



# Cisco Storage Networking Overview



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# Agenda

- Cisco Service Oriented Data Center
- Storage Evolution
- Cisco Storage Networking: MDS 9000



## Cisco Service-Oriented Data Center



# Industry IT Evolution

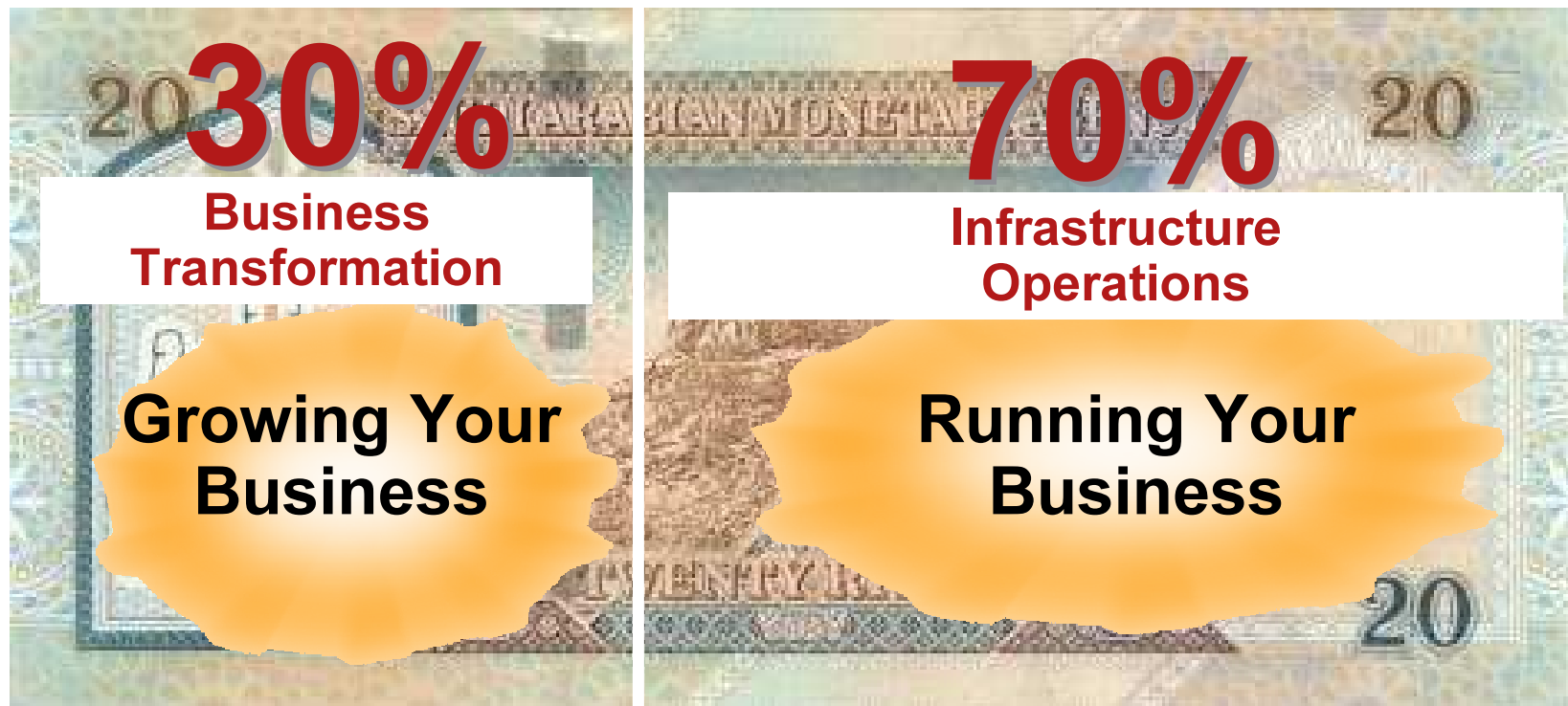
	TODAY	FUTURE
APPLICATIONS	Disconnected applications. Tightly bound business logic.	Modular. Loosely bound logic.
SERVICES	Fragmented. Layer/device-specific.	Shared. Consistent.
STORAGE	Islands. Physical limitations.	Consolidated. Virtual.
NETWORK	Connectivity.	Intelligent.

The industry is shifting to a service-oriented paradigm

- Common, shared application and infrastructure services ...
- Based on protocols and formats ...
- Utilizing policy-based management.

# Tackling Business Challenges Where to Invest?

**70% of the IT Budget for *Maintenance*  
30% Available for *Assets and Innovation\****

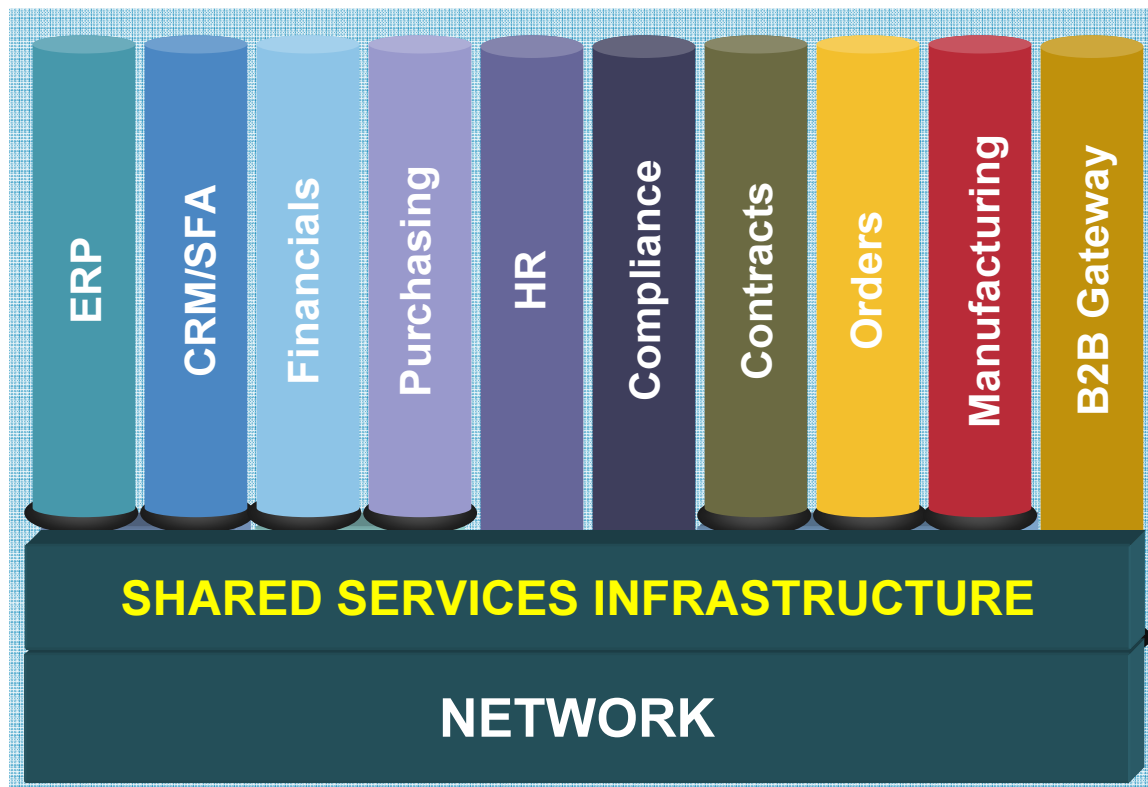


**\*Source: Gartner - IT Infrastructure, And The Shift To “Real-Time” Feb, 2005**

# The Expanding Role of the Network

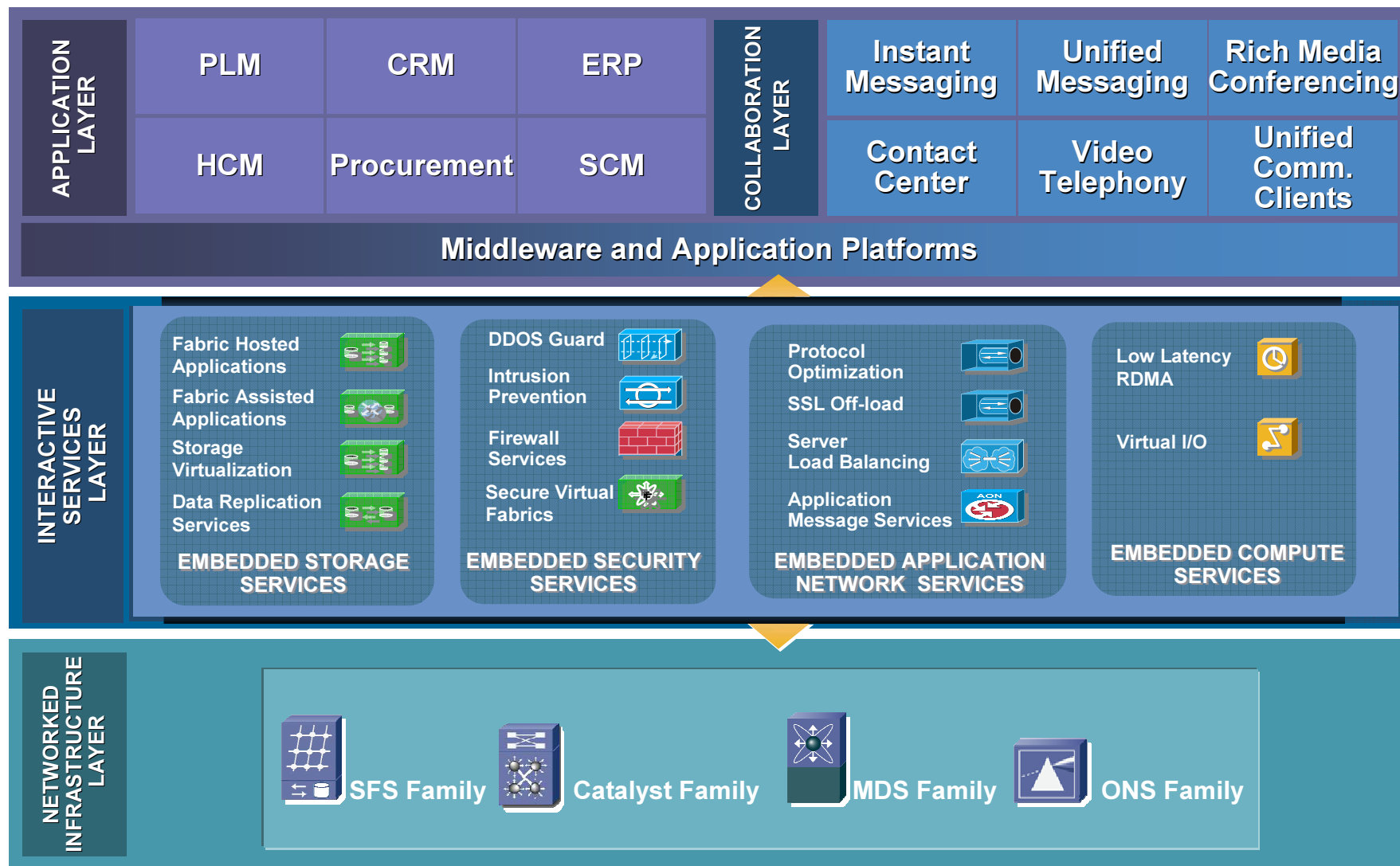
The logical place to begin to build an extended shared services infrastructure.

