

# SNIA

STORAGE NETWORKING INDUSTRY ASSOCIATION

EDUCATION

## IP Storage

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## 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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- IP Networking
- IP Storage Technologies
- iSCSI
  - How it Works
  - Security Considerations
  - Performance
- iFCP
- FCIP
- Summary

# IP Network Bandwidth

<u>Year</u>	<u>Storage</u>	<u>Network</u>	<u>Penalty</u>
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:*  
SCSI  
Fast-Wide SCSI  
Ultra SCSI  
Fibre Channel

*Wires to Network:*  
10bT shared ( $\div 10$ )  
FDDI shared ( $\div 10$ )  
100bT switched  
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

## Security Levels:

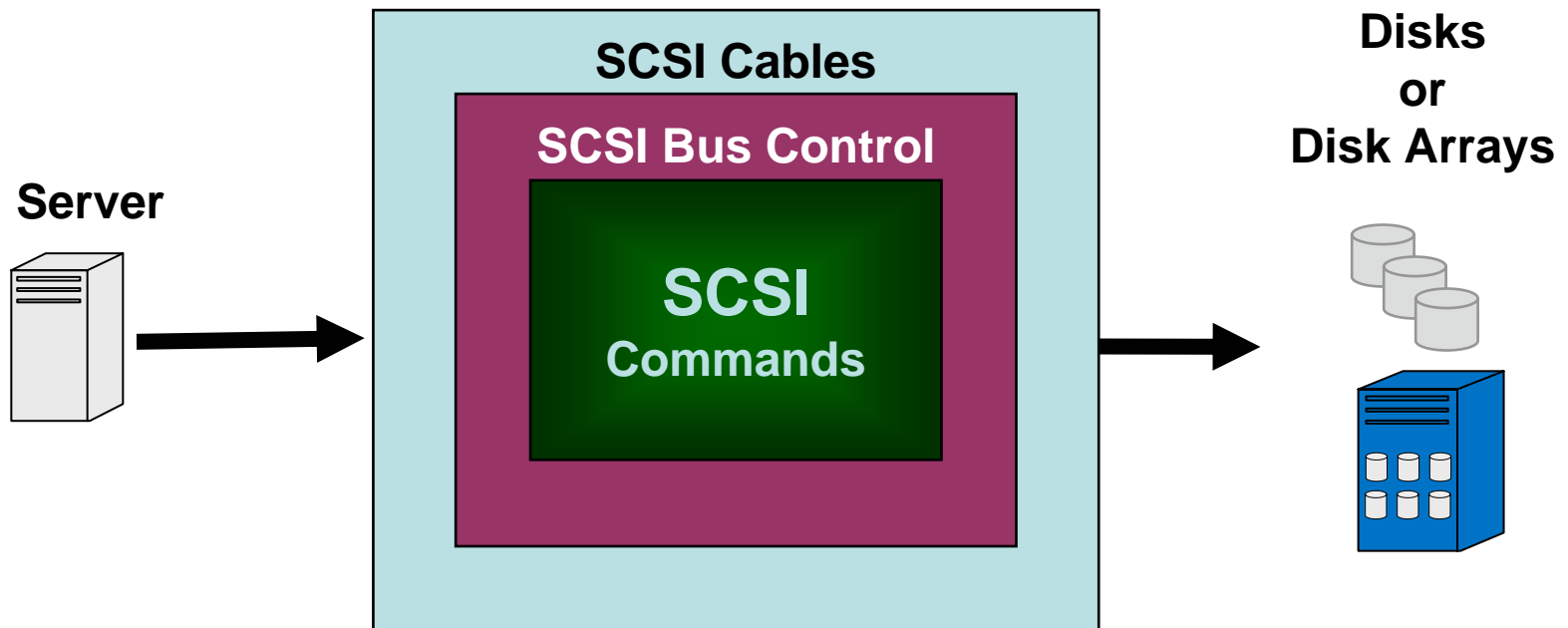
- None
  - Equivalent to Fibre Channel
  - OK in controlled (private network) environments
- iSCSI Initiator and Target (RADIUS) authentication
  - Prevents unauthorized access
  - Permits only trustworthy nodes
  - Uses CHAP, SRP, Kerberos, SPKM
- IP based firewalls
- IPsec Digests and anti-Reply
 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

