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IP Storage

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Abstract

IP Storage

This session will appeal to IT managers, administrators and storage architects interested in a broad overview of IP Storage (covering iSCSI, FCIP and iFCP).

The presentation explains what IP Storage is; compares and contrasts it to other storage technologies and topologies; highlights implementation details such as security, performance, and availability; and explains how IP Storage fits in the infrastructure of both large Enterprises, and small/medium Enterprises.

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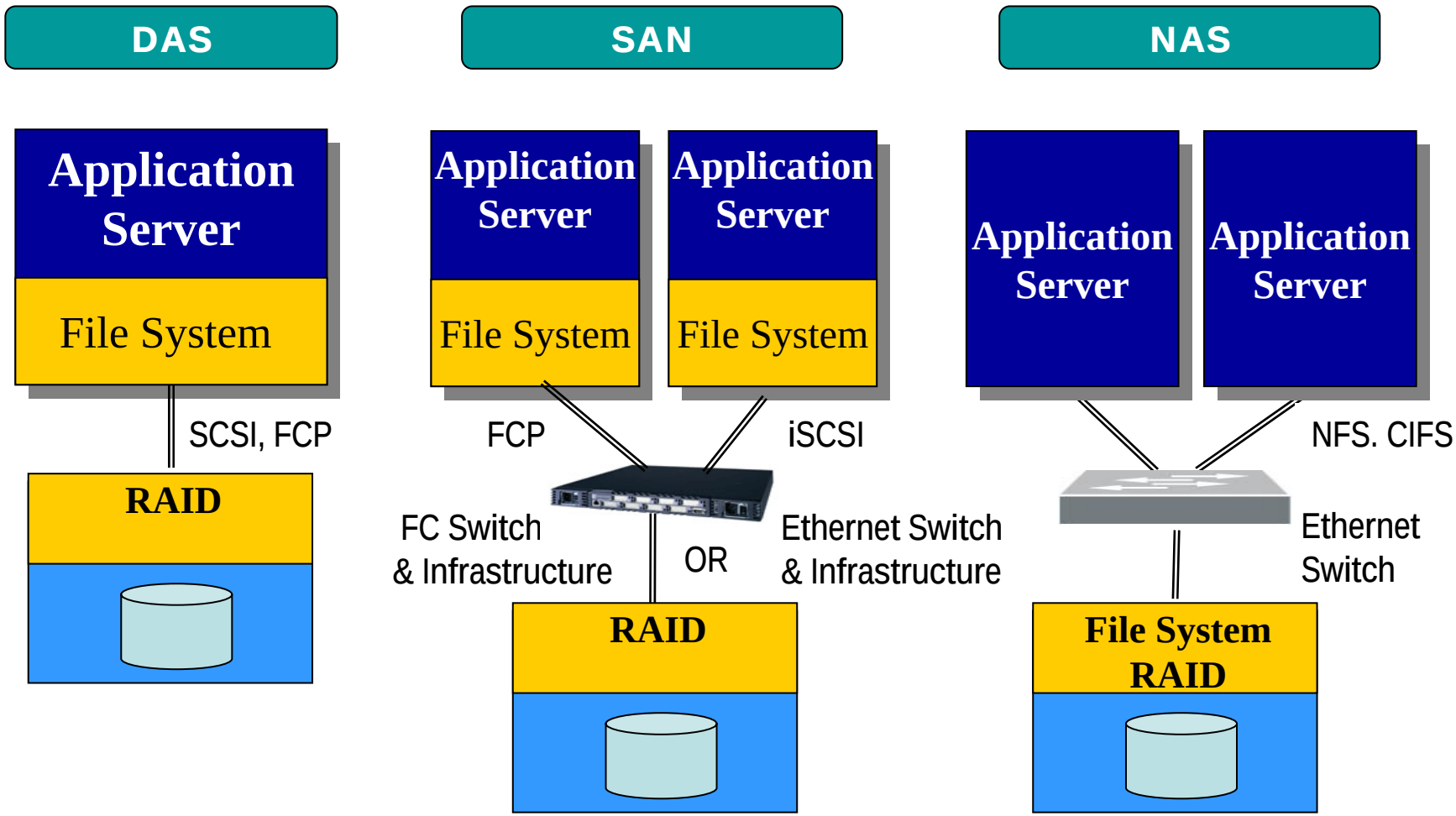
- Storage Architectures Compared
- Enterprise IT Environment
- IP Networking
- IP Storage Technologies
  - iSCSI
  - FCIP
  - iFCP
- Where IP Storage Fits
- What's Next
- Summary

