrated environment
- Fully documented architectures and best practices

Standardization
- Use standard technologies (FC, iSCSI, FCIP) and interfaces (SMI-S)
- Adopt rule-based SAN architectures
- Delivering open, standard based Fabric interoperability

Modularity
- Break down monolithic structures
- Introduce subnet routing for deployment of modular SANs
- Seamless scalability (performance, capacity, distance)

Integration
- Fully integrated with HP products and solutions
- Connectivity driving applications and business processes within & outside the enterprise

Customer Benefits

Agility
- Flexibility to respond to change
- Faster time to solution

Simplicity
- Higher efficiency
- Streamlined operations
- Improved management

Value
- Higher asset utilization and return on investment
- Superior service levels
- Increased performance and reliability

HP StorageWorks SAN

SAN architecture Rules	Solution blue-prints	Interoperability testing	Partner auditing & testing	Fabric SW & OV-SAM integration

Drivers	Fabric Software & Firmwares

Network Devices

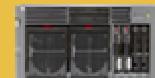| HBAs	B-Series Prod line	M-Series Prod line	C-Series Prod line	IP Storage Routers	SAN Extenders	NAS

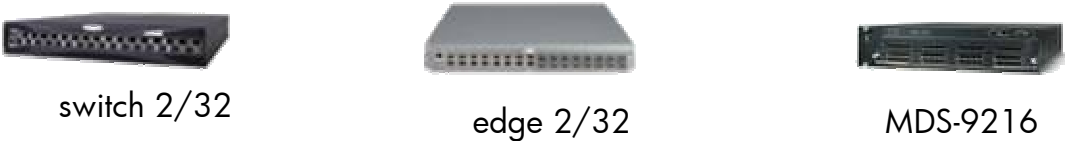# SAN Infrastructure product portfolio

Infrastructure alternatives that span the enterprise

Business enterprise

core 2/64
core 2/128
director 2/64
director 2/140
MDS-9509
MDS-9506

Business mid-range

switch 2/32
edge 2/32
MDS-9216

Business entry

switch 2/8
switch 2/16
blade 2/8
edge 2/24
edge 2/12
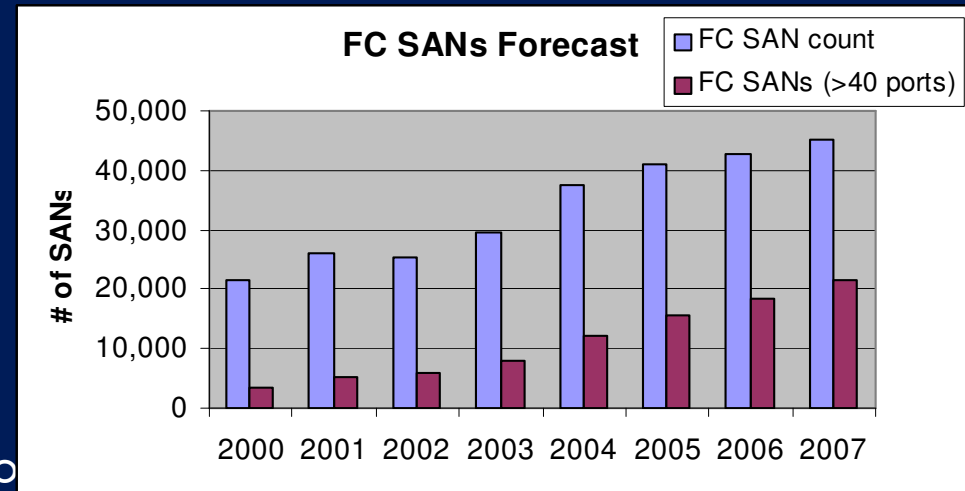MDS 9120 &
MDS 9140
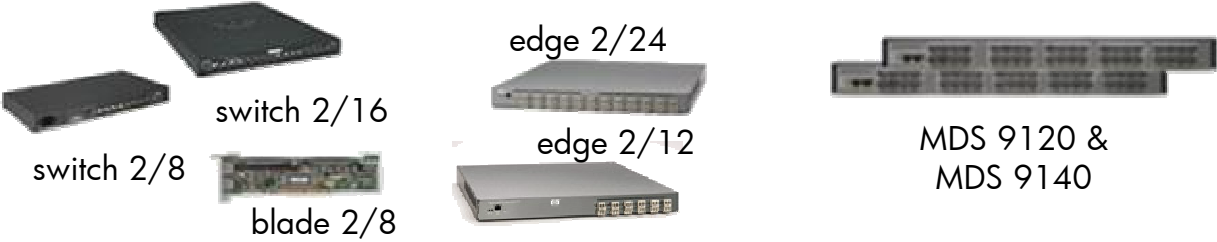
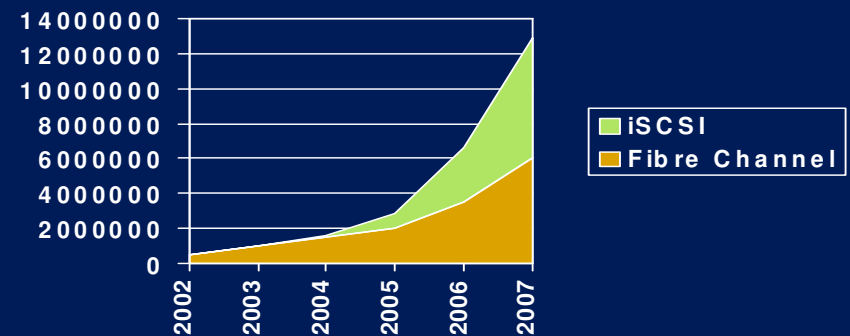**B-Series**   **M-Series**   **C-Series**

Key Market Trends

- Number of SAN islands projected to grow to about 41,000 by 2005 (Gartner, June 2003) driven by DAS/SAN migration

- Fibre Channel will continue to be the technology of choice for large, mission critical data centers

- Strong growth for iSCSI projected for years 2005 and beyond

- Strong adoption of SAN extension for business continuance applications

  - Disaster recovery sites used for backup and fail-over

FC SANs Forecast

Legend: FC SAN count, FC SANs (>40 ports)

# of SANs — 0, 10,000, 20,000, 30,000, 40,000, 50,000

Years: 2000 2001 2002 2003 2004 2005 2006 2007

Source: Gartner, June 2003

Chart axis: 0, 2000000, 4000000, 6000000, 8000000, 10000000, 12000000, 14000000

Legend: iSCSI, Fibre Channel

Years: 2002 2003 2004 2005 2006 2007

Source: IDC, May 2003

Customers would/will need to interconnect an increasing # of SAN islands to fully realize the benefits of storage consolidation and network storage

Customer Needs

Growing need to connect SAN islands for:

- ✓ Improve ROI on storage investment – *reduce costs*
- ✓ Greater levels of storage consolidation
- ✓ Simplify management through centralization – *reduce IT complexity*
- ✓ Selective data migration
- ✓ Business continuity strategies – *deliver critical business services*
  - Data replication and backup over IP networks
  - Synchronous or asynchronous storage mirroring
  - Disaster recovery/business continuity solutions

Maximize IT resources

Multi-protocol Support
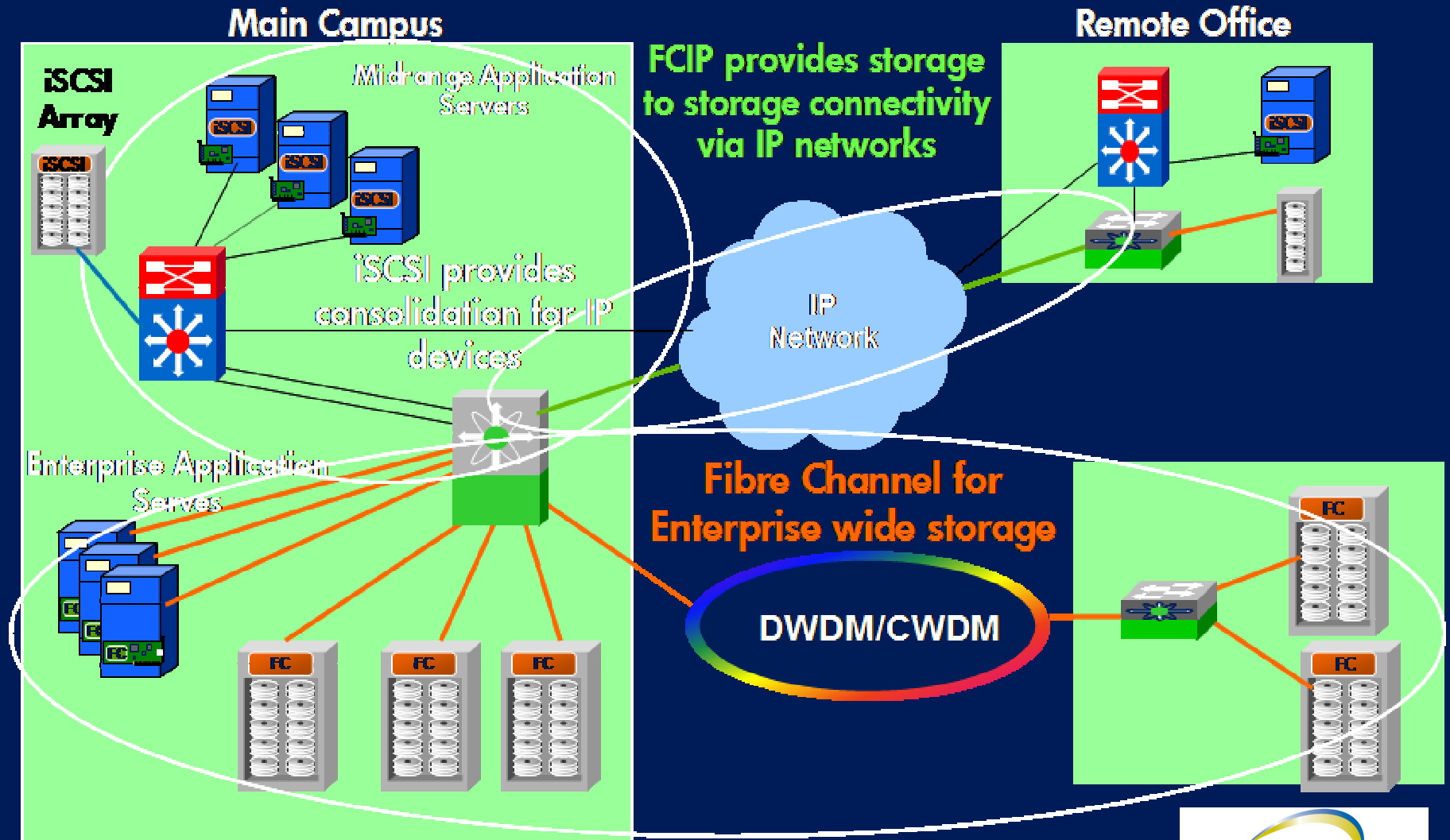
HP SANs: Multi-protocol focus

