



Education

Ethernet Storage - Benefits & Futures

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Abstract

- This presentation presents an overview of Ethernet-based storage networking technologies and solutions. It examines the relevant storage protocols, features and benefits of storage systems using those protocols, and where they are deployed in a typical IT environment today.
- The presentation goes on to examine the latest developments in Ethernet standards, and storage protocols, including Data Center Bridging, FCoE and pNFS, and how they may change the storage landscape over the next few years.

➤ Introduction

- ◆ Storage Topologies Compared
- ◆ Benefits of Networked Storage
- ◆ Ethernet as a Storage Fabric

➤ Ethernet Storage Today

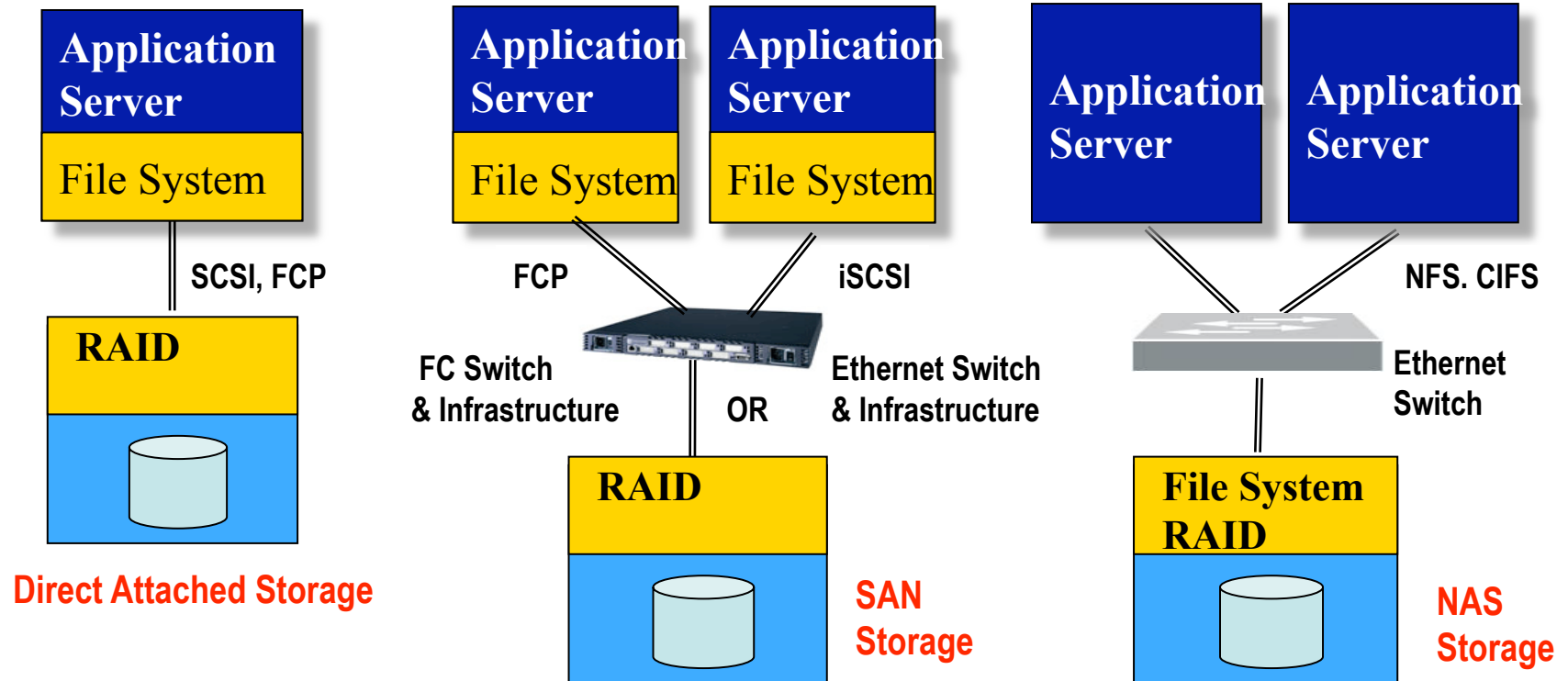
- ◆ NAS Features and Benefits
- ◆ iSCSI SAN Features and Benefits
- ◆ Typical Ethernet Storage Deployments

➤ Latest Developments

- ◆ Ethernet beyond 10 Gigabit
- ◆ Fibre Channel over Ethernet
- ◆ NFS and scale-out architectures

➤ Summary

Storage Technologies



- Server-based data management
- No resource sharing
- No data sharing
- Works with all apps

- Server-based data management
- Resource sharing
- Complex data sharing
- Works with all apps