# 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

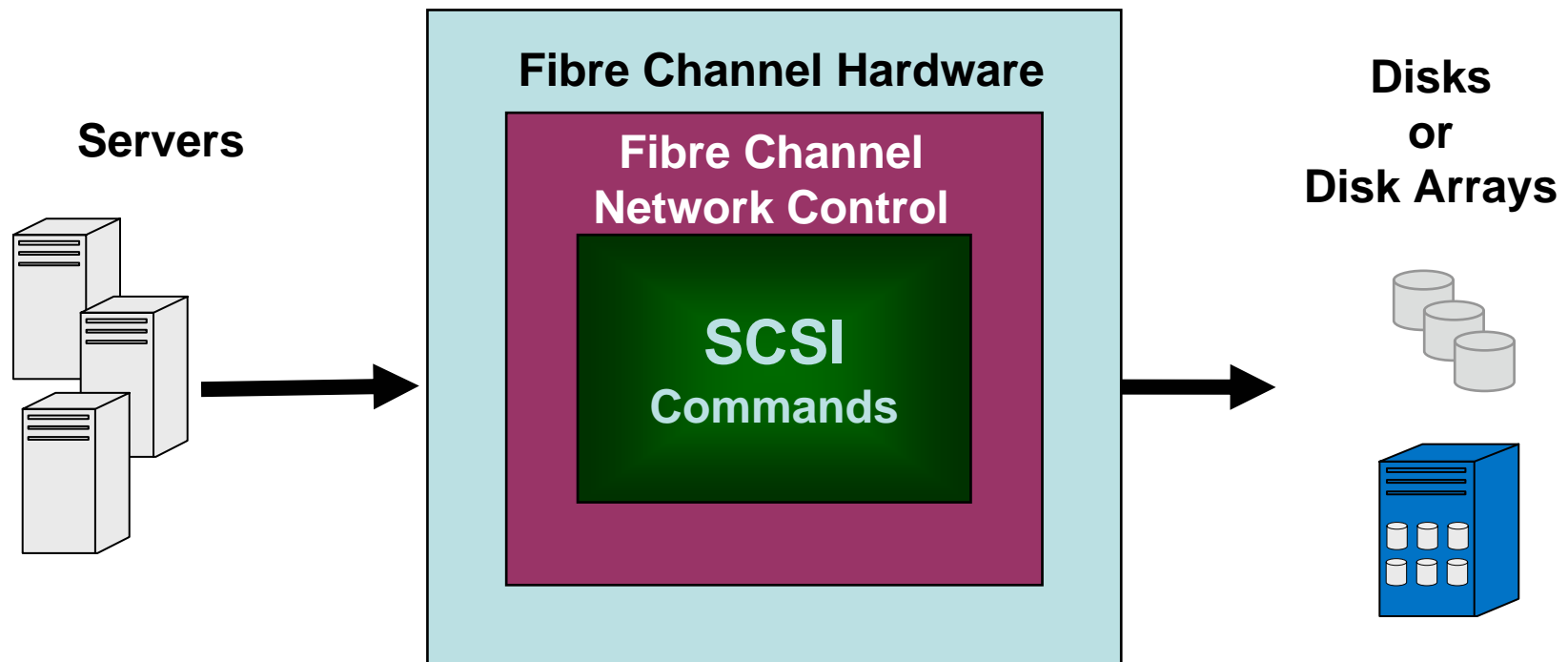
# The Foundation: SCSI

- A type of parallel communications cable
  - A way to control communications on the cable
- Set of commands servers use to control storage