- HP provides leading edge capabilities to satisfy the local and remote connectivity needs of enterprise-class customers

- Infrastructure Multi-protocol Strategy focus in four areas:

  – NAS/SAN fusion

  – Extension to IP networks via iSCSI routers/gateways

  – Extension to unite SAN islands via subnet routers

  – Remote SAN extension via translative (FCIP, SONET) and non-translative transport technologies (LW SFP's, and xWDM)

HP SANs: NAS/SAN fusion

HP NAS/SAN fusion solutions extends SAN benefits to IP LAN and file storage architectures

NAS Servers

SAN

IP network

remote servers (clients)
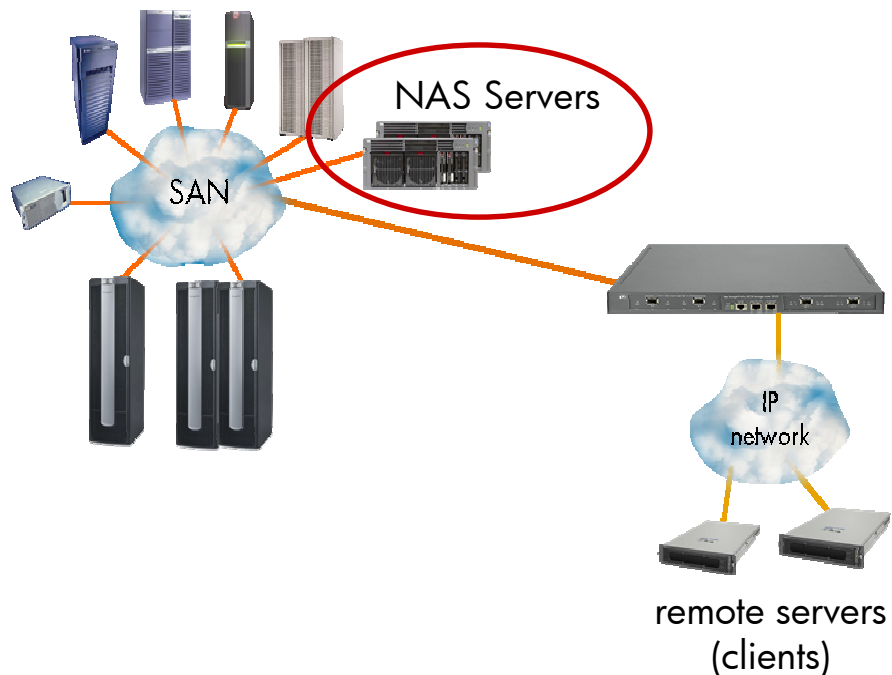
- the fusion of NAS and SAN combines the best of both technologies

- enhances NAS with SAN scalability and management

- enhances SAN with file-level access and virtualization

- eliminates storage islands

- reduces overall management complexity

- drives down cost

- optimized for storage environments

iSCSI bridging

Windows clients

LAN

iSCSI Router
or blade

StorageWorks SAN
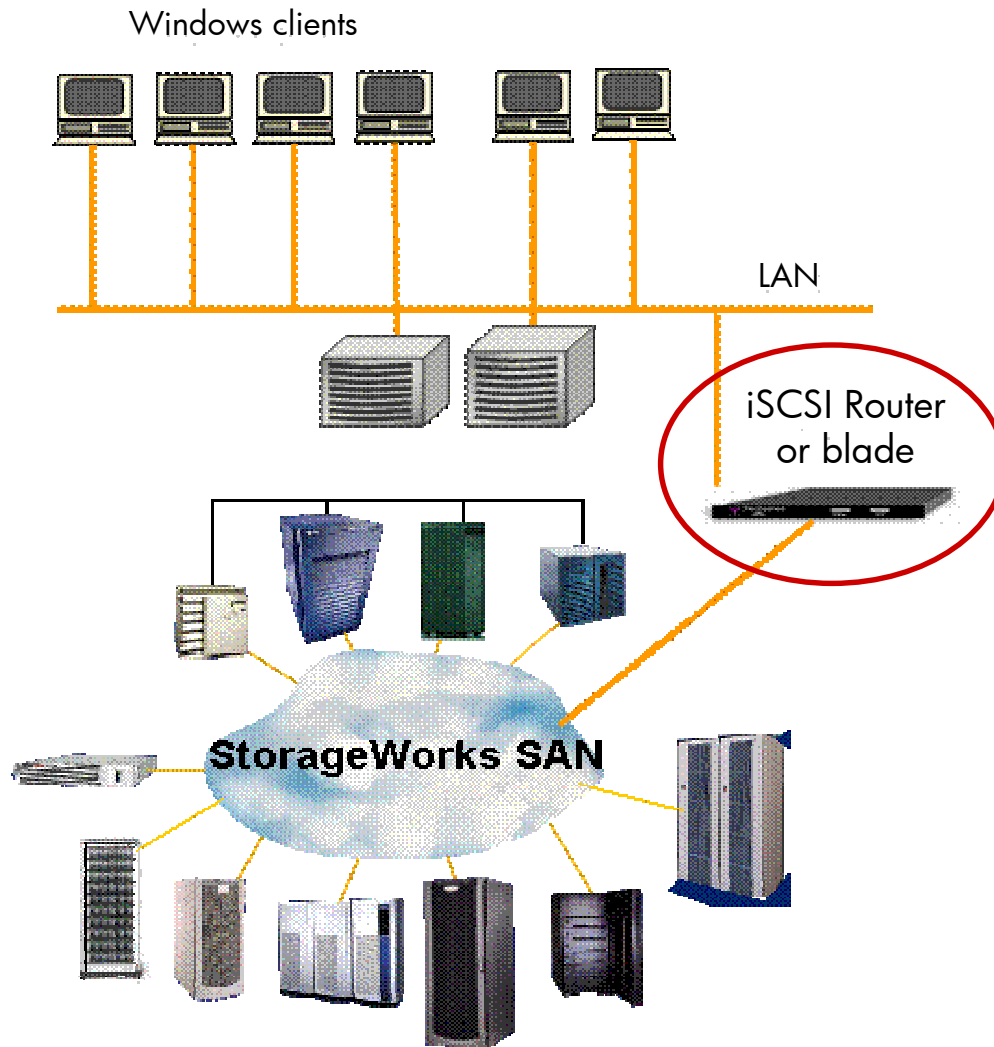
- Provides access to enterprise-class storage resources of the SAN to   non-critical or remote servers

- Delivered as a stand-alone gateway and/or blades in director-class products

- Enables greater flexibility, and asset utilization

- Ties "remote" servers, located across MAN/WAN, to FC SANs

- Connects SAN storage to Blade Servers that do not have FC connectivity

- Integrates the technologies that are important to the user in a single multi-protocol infrastructure

Uniting SAN islands: Subnet routers

- **Increased ROI's for customers**
  - ✓ Enables higher levels of storage consolidation (SAN Island integration)
  - ✓ Overcomes FC scalability limits
  - ✓ Ability to integrate heterogeneous environments
- **Increase SAN management effectiveness**
  - ✓ Focus on management of the complete infrastructure, not only a SAN island
  - ✓ Enables interoperability between homogeneous SAN on different vendors
  - ✓ Isolates and manages proprietary zoning between subnet
 - ✓ Reduces complexity at enterprise level
- **Increase service levels**
  - ✓ Improves network stability & reliability
  - ✓ Higher stability by enabling SAN island integration with fault isolation (SAN island problems do not bring down the whole infrastructure)
  - ✓ More stable configurations for CA/DRM extension and general SAN extension