## TODAY'S INFRASTRUCTURE









- Extensions for
- ~~Common, shared~~ applications not designed for integration application and resource **services** and **protocols**
- Multiple application platforms
- Common, shared, ubiquitous network
- ~~Extend the network's legacy as a~~ virtualization enabler

# The Data Center is a Proof Point for SONA







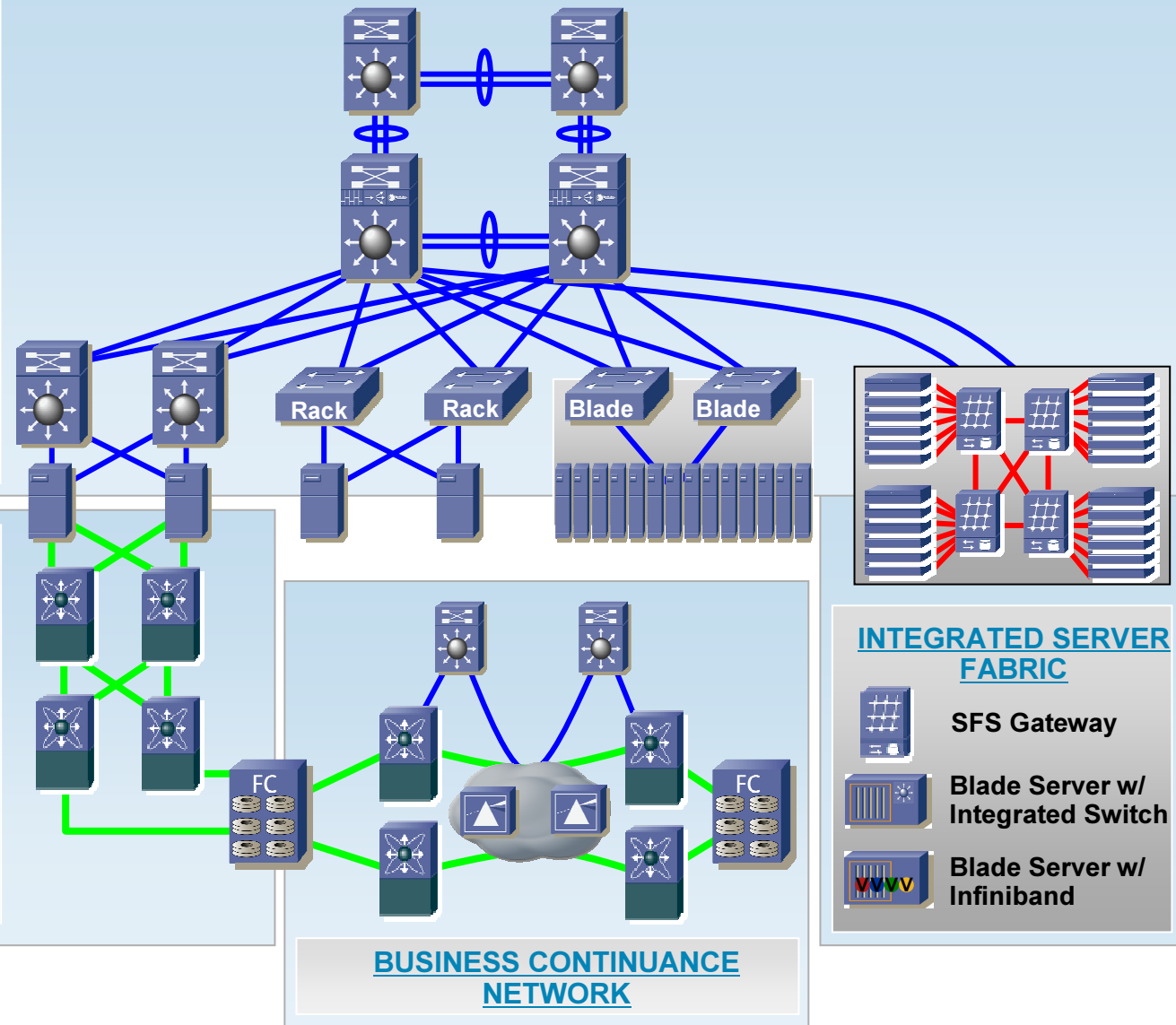
# End to End Data Center Systems/Solutions

## INTEGRATED NETWORK SERVICES




-  Firewall Services
-  Server Load Balancing
-  SSL Off-load
-  Wide-Area Application Acceleration
-  Network Virtualization
-  Virtualized Services

## INTEGRATED STORAGE SERVICES

-  Virtual Fabrics (VSANs)
-  Storage Virtualization
-  Fabric Assisted Applications
-  Data Replication Services



## INTEGRATED SERVER FABRIC

-  SFS Gateway
-  Blade Server w/ Integrated Switch
-  Blade Server w/ Infiniband

## BUSINESS CONTINUANCE NETWORK



# Data Center Network Strategy and Evolution

## Consolidation



Scale  
Performance  
Density  
Availability  
Operational  
Manageability  
Investment  
Protection

## Virtualization



- Immediate Power Savings
- Service Velocity
- Opex Alignment
- Capital Asset Utilization Improvement

## Integration



- Single Unified Network Fabric
- Real-Time Provisioning Capabilities
- Data Center Class Platforms
- Integrated Services

## Automation



- Net-Centric Server Evolution
- Virtual Machine Integration
- Inline Data Protection
- Separation of Policy and Forwarding



# Storage Evolution



# Drivers and Trends of Worldwide Storage

- **Current Buying Trends for Storage Networking**

- Disaster Recovery;

- Regulatory Compliance (Sarbanes Oxley, Basel II)

- SAN Consolidation

- High availability, security, reliability

- Centralization of Data

- **Current data storage trend not sustainable**

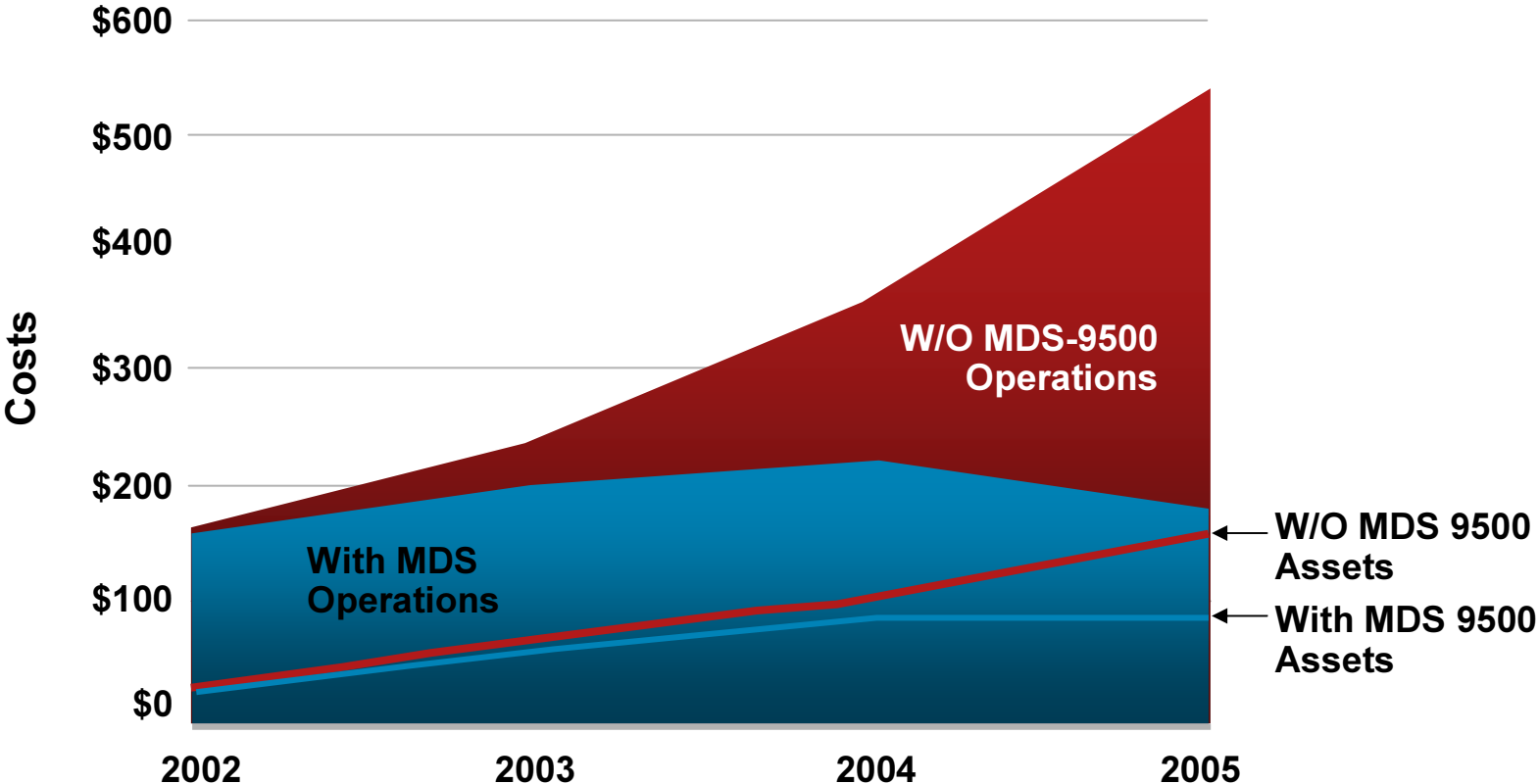
- Annual capacity increase consistently at 50–60%

