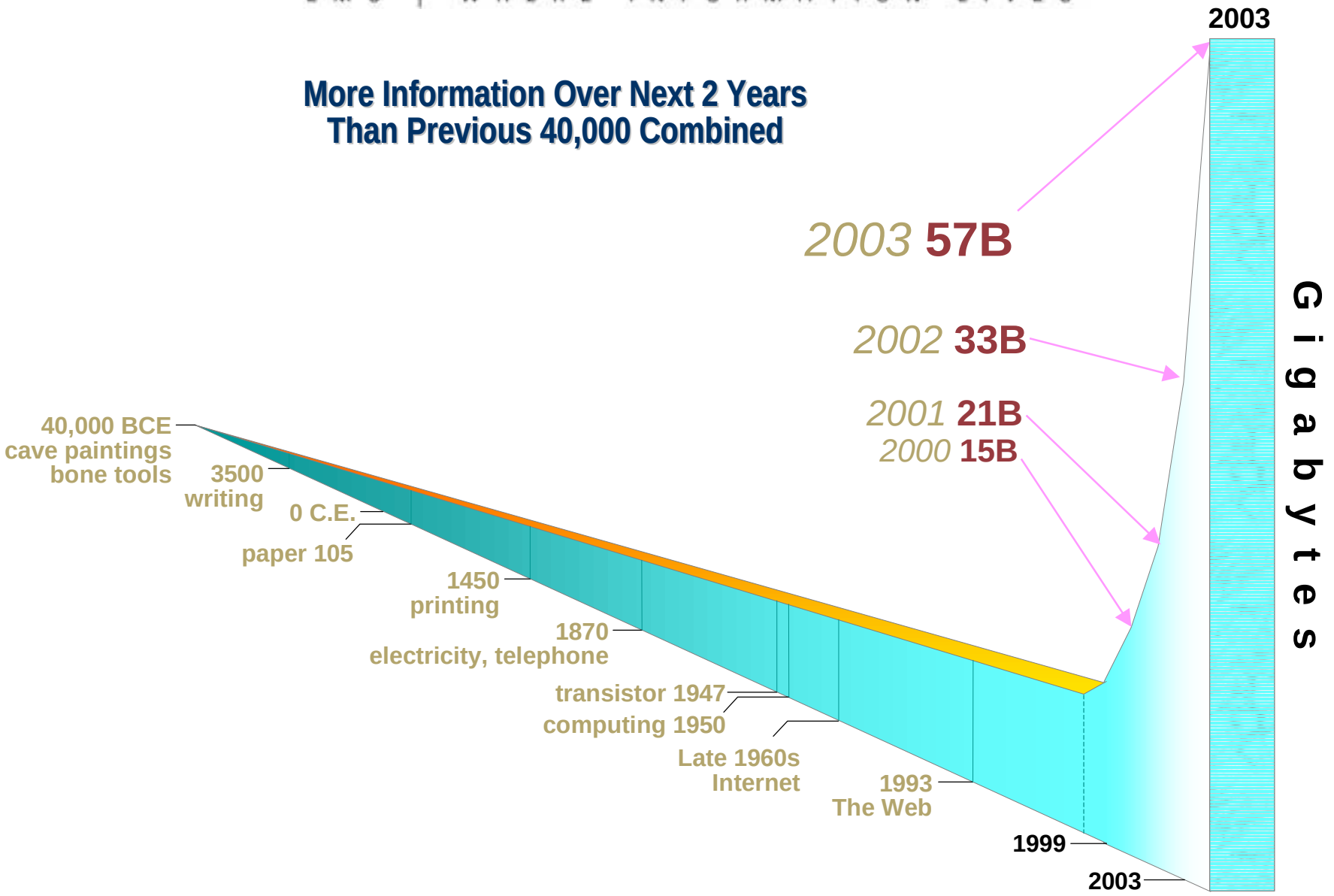
EMC | WHERE INFORMATION LIVES

Network Storage
NAS and SAN in the Information Age

More Information Over Next 2 Years Than Previous 40,000 Combined



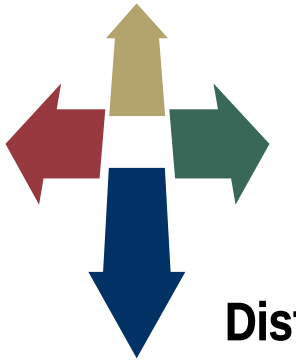
Source: UC Berkeley, School of Information Management and Systems.

The Roads to Information: Networked Storage

What is Networked Storage?

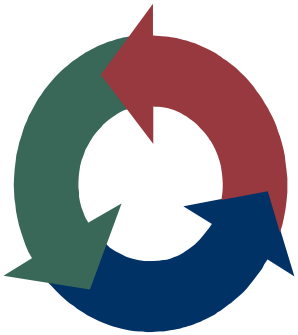
A single infrastructure that delivers information from where it lives to where it needed

SAN and NAS are different ways to network your storage, good for different things, and together they create the delivery layer that enables everything else.