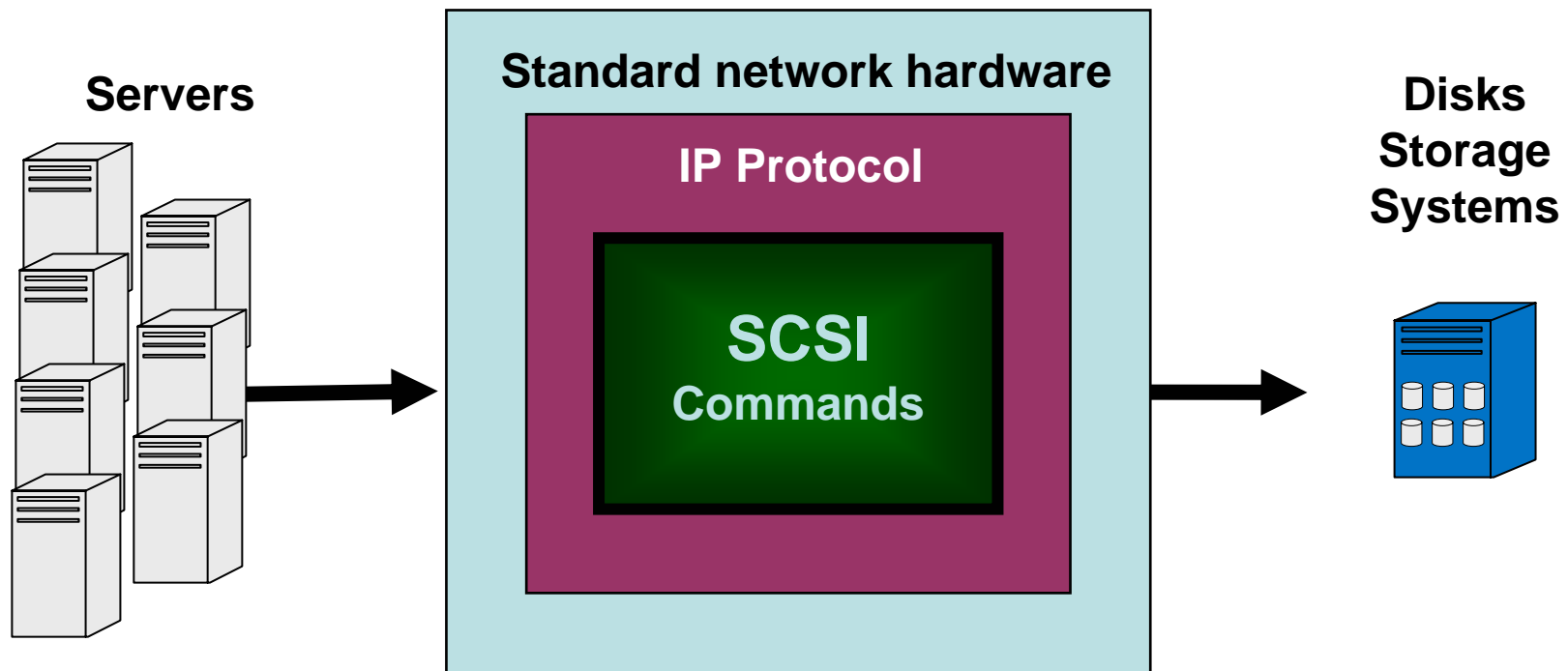
# Fibre Channel SCSI (FCP)

- A serial communications network
  - Network control standard to deliver packets
- Purpose: Deliver SCSI commands with better connectivity