- Spiraling costs (avg. 35% of some IT budgets)

- We are just seeing the start of information explosion  
(video growth means extreme storage needs)

# Storage Consolidation—Reduced Cost

Cisco-on-Cisco—Increasing Storage Effectiveness



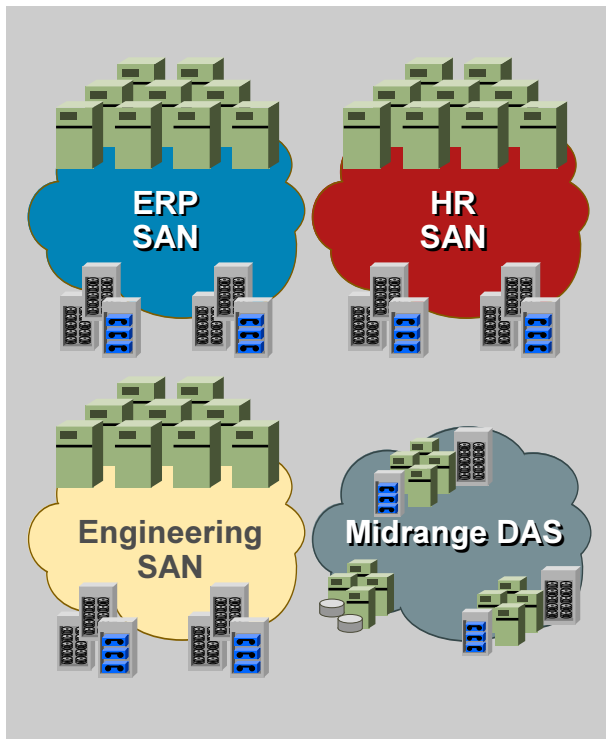
Based on 20c/MB TCO—Gartner

# Evolution to Multilayer Storage Utility Model

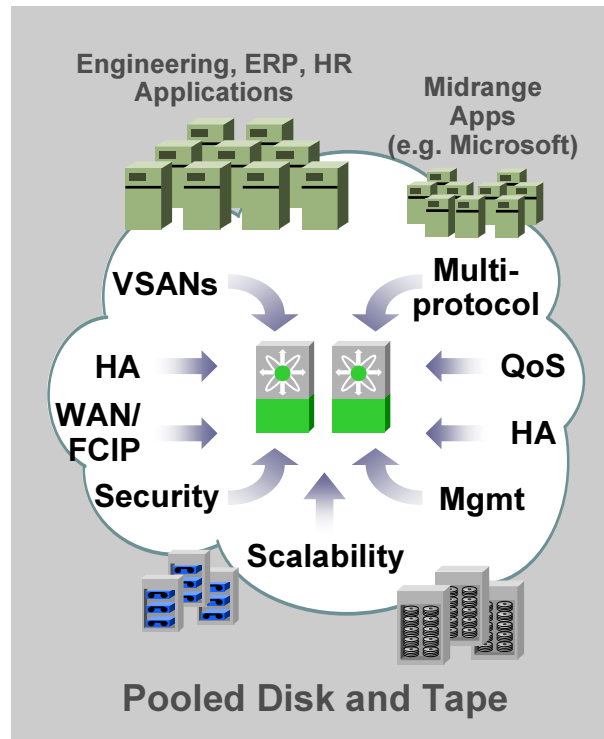
Homogenous  
"SAN Islands"