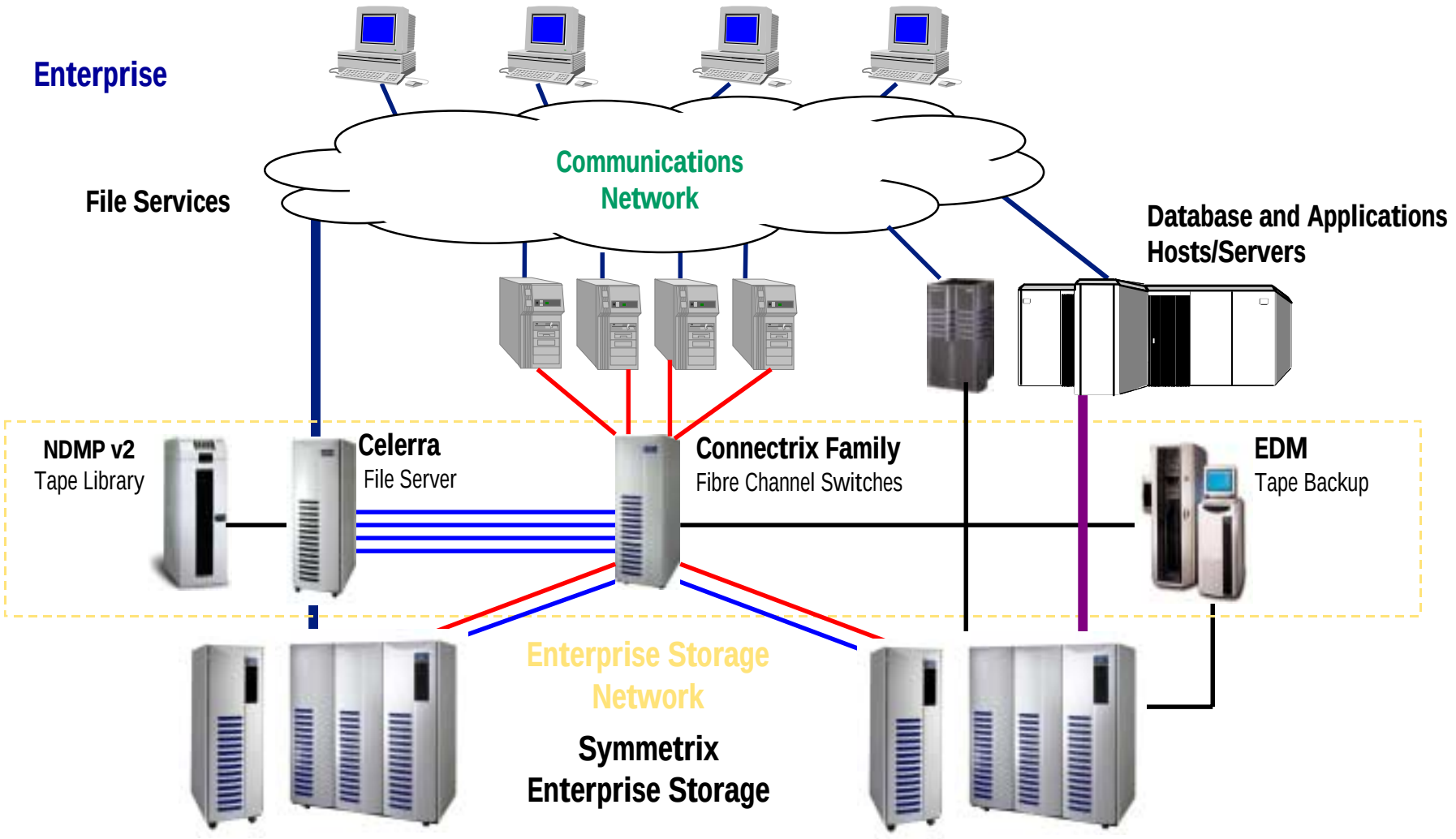
Distribution

Consolidation



Collaboration

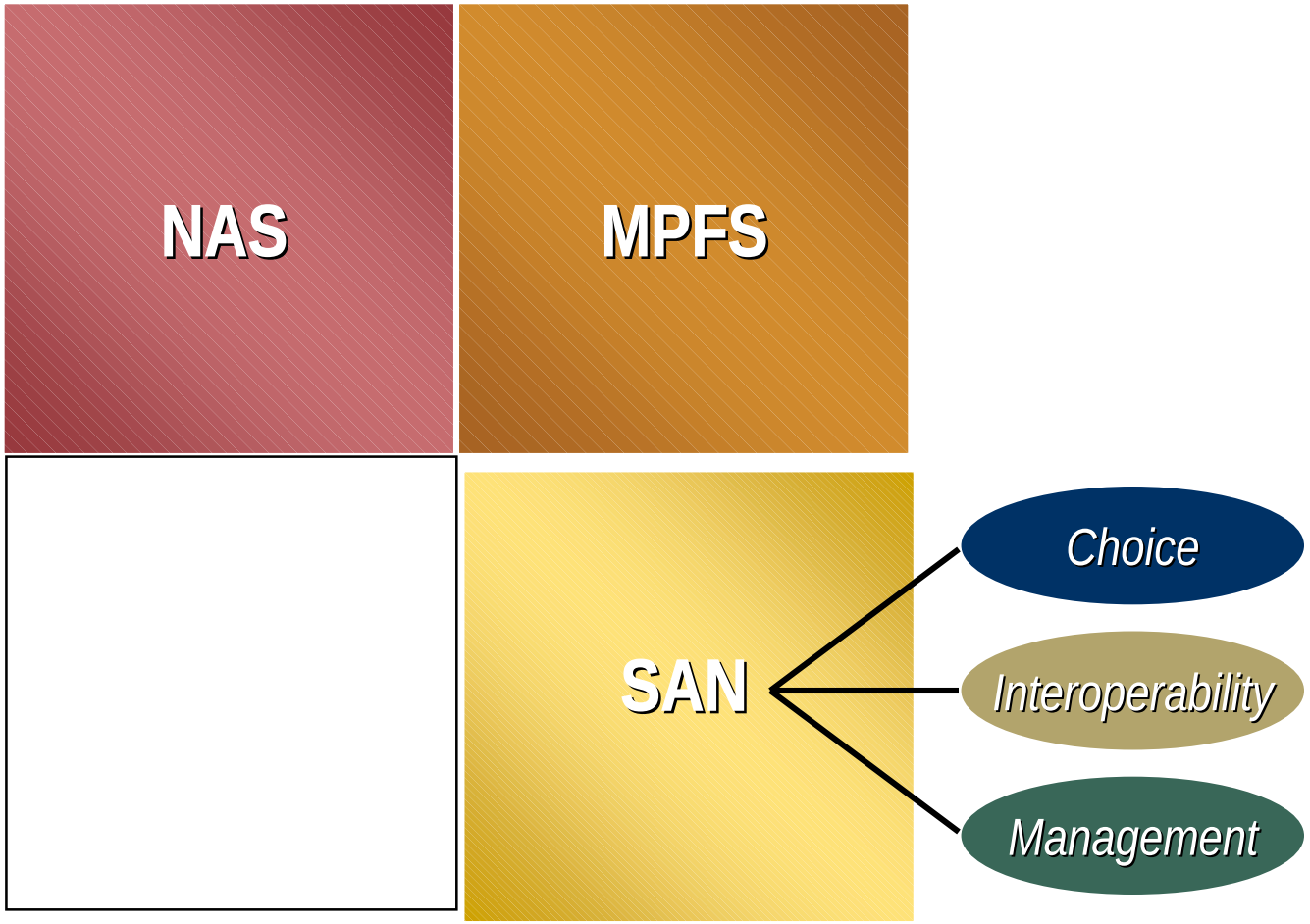
Enterprise Storage Network



NAS and SAN Compared

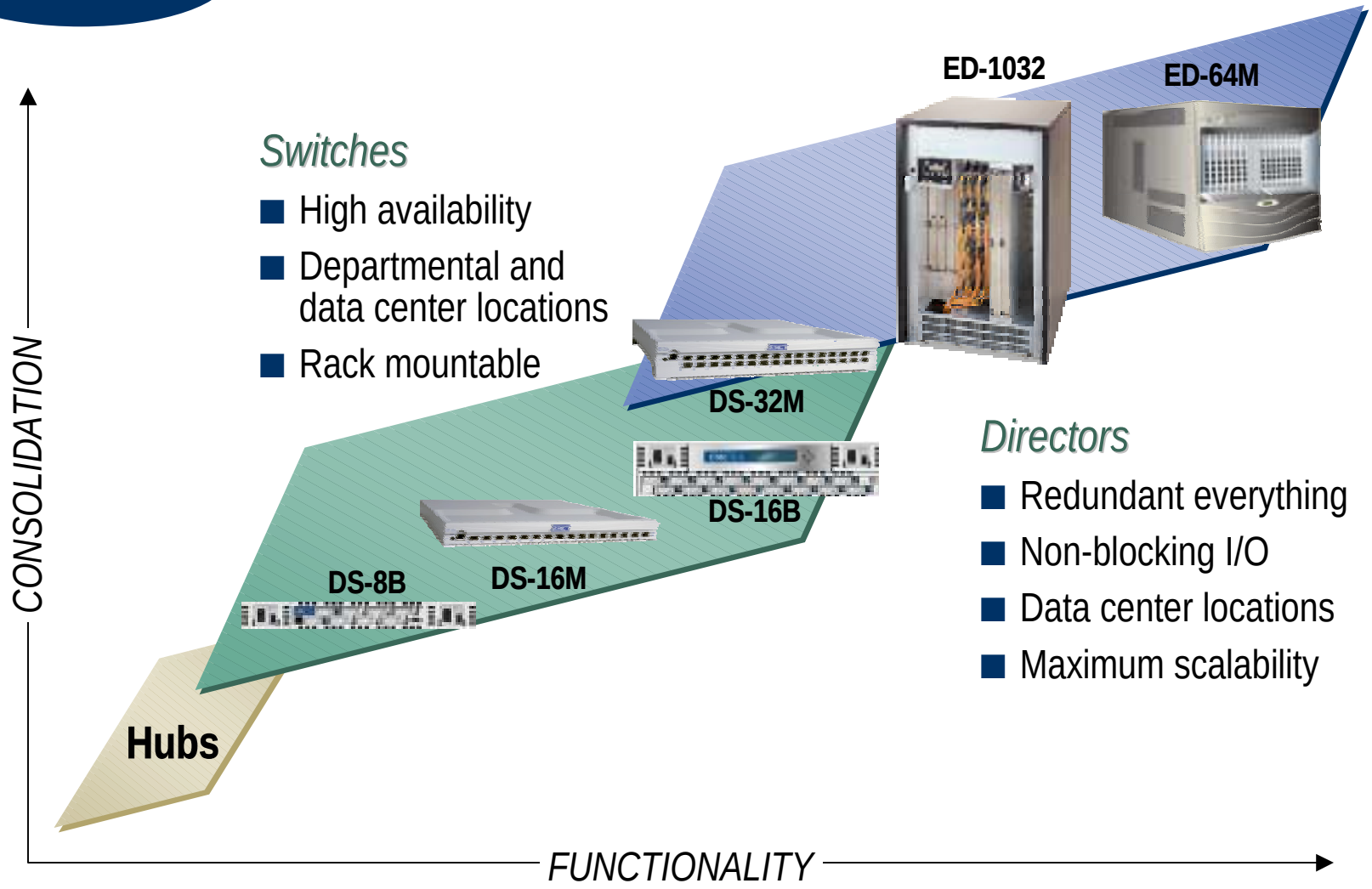
- NFS / CIFS Services
- GbE, 10/100, ATM, FDDI
- Multi-platform Shared File Access
- Long distance
- Network Cycles
- CPU overhead
- Simple management
- Moderate unpredictable performance
- Read/Write I/O
- FibreChannel connections
- Not shared Block Access
- Campus access (0.5 – 10 KM)
- Private scalable connection
- Low overhead transfer protocol
- Customized management
- Very High predictable performance

A Focus on SAN (FibreChannel)