DAS, SAN & NAS Compared

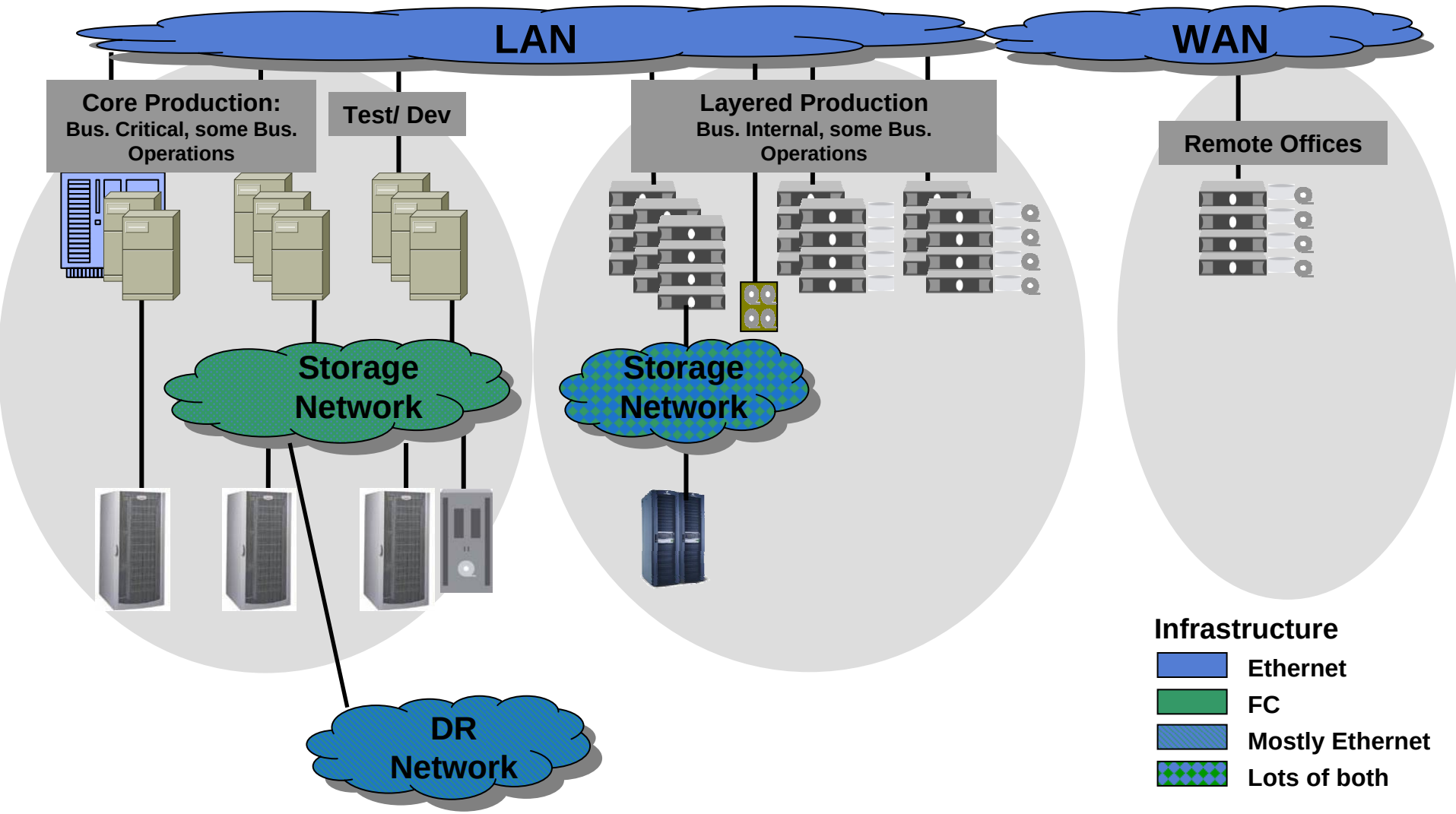


What SANs Deliver to IT

- Value 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 a SAN*
  - Back-up 46.0%
  - Storage consolidation 40.0%
  - Satisfy on-going demands for additional capacity 37.0%
  - Performance 31.0%
  - Disaster recovery 27.0%
  - New project or application deployment 23.0%