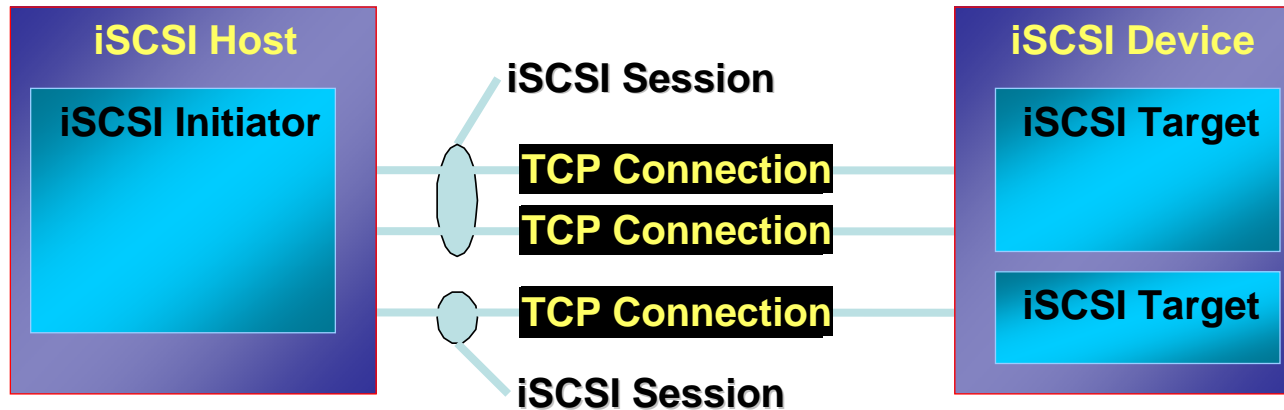


# iSCSI: SCSI over TCP/IP

- Uses standard network hardware
  - Relies on transports for TCP/IP and TCP/IP commands
  - Builds on top of rich features in TCP/IP
- Purpose: Deliver SCSI commands simpler and cheaper