Choice

EMC Connectrix – FibreChannel Fabric



Choice

SAN Choice

Ports	Fabric*	Availability	Rack size / ports	Other
DS-8B	128	Via redundant switches	1u/--	FC-AL support ED-1032 interoperability
DS-16B	256	Via redundant switches	2u/--	FC-AL support ED-1032 interoperability
DS-16M	128	Via redundant switches	1u/192	Strong Director / Switch interoperability
DS-32M	256	Via redundant switches	1.5u/384	Strong Director / Switch interoperability
ED-1032	256	Built in redundancy	18u/64	Strong Director / Switch interoperability
ED-64 M	512	Built in redundancy	9u/256	Strong Director / Switch interoperability

** Tested, delivered, and supported*

Interoperability

SAN Interoperability

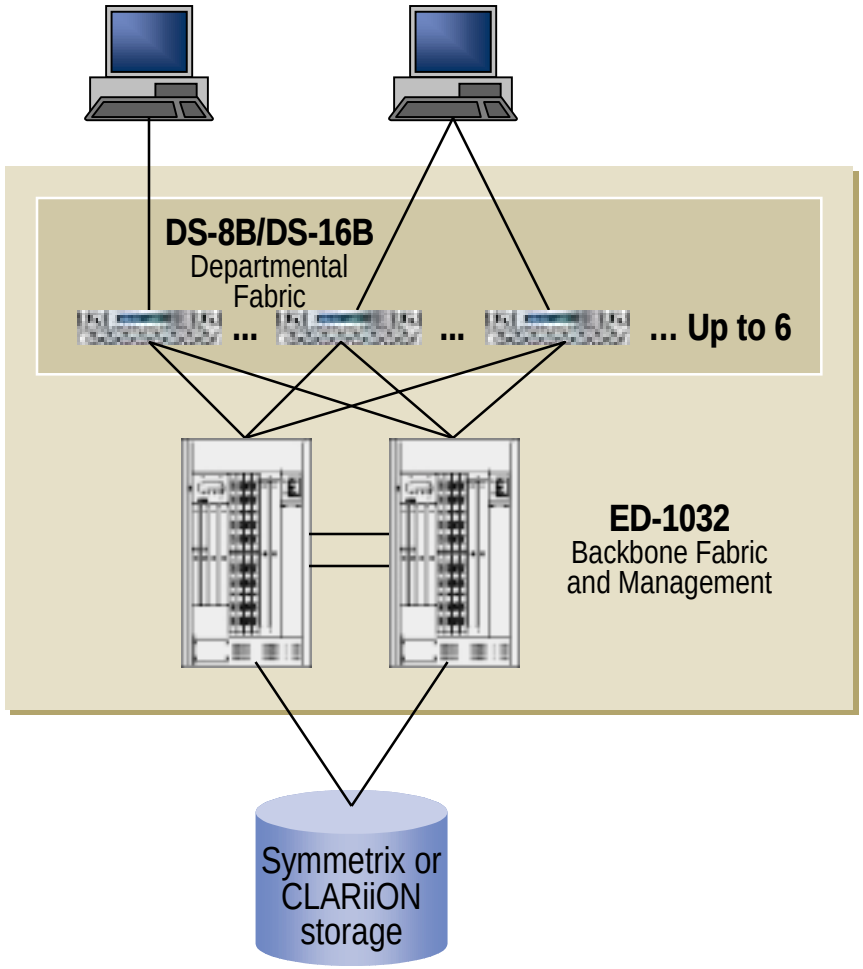
- EMC eLabs tested: assured compatibility
- Host, operating system, and HBAs
  - Sun, IBM, HP, SGI, Intel, etc.
  - Solaris, AIX, HP-UX, Irix, Linux, Windows NT 4.0/2000, etc.
  - QLogics, JNI, Emulex, etc.
- Interoperability between multivendor connectivity devices
  - E_Port interoperability between ED-1032 and DS-16B
- Storage
  - EMC, Compaq, Hitachi, HP
- SAN extensions (DWDM, FCoIP, MAN, etc.)
  - Cisco, Nortel, Lucent, CNT, etc.

EMC² elab Tested™

$2B
Invested

Interoperability

Multi-Vendor Interoperability



- Interoperability between multi-vendor Fibre Channel switch products
- Enables SAN fabrics using ED-1032 director-class products and DS-8B/16B departmental switches
- Enables core-to-edge connectivity between multiple hosts and storage devices

Management

SAN Management

Enterprise Management
Third party

Enterprise Storage Management
ControlCenter

SAN Management
ESN Manager

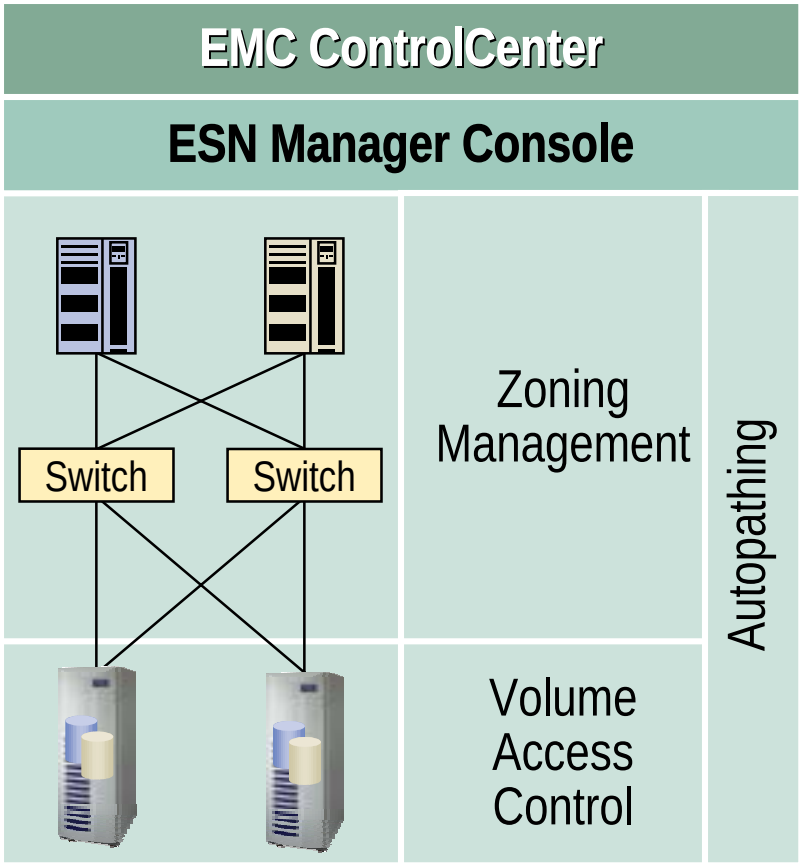
Element Management

- ATF
- PowerPath
- Access Logix
- Volume Logix
- Brocade Manager
- Connectrix Manager

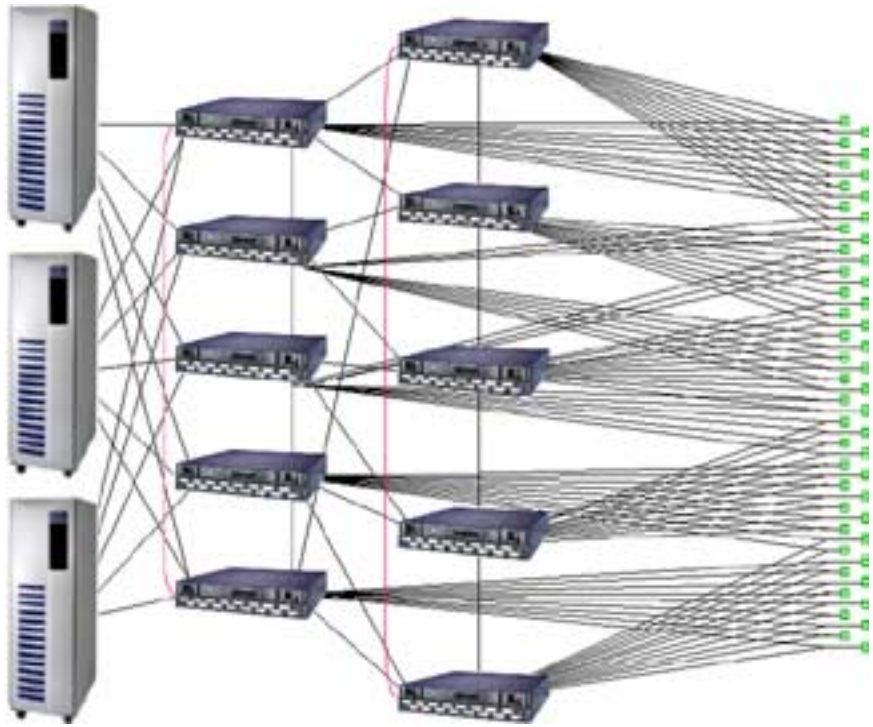
Management

ESN Manager

- Zoning management
  - Addresses heterogeneous SAN device management
- Volume access control
  - Assigns volumes to hosts
- Autopath functionality
  - Simplifies end-to-end path management
- Centralized management
  - Provides single point of control
  - Easy to use GUI