* *Source: IDC, December 2004*

Enterprise IT Environments



SAN Protocol Options

- Fibre Channel (FCP)
  - FCP works and will not disappear any time soon
  - Entrenched; excellent high-performance solution
- FC island connectivity across the WAN
  - FCIP: Tunneled solution
  - iFCP: FCP routed solution
- iSCSI provides end-to-end native IP storage
  - Affordable SAN solutions for cost-sensitive server environments are available today
  - Native support from all OS vendors today
  - Vendor platform certifications well established

IP Network Bandwidth

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Year	Storage	Network	Penalty
1992	10 MB/s	0.1 MB/s	100-to-1
1994	20 MB/s	1 MB/s	20-to-1
1996	40 MB/s	10 MB/s	4-to-1
1998	100 MB/s	100 MB/s	1-to-1

Wires to Disk:	*Wires to Network:*
SCSI	10bT shared (÷ 10)
Fast-Wide SCSI	FDDI shared (÷ 10)
Ultra SCSI	100bT switched
Fibre Channel	Gigabit switched

➔ **IP Networks are fast enough for storage**

Advantages of IP Networking

- Ubiquitous Technology
  - Low Acquisition Costs
  - Standards-based solutions
  - Commodity economics
  - Installed in every corporation
- Low Management Costs
  - Familiar network technology and management tools
  - Proven reliable/interoperable transport infrastructure
- Wide Area Connectivity
  - Enables remote data replication and disaster recovery
- Long-term viability
  - Large R&D investment profile, strong roadmap
  - 10 Gb Ethernet emerging; 40 Gb roadmap

TCP/IP Transport

- IP Storage protocols (iSCSI, iFCP & FCIP) all use TCP/IP for transport
- TCP/IP provides:
  - Connection oriented delivery
  - Guaranteed packet delivery
  - Guaranteed order
  - End to end flow control
  - Quality of Service tagging for service differentiation

Standard Networking Capabilities

- IP Network Tools (ping, traceroute, etc)
- IP Traffic Shaping – QoS
- IP Interoperability
  - Ethernet, ATM, Sonet, Switches, Routers, Hubs, etc
- IP Network Provisioning
- IP Routing – Spanning Tree, etc…
- Familiar Auto Address Mgmt
  - DHCP, DNS
- IP Authentication, Access Control and Security
  - IPSec, CHAP, RADIUS, etc

➔ **Can bring improved flexibility and ease-of-use to SANs**

IP Storage Security

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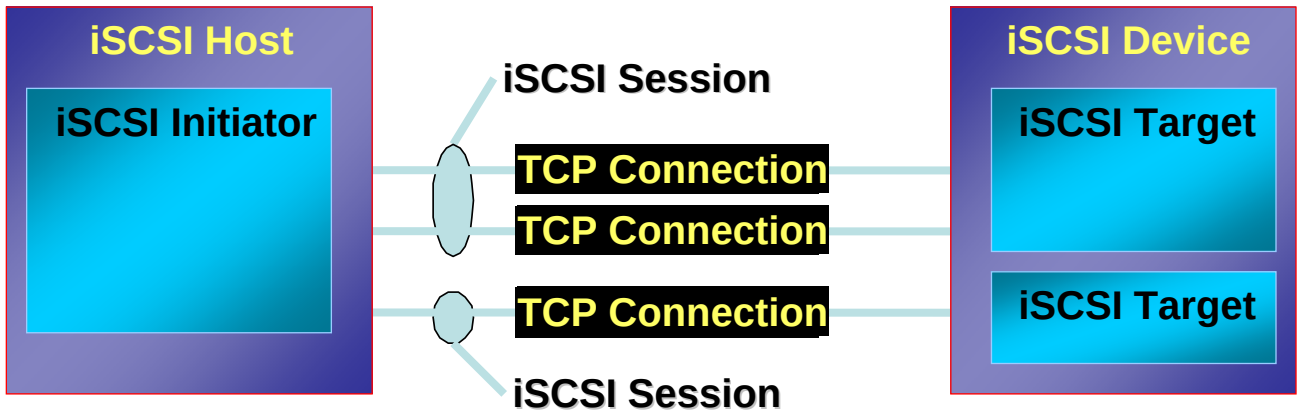
Security Levels:

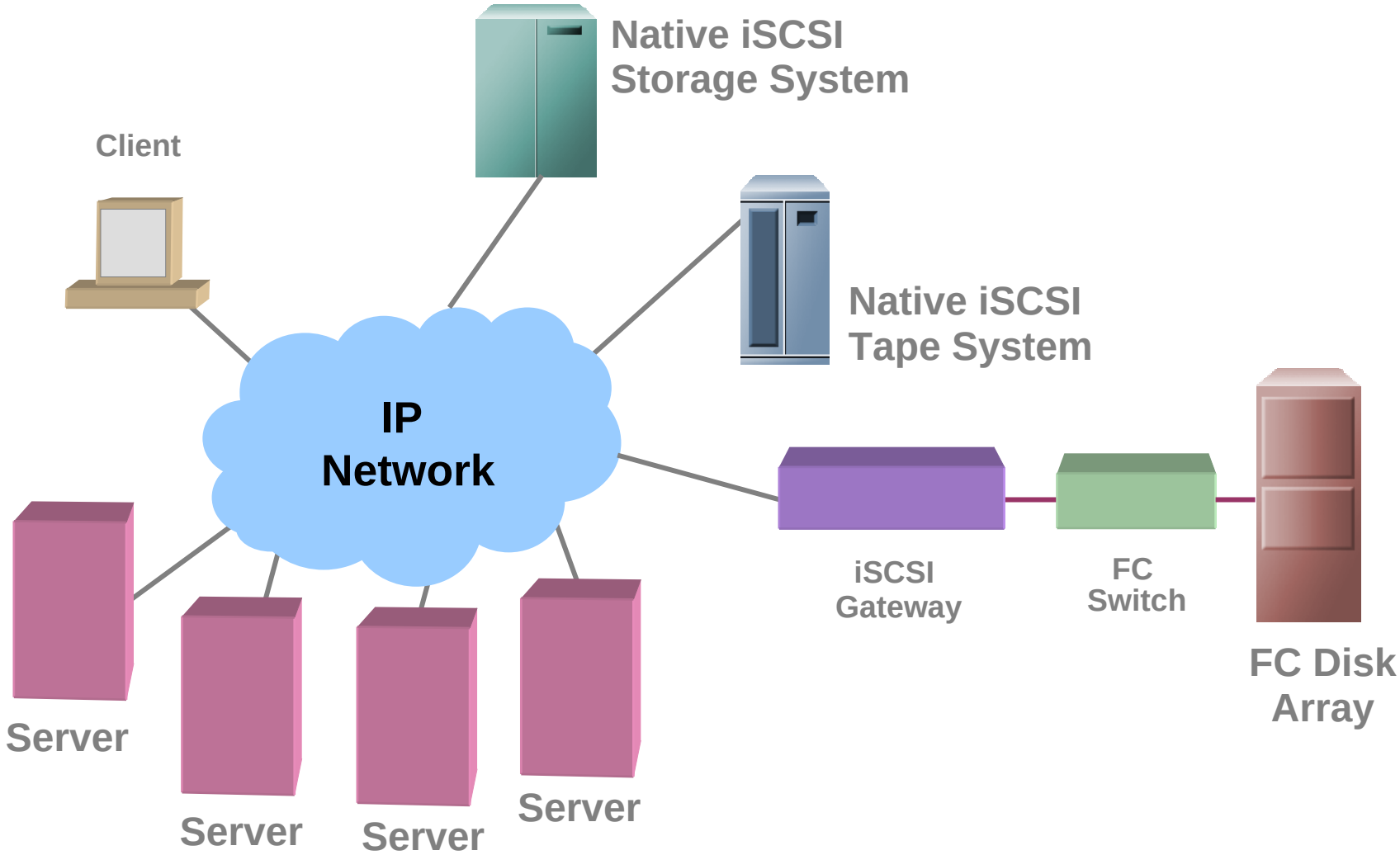
- None
  - Equivalent to Fibre Channel
  - OK in controlled (private network) environments
- iSCSI Initiator and Target (RADIUS) authentication
  - Prevents unauthorized access
  - Permits only trustworthy nodes
  - Uses CHAP, SRP, Kerberos, SPKM
- IP based firewalls
- IPsec Digests and anti-Reply
  - Prevents insertion, modification and deletion
- IPsec Encryption
  - Provides privacy
  - Prevents eavesdropping