- Storage-based data management
- Resource sharing
- Automatic data sharing
- Works with qualified apps

- Benefits of Storage Networking
 - ◆ Improved reliability and reduced cost of backup
 - ◆ Improved scalability of storage capacity and performance
 - ◆ Simplified storage provisioning
 - ◆ Improved data availability
- Top reasons for deploying networked storage
 - ◆ Back-up
 - ◆ Storage consolidation
 - ◆ Satisfy on-going demands for additional capacity
 - ◆ Performance
 - ◆ Disaster recovery
 - ◆ New project or application deployment

Ethernet as a Storage Fabric

- Ethernet and TCP/IP are widely deployed and dominant
 - ◆ Not just the Fortune 1000
 - ◆ Well understood technology – every company has expertise
 - ◆ Low acquisition cost
 - ◆ Unlimited distance
- Ethernet is scalable, with 100/1000/10000 Mbps available today
 - ◆ 40/100 Gb Ethernet emerging during 2010
- Allows the creation of a single physical network using familiar standards
- Virtualization built in
 - ◆ End points virtualization
 - ◆ VLAN's maybe used for separating traffic
- Brings Ethernet interoperability & economics to storage
- Enables native remote data replication and disaster recovery



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Ethernet Storage Today

Networked Storage

Market Share by Revenue

	2006	2007	2008	2009
FC SAN	73%	72%	68%	61%
iSCSI SAN	4%	6%	10%	13%
NAS	22%	22%	22%	26%

Market Share by Capacity

	2006	2007	2008	2009
FC SAN	64%	62%	58%	53%
iSCSI SAN	6%	8%	13%	15%
NAS	30-%	29%	29%	32%

Source: IDC Worldwide Storage Systems Tracker, 2006, 2007, 2008, 2009

Ethernet Storage Protocols

➤ iSCSI (IETF)

- ◆ SCSI commands over TCP/IP
- ◆ Minor update (STORM) started 2009

➤ NFSv4 (IETF)

- ◆ Standard file access over TCP/IP
- ◆ Supporting UNIX and Windows file semantics
- ◆ Lease based state
- ◆ Mandates strong authentication
- ◆ Universal character set for file names

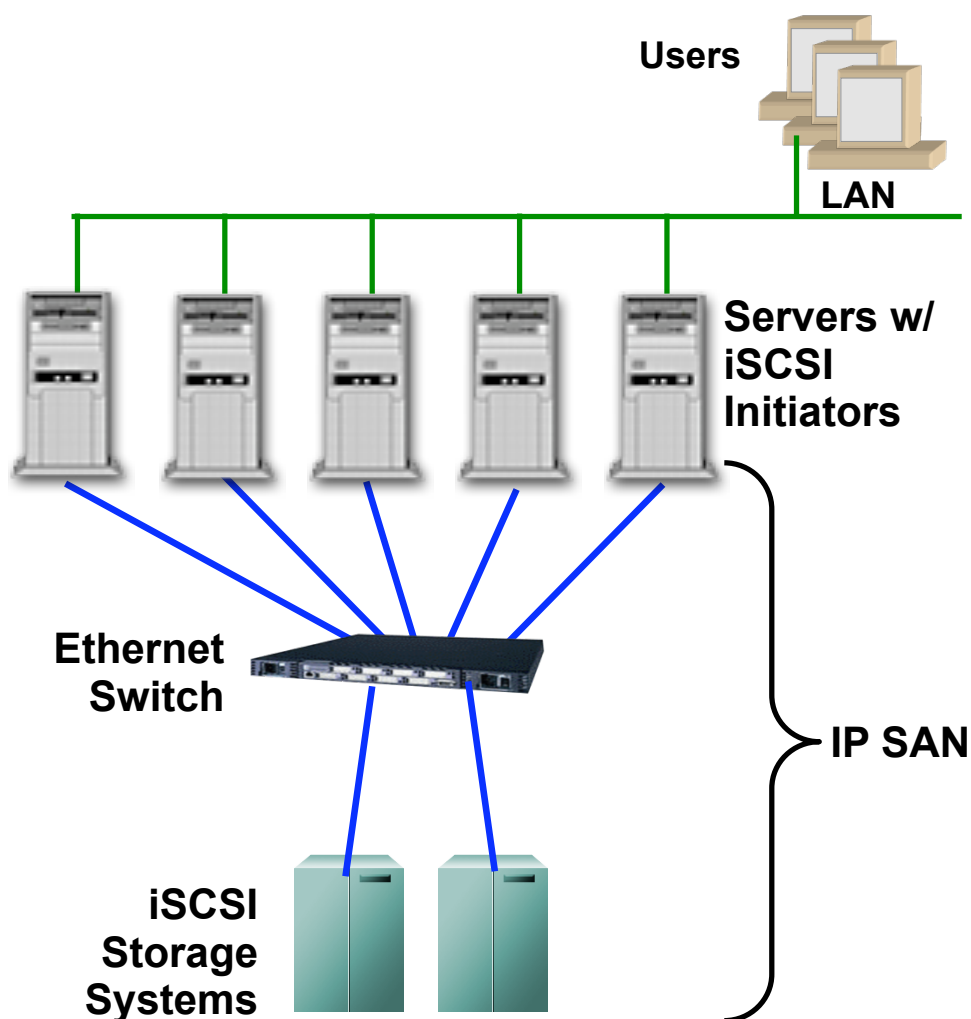
➤ CIFS/SMB (Microsoft, et al)