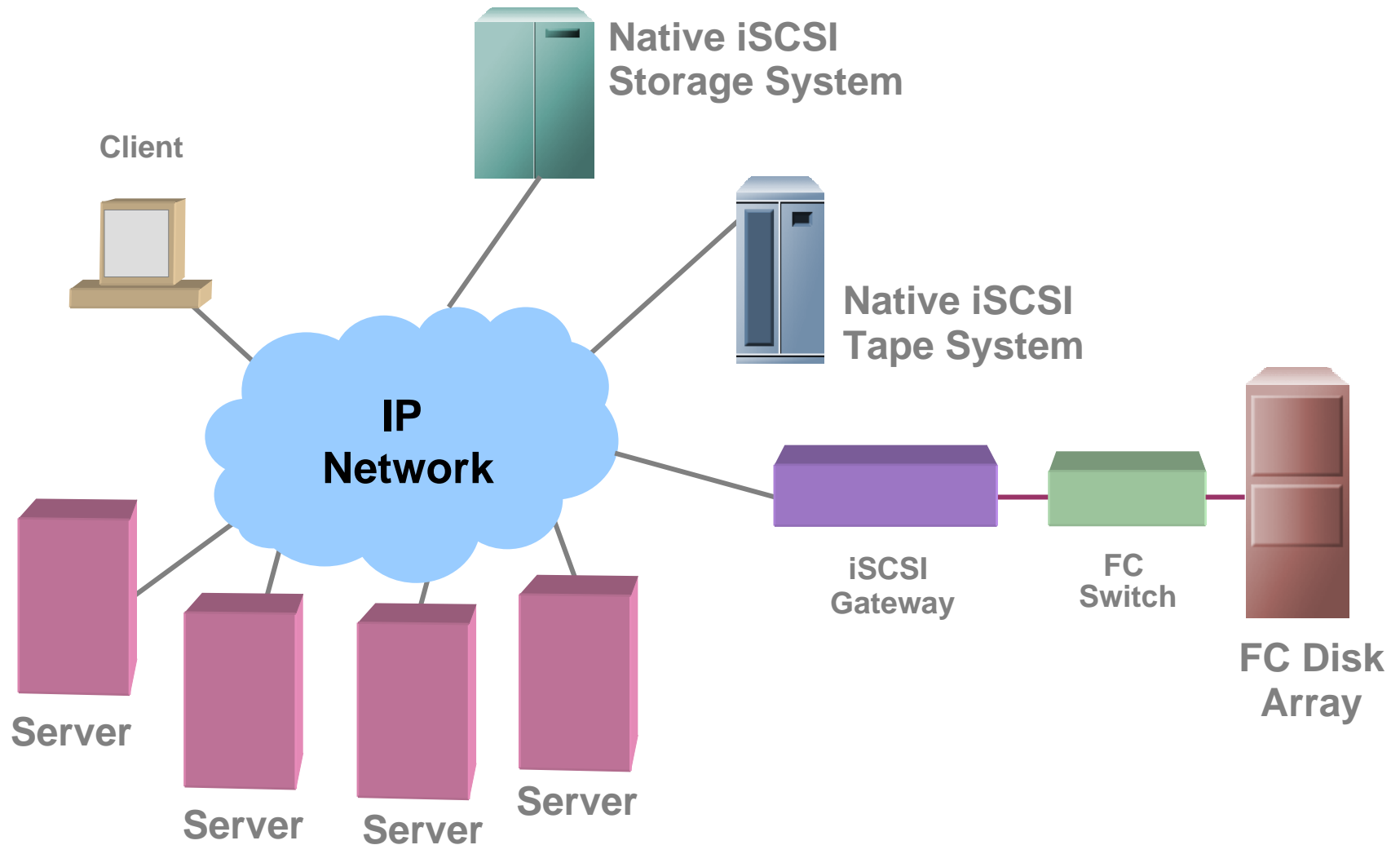


# iSCSI Operation

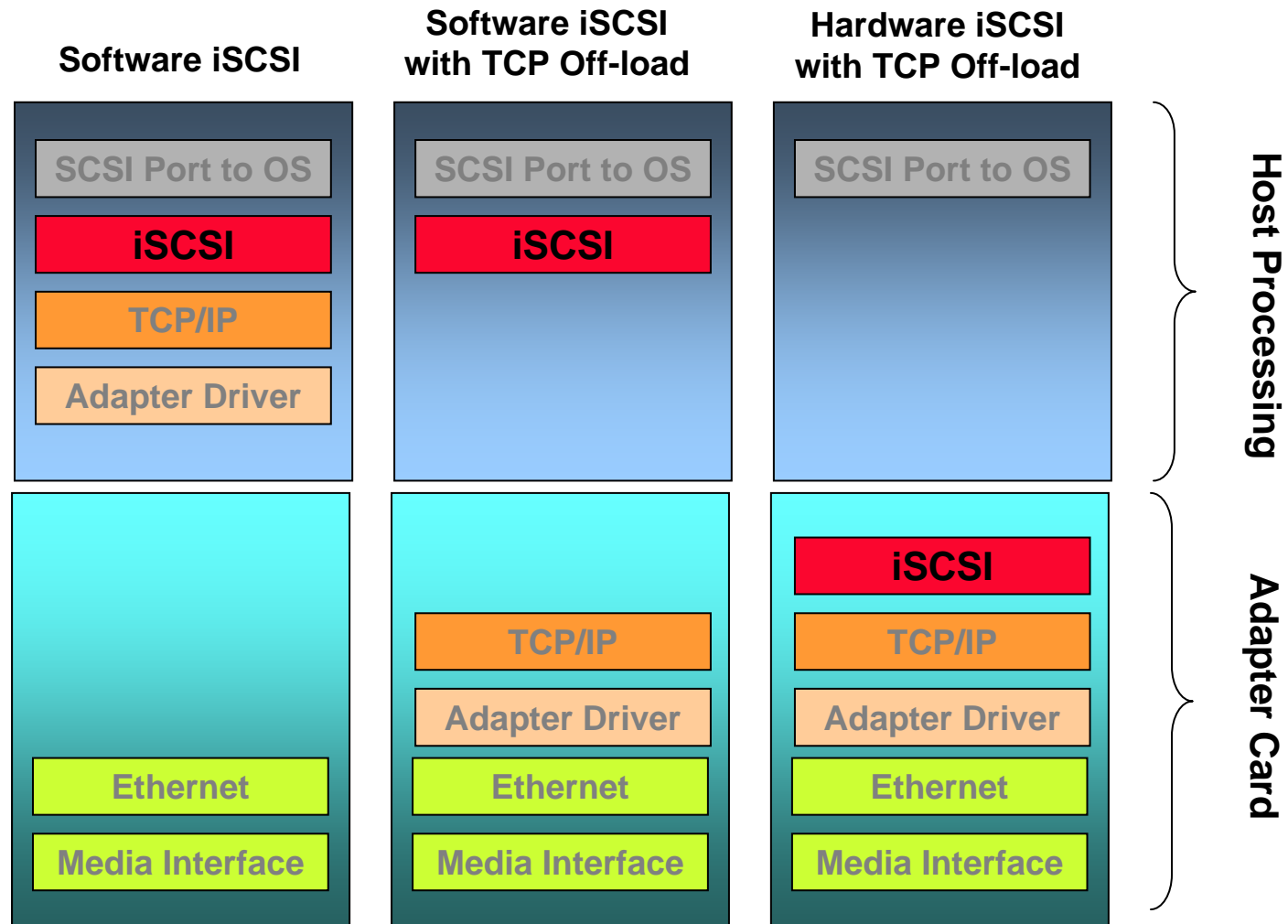


- Initiators and targets can be implemented in H/W or S/W
- Session between initiator and target
  - One or more TCP connections per session
  - Login phase begins each connection
- Services (e.g., authentication, security) negotiated during login
- TCP Protocol provides
  - Delivery of SCSI commands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