SAN: Switch Fabric Infrastructure



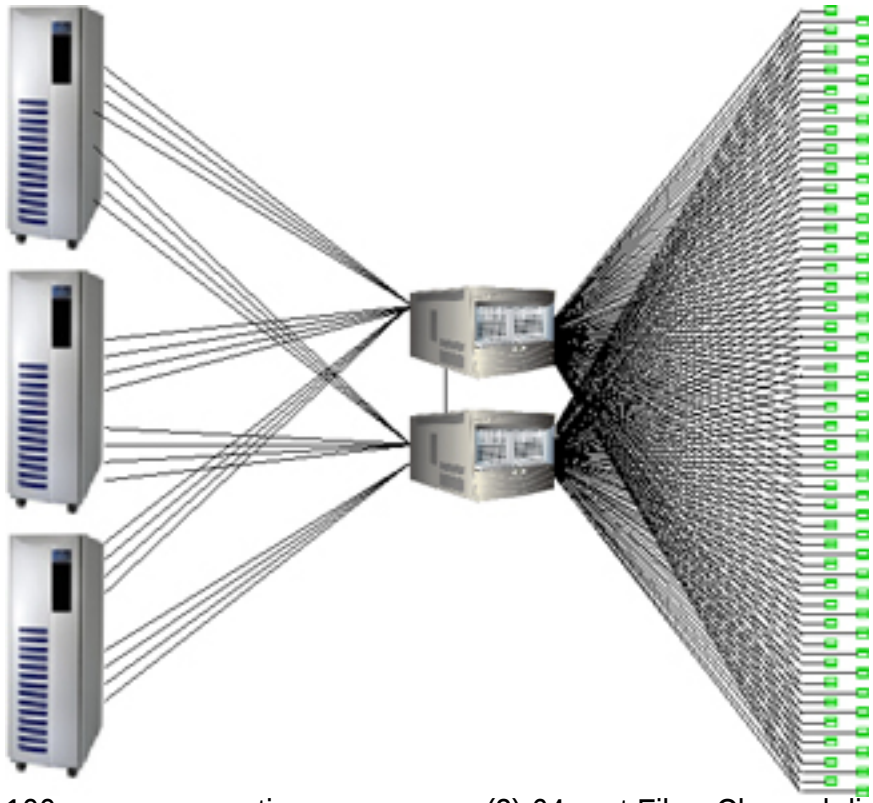
100 server connections
(50 servers)

(10) 16-port Fibre Channel switches

Total	160 ports
ISLs:	38 ports
Storage:	15 ports
Hosts:	100 ports
Spares:	7 ports

- Small-to-medium scale
- Distributed architectures
- Price / port driven
- Granular architecture
- Larger = more complex
- Availability = complexity
- ISL—limited throughput

SAN: High-Density Director Fabric



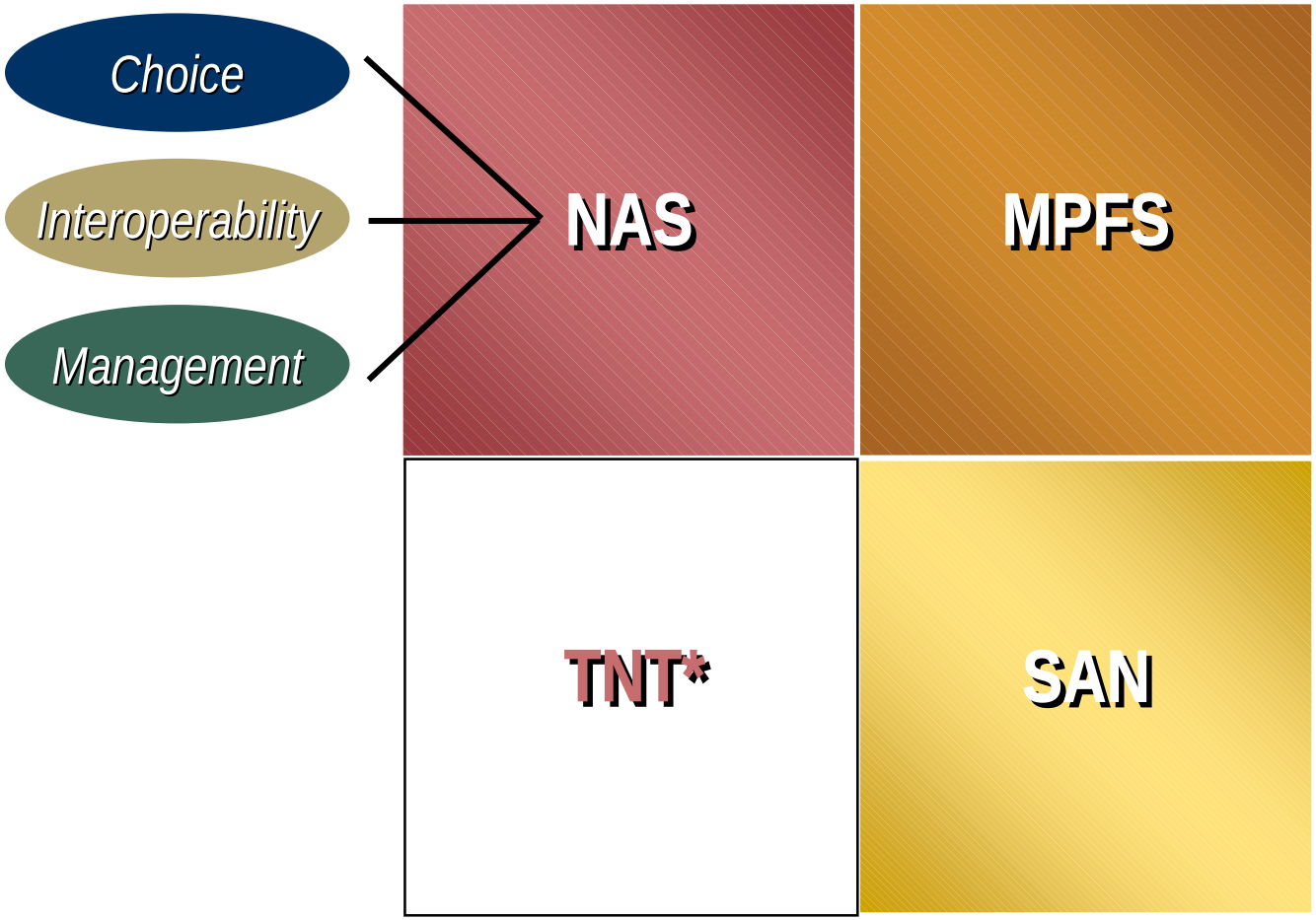
100 server connections
(50 servers)

(2) 64-port Fibre Channel directors

Total:	128 ports
ISLs:	1 port
Storage:	24 ports
Hosts:	100 ports
Spares:	3 ports

- Medium-to-large scale
- Centralized architectures
- Scalability driven
- Consolidated architecture
- Serviceability
- High throughput