- ◆ Windows file sharing protocol
- ◆ SMB 2 released with Vista

NAS/NFS Benefits

- NAS delivers ease-of-use, reliability, scalability, and built-in data protection
- Very prevalent data center storage solution
 - ◆ Home Directory environments; Storage consolidation;
 - ◆ Unix/Linux build farms; diskless boot
 - ◆ Virtual environments over NFS
- Databases and business apps on NFS
 - ◆ About a 3rd of databases out there are NFS server backed
 - ◆ Direct I/O modifications to NFS clients/servers
 - ◆ posix based Async I/O and Direct NFS (dNFS)
- Grid Computing with NFS
 - ◆ HPC & Technical Computing Applications
 - ◆ Clusters on demand

iSCSI SAN Benefits



- **Standard SAN storage**
 - ◆ Block storage access
 - ◆ Supports all apps
 - ◆ Transparent migration from direct attached storage
- **Lower TCO than FC**
 - ◆ Zero host connection cost
 - ◆ Less costly infrastructure
 - ◆ Easier to manage; leverage existing staff
- **Security**
 - ◆ Built-in authentication
 - ◆ Optional IPsec; encryption key management
- **Performance**
 - ◆ 1Gb and 10Gb
 - ◆ Offload technologies

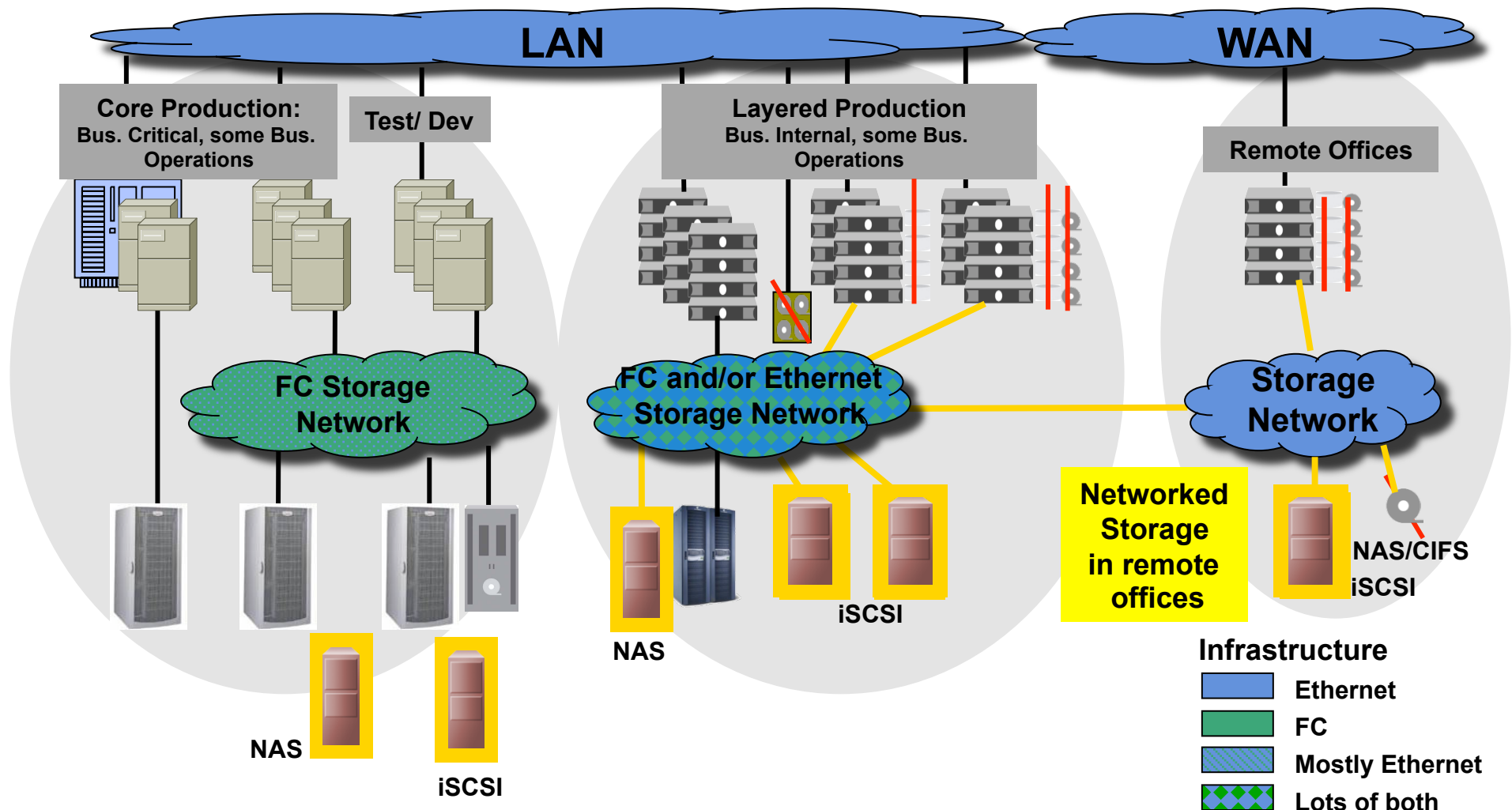
iSCSI Deployment

- Mainstream storage consolidation solution for Windows application server environments
- Mainstream deployment in multi-OS host environments
 - ◆ Windows plus Linux and/or Unix)
- Mainstream deployment in virtual server environments
 - ◆ VMWare, Xen, Hyper-V
- Broad deployment in small blade server environments
- Increasing deployment with 10GbE infrastructure