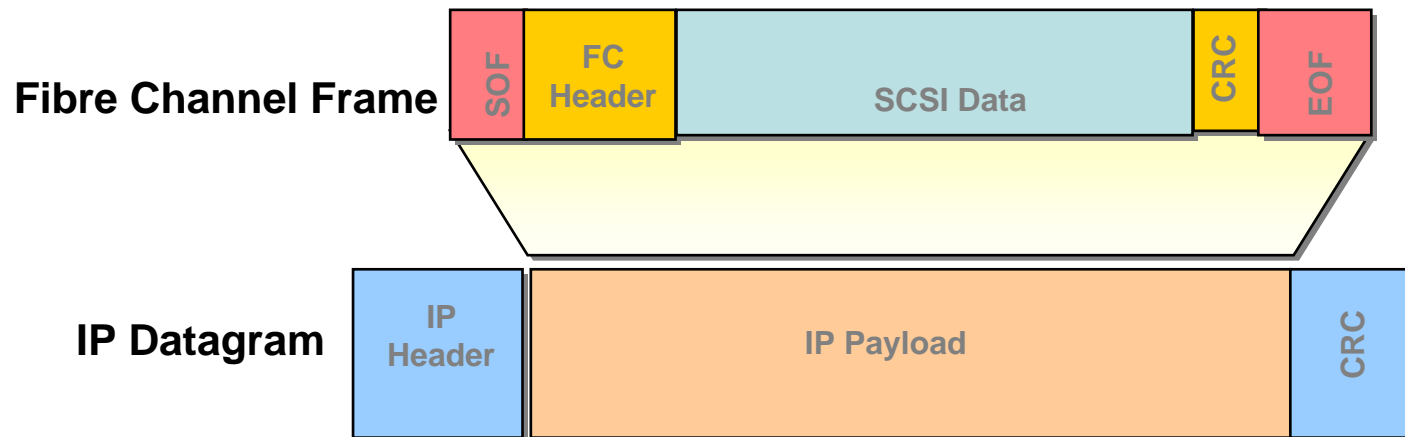
# iSCSI – Why It's Important

- 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)

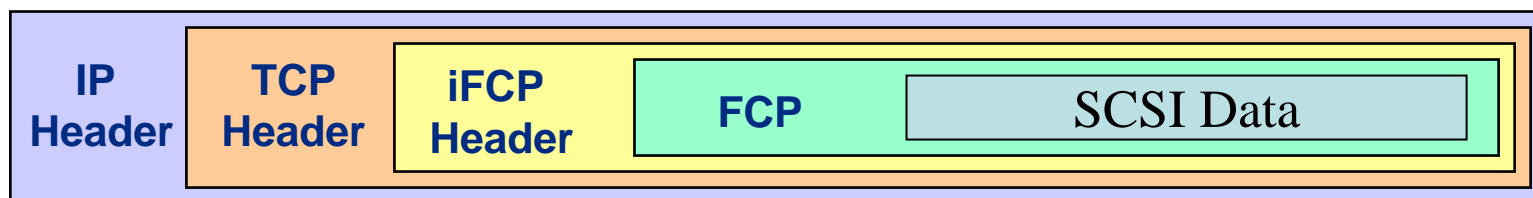
- A tunneling protocol that encapsulates and transports FC frames over TCP/IP
- Only FCIP Gateways need to be aware of FCIP encapsulation (iFCP requires iSNS)
- IP is unaware of the FC Payload and the FC fabric is unaware of the IP transport