iSCSI Operation

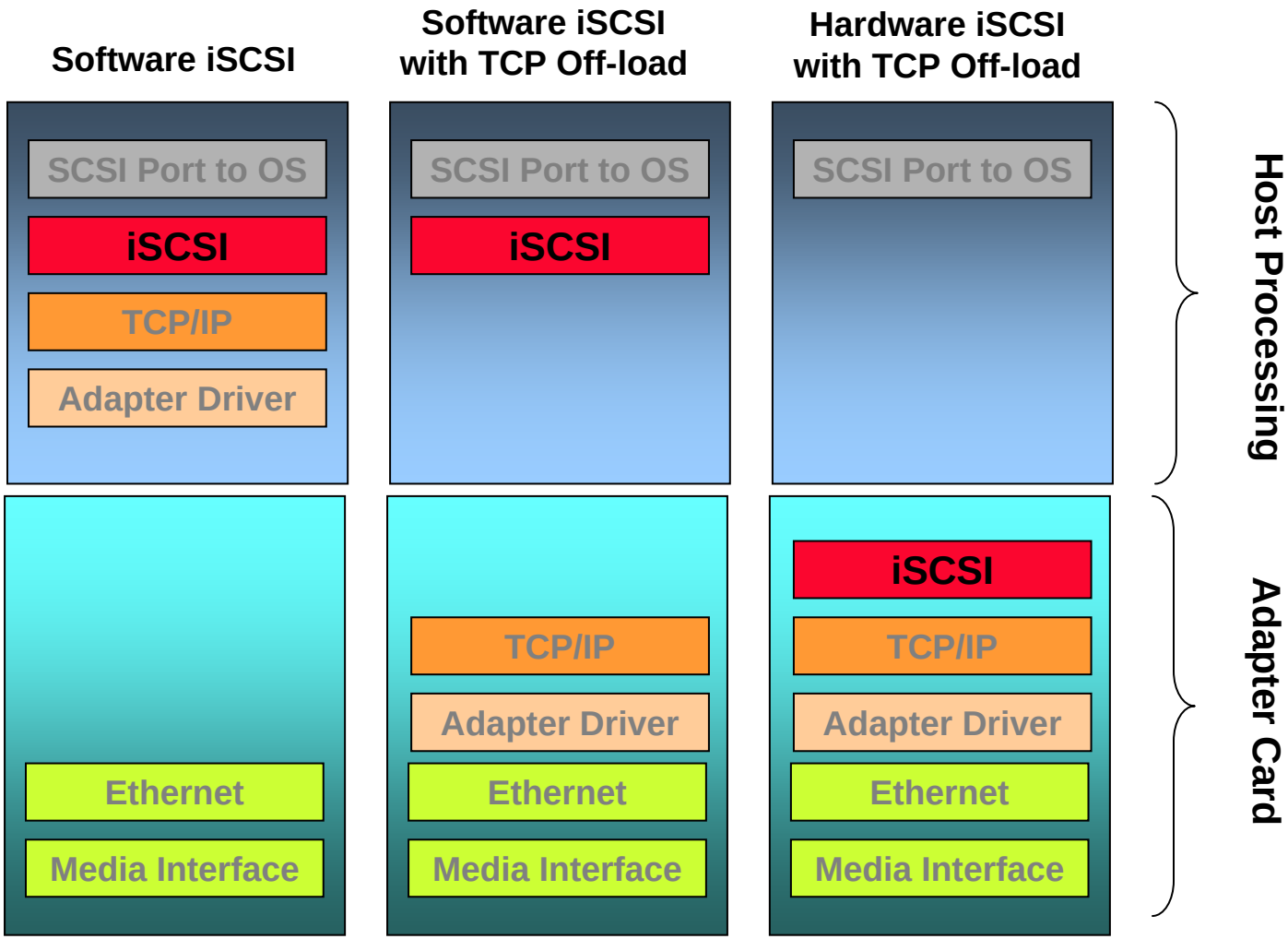


- Initiators and targets can be implemented in H/W or S/W
- Session between initiator and target
  - One or more TCP connections per session
  - Login phase begins each connection
- Services (e.g., authentication, security) negotiated during login
- TCP Protocol provides
  - Delivery of SCSI commands in order
  - Recovery from lost connections

iSCSI Implementations



iSCSI & TOE Adapters



Performance Considerations

- Software iSCSI initiator + standard NIC
  - Host CPU overhead ~500MHz to saturate 1GbE
  - Pros: Low cost (free download)
    Adequate for many mid-range applications
  - Cons: Cannot implement remote boot.
- iSCSI TCP Offload (TOE) NICs
  - Pros: More than adequate performance for vast majority of applications
  - Cons: Cannot implement remote boot.
- iSCSI HBAs
  - Pros: Higher performance with CPU offload
    Optional IPSec for security and Data Digest for higher data integrity
    Ideal for data center applications
  - Cons: More expensive than standard NIC