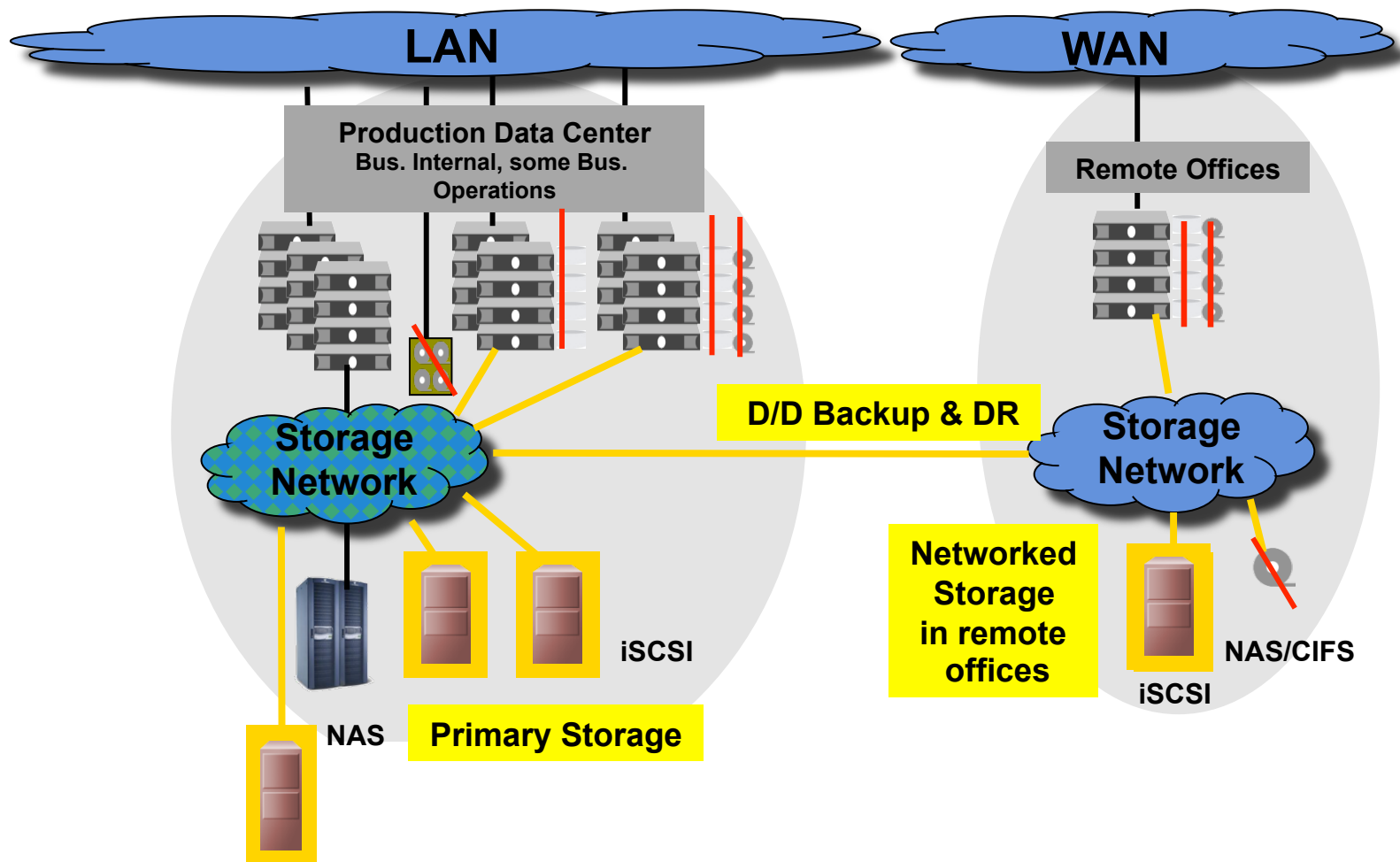
10 Gigabit Ethernet

- IEEE 802.3ae ratified 2002
- Broadly deployed in inter-switch links
- Host-side proliferation now happening
 - ◆ Affordable Price
 - ◆ Server I/O architecture support
 - ◆ Standard component on commodity servers
 - ◆ Offload built into on-board components, supported by operating systems
- Deployment/applications
 - ◆ Backbone and port aggregation for 1 Gb LANs
 - ◆ File and block storage over 10GbE