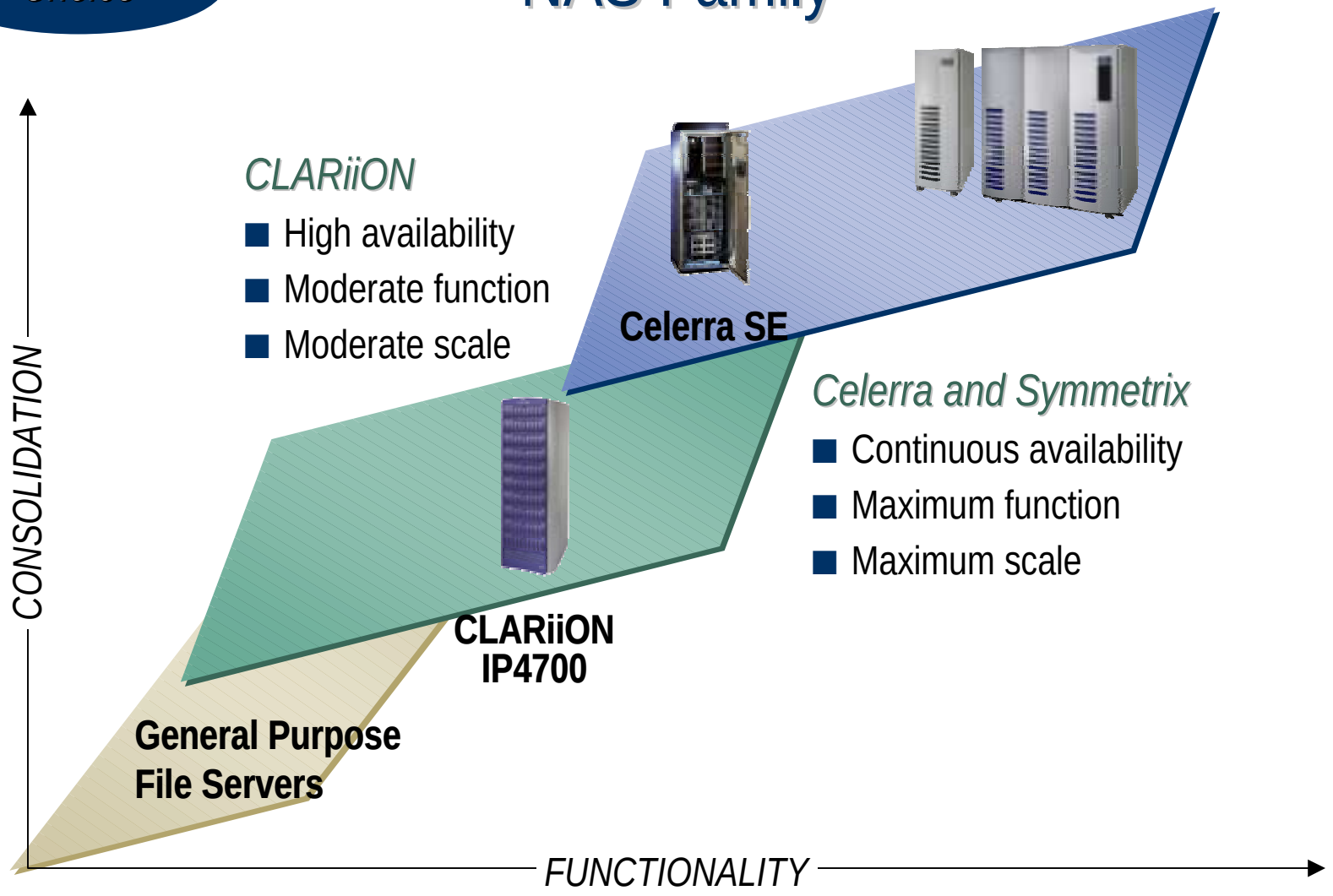
A Focus on NAS



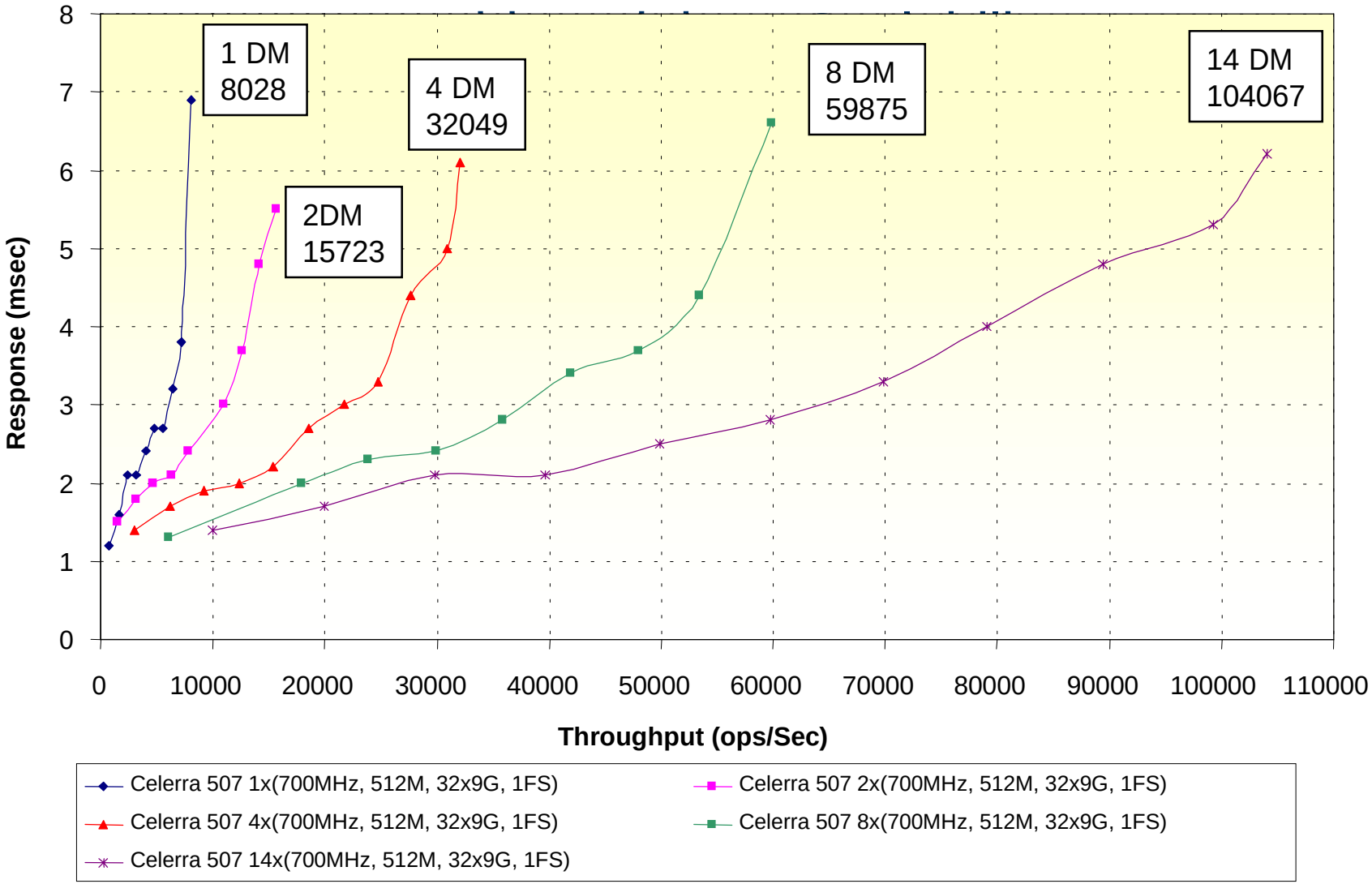
*TNT= The Next Thing

Choice

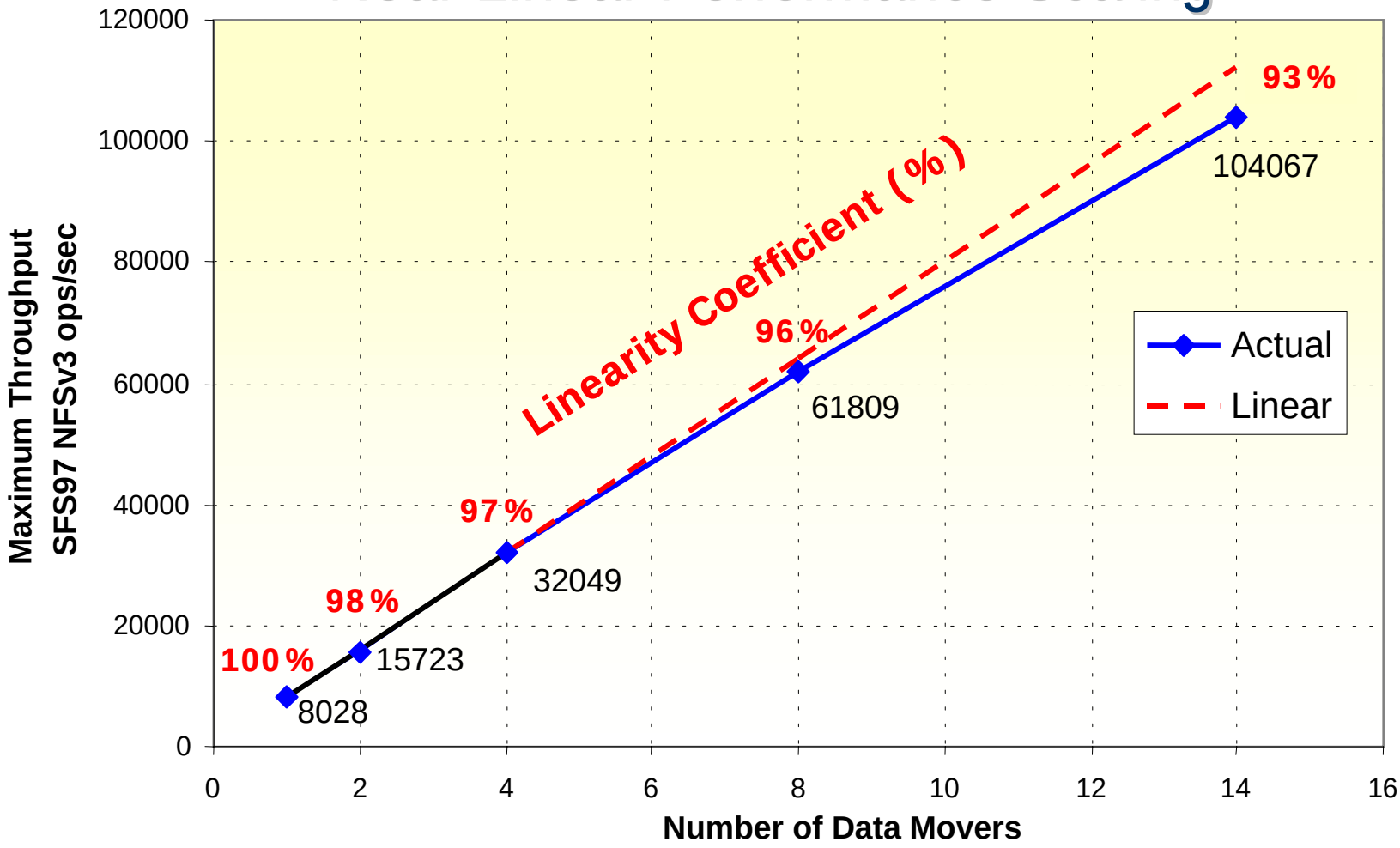
NAS Family



Celerra File Server



Celerra File Server Provides Near Linear Performance Scaling



Interoperability

NAS Interoperability

- Clients supported
  - UNIX and Windows
    - NFS and CIFS protocols
    - Heterogeneous access control, locking, and management
- Typical applications supported and tested
  - Internet
  - CAD / CAM
  - Software development
  - Telco
- Standards
  - NFS, CIFS, FTP, TCP, UDP, SNMP, NDMP, ...

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Management

NAS Management

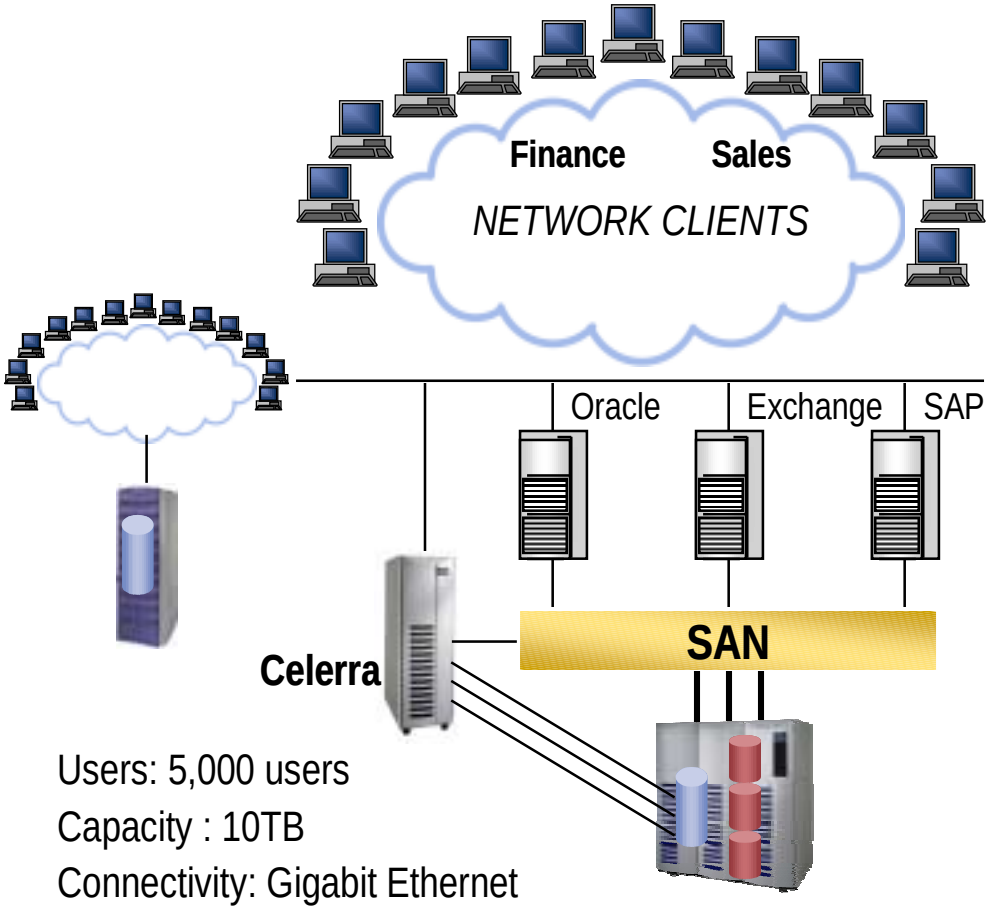
Enterprise Management
Third party

Enterprise Storage Management
ControlCenter

IP Management
Navisphere and Celerra Manager