FC-SAN

FC-SAN

FC Routers

FC-SAN

15
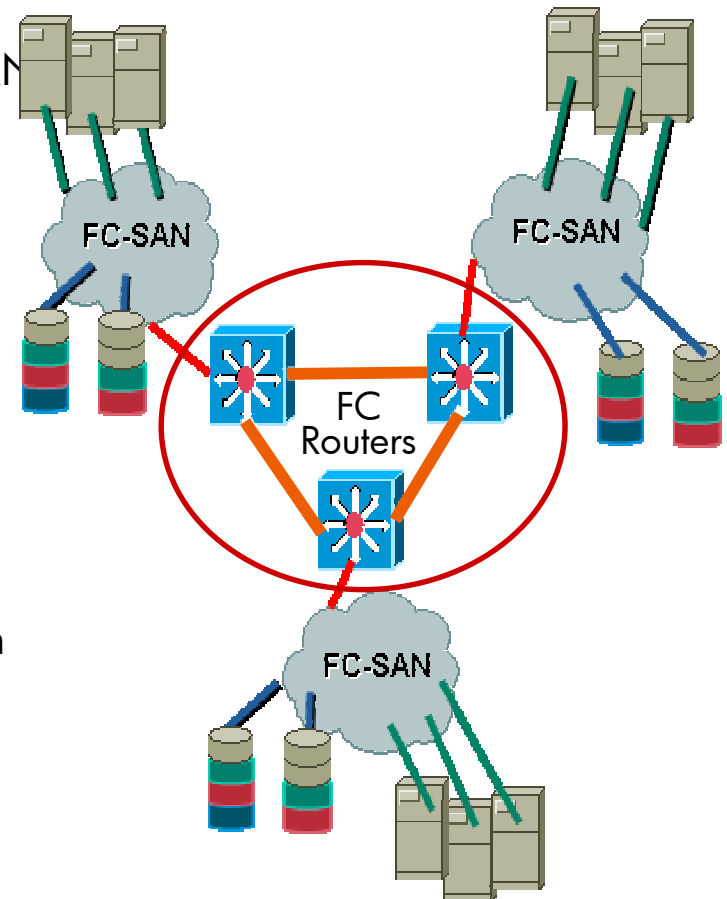
Remote SAN Extension
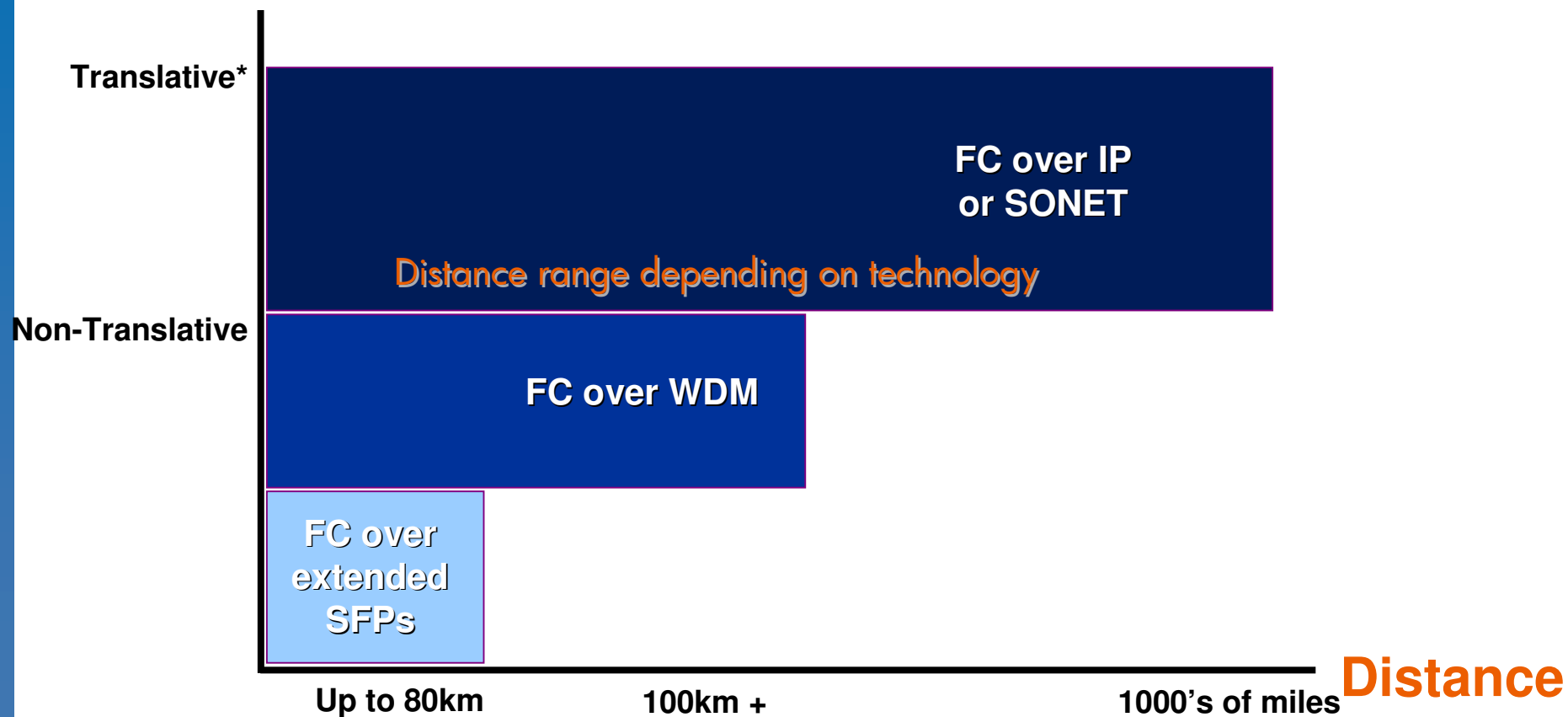
*Note: Fibre Channel mapped to another protocol for transport

Remote SAN Extension (Cont'd)

- FC over long distance SFP (transceivers):
  - Direct ISL between two switches
  - LW SFPs up to 35 KM (all series)
  - LW CWDM SFPs up to 100 KM (C-Series)

- FC over WDM
  - Wavelength Division Multiplexing devices used to extend the distances between two FC switches
  - Partnering strategy
  - Fibre Channel runs over xWDM with no translation of FC packets
  - May run at 1Gbps or 2Gbps
  - Customer may use their own xWDM infrastructure or may be able to lease services from a carrier
  - Use DWDM (Dense) or CWDM (Coarse) technology
    - CWDM - a lower cost version of WDM with fewer wavelengths per fiber at lower cost.

Remote SAN Extension (Cont'd)

- Translative methods

  - Fibre Channel over IP
    - ✓ FC encapsulation over TCP/IP
    - ✓ Preferred technology for WAN extension
    - ✓ Used for very long distances
    - ✓ Partnering strategy today
    - ✓ Introducing integrated options and products for all product lines in FY05

  - SONET
    - ✓ Layer 1 transport technology used by every long haul (WAN) carrier in the world
    - ✓ Service often available in local areas (MAN) as well
    - ✓ Requires translation or encapsulation of FC packet
    - ✓ Partnering strategy
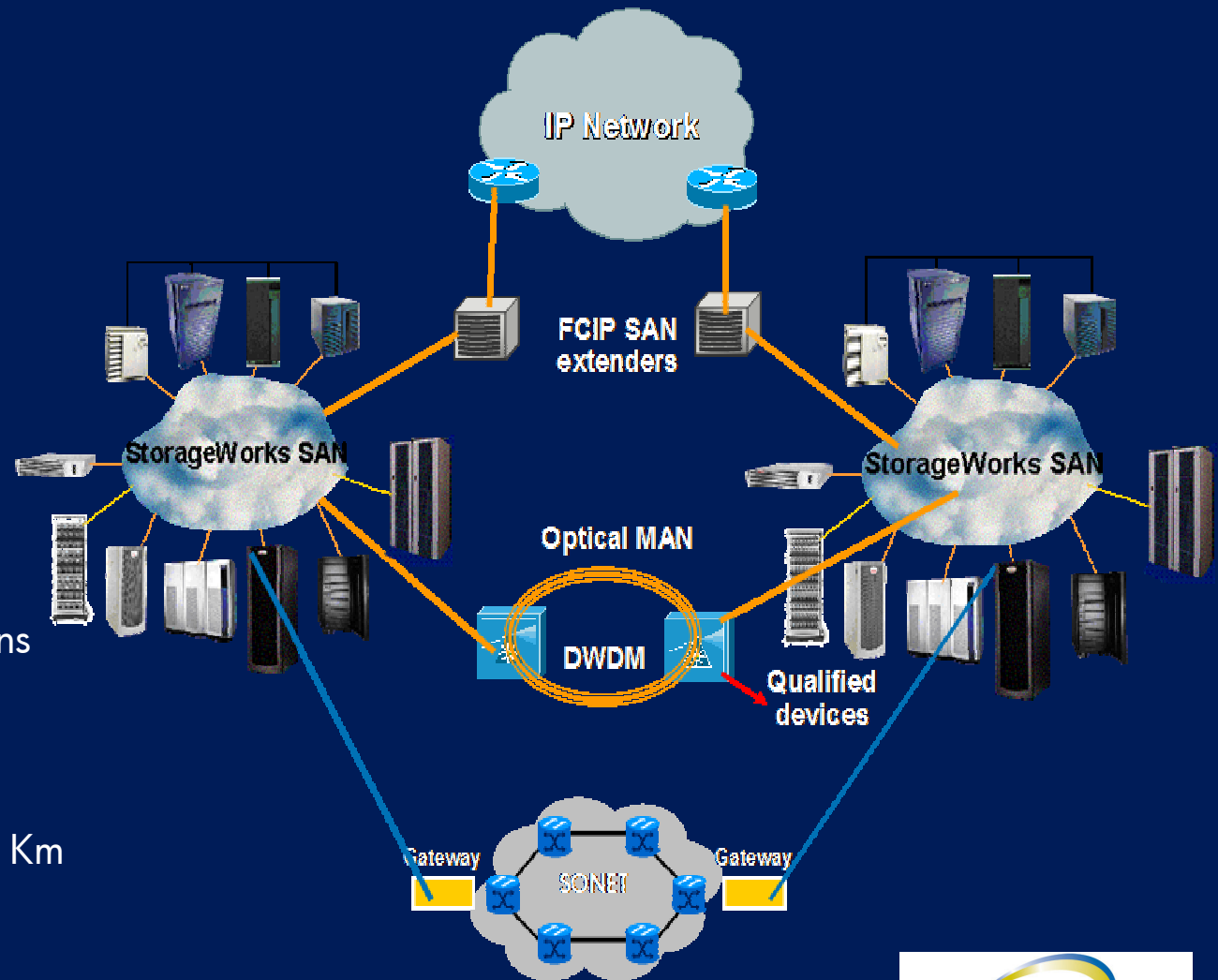
Remote SAN Extension (Cont'd)

IP Routed WAN

- Low speed (T1 – DS3)
- Long distance > 160 Km
- Higher latency
- Longer distance
- Mainly asynchronous

Metro Ethernet

- 1Gb->OC48 or Higher
- short distance <= 60 Km
- Relatively low latency
- Synch/Asynch Applications

SONET

- Typical OC3 / OC12
- Medium distance <= 160 Km
- Relatively low latency
- Mainly asynchronous
- Suitable for some synchronous apps