Multilayer  
Storage Network

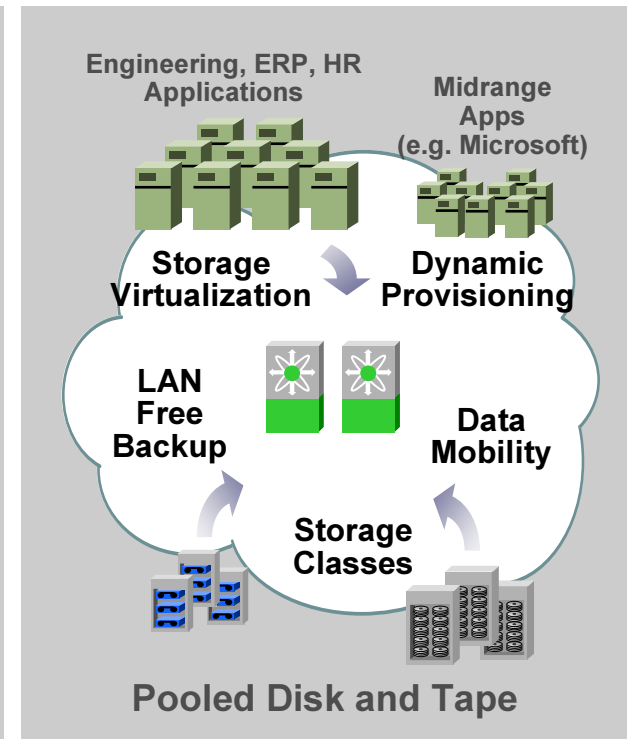
Multilayer  
Storage Utility



Isolated SANs and  
Mid-range DAS



High-end and Mid-range  
Consolidation



Network Hosted Storage  
Applications

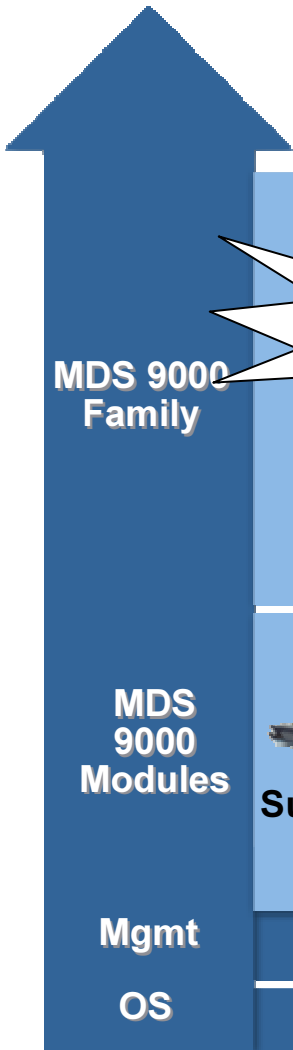


# Cisco MDS 9000

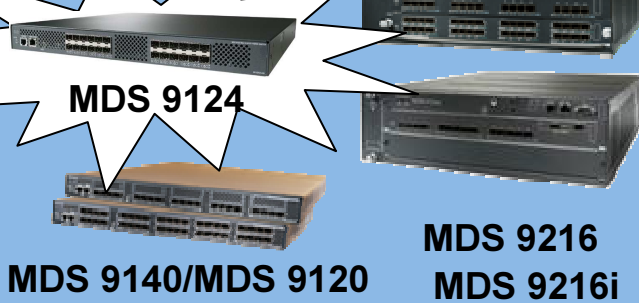


# Cisco MDS Storage Networking Products

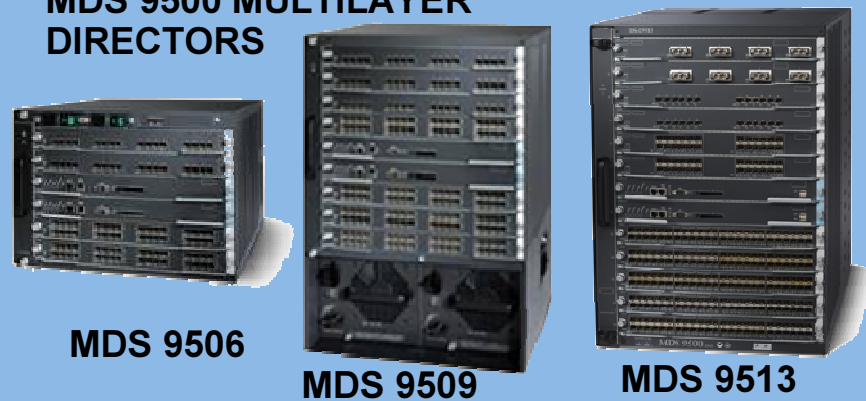
INDUSTRY LEADING INVESTMENT PROTECTION ACROSS A COMPREHENSIVE PRODUCT LINE



## MULTILAYER FABRIC SWITCHES

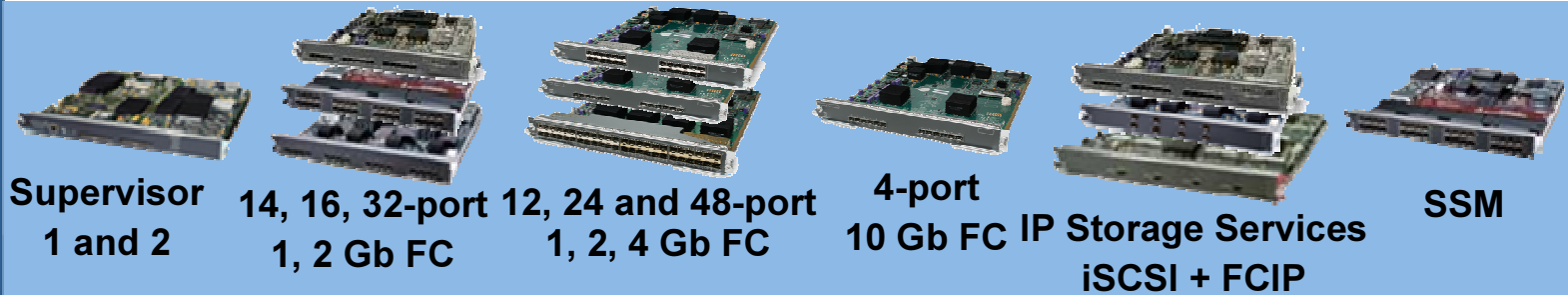


## MDS 9500 MULTILAYER DIRECTORS



MDS 9000 Family

MDS 9000 Modules



Mgmt  
OS

CISCO FABRIC MANAGER

Cisco SAN-OS

# Extensible Architecture for Ease of Migration

## Existing Switching Blades

*(1–2 Gb Fibre Channel and IP)*



16 or 32 2 Gb  
Fibre Channel ports



14 2 Gb Fibre  
Channel ports and  
two IP ports



Storage Services  
Module

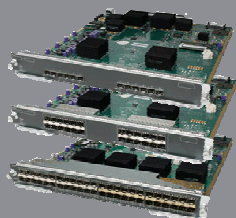


Four IP ports



Eight IP ports

**Switching modules are forward- and backward-compatible  
Common operating system with consistent features**



12, 24, or 48 4 Gb  
Fibre Channel ports



Four to 10 Gb  
Fibre Channel ports

## New Switching Modules

*(1, 2, 4–10 Gb Fibre Channel)*

## MDS 9200 Series Switches

Now  
64 ports



MDS 9216A

Now  
64 ports



MDS 9216i

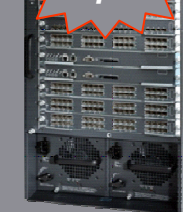
## MDS-9500 Series Directors

Now  
192 ports



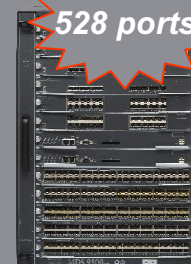
MDS-9506

Now  
336 ports



MDS-9509

528 ports

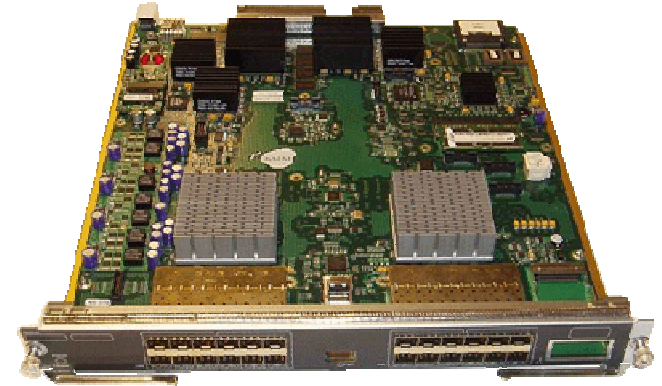


MDS-9513



# MDS Fibre Channel Blades

- **12-port 1, 2, 4 Gb/s Fibre Channel blade**  
Full-rate 4 Gb/s performance for ISLs and highest-performance server and tape applications
- **24-port 1, 2, 4 Gb/s Fibre Channel blade**  
Shared-bandwidth 4 Gb/s and full-rate 2 Gb/s performance for enterprise storage connect and high-performance server applications
- **48-port 1, 2, 4 Gb/s Fibre Channel blade**  
Shared-bandwidth 2 Gb/s performance for mainstream server applications
- **Four-port 10 Gb/s Fibre Channel blade**  
Full-rate 10 Gb/s performance for ISL consolidation and high-bandwidth metro connect

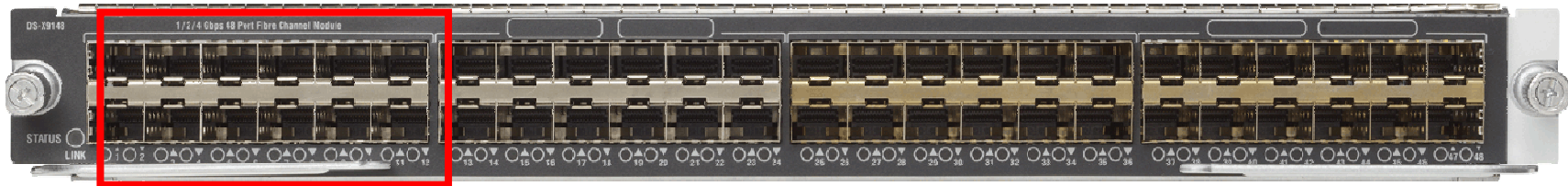


## ***Maximum subscription ratio with all ports active***

	<b>1 Gb/s</b>	<b>2 Gb/s</b>	<b>4 Gb/s</b>	<b>10 Gb/s</b>
<b>12-port</b>	1:1	1:1	1:1	NA
<b>24-port</b>	1:1	1:1	2:1	NA
<b>48-port</b>	1:1	2:1	4:1	NA
<b>4-port</b>	NA	NA	NA	1:1

# Port-Bandwidth Reservation

## 48-port Blade



Port group

- Enables bandwidth to be dedicated to individual ports in each port group

# MDS 9124 Fabric Switch



The MDS 9124 is a new breed of **1RU fabric switch**:

- Enterprise-class features

- Easy to configure and use

- Flexible and scalable configuration

- Affordable price

24 full-rate 4-Gbps FC interfaces

Supports SAN-OS Release 3.1(1)

# On-Demand Port Activation

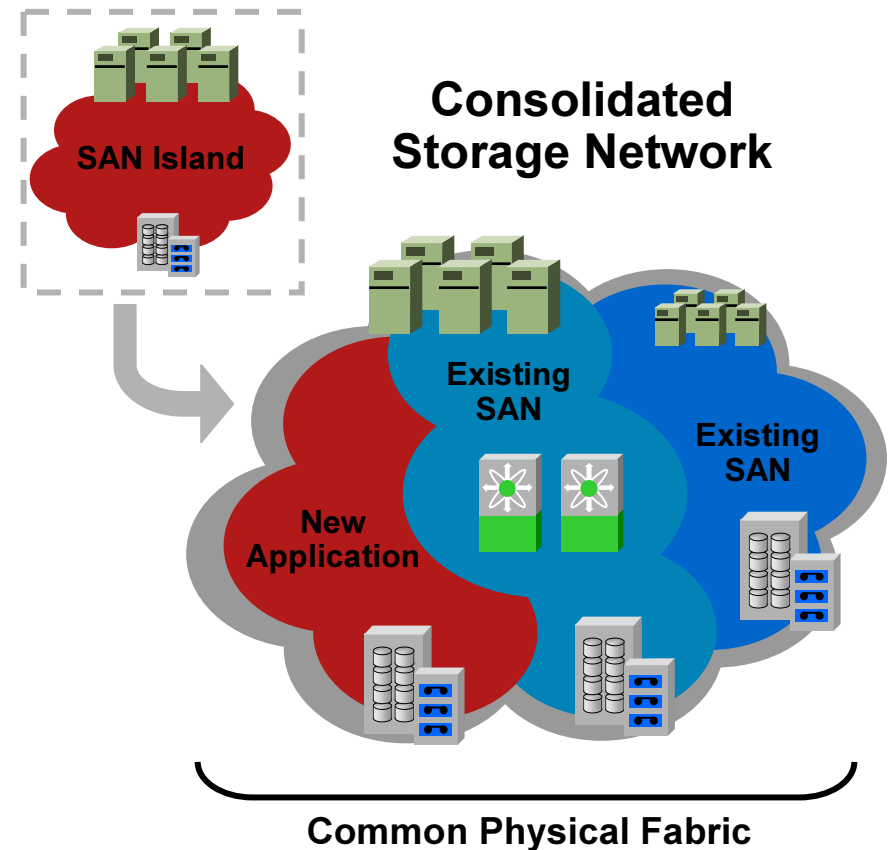
- On demand port activation—Pay as you grow  
8, 16, and 24-port configurations to optimize price and growth



- The base configuration → enables **ports 1-8**
- Installing 8-port activation license → enables **ports 9-16**
- Installing 8-port activation license → enables **ports 17-24**
- Base configuration will have 8 ports active with a single power supply

# Consolidation Using Cisco's Virtual SAN (VSAN) Technology

- Virtual fabrics support the need to consolidate numerous SAN islands
- Fabrics can be migrated from physical to virtual implementations
- New fabrics are provisioned through switch commands, not physical adds, moves, changes
- Fabrics provide basis for shared network-based storage services