Element Management

Celerra-Based NAS Architecture



Users: 5,000 users
Capacity : 10TB
Connectivity: Gigabit Ethernet
Servers: 50
Protocols: NFS and CIFS

- Medium-to-large businesses
- Centralized deployment
- Driving factor:
  - Availability
  - Scalability
  - Performance

Telecommunications Business Support Systems NAS Solution Set

- **Billing Records Management**

  Highly available, reliable and scalable Celerra File Server infrastructure. Offering scalable high performance NFS/CIFS services with Symmetrix

- **Call Collection Records Management and Distribution**

  Solution offering addressing improved management of call detail records at point of capture, replication and distribution to downstream telephony applications.

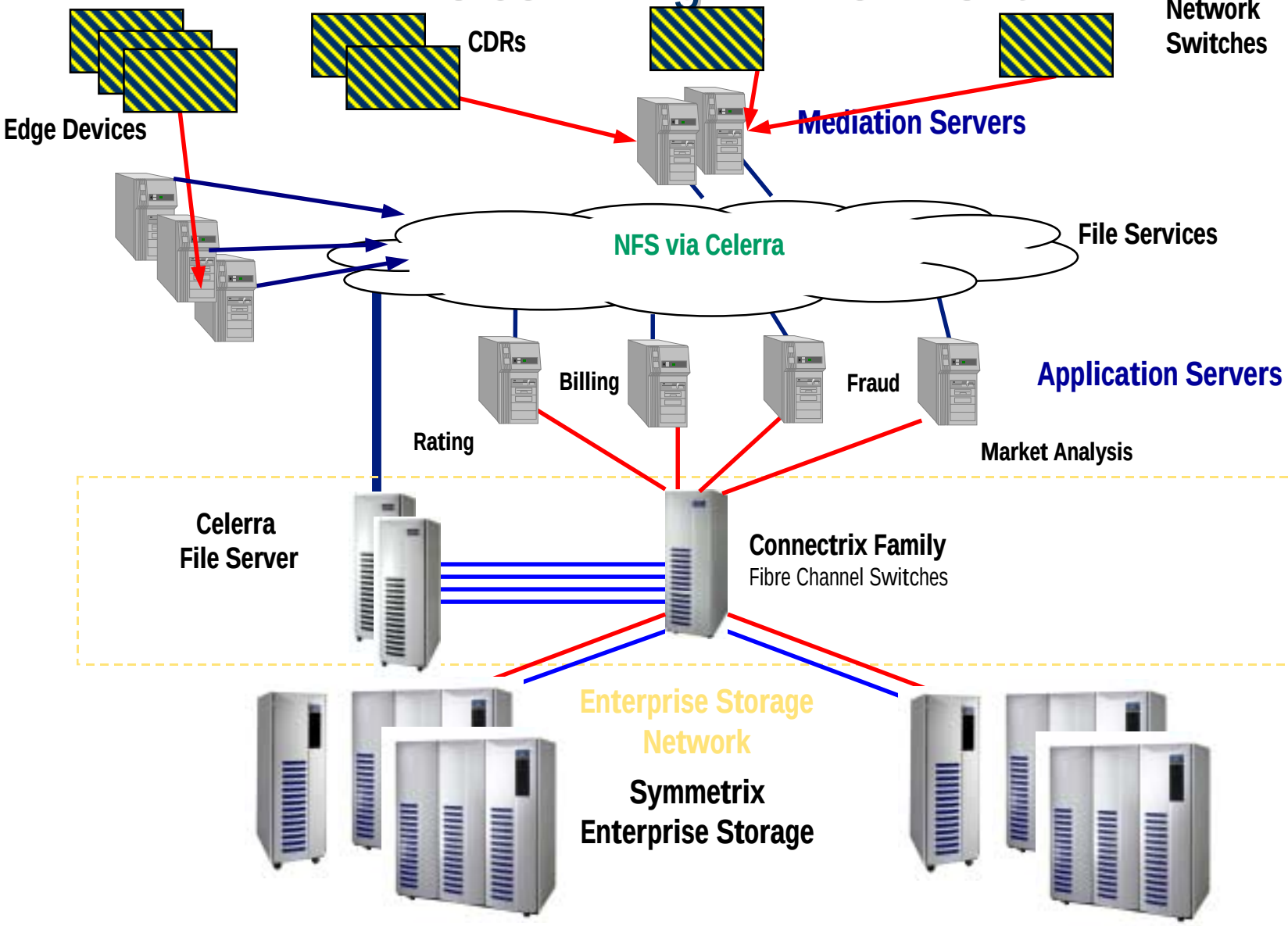
- **Intelligent Telecommunications Record Management**