IP Network

FCIP SAN extenders

StorageWorks SAN

StorageWorks SAN

Optical MAN

DWDM

Qualified devices

Gateway

SONET

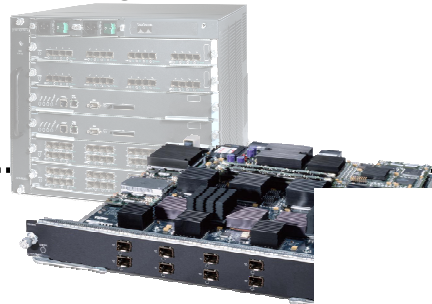Gateway

HP StorageWorks SAN

Multi-protocol products

and support

SAN Extensions portfolio

Multi-protocol alternatives that extend the enterprise

C-series
IPS 9000
Storage Module

B-series
Multi-protocol Storage
Router

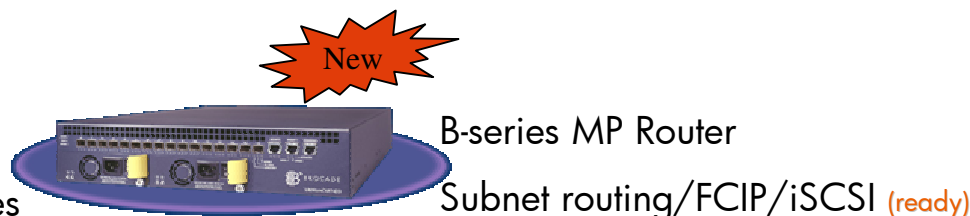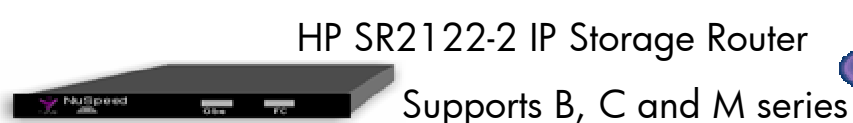**Business enterprise**

C-series
CWDM
Multiplexer

Business mid-range

HP StorageWorks
Storage Router
SR 2122-2

Business entry

Multi-protocol products and support

iSCSI Bridging/FCIP

New

HP SR2122-2 IP Storage Router

Supports B, C and M series

B-series MP Router

Subnet routing/FCIP/iSCSI (ready)

Remote SAN Extension

FC over IP SONET

C-series Integrated IP module
FCIP support

Support for
3rd party IP networking devices

FC over WDM

Support for third party WDM devices

New

C-series CWDM mux and SFP's - *Now supports B-series too!*

FC over extended SFPs

LW SFP's for B, M & C-series

LW CWDM SFP's for the C-series

HP StorageWorks IP Storage Router

- 2122-2 is HP's second generation IP router

- enables (SMBs) and enterprise workgroups to migrate servers from a direct-attached storage (DAS) to a storage area network (SAN) environment

- highly effective consolidation and utilization of storage assets for higher returns on investment.

✓ iSCSI bridging functionality for storage consolidation

✓FCIP connectivity for SAN extension, fully integrated with HP's Continuous Access solutions

✓Flexible combination of IP and Fibre Channel technologies at entry-level prices

✓Support B, M, and C series

2 GbE ports   2 1/2Gb FC ports

SR 2122-2 Features & Benefits

- Software Features

    - FCIP & iSCSI support   - Management SNMP

    - Access control lists   - Virtual LANs (VLANs)

    - LUN mapping and masking   - Fibre Channel Zoning

    - Leverage existing IP security (firewalls, encryption, etc.)

   - AAA - Authentication, Authorization, and Accounting

- Benefits - the flexible IP capabilities enable customers to have:

    - access to storage across an IP network as though it is locally attached

    - cost effective storage connectivity for non-critical and stranded servers

    - higher utilization of IP resources

    - ability to share SAN Resources across an IP Network

    - ability to provide the efficiencies of block access to enterprise applications with no additional changes

C-series IPS Storage Module

- Multi-protocol Flexibility
  - iSCSI and FCIP on all ports concurrently

- Simplifies Enterprise Scale Business Continuance
  - Enables backup, remote replication, and disaster recovery over WAN distances using open-standard FCIP tunneling

- Lowers Storage TCO for Midrange Servers
  - Enables consolidation of midrange server storage using industry standard iSCSI protocol (support pending, see roadmap)
  - Provides midrange servers access to SAN-based backup and business continuance services

- Simplifies Management of Multi-Protocol SANs
 - Enables unified SAN services and management independent of the protocol being used
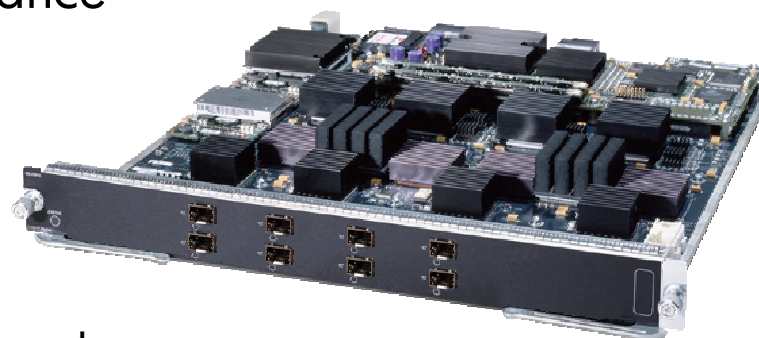
8-port 1Gbps Ethernet

# C-series IP Storage Module FCIP Advantages

- Scalability
  - 8 Gigabit Ethernet interfaces yield up to 24 remote ISL links (up to 3 FCIP tunnels per port)
- Performance
  - Optimized for full performance in WAN environments
- Stability
  - VSANs Insulate Local SANs from WAN and Remote events
  - Replication end-points on their own VSAN
- MDS Family Services
  - All MDS SAN services supported on both Fibre Channel and IP interfaces
- Reduced Storage TCO
  - Integrated WAN and iSCSI extension maximizes SAN value (iSCSI support pending, see roadmap)
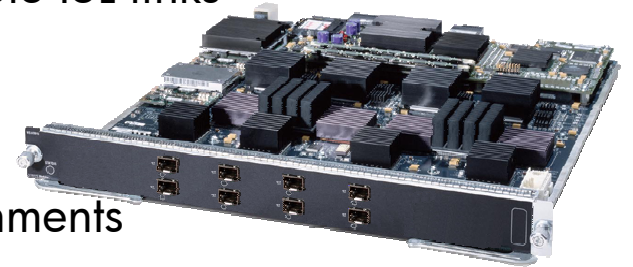
C-Series Inter-VSAN Routing (IVR) : Sharing Resources Across VSANs

- Allows sharing of centralized storage services such as tape libraries and disks across VSANs

- Key Attributes:
  - Works for all MDS 9000 switches with a software upgrade to SAN-OS 1.3(1)
  - Distributed, scaleable, and highly resilient architecture
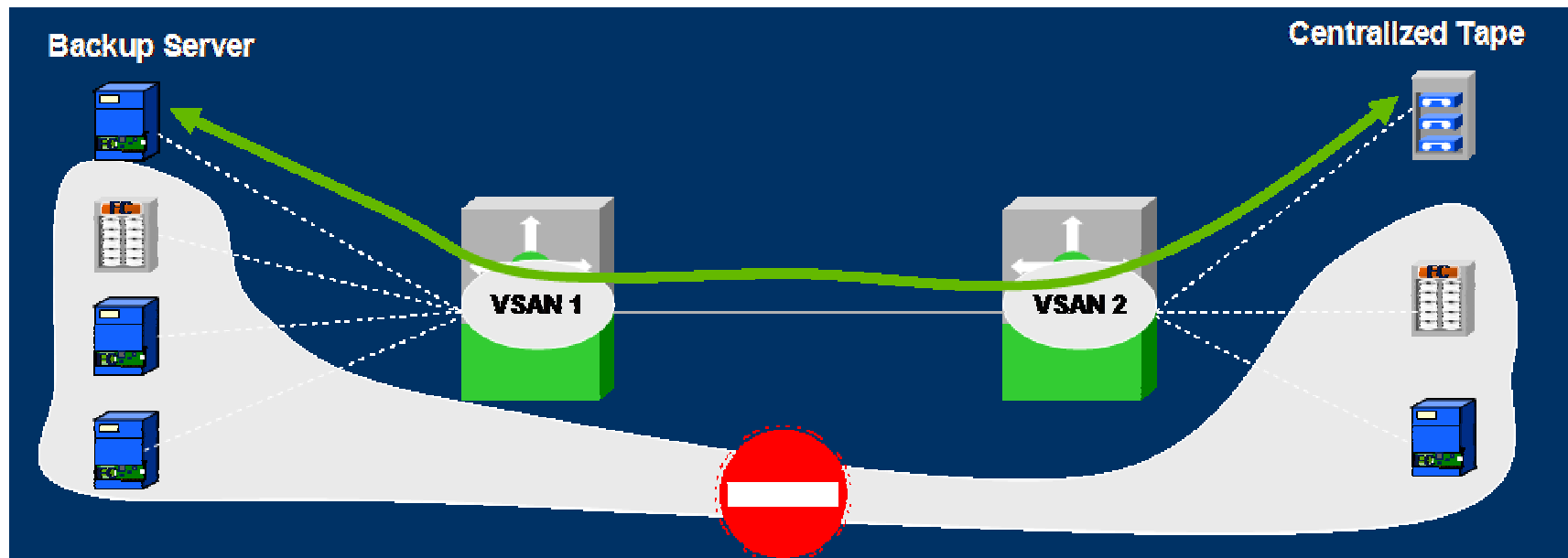
C-Series CWDM Solution

The C-series CWDM GBIC/SFP Solution is a convenient and cost-effective solution for the adoption of Gigabit Ethernet and Fibre Channel in campus, data center, and metropolitan-area access networks

Key Features and Benefits

- **Multi-vendor support**
  - *Supports both B-series and C-series switches*

- **Scalability**
  - Enables the transport of up to eight channels
    (Gigabit Ethernet and/or Fibre Channel) over single-mode fiber strands.

- **Easy Deployment and Flexible Implementation**
  - Fits into a standard GBIC (and SFP) port supporting the IEEE 802.3z standard.
    Neither the CWDM GBIC (and CWDM SFP) nor the CWDM OADM requires configuration.
  - The CWDM GBIC/SFP Solution allows for a variety of network configurations - from multichannel   point-to-point to hub and meshed-ring configurations

- **High Availability**
  - The CWDM GBIC/SFP Solution takes advantage of a multichannel architecture and the inherent   protection of ring architectures. The solution enables:
    - Use of Layer 2 and Layer 3 redundancy and failover mechanisms at the channel endpoints (CWDM GBIC/SFP) to build highly available links
    - Use of two-path link configurations in a ring architecture to provide protection from fiber cuts

C-series CWDM Solution

Connecting MDS 9000 IP Storage Services Modules together via a long distance (up 100km) high speed fibre optic links.