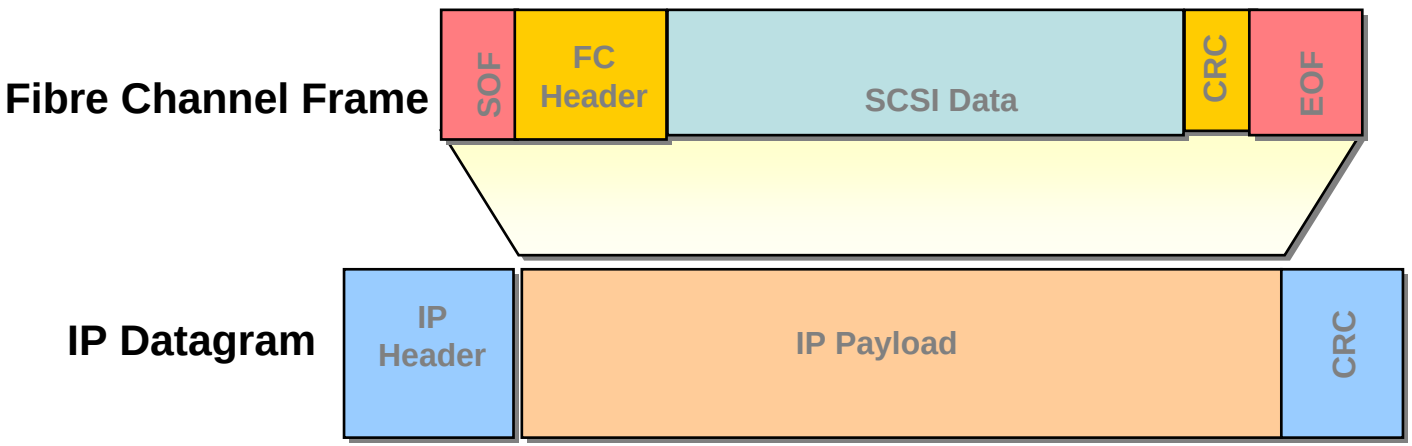
iSCSI – Why It's Important

- Software iSCSI initiators included with operating system make it easier to deploy SANs
- Lower cost infrastructure broadens reach of SAN solutions
- Built-in networking capabilities simplify SAN management
- Leveraging IP networking investments and knowledge base lowers total cost of ownership

➔ **Excellent SAN solution for smaller servers today**

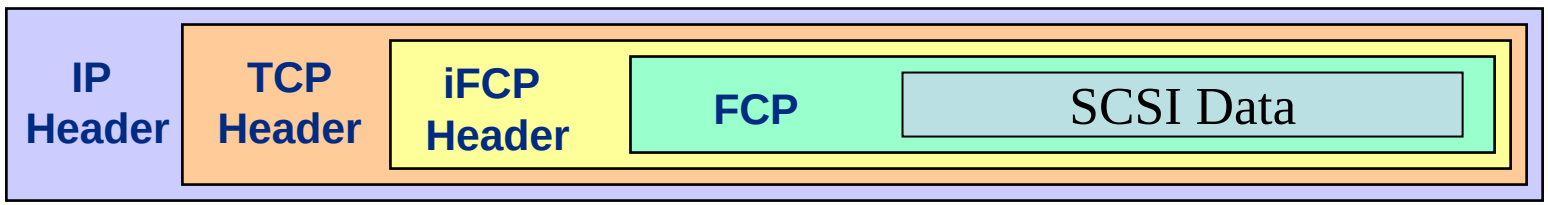
Fibre Channel over TCP (FCIP)

- A tunneling protocol that encapsulates and transports FC frames over TCP/IP
- Only FCIP Gateways need to be aware of FCIP encapsulation (iFCP requires iSNS)
- IP is unaware of the FC Payload and the FC fabric is unaware of the IP transport