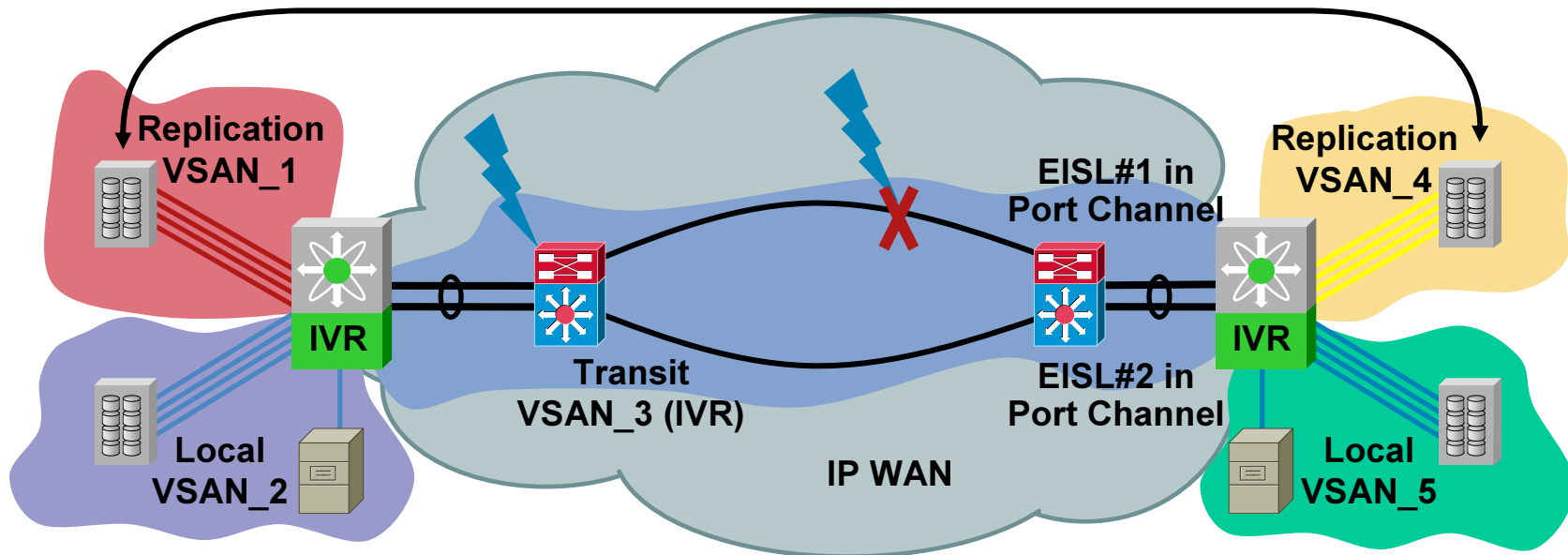
# Virtual SANs—Cisco MDS 9000 Family

- Each port on the MDS 9000 Family exists in a VSAN
- Up to 256 VSANs in a single switch (hardware can support up to 4095)
- Logical configuration to move a port from one fabric to another



# InterVSAN Routing (IVR)

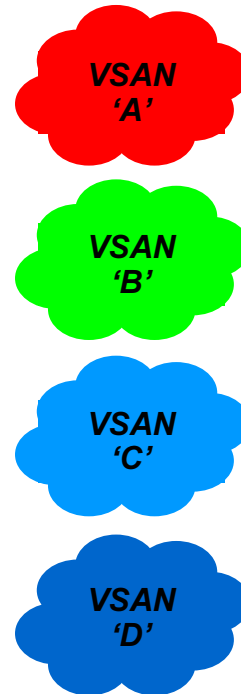
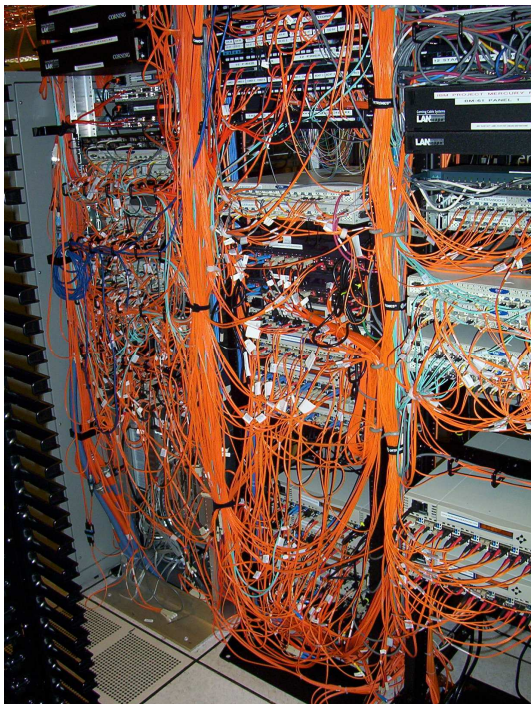
## Inter-VSAN Connection Between Completely Isolated Fabrics



- Allows sharing of centralized storage services (such as tape libraries and disks) across VSANs—without merging separate fabrics (VSANs)
- Enables devices in different VSANs to communicate
- Enable replication while preventing local devices or VSANs from traversing WAN

# SAN Consolidation with Virtual SANs

Migrating storage infrastructure from several SAN islands to a consolidated MDS 9000-based SAN designed for availability, recoverability, and growth

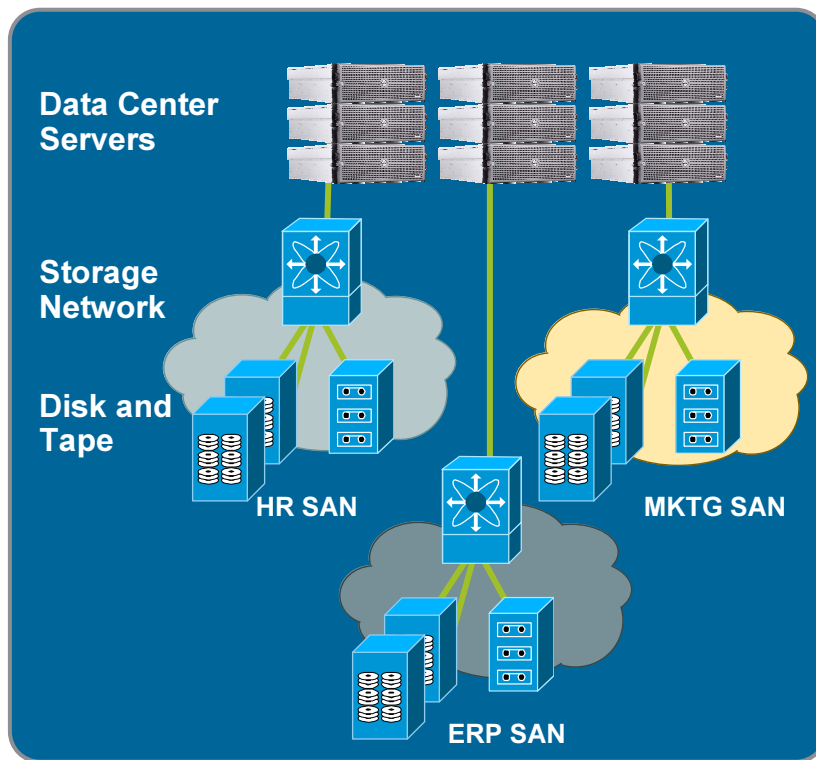




# Data Center Storage Evolution

## SAN Consolidation

Virtualized Data Center



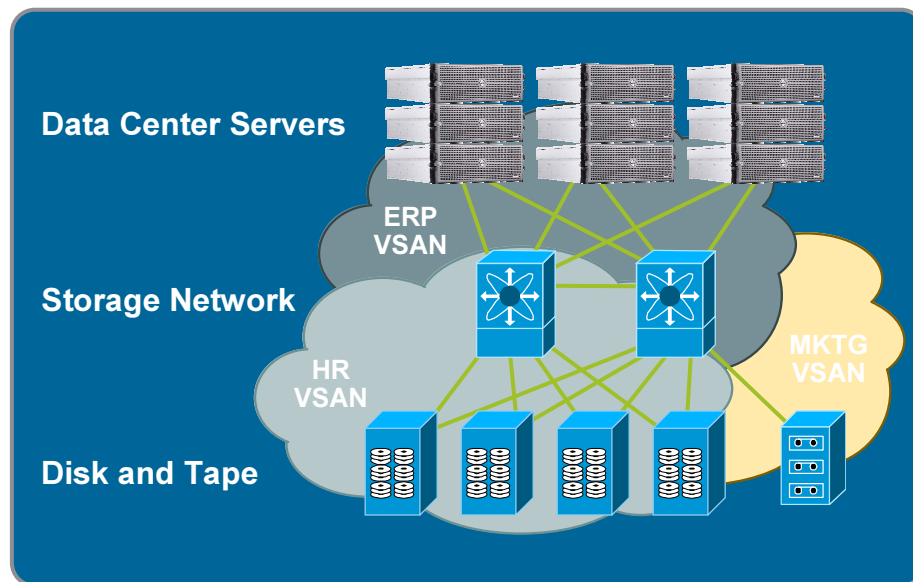
2004 and Ongoing

- As Storage Networks allowed increased disk utilization they started appearing all over the data center
- Storage networks grew into 'islands' predicated on the size of the storage switches available at the time
- Cisco released the MDS9500 with Virtual SANs (VSANs) which allowed the consolidation and virtualization of SAN islands into a large common resource pool