The CWDM GBIC/SFP Solution has two main components:

- a set of eight different pluggable transceivers (CWDM GBICs and CWDM SFPs)

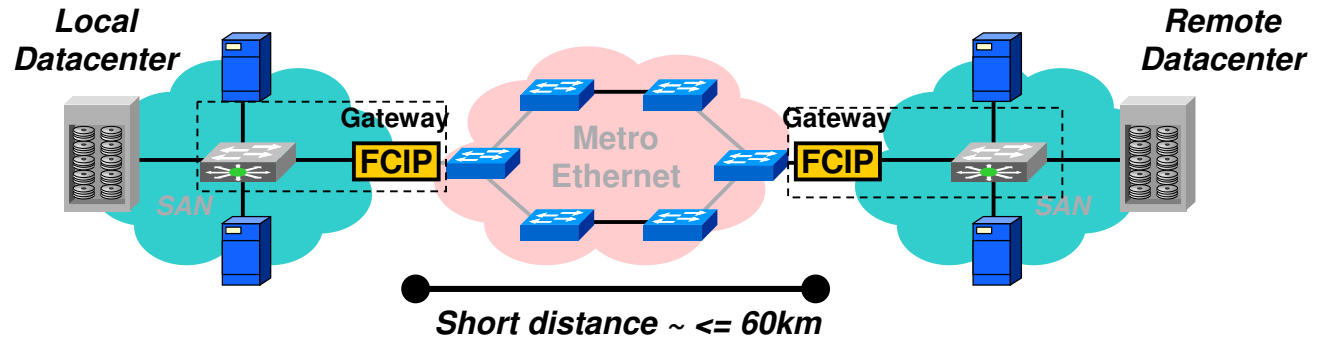- a set of different CWDM optical add-drop modules (OADMs).

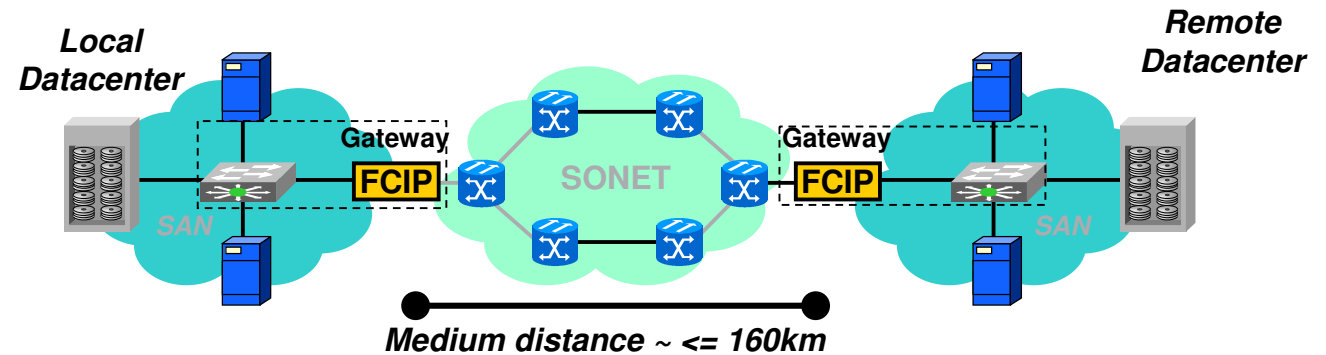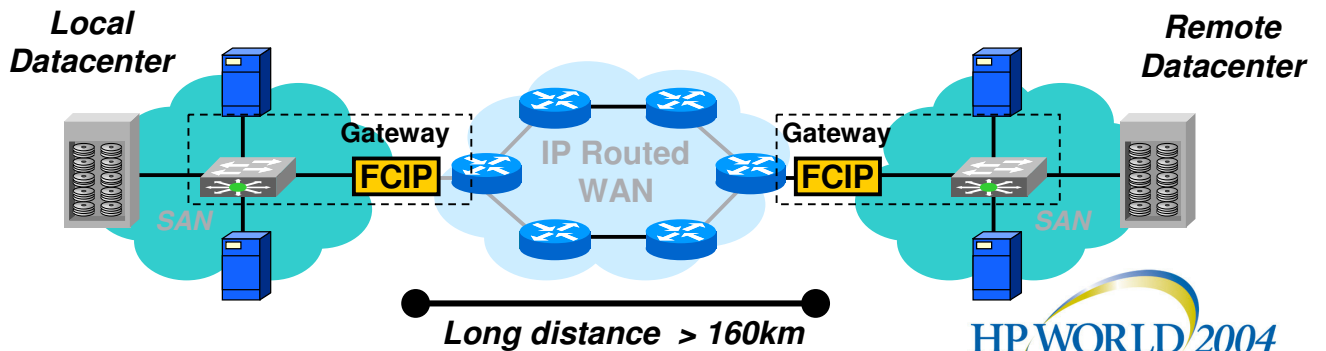CWDM MUX supports B-series connections now too

FCIP Environments

- 1Gb->OC48 or Higher
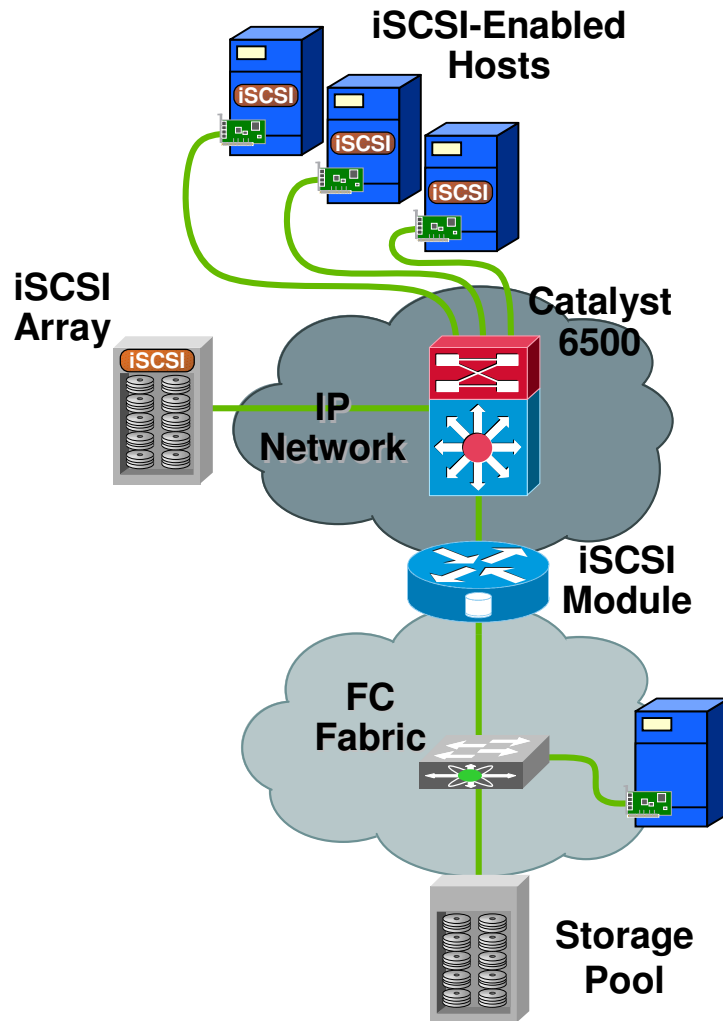- Relatively low latency
- Synch/Asynch Applications

Local Datacenter / Remote Datacenter / Gateway / FCIP / Metro Ethernet / SAN

Short distance ~ <= 60km

- Typical OC3 / OC12
- Relatively low latency
- Mainly asynchronous
- Suitable for some synchronous apps

Local Datacenter / Remote Datacenter / Gateway / FCIP / SONET / SAN

Medium distance ~ <= 160km

- Low speed (T1 – DS3)
- Higher latency
- Longer distance
- Mainly asynchronous

Local Datacenter / Remote Datacenter / Gateway / FCIP / IP Routed WAN / SAN

Long distance > 160km

C-series MDS 9000 IP Storage Module – iSCSI Solution

iSCSI-Enabled Hosts

iSCSI Array

IP Network

Catalyst 6500

iSCSI Module

FC Fabric

Storage Pool

- Share block-level storage resources over IP

- Extend storage over IP networks

- Security via IP ACLs, authentication, LUN mapping

- High availability cluster mode

- Windows, Linux, HP-UX, Netware, Solaris and AIX

- Web-based management

# HP StorageWorks Multi-protocol Router

- Multi-protocol (1-2 Gbit/sec FC, IP) native *at each port*

  - FCRS (FC-FC Routing)
  - FCIP (FCIP Tunneling)
  - iSCSI (iSCSI Gateway Service)

- 16 ports, individually software selectable

- 1 ASIC per port, processing scales linearly

- Line rate applications processing

- Same hardware that will host storage applications

- Seamless integration with more than 60,000 existing Brocade fabrics
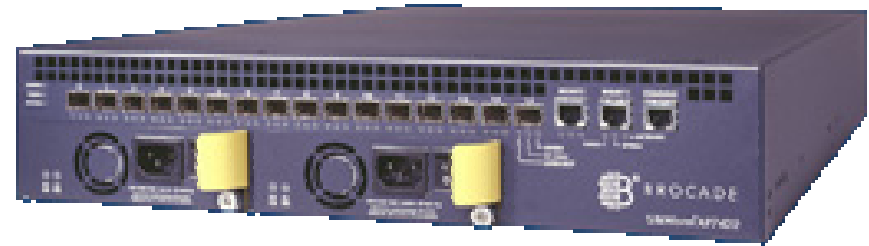
HP StorageWorks Fabric Manager