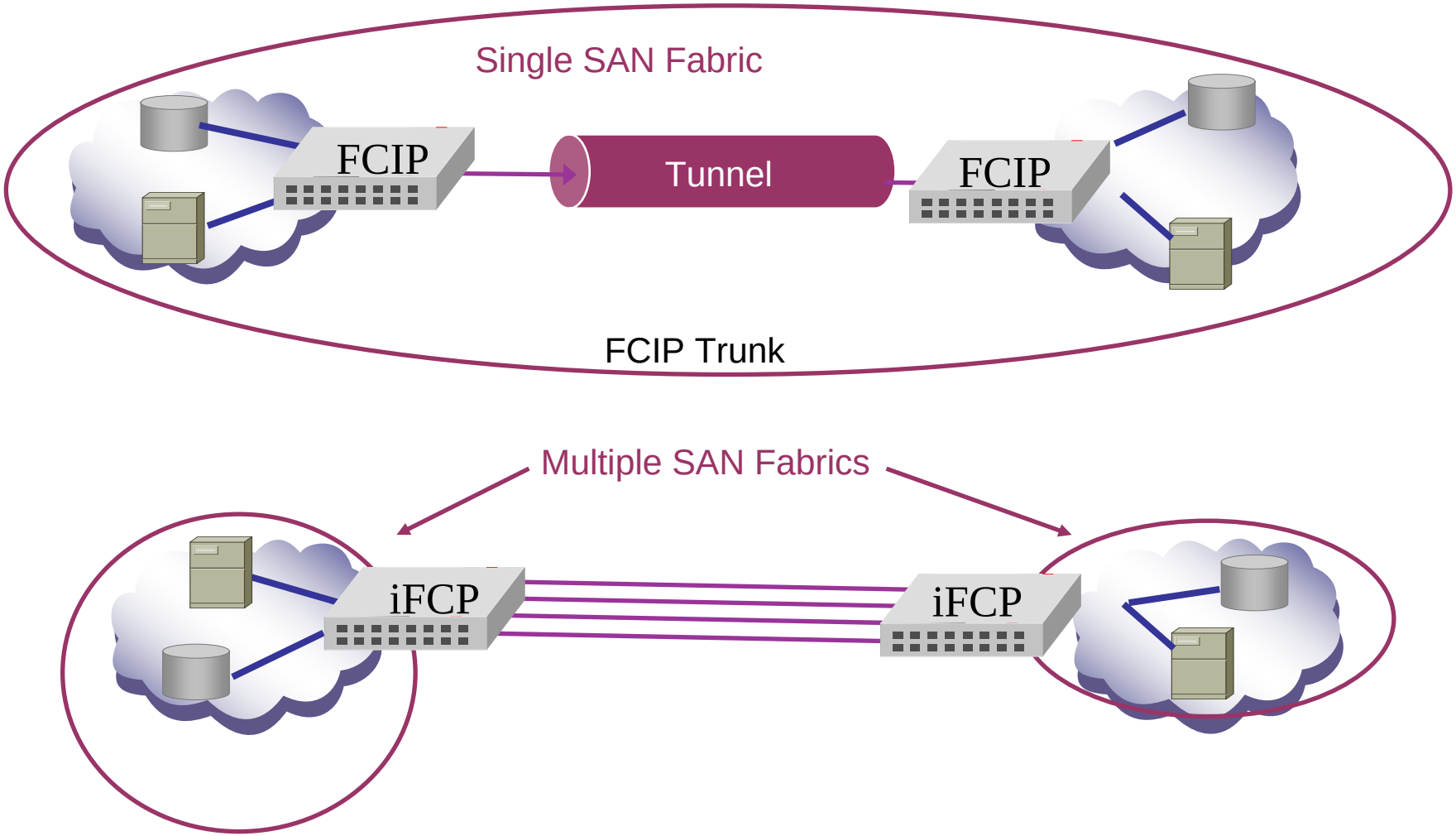


Internet Fibre Channel (iFCP)