Where Ethernet Storage Fits – Large Enterprise



Where Ethernet Storage Fits – Medium/Small Enterprise

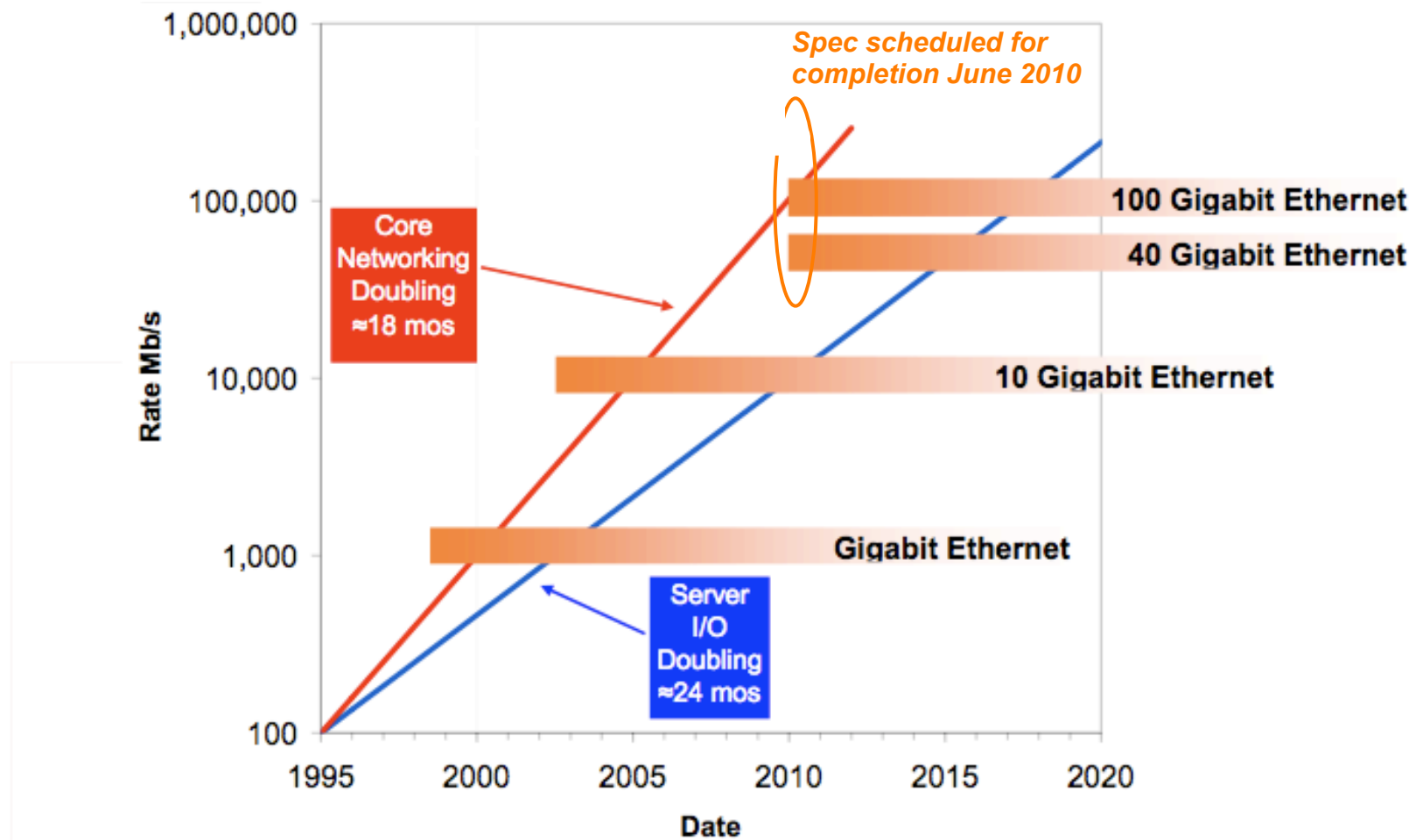




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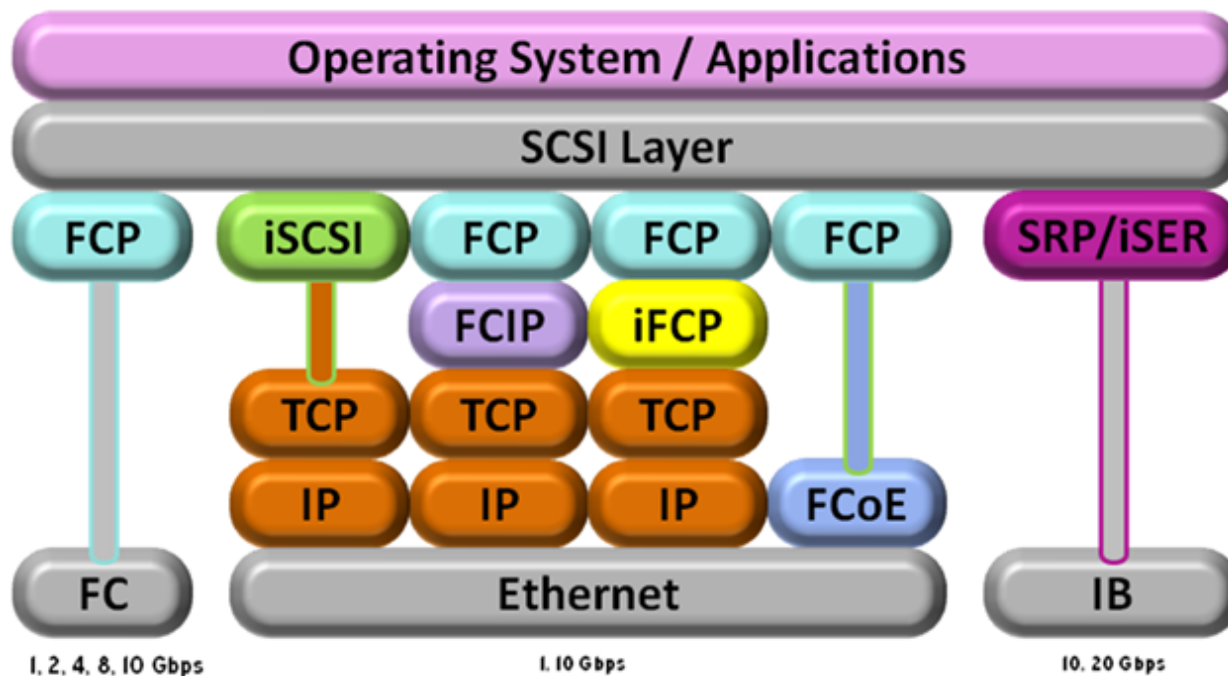
Latest Developments in Ethernet Storage

Ethernet Beyond 10Gb/s



Source: John D'Ambrosia, Force 10 Networks; Copyright 2008
Chair, IEEE P802.3ba Task Force; Ethernet Alliance Member

I/O Consolidation – FCoE



- An Extension of Fibre Channel onto a 10Gb Ethernet network
- FCoE is a direct mapping of Fibre Channel over Ethernet
- TCP/IP is not required and not present for FCoE
- Preserves ops, control and management environments for the FC layer