Configure and Manage B-series Fabrics with Greater Efficiency

- ✓ Fabric-Focused Topology
- ✓ Usability Enhancements
- ✓ Fabric Snapshot/Compare
- ✓ Call Home
- ✓ HBA Management
- ✓ Multi-user support
- ✓ E-Licensing
- ✓ Integrated Ports
- ✓ Port Groups
- ✓ ISL performance
- ✓ Security and change management
- ✓ New routing services management
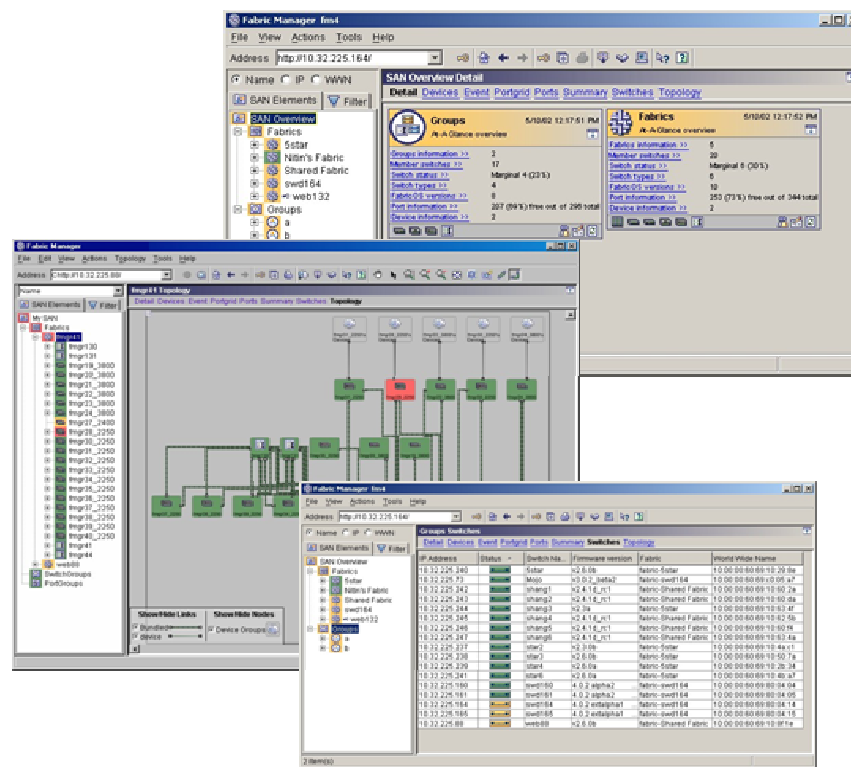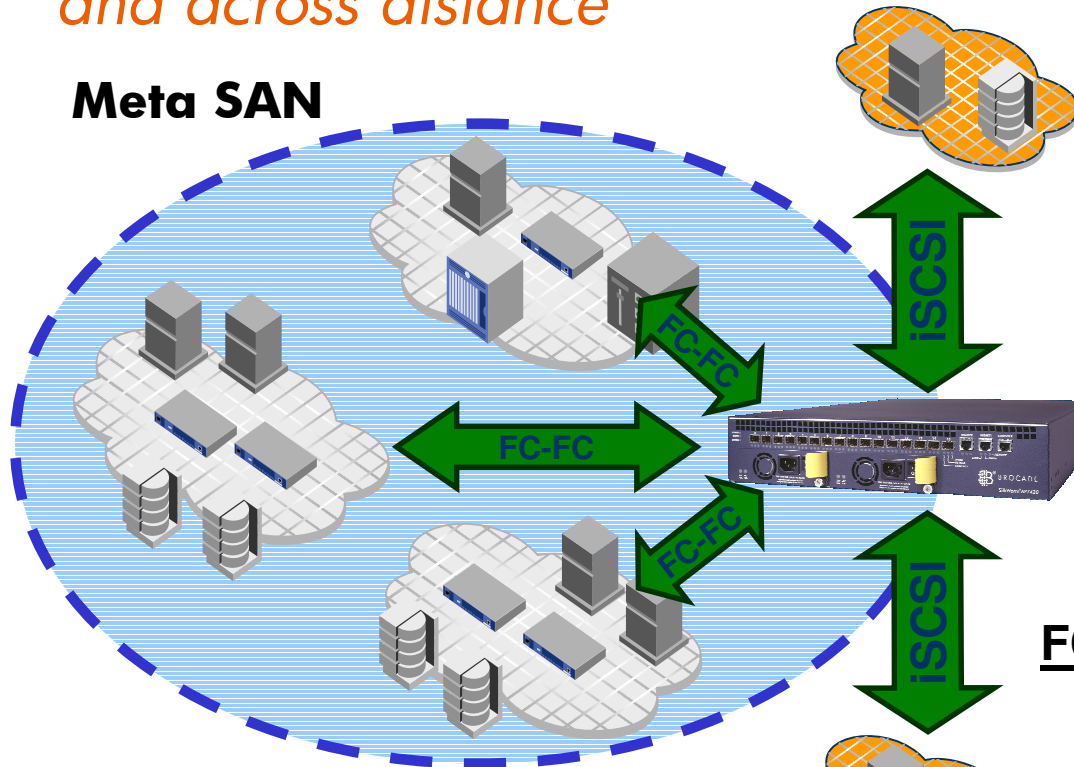
FM – Multi-protocol Router Support

- Wizard for device sharing
  - Walks user through series of steps to share devices between fabrics
  - Includes steps to connect Edge Fabric to MP Router
    - Without this, sharing would be a manual operation on multiple different fabrics

- Collate information from multiple sources
  - What are different fabrics reporting, analyze to inform user about overall state of affairs

- Information on FC Router, EX ports, LSANS

Multi-protocol Routing Services at a Glance

New

Extend the value of SANs to any size, over multiple networks, and across distance

Meta SAN

iSCSI-to-FC Bridging

– Bridge from iSCSI to Fibre Channel SANs to connect lower-cost Ethernet servers to FC SANs, cost-effectively

FCIP

iSCSI

FC-FC

FC-to-FCIP for Distance Extension

– Seamlessly, reliably extend FC SANs across MAN/WAN IP networks via FCIP

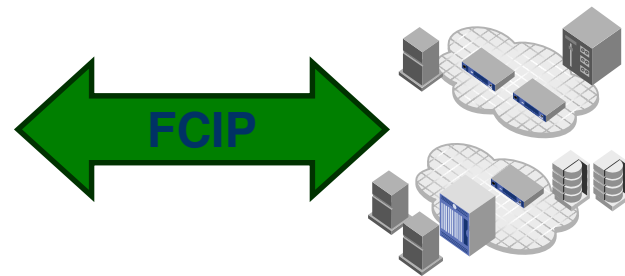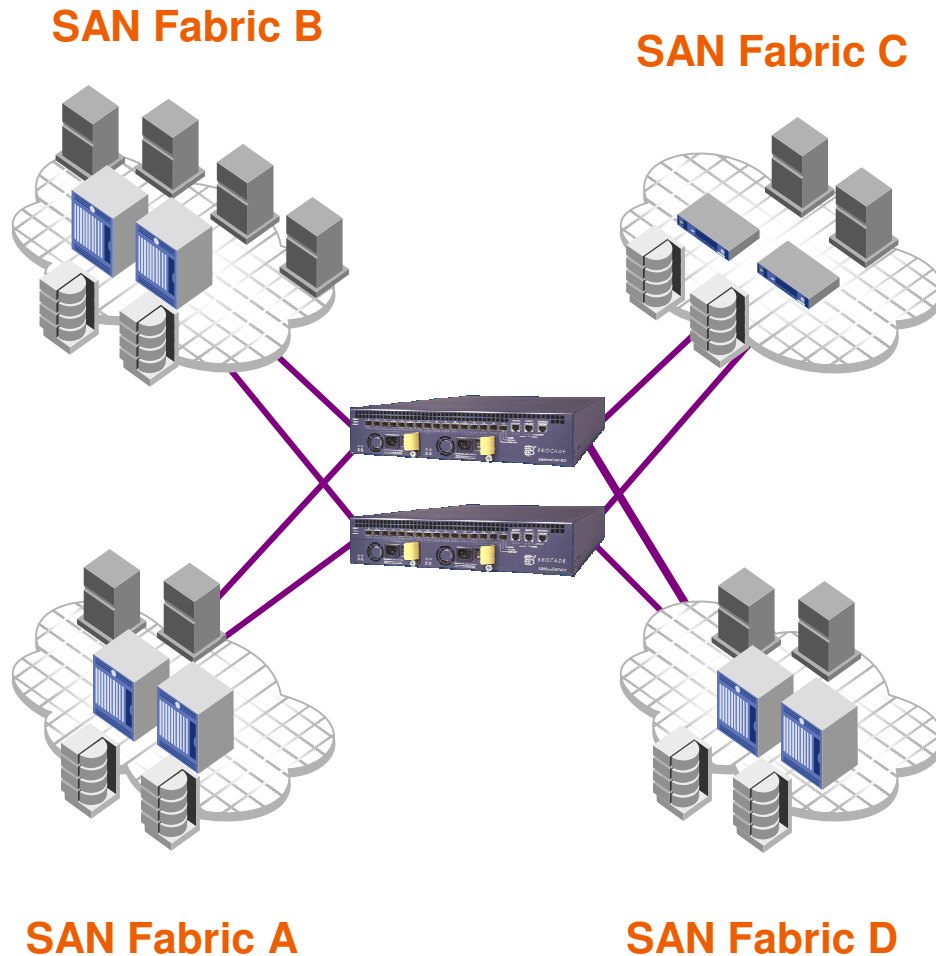– Performance varies with distance

FC-to-FC Subnet Routing

– Logically connect SAN islands and share resources across multiple fabrics

– Maintain administration and fault isolation of separately managed fabrics

Use Case 1: SAN Island Consolidation

SAN Fabric B

SAN Fabric C

SAN Fabric A

SAN Fabric D

- Introduces modularity in SAN designs

- 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

Use Case 1: SAN Island Consolidation

Business Requirement

- Ease of scalability to high port count
- Geographical, functional, and departmental resource sharing
- Secure connectivity of selective resources
- Heterogeneity of devices
- Troubleshooting, fault isolation, and management of large SANs

Solution

- Resource sharing across multiple SANs using routing
- Scalability beyond current SAN port count support constraints **
- Support multiple OEMs and firmware revisions
- Ability to organize heterogeneous resources in separate SANs

Benefits

Simplify scalability for growing SAN environments
- Connect SAN islands without the need to merge them
- Enable secure, selective resource sharing using LSANs
- Simplify troubleshooting, fault isolation, and management
- Design in isolation and benefit from consolidation
- Improve asset utilization