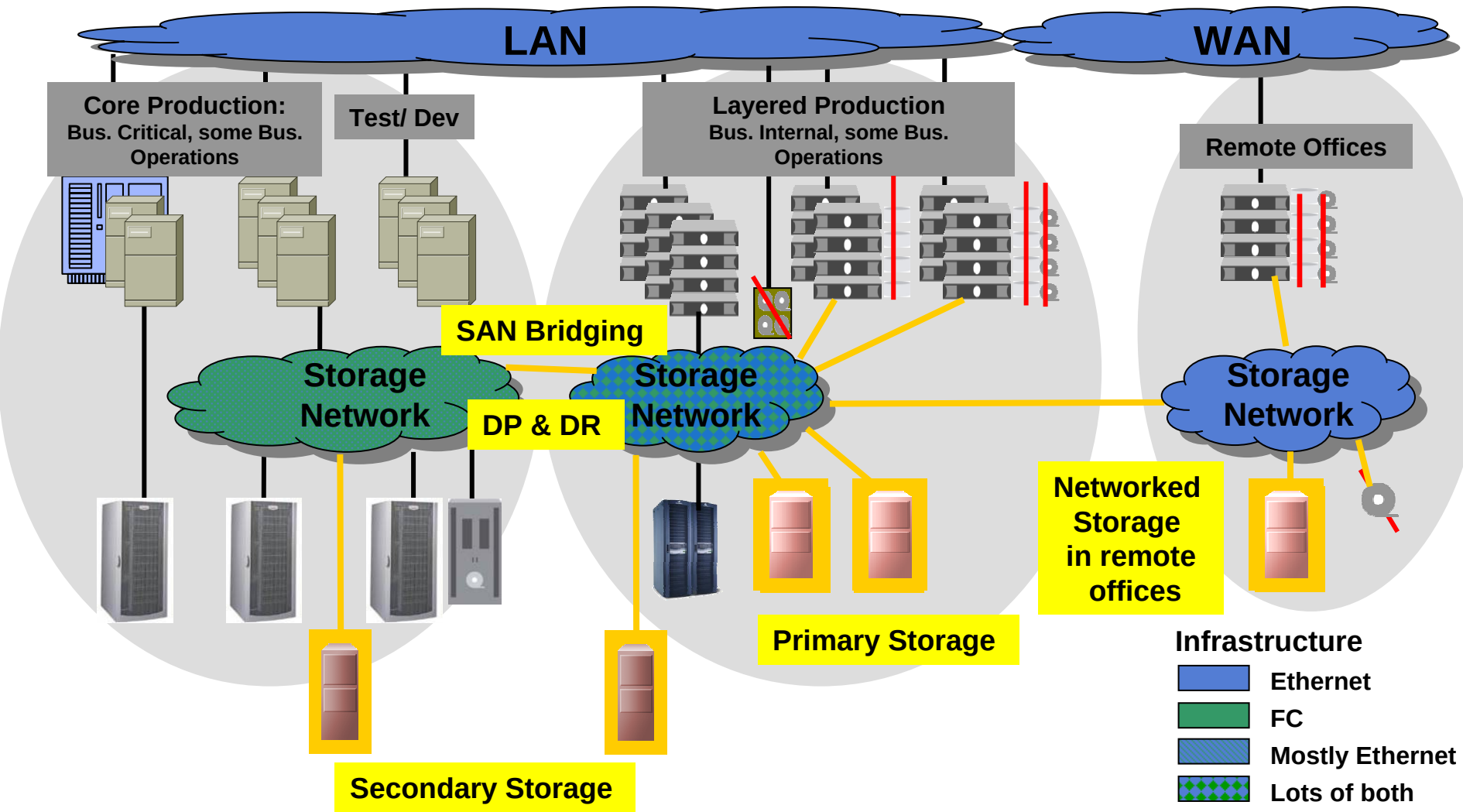
- Allows users to interconnect FC devices over a TCP/IP network at any distance (same as FCIP)
- iFCP maps each FC address to an IP address and each FC session to a TCP session
- FC messaging and routing services are terminated at the gateways so that fabrics are not merged



FCIP & iFCP Comparison



Where IP Storage Fits



IP Storage – What's Next

- Implementations
  - Broad array vendor support
  - Second generation iSCSI initiators
  - Complete open systems OS support
- Standards
  - RDMA/10GbE
  - iSER
  - SMI-S 1.1 support for iSCSI

Summary

- IP Storage is based on industry standard protocols
- IP Storage leverages current investments in IP infrastructure and expertise
- IP Storage complements and extends existing FC SAN infrastructure
- IP Storage brings SAN solutions to more environments and more price points
- IP Storage solutions are available today

Q&A / Feedback

- Please send any questions or comments on this presentation to SNIA: track-networking@snia.org

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SNIA Education Committee

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