FCoE: Smooth Transition to Ethernet for Fibre Channel SAN Investments

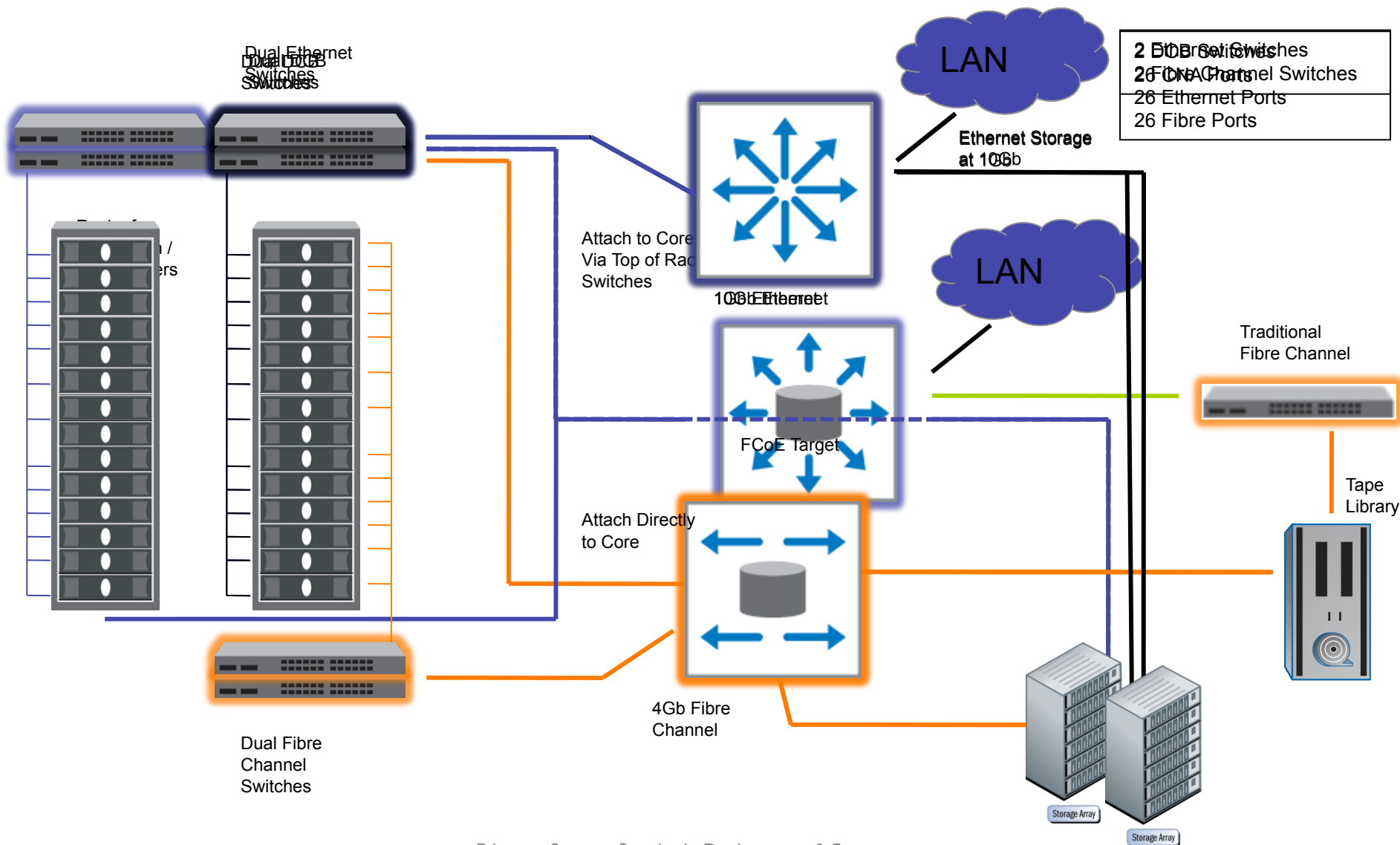
- FCoE enables Fibre Channel to run on a “lossless” Ethernet network
- Benefits
 - ◆ Fewer cables
 - › Block I/O and Ethernet traffic coexist on same cable
 - ◆ Fewer adapters
 - ◆ Less power
 - ◆ Interoperates with existing SANs
 - › Same SAN management



I/O Consolidation – DCB

- Data Center Bridging
 - ◆ Also known as “Converged Enhanced Ethernet” and “Data Center Ethernet”
- FCoE requires “lossless” Ethernet
 - ◆ Possible with Ethernet plus some extensions
- The IEEE 802.1 DCB WG has defined these extensions
 - ◆ Priority-based Flow Control (PFC): 802.1Qbb
 - Required for FCoE
 - ◆ Enhanced Transmission Selection (ETS): 802.1Qaz
 - Highly recommended for FCoE
 - Including DCBX (DCB eXchange protocol)
 - ◆ Congestion Notification (CN): 802.1Qau
 - Optional for FCoE
- Standards completed 2H2009
- DCB required for multiprotocol support (FCoE and TCP/IP)