FC-to-FC Subnet Routing Enables Logical Private SANs (LSANs)

New
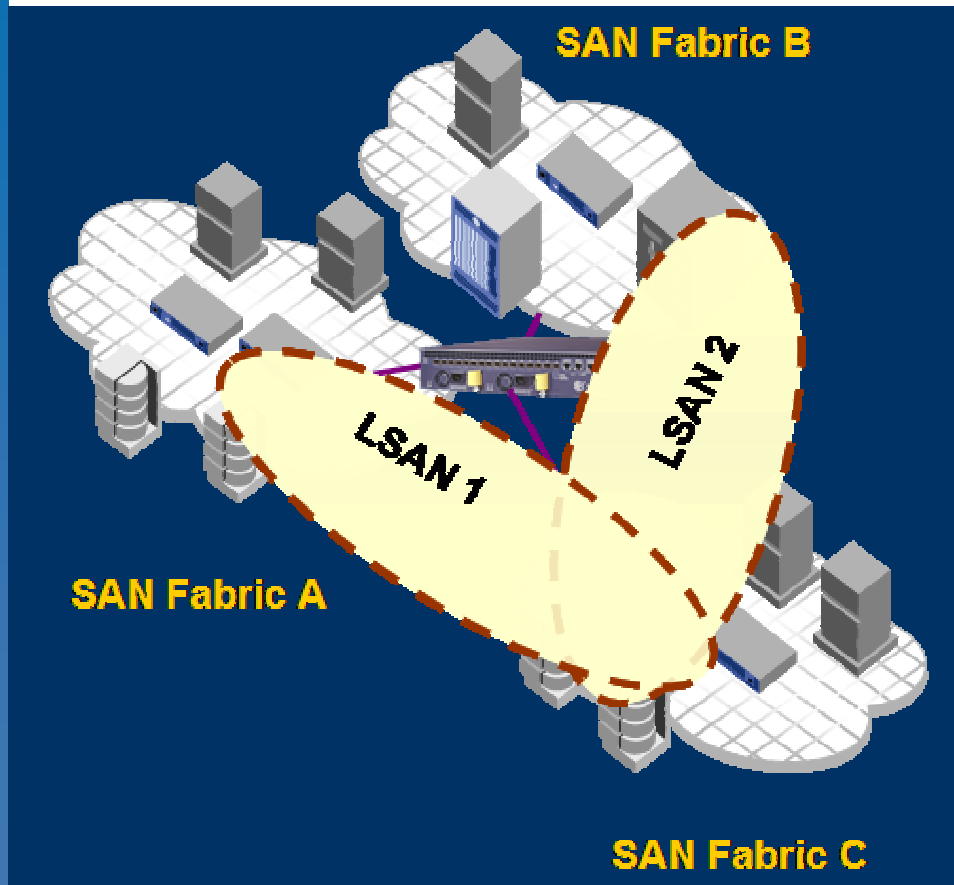
Optimize resource utilization:
- Consolidate resources from separate SANs

Scale SANs:
- Minimize the risk and complexity of large fabrics
- Right-size SANs based on application and business constraints

Management, fault isolation, and stability

Protect and extend investments (LSANs require no changes to existing switches or edge devices)

Logical Private SANs (LSANs)
Capabilities and Benefits

New

- Securely connects fabrics and devices between different SAN Islands

- High level of isolation and fault tolerance

- Based on storage industry standardized zoning methods – applicable to installed base of SANs

- Share devices selectively across LSANs

- Multi-protocol support

- Evolution: extension of proven zoning techniques. If you can zone, you can create LSANs!

Use Case 2: FCIP for Business Continuity
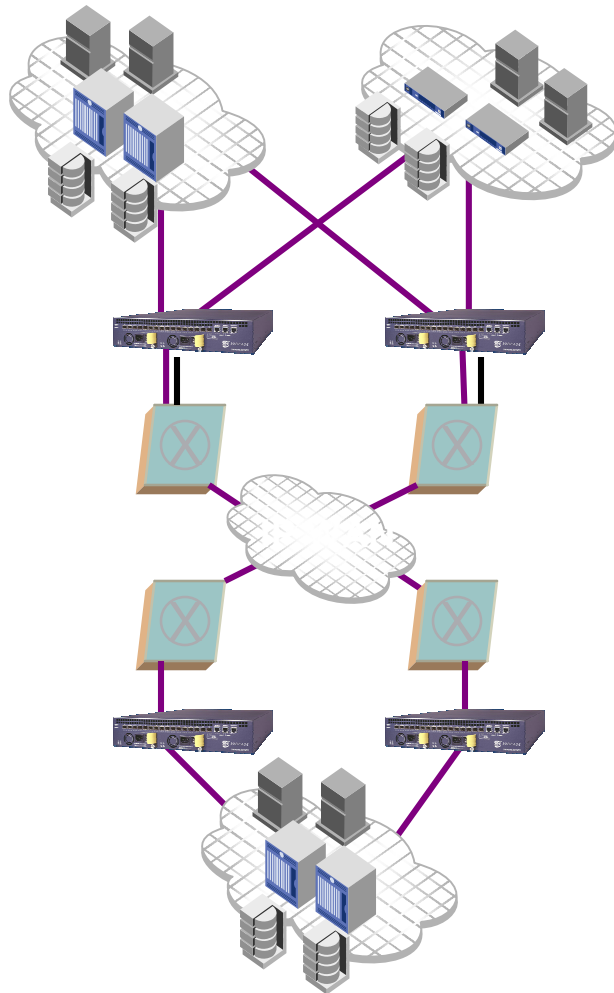
- Ability to share resources and move data between geographies

- Powerful combination of FCIP with subnet routing, provides a significantly more stable implementation since a fabric merge is not required. Traditional FCIP gateways do not provide such capabilities.

- A reliable foundation for business continuance solutions such as remote replication over IP

- Integrated with HP products and solutions

- Simple, cost-effective foundation for utility computing

- Excellent solution for mid distances

41

Solution 2: FCIP for Business Continuity

Business Requirement

- Distance limitation of Fibre Channel networks
- Increasing needs for business continuance solutions
- Consolidation of resources across long distances is complex
- Management, training, fault isolation, and cost of multivendor solutions

Solution

- Share resources and move data between geographies
- Leverage IP MAN/WAN in conjunction with SAN resources
- Integrate FCIP tunneling within a B-series framework
- Minimize protocol conversion events
- Deploy a standards-based solution

Benefits

- Simplify management for B-series SANs
- Reduce management, training, and troubleshooting costs (compared to multivendor solutions)
- Extend remote replication and backup functions to longer distances
- Share a platform that will host fabric-based disaster recovery apps
- Help provide a flexible, cost-effective utility computing architecture

Use Case 3: Tape Backup Consolidation

Tape SAN

Disk SANs
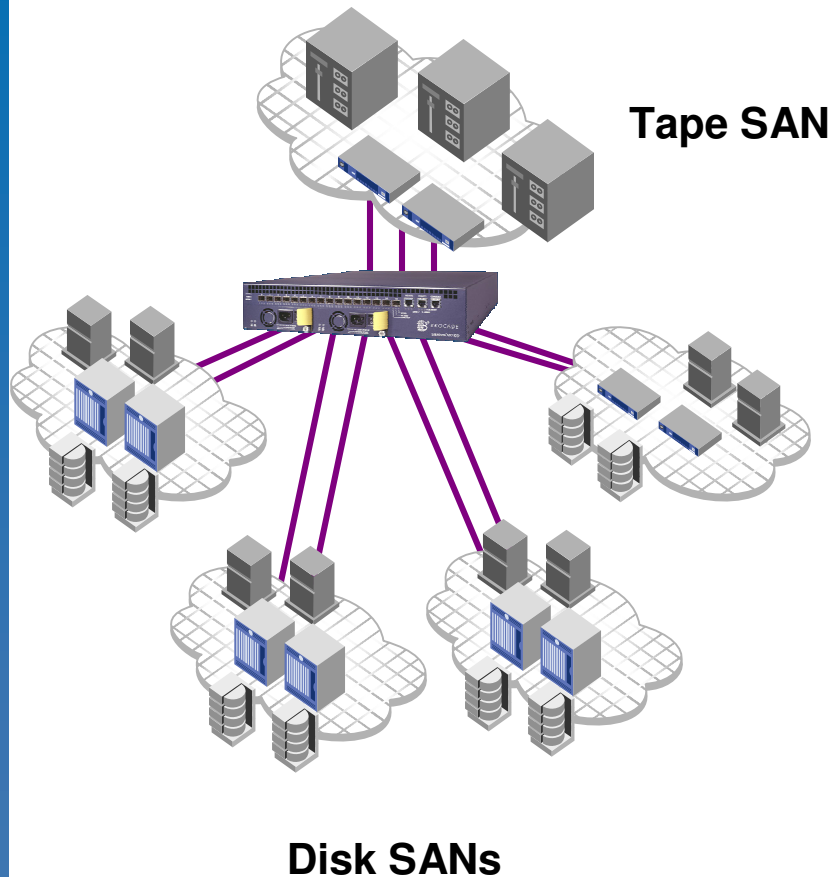
- Share a tape library fabric without merging disk fabrics

- Reduce management overhead and improve the quality of backup functions by independently managing backup fabrics