# Data Center Storage Evolution

## SAN Virtualization

Virtualized Data Center

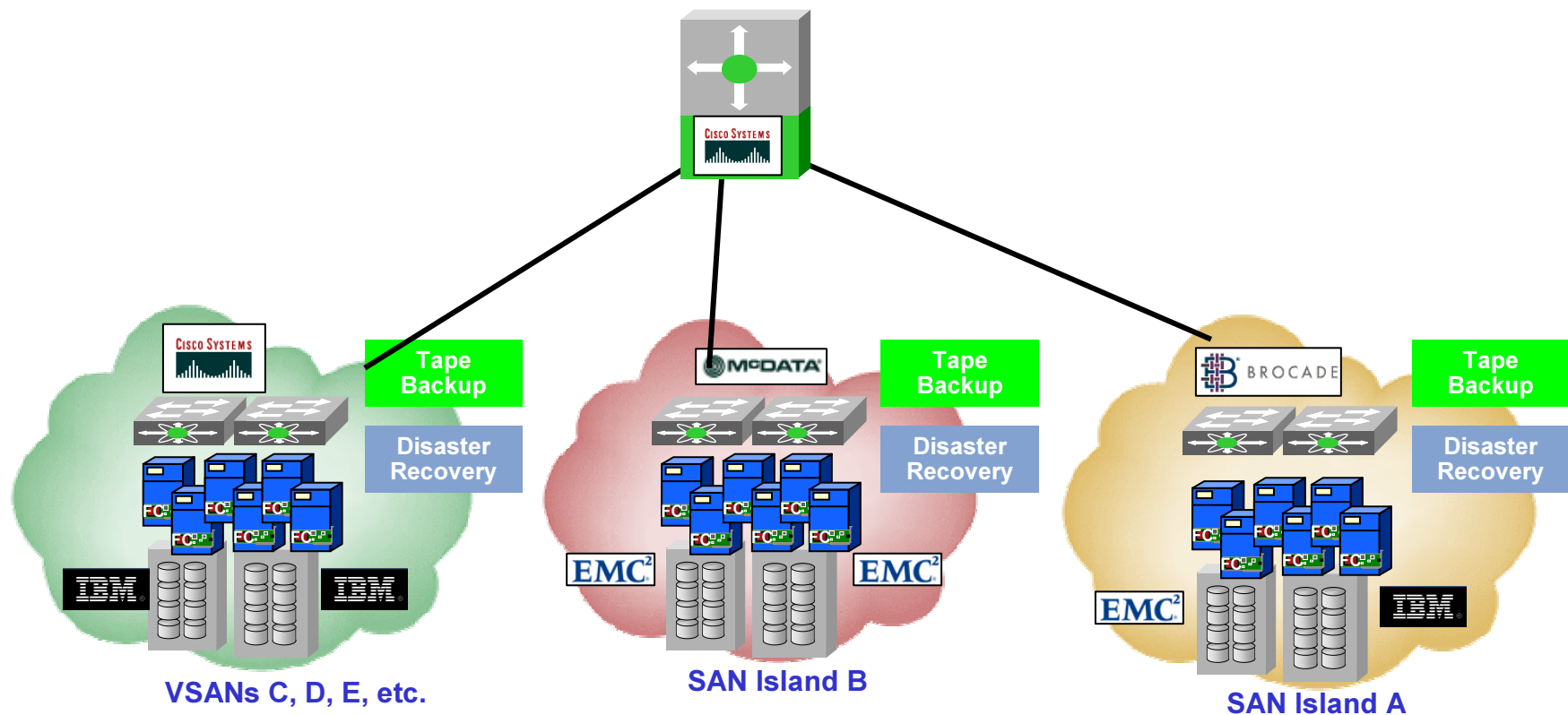


2004 and Ongoing

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- Cisco released the MDS9500 with Virtual SANs (VSANs) which allowed the consolidation and virtualization of SAN islands into a large common resource pool
- This drove storage utilization to ~70%

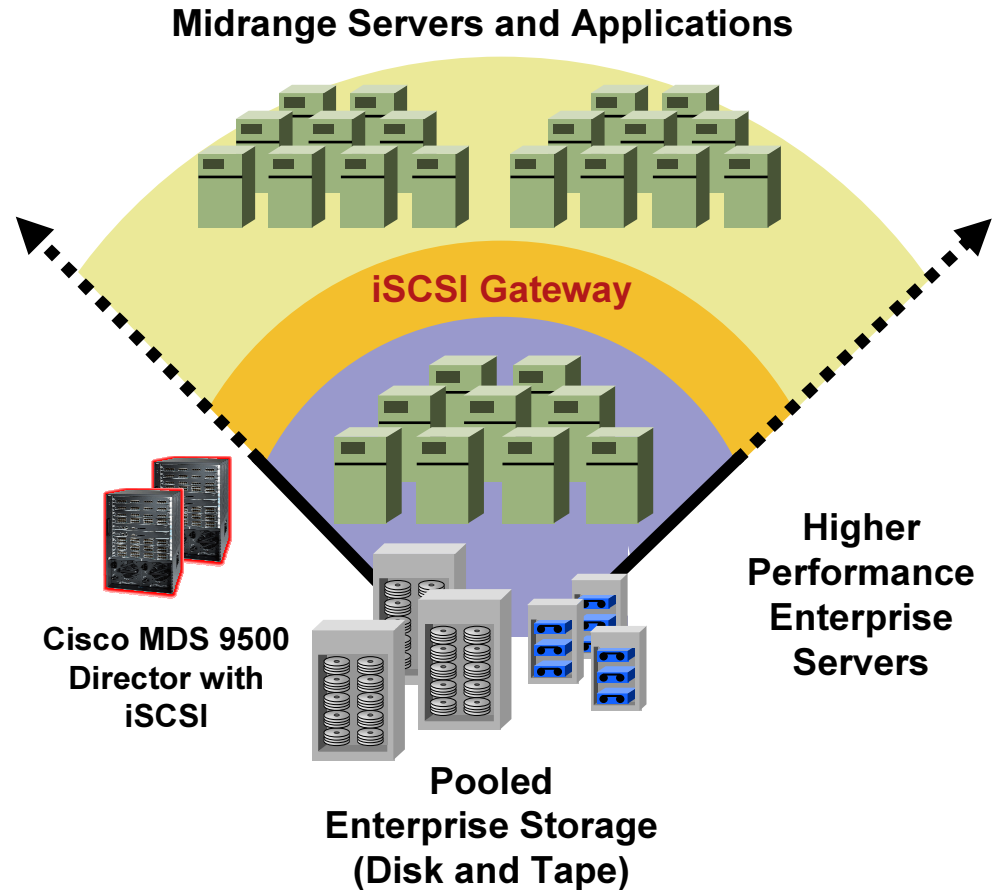
# Infrastructure Simplification: Supporting Heterogeneous SANs with Cisco SAN Fabrics

- Multi-vendor SANs interconnect via Cisco MDS 9000 Family
- Scales beyond physical ports with Cisco integrated routing (IVR)
- Lowers TCO for Customers



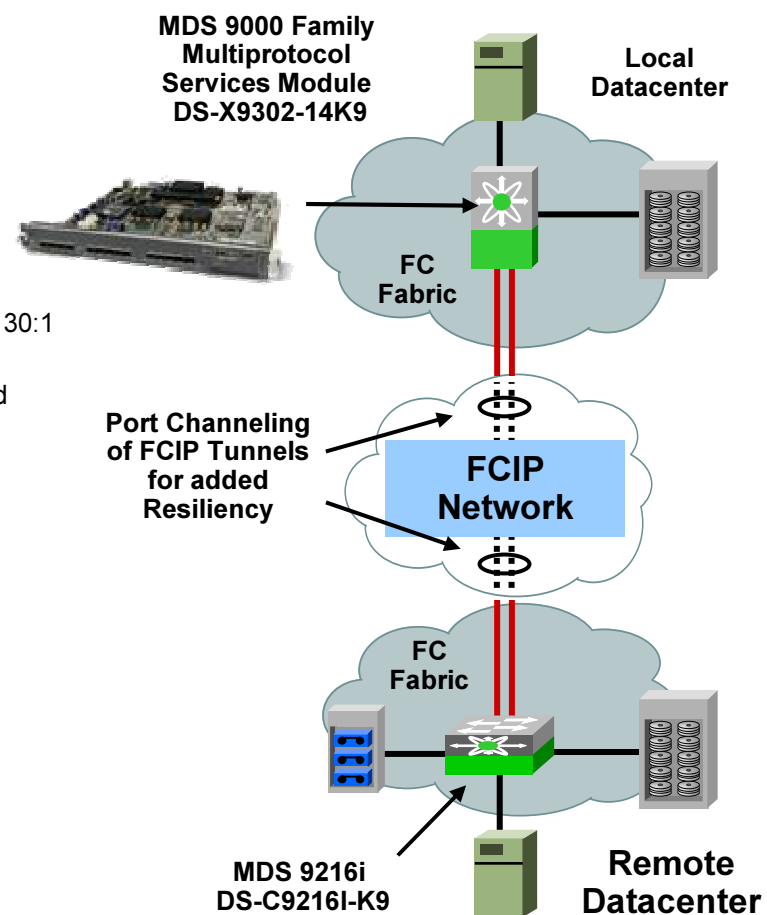
# Integrated iSCSI Support- Driving Further Storage Consolidation and cost relief

- iSCSI enables further consolidation of midrange  
Migration from DAS
- Lower cost expansion of SAN  
more inline with midrange costs
- Connect at both 1Gb and 100Mb speeds
- Leverage pooled storage across entire enterprise
- Full-service **Ethernet SAN**
  - Host-based multi-pathing
  - Fabric-based multi-pathing
  - Host-based replication
  - Enhanced fabric security
  - Traffic accounting
  - IP and SCSI-based diagnostics



# Integrated SAN Extension- Lowering the cost of Business Continuance

- FCIP compression with IP storage services module
  - Hardware-based compression for high b/w performance
  - Optimized algorithms for maximum low b/w efficiency
- Integrated IP-sec encryption
  - Line-rate encryption at GE speeds
  - Dedicated to GE ports
- Compression performance\*
  - Low-speed WAN links—Up to 70 Mbps application throughput per GigE port and 30:1 compression ratio
  - High-speed WAN links—Up to 1.5 Gbps application throughput per GigE port and 10:1 compression ratio
- Integrated CWDM
  - Order of magnitude cost reduction vs. DWDM
  - Simplified management



# MDS 9000 Storage Services Module

- High performance virtualization engine
- Flexible architecture
- SSM Features
  - 32 x 2Gbps FC ports
  - FC Write Acceleration
  - Network-assisted backup
  - SANTap functionality
  - Partner Application hosting