  Storage consolidation - Extend the information management role for EMC products to the edge of the network –(network switches, routers and gateways) for improved call or IP event records collection, management and distribution.

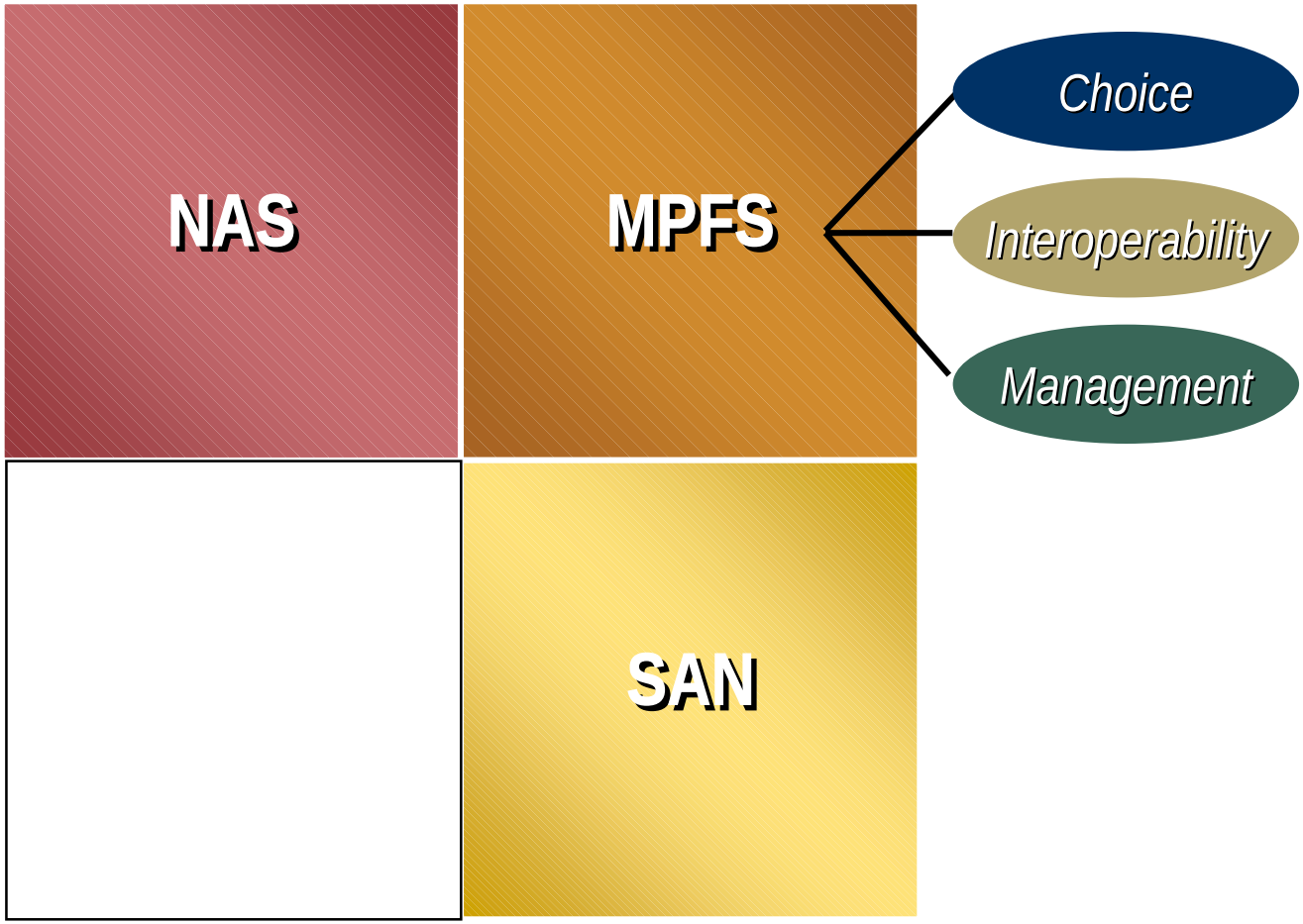
- **Internet and Web based applications**

  Storage for Rich Media (3G), Mail Systems, ISP, XSP, etc. Industry leading Celerra File Server

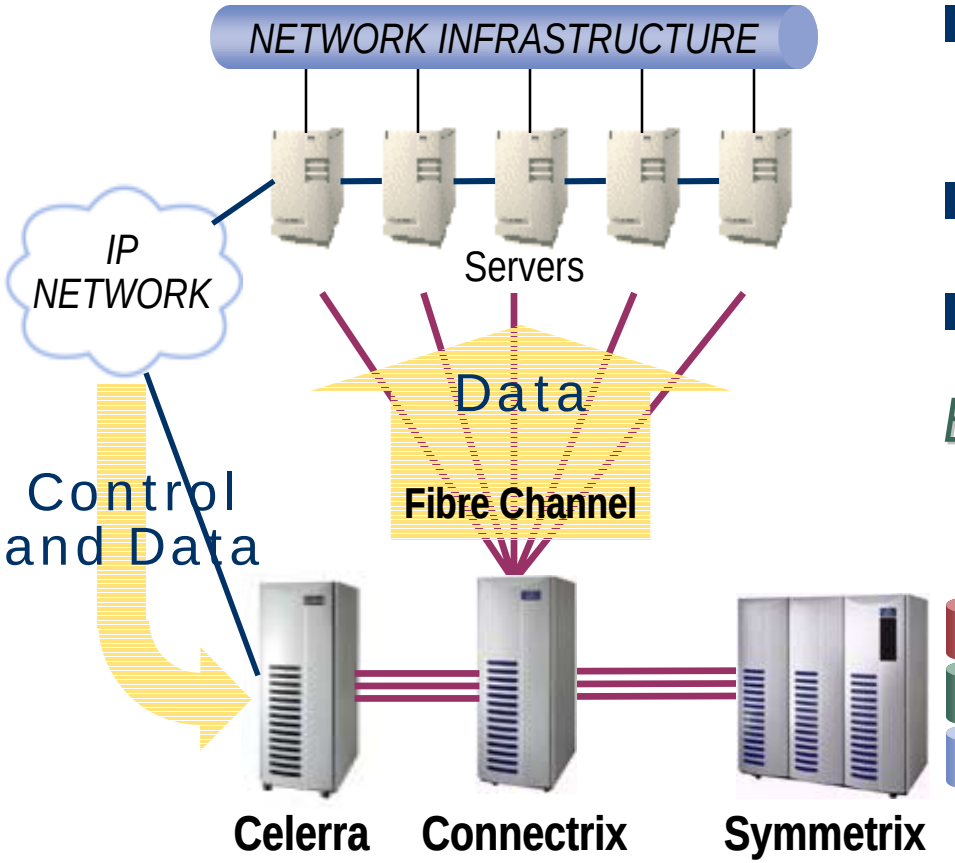
Telco Billing Environment



A Focus on HighRoad (MPFS)