- Eliminate the need for separate HBAs in every backup server on every fabric

- Increase asset utilization

- Fully integrated with HP EBS solutions

- Targeted for the Fall 2004

Use Case 3: Tape Backup Consolidation

Business Requirement

- Backup resources are scarce and expensive (people, tape libraries, other assets, etc.)
- Cumbersome and time-consuming management of backup environments
- Hard to organize backup function as a low-cost business continuance solution in highly distributed environments
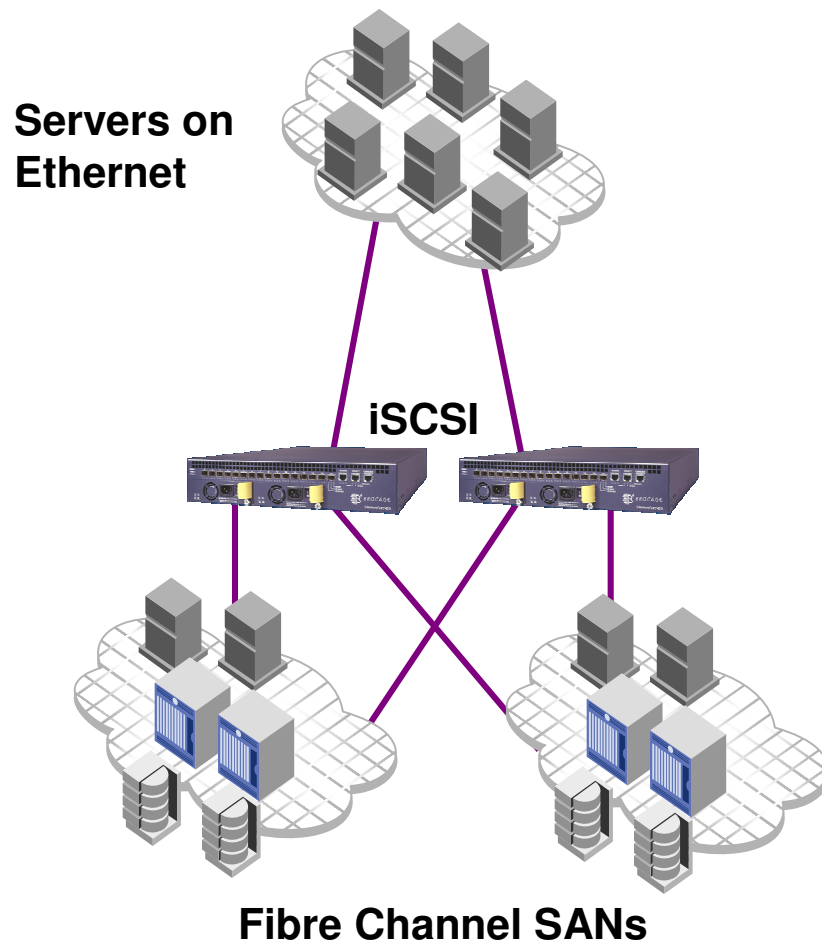
Solution

- Centralize backup of multiple SAN islands in a single location
- Streamline and consolidate backup activities
- Simplify day-to-day management of backup functions
- Organize backup functions to move data between geographies or functions

Benefits

- Maximize the value of backup devices and resources
- Reduce management overhead requirements
- Leverage off-peak network activity
- Organize backup as a low-cost business continuance solution
- Facilitate delivery of a shared backup service in the enterprise
- Improve asset utilization

Use Case 4: iSCSI-to-FC Gateway

Servers on Ethernet

iSCSI

Fibre Channel SANs

- Ability for low-cost servers to access Fibre Channel SAN resources

- Cost-effective solution

- Ease of implementation

- No additional licenses required, product is iSCSI ready

- Target O/S's: HP-UX, Windows, Linux

- Targeted for FYQ105

Solution 4: iSCSI-to-FC Gateway

Business Requirement
- Need for more cost-effective ways to share Fibre Channel resources with low-cost servers
- Create a unified environment to share corporate-wide resources

Solution
- iSCSI-to-Fibre Channel protocol conversion
- Integrated iSCSI for B-series SANs
- Standards-based solution
- Ability for low-cost servers to access Fibre Channel SAN resources

Benefits
- Cost-effective access of Fibre Channel resources for low-cost servers
- Simplified management, integrated with B-series solutions
- Reduced implementation, management, training, and troubleshooting costs
- Leverage corporate Ethernet infrastructure and know-how
- Flexible, cost-effective foundation for a utility computing architecture

Multi-protocol routing products

Market	B-Series SAN	C-Series SAN	M-Series SAN

Enterprise	• MP Router 16-port model:
	  ✓ iSCSI
	  ✓ FCIP
	  ✓ Subnet routing
		• MDS IP 9000 IPS 8-port module:
		  ✓ iSCSI
		  ✓ FCIP
		• V-SAN supported in all switches	

Mid Range	• MP Router 8-port model:
	  ✓iSCSI
	  ✓FCIP
	  ✓Subnet routing
		• V-SAN supported in all switches	

Entry level	• HP IP Storage Router 4-port model:
	  ✓iSCSI/FCIP
		• HP IP Storage Router 4-port model:
		  ✓iSCSI/FCIP
			• HP IP Storage Router 4-port model:
			  ✓iSCSI/FCIP

Third Party Certification Support

| Technology | Prod Line | EVA | CA Extension | | SAN Extension |
			XP	MA/EMA	EVA/MA/EMA/MSA
FCIP	B-series	CNT Cisco SAN Valley HP 2122-2 MP-Router	CNT Inrange HP 2122-2 SAN Valley Cisco MP-Router	CNT Cisco SAN Valley Nishan Lightsand Lucent HP 2122-2	SAN Valley HP 2122-2
	M-series	CNT Cisco SAN Valley HP 2122-2		Lucent SAN Valley HP 2122-2	SAN Valley HP 2122-2
	C-series	Cisco HP 2122-2	Cisco HP 2122-2	Cisco HP 2122-2	

Note:

- For model information, please check the spreadsheet embedded comments
- CA extension involves extending the SAN with HP's business continuity solutions
- Only the Cisco support related to the 7200 & 7400 is included in the third party certification matrix

Third Party Certification Support (Cont'd)

Technology	Prod Line	CA Extension			SAN Extension
		EVA	XP	MA/EMA	EVA/MA/EMA/MSA
SONET	B-series	Akara			
	M-series	Akara			
	C-series				
WDM	B-series	All Products	All Products		All Products
	M-series	All Products	All Products		All Products
	C-series	All Products	All Products		All Products

Notes:

WDM technology has reached a state of maturity such that support for all vendors is possible (see notes for examples)

Multi-Protocol Products Roadmap

iSCSI
FCIP

| 8-port IP Services Module C-Series |
| SR2122-2 with iSCSI/FCIP B-, C-, & M-Series |
| CWDM Solutions C-Series & B-Series |

| MP-Router iSCSI support B-Series | More Good Stuff !! |

Subnet Routing

| Inter-VSANs C-Series | MP-Router Subnet Routing & FCIP Services B-Series | | Good Stuff ! |

| CY Q2 2004 | CY Q3 2004 | CY Q4 2004 | CY 2005 |

Current products

Time

Summary

Multi-protocol integration is a strategic component of the adaptive enterprise

- HP provides leading edge capabilities for local and remote SAN multi-protocol connectivity to serve the needs of enterprise-class customers

- HP product strategy for multi-protocol products focus on 4 areas:
  - NAS/SAN fusion
  - Extension to unite SAN islands via subnet routers
  - Extension to IP networks via routers/gateways
  - Remote SAN extension via translative (FCIP, Sonet) and non-translative transport technologies (LW SFP's, and WDM)

Darwin Architecture

Business Strategy

Business Processes

Application Services

Infrastructure Services

Virtualization

Resources

Infrastructure

Supply

Demand

Storage

Business Level

Service Level

Resource Level

Manage & Control

iSCSI
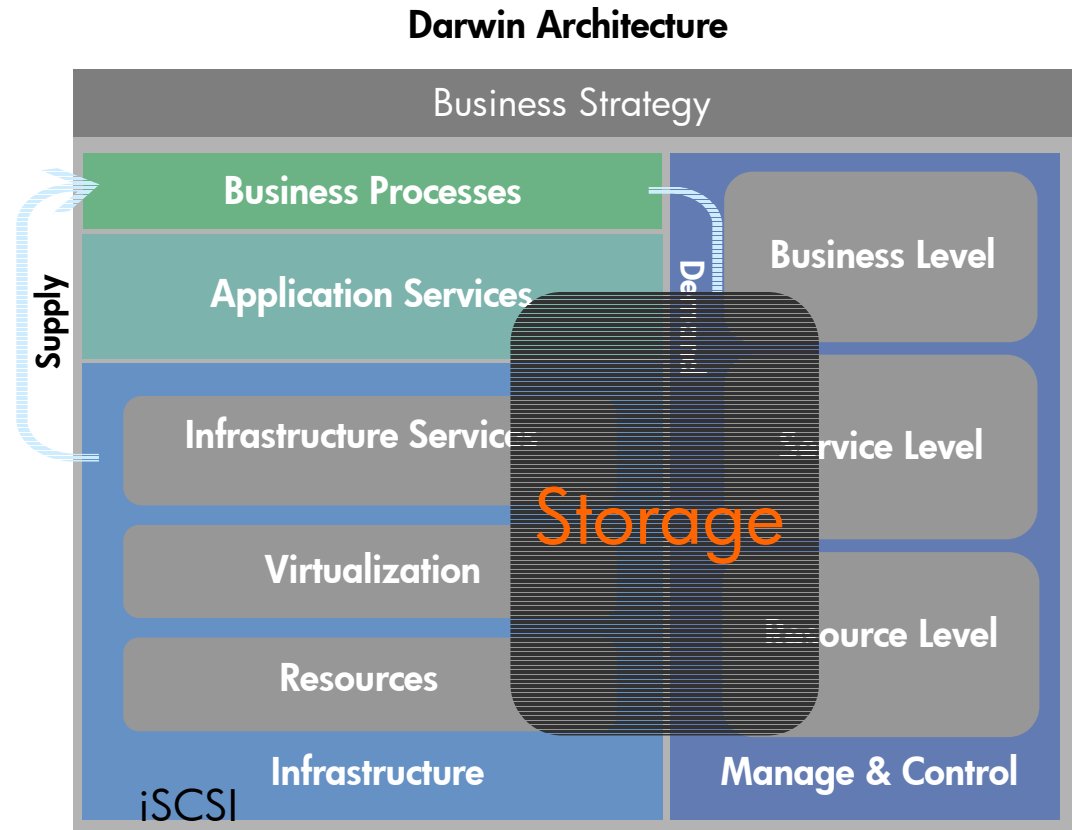
Storage-related capabilities throughout delivered by ENSAextended

For further information

http://www.hp.com/go/storage

http://www.hp.com/go/san

http://www.hp.com/go/sandesig

HP WORLD 2004

Solutions and Technology Conference & Expo

Co-produced by:

interex
shared knowledge • shared power

encompass
AN HP USER GROUP

RECOMMENDED TRAINING VENUE FOR THE
HP Certified Professional