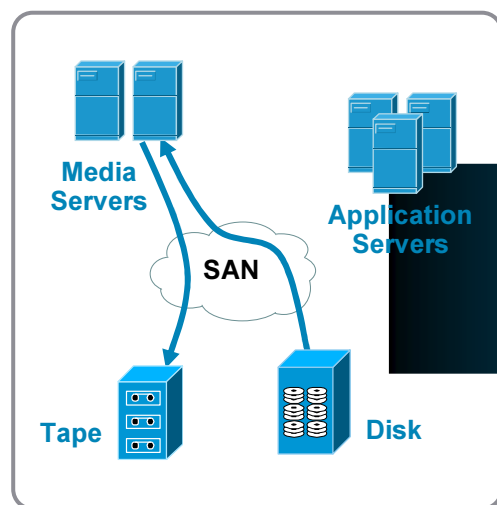


Storage Services Module

# “Network-Assisted” Storage Applications

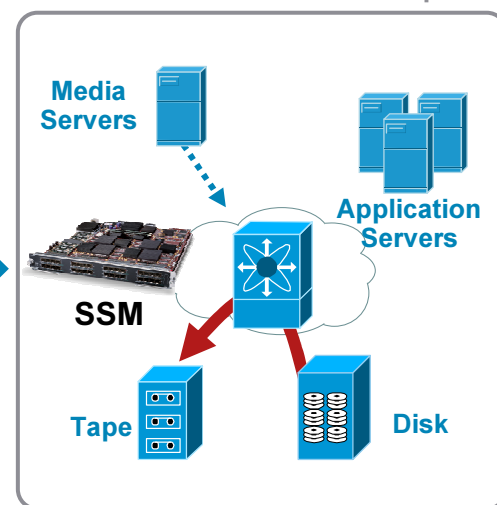
## Serverless Backup

Serverless Backup—Today



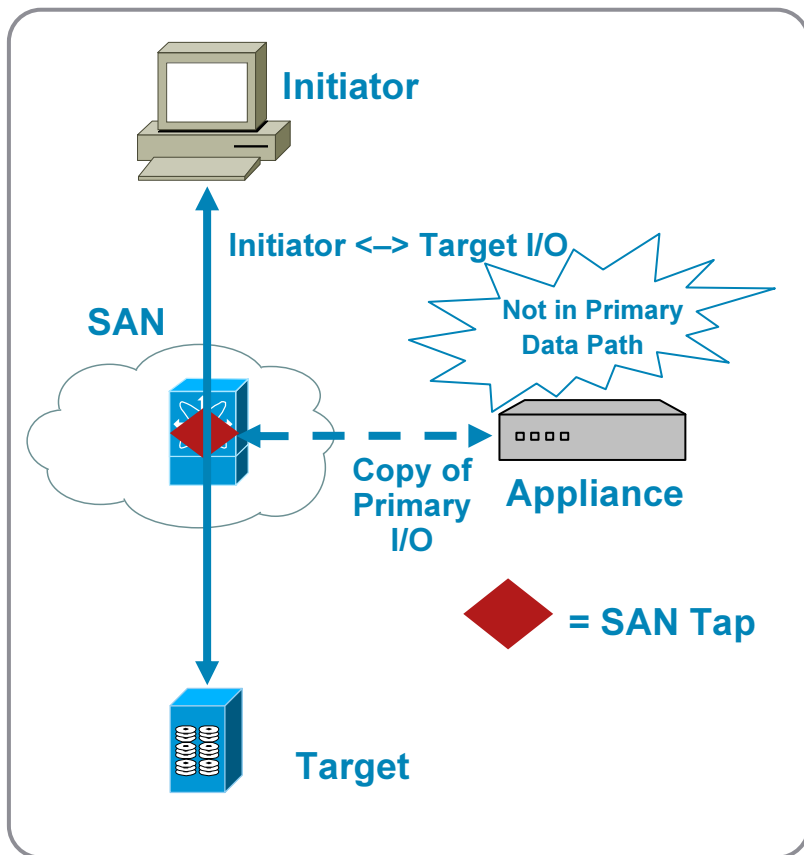
Instead of Media Servers,  
MDS (with SSM) Moves  
Data from Disk to Tape

“Network-Assisted”  
Serverless Backup



Customer Benefit	Benefit Description
Lower TCO	<ul style="list-style-type: none"> <li>Offload I/O and CPU work from Media Servers to SSM</li> <li>Reduce server admin and mgmt tasks</li> </ul>
Higher Performance and Reliability	<ul style="list-style-type: none"> <li>Each SSM delivers up to 16 Gbps throughput</li> <li>SSM integrated in a HA MDS platform</li> </ul>
Investment Protection	<ul style="list-style-type: none"> <li>No changes to existing backup environment</li> <li>SSM Data Movement can be enabled w/ software</li> </ul>

# Cisco MDS SAN Tap

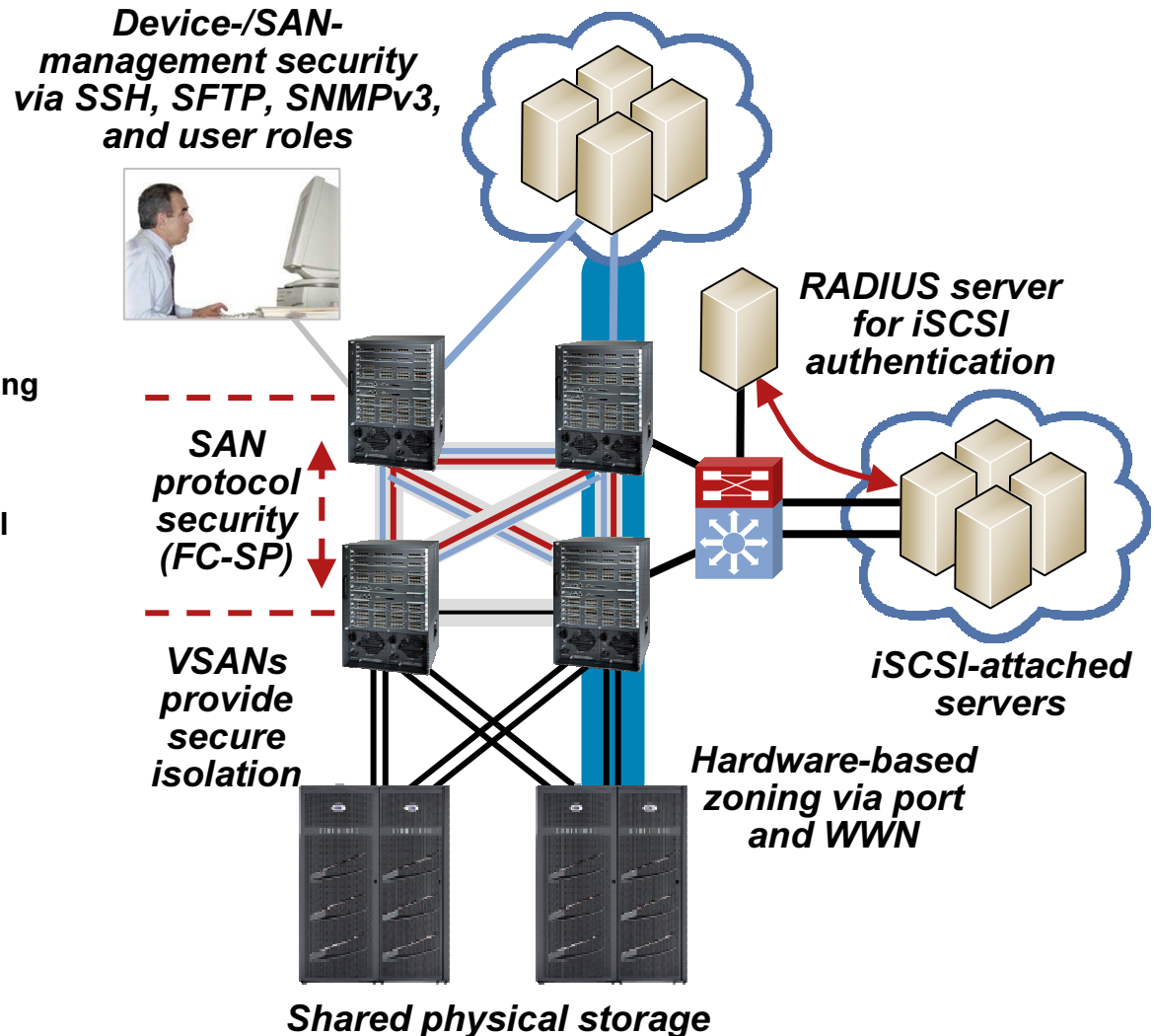


- SAN Tap is a protocol between an MDS switch and a storage application appliance
- SAN Tap allows storage application appliances to get a copy of the I/Os between the servers and storage
- SAN Tap enables storage application appliances without impacting primary I/O
- Appliance does not reside in primary data path



# Intelligent SAN Security

- **Secure SAN management via role-based access**
  - 64 customizable roles
  - Roles apply to command-line interface (CLI), SNMP, and Web access
  - Full accounting support
- **Secure-management protocols, including Secure Shell, SFTP, and SNMPv3**
- **Secure switch-control protocols, leveraging IPsec ESP to yield FC-SP**
- **Port and Worldwide Name (WWN) Zoning**
- **Full RADIUS support for switch and iSCSI host authentication**



# Diagnostic & Troubleshooting Tools: Minimize Downtime and Improve Performance

- Cisco Fabric Analyzer

Decode and analyze Fibre Channel and SCSI protocols and send to workstation over IP

- (R)SPAN

Provides the ability to intelligently capture traffic

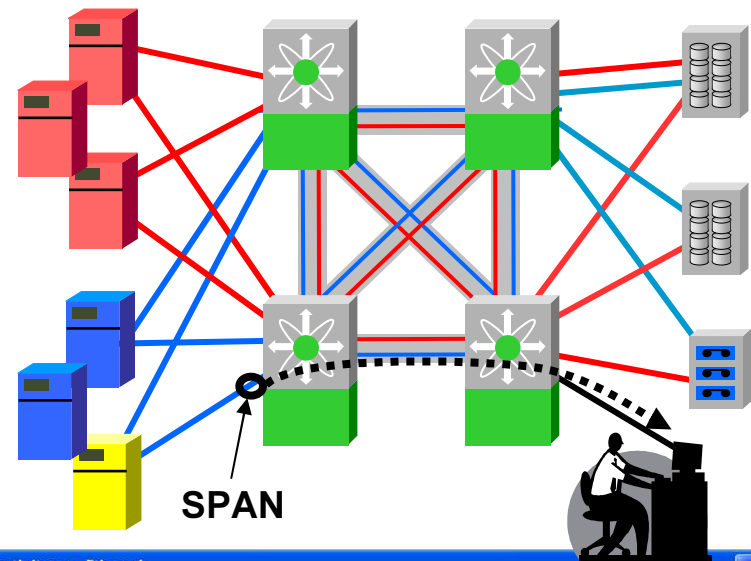
- FC Traceroute

Check reachability & logs timestamps of each hop

- FC Ping

- Full IOS-like debugging

- Switch-integrated Call Home



The screenshot shows a network capture tool interface with a table of captured frames. The table has columns for No., Time, Source, Destination, Protocol, and Info. Below the table, there is a detailed view of a selected frame (Frame 1) showing its structure: Ethernet II, Vegas (FC, soFf/EOFn), and Fibre Channel. The Fibre Channel section includes R\_CTL, Dest. Addr, CS\_CTL, and Src. Addr.