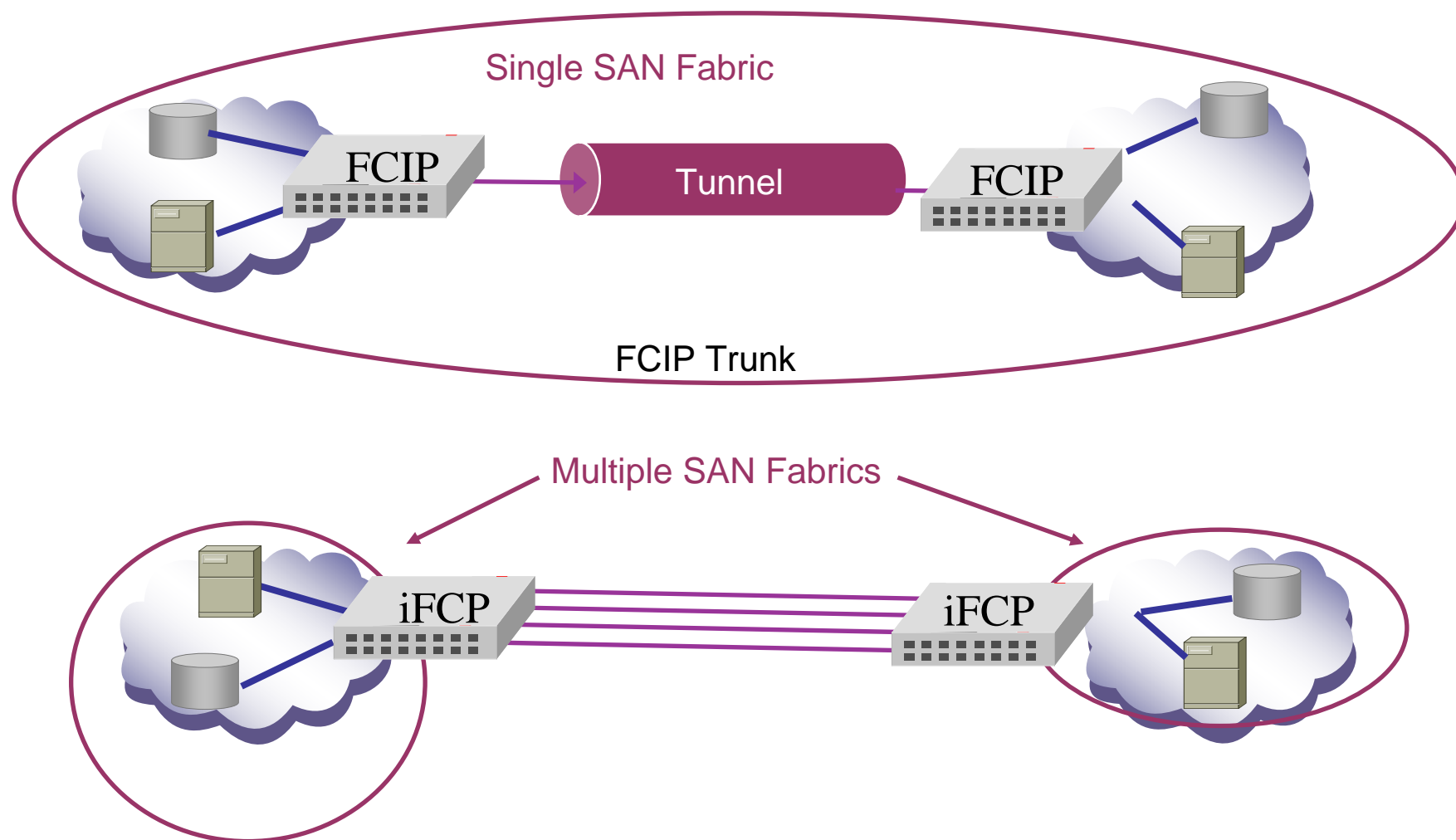


# Internet Fibre Channel (iFCP)

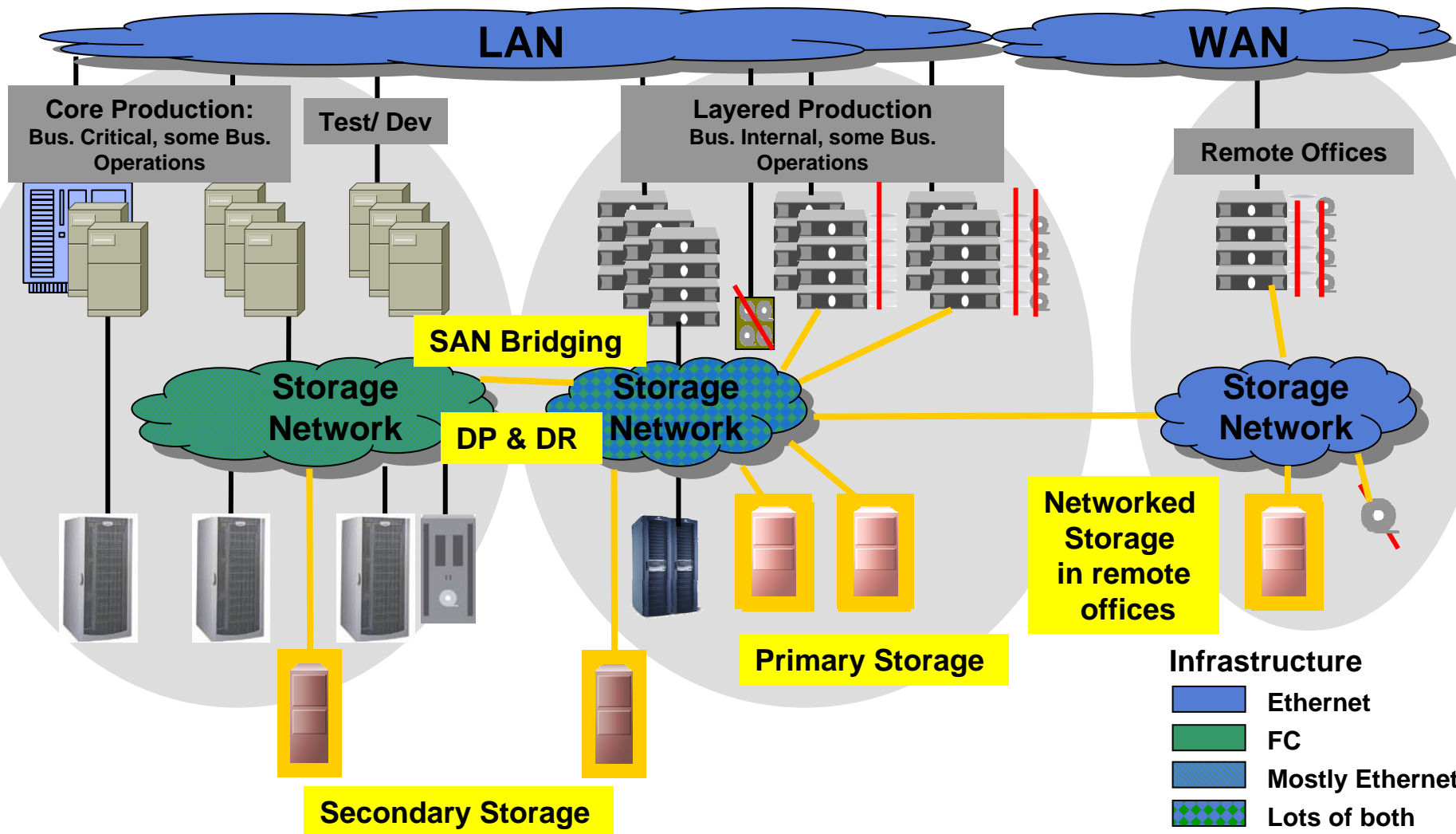
- Allows users to interconnect FC devices over a TCP/IP network at any distance (same as FCIP)
- iFCP maps each FC address to an IP address and each FC session to a TCP session
- FC messaging and routing services are terminated at the gateways so that fabrics are not merged



# 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](mailto:track-networking@snia.org)

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