Consolidation Example

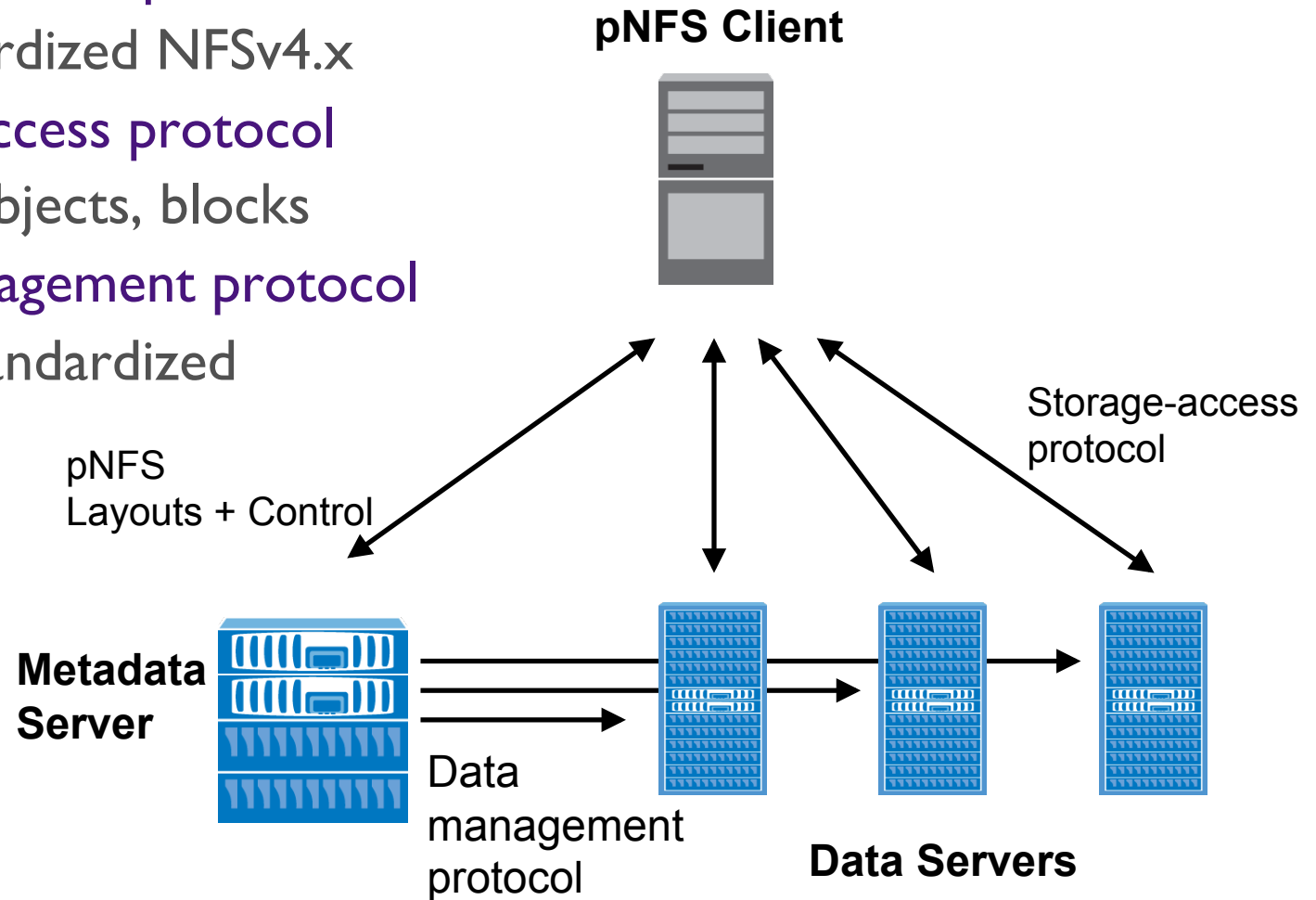


Latest Developments: NFSv4.1

- A dot release of NFSv4
- New features:
 - ◆ Delegations on directories,
 - ◆ Symbolic links,
 - ◆ Session model
 - ◆ Parallel NFS (pNFS)
 - › Major advance in enabling standards-based scale-out host environments
 - › A single client supports block, file and object-based storage access
- Improved performance over NFSv4.0
- Spec approved December 2008; RFC number issued January 2010

Supporting scale-out – pNFS

- pNFS metadata protocol
 - ◆ standardized NFSv4.x
- Storage-access protocol
 - ◆ files, objects, blocks
- Data-management protocol
 - ◆ not standardized



Summary

- 40% of networked storage shipped today is Ethernet-connected
- NAS and iSCSI continue to be the fastest growing storage networking technologies
- 10Gb Ethernet has now entered the mainstream
- Many IT organizations are in an upgrade cycle for their data centre networking architecture
 - ◆ Cost and complexity reduction
 - ◆ Server and storage consolidation/virtualization
- A range of standards activities are enabling:
 - ◆ Greater functionality of Ethernet storage solutions
 - ◆ An orderly transition to a “unified” data centre network based on 10Gb Ethernet supporting all networked storage protocols