No.	Time	Source	Destination	Protocol	Info
1	0.000000	ff:ff:fd	ff:ff:fd	SW_ILS	EFP
2	0.000000	ff:ff:fd	ff:ff:fd	FC	Link Ctl, ACK1
3	1.000001	ff:ff:fd	ff:ff:fd	SW_ILS	SW_ACC (EFP)
4	2.000002	ff:ff:fd	ff:ff:fd	FC	Link Ctl, ACK1
5	3.000003	ff:ff:fd	ff:ff:fd	SW_ILS	EFP
6	4.000004	ff:ff:fd	ff:ff:fd	FC	Link Ctl, ACK1
7	5.000005	ff:ff:fd	ff:ff:fd	SW_ILS	SW_ACC (EFP)
8	6.000006	ff:ff:fd	ff:ff:fd	FC	Link Ctl, ACK1
9	7.000007	ff:ff:fd	ff:ff:fd	SW_ILS	Build Fabric
10	8.000008	ff:ff:fd	ff:ff:fd	FC	Link Ctl, ACK1
11	9.000009	ff:ff:fd	ff:ff:fd	SW_ILS	SW_ACC (Build Fabric)
12	10.000010	ff:ff:fd	ff:ff:fd	FC	Link Ctl, ACK1
13	11.000011	ff:ff:fd	ff:ff:fd	SW_ILS	FSPF: Hello
14	12.000012	ff:ff:fd	ff:ff:fd	FC	Link Ctl, ACK1
15	13.000013	ff:ff:fd	ff:ff:fd	SW_ILS	FSPF: Hello
16	14.000014	ff:ff:fd	ff:ff:fd	FC	Link Ctl, ACK1

Frame 1 (170 on wire, 170 captured)

- Ethernet II
- Vegas (FC, soFf/EOFn)
- Fibre Channel
  - R\_CTL: 0x02
  - Dest. Addr: ff:ff:fd
  - CS\_CTL: 0x00
  - Src. Addr: ff:ff:fd

0000 01 01 01 01 01 01 02 02 02 02 02 02 fc fc 00 08  
 0010 00 8a 00 0a ac 01 00 00 00 00 00 00 00 02 ff  
 0020 ff fd 00 ff ff fd 22 29 00 00 8a 00 00 00 03 bc

# MDS Fabric Manager

## Simplifies Management of Multiple Switches and Fabrics

- Switch-embedded, Java-based application
- Discovery and topology mapping
- Multiple views:
  - Fabric View
  - Summary View
  - Physical View
- Configuration
- Monitoring and alerts
- Network diagnostics
- Security:
  - SNMPv3
  - SSH
  - RBAC

The screenshot displays the CiscoWorks Fabric Manager interface. The main window is titled 'CiscoWorks Fabric Manager' and shows a tree view on the left with categories like Physical, Interface, Port Channels, ISLs, EdgeLinks, PortErrors, All, Fabric, Vsans, Name Server, RSCN, Timers, Domain Manager, WWN Manager, Routing, FSPF, Zone Server, Defaults, and Stats. The 'Configuration' folder is selected. The main area shows the 'Zone Manager' for VSAN0001, listing ZoneSets (April, Marketing, Sales, IT\_Services, July, Expansion\_Proposal, ZoneSet5) and Zones (ZoneA, Marketing, FcId0x125476, Lun:0x02:00). Below this is a 'Map' view showing a network topology.

Overlaid on the main window are two other windows. The 'Fabric Manager-Physical View' shows a physical view of the fabric with a grid of ports and their status (E, F, FU, F). The 'Fabric Manager-Summary View' shows a summary of the fabric's performance and configuration. It includes a 'Physical Summary' tab with a 'Poll Interval' of 'None', a 'Scale' of '50%', and 'CPU %: 64', 'Flash %: 10', and 'Memory %: 58'. Below this is a table of 'xEPorts (Inter Switch Links)' with columns for Port, Mode, Channel, Speed, VSAN(s), Neighbor WWN, Neighbor Name, Rx Utilization%, Tx Utilization%, Errors, and Discards.

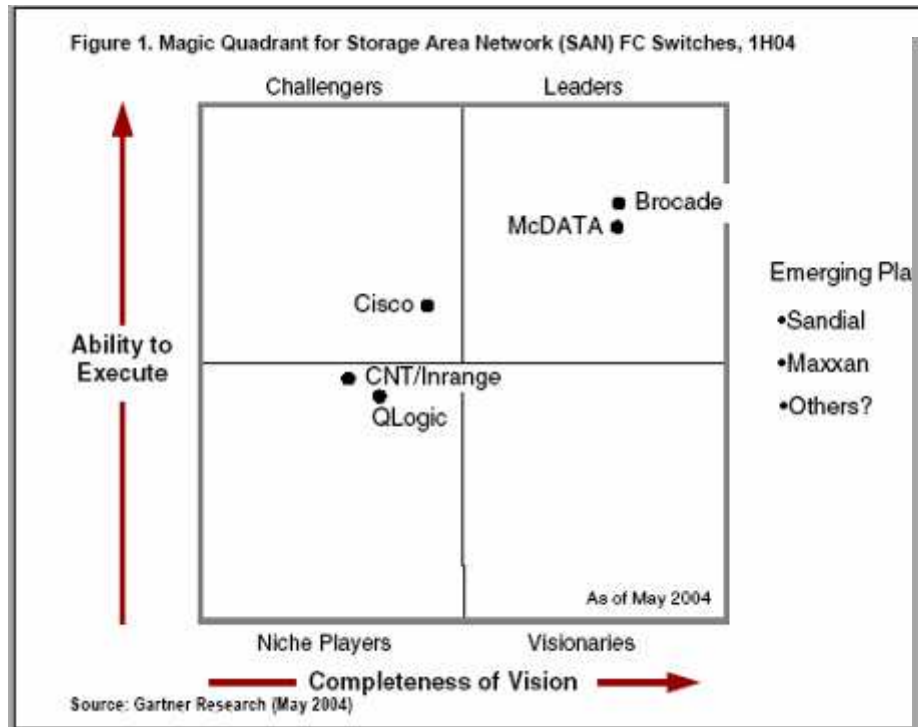
Port	Mode	Channel	Speed	VSAN(s)	Neighbor WWN	Neighbor Name	Rx Utilization%	Tx Utilization%	Errors	Discards
9/1	E		1Gbps	1	10:00:00:00:88:00:00:00		98	68	1,444	722
3/3	E		1Gbps	1	10:00:00:10:9b:00:00:00		90	85	1,524	762
4/1	E		1Gbps	1	10:00:00:10:9b:00:00:00		90	2	1,462	731
1/3	E		1Gbps	1	10:00:00:c0:dd:00:00:00		86	49	1,434	717
1/1	E		1Gbps	1	10:00:00:10:9b:00:00:00		85	60	1,586	793
9/3	E		1Gbps	1	10:00:00:10:9b:00:00:00		70	18	1,468	734
3/1	E		1Gbps	1	10:00:00:00:88:00:00:00		67	67	1,512	756
3/2	E		1Gbps	1	10:00:00:c0:dd:00:00:00		57	31	1,494	747
8/1	E		1Gbps	1	10:00:00:c0:dd:00:00:00		55	61	1,566	783
8/3	E		1Gbps	1	10:00:00:00:88:00:00:00		52	91	1,570	785
7/1	E		1Gbps	1	10:00:00:10:9b:00:00:00		49	52	1,544	772
7/2	E		1Gbps	1	10:00:00:00:88:00:00:00		46	50	1,492	746
7/3	E		1Gbps	1	10:00:00:c0:dd:00:00:00		44	0	1,482	741
2/3	E		1Gbps	1	10:00:00:00:88:00:00:00		38	1	1,496	748

# Cisco Storage Networking Delivers Innovation Leadership

- **Virtual SAN (VSAN)** to enable scalable SAN design, growth, and consolidation of storage and network resources—provides fault and management isolation
- **Integrated InterVSAN Routing** enables sharing of common resources across VSANs—routing is integrated in hardware, eliminating expense and mgt of separate routing devices
- **Integrated multi-protocol support** including Fibre Channel, iSCSI, and FICON for flexible, lowest-cost connectivity options within the data center
- **Integrated SAN extension** via FCIP and CWDM for cost effective business continuity
- **Integrated compression and encryption** reduces leased line charges and provides secure SAN extension without the cost and management of separate encryption devices
- **Network-hosted storage applications** (including volume management) for improved operational efficiency, storage utilization and data mobility—enables Information Lifecycle Management
- **Network-acceleration features** reduce cost of media servers and backup application licenses, improve backup and application performance
- **Diagnostic and troubleshooting tools** including FC Ping, Traceroute, SPAN, hot-spot and historical performance analysis—reduces downtime and improves performance
- **Advanced security suite** including role-based access control, AAA RADIUS and TACAS+, SSH, SFTP, SNVp3, FC-SP, IPsec

# Gartner Magic Quadrant 2005

## 2004: Cisco Challenges



## 2005: Cisco Leads!



Questions?



<http://www.cisco.com/go/storagenetworking>

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