Celerra HighRoad Integrates SAN and NAS

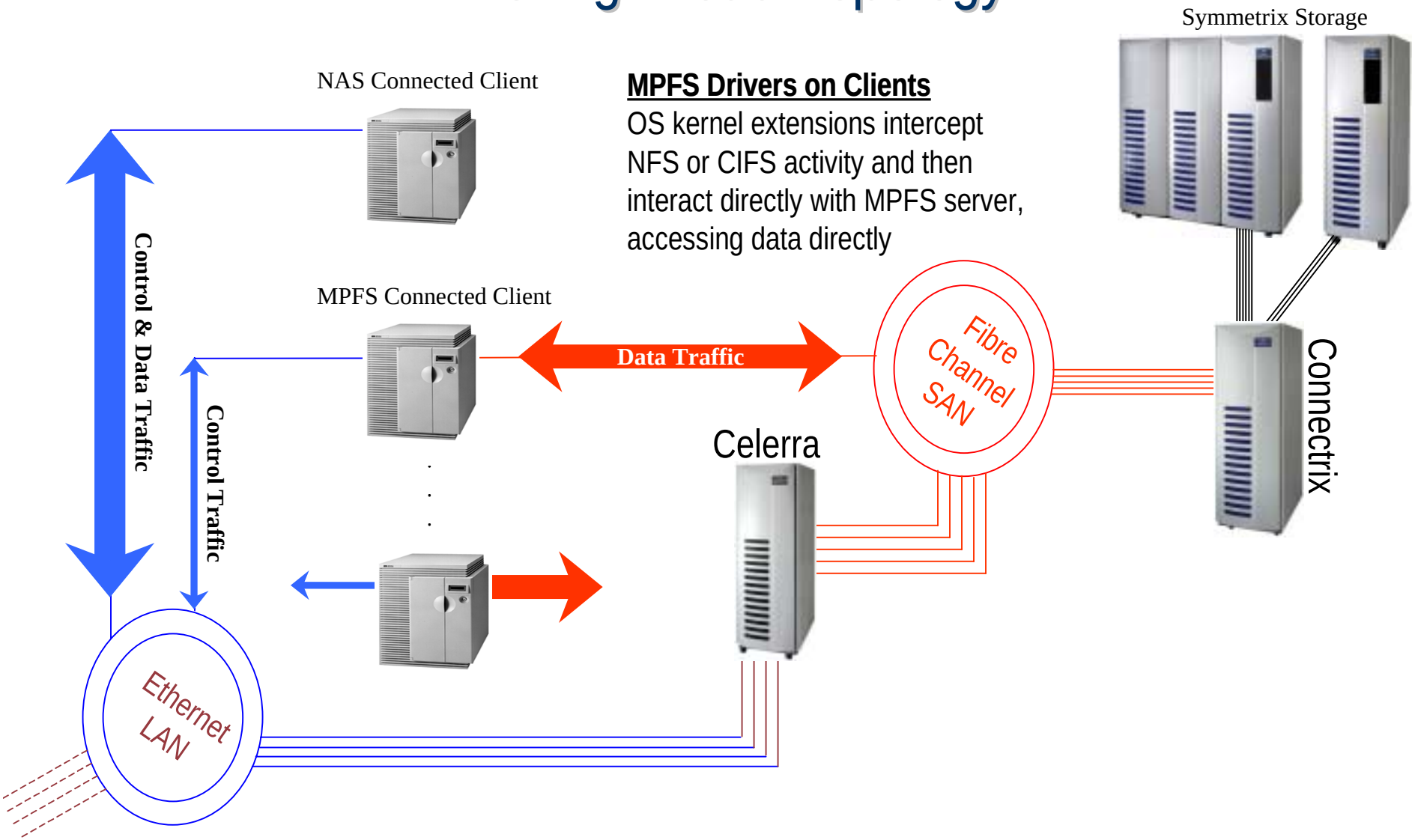


- Network request, channel or network delivery
- Delivery optimization
- Performance and sharing

Best of both worlds: SAN and NAS

Ad Server content
Web content
Binary Large Objects (BLOBs), flat files

The HighRoad Topology



HighRoad Customer Benefits

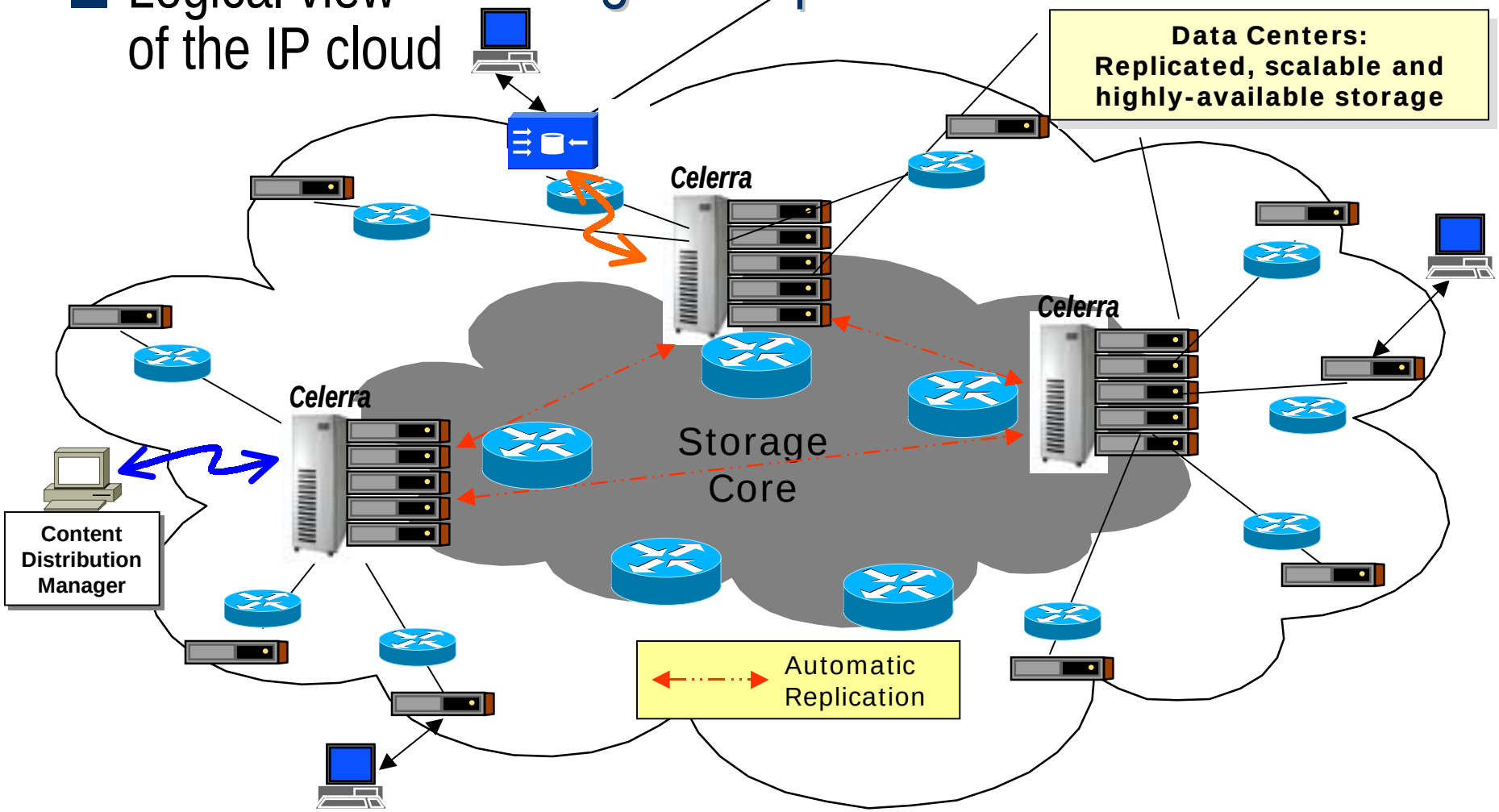
- Supports simultaneous multi-protocol access by MPFS, NFS and CIFS clients (Unix and NT)
- Shared Data Access at Channel Speeds
- Entirely transparent to applications - including Backup
- File Sharing among Heterogeneous Clients
- Concurrent Shared Data Access for IP and SAN
- Flexible storage layout – storage space can be used as NAS, SAN and direct attached storage
- Permit direct channel access to a single image of data, thus saving the cost of deploying replicas

HighRoad Performance Benefits

- Dynamic selection of the best I/O path
- Reduce network traffic and processing cycles
- Improve client and application performance
- Enhance network file server performance
- Best Scalability (93% from 1 to 14)
- High Availability – embedded N+1 cluster
- Complete file system functionality

Content Delivery Networks: A Storage Perspect

- Logical view of the IP cloud



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