

Cisco and Panduit have collaborated to create enterprise data center topologies that provide guidelines for better storage network design in the data center. These topologies are based on the vision of a Unified Physical InfrastructureSM (UPI) and incorporate:

- Storage networking design best practices
- Physical layer infrastructure best practices
- Power, cooling, and space considerations
- Connectivity and cabling impact
- Data center standards

Data center designs featuring storage networking must address the interdependencies between the logical network and physical layer infrastructure. This at-a-glance provides an overview of the key design considerations.

Storage Networking Design

Data center storage networking design requires a layered approach:

- Logical network design determines overall capacity of the data center and physical layout for the storage network infrastructure.
- Logical network design and tiered storage topology determine the active hardware and physical layer requirements (tiered storage includes mission-critical, business-critical, and backup/disaster recovery storage).
- Integration of active and physical layer components determine facility requirements for floor space, power, and cooling.

Future capacity, new technologies such as Fibre Channel over Ethernet (FCoE) and Data Center Ethernet (DCE), faster data rates (10 Gbps and beyond), and industry standards must be taken into account throughout the design process.

Storage Network Considerations

A logical network architecture design must consider the following capacity measurements:

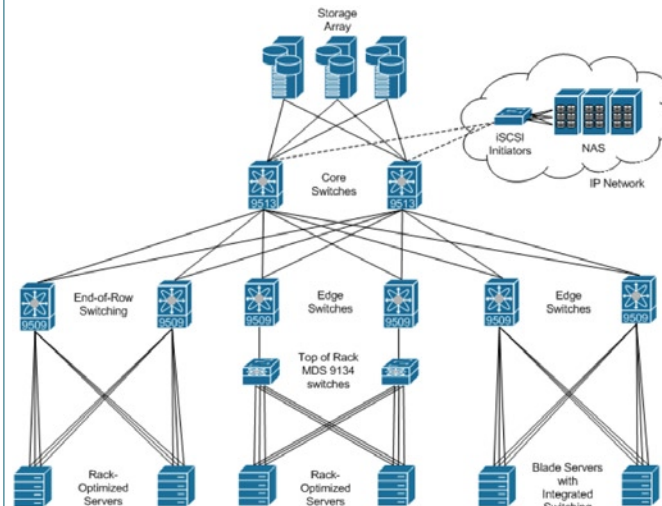
- Port density
- Link bandwidth
- Server capacity
- Storage capacity
- Fan-in, Fan-out, and Oversubscription of free storage space

If these considerations are not carefully addressed, network bottlenecks can limit data center performance and underutilize storage space in the storage network.

Cisco Storage Network Logical Topology

Figure 1 shows a storage network topology for deployment of the Cisco[®] MDS 9500 Series directors and MDS 9200/9100 Series switches in a data center environment.

Figure 1. Storage Network Topology



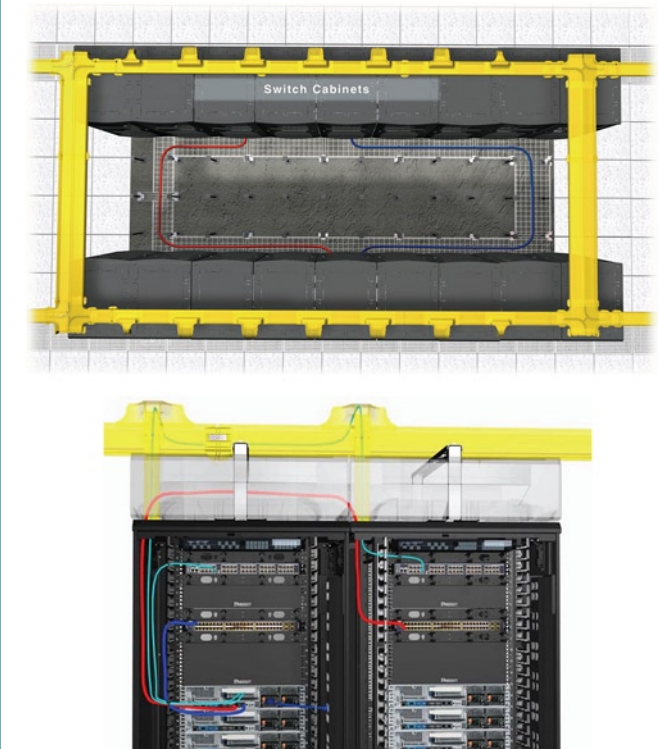
Storage Network Equipment Architectures

Cisco and Panduit have partnered to create enterprise infrastructure topologies for three distinct storage network logical architectures:

- End of row: A modular chassis supports one or more racks or cabinets of servers within a row.
- Top of rack: A native Fibre Channel or consolidated I/O switch supports server equipment within the rack.
- Integrated switching: Integrated Fibre Channel switches address blade chassis server environments.

Cisco-Panduit topologies (see Figure 2) provide the flexibility to interchange architectures without substantial impact to the overall data center infrastructure.

Figure 2. Example Module POD Topology Layout (top) and Cabinet Elevation with Top-of-Rack Switching (bottom)



Infrastructure Considerations

Specific business applications determine the active hardware requirements:

- Number of storage networking switches:
 - Ports on each network layer (core and edge)
 - Zoning and VSAN assignments per port
 - Bandwidth per port and per switch
- Number of servers:
 - Storage network ports per server
 - Bandwidth requirements per server
 - Type of server connection (LC or SFP+)
- Number of storage components:
 - Storage classification (tier)
 - Component type (disk array, tape library)

These in turn determine the requirements in the physical layer (or connectivity) infrastructure to host and interconnect active components. This includes cabinets, cabling and connectivity, cable management, cable pathways, and grounding.

Panduit and Cisco's comprehensive connectivity solutions integrate server, storage, and storage networking components to help ensure efficient installation and long-term interoperability. The Panduit® Net-Access™ Switch Cabinet provides the security and aesthetics of a cabinet with accessibility and thermal performance comparable to an open rack (Figure 3).

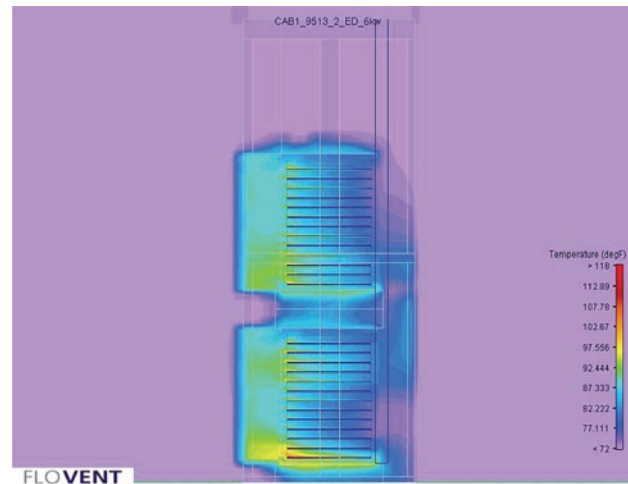
Figure 3. Panduit NetAccess Cabinet with Two Cisco MDS 9513 Switches and Associated Fiber Connectivity



Features include:

- Thermal ducting to provide hot/cold aisle deployments for side-to-side airflow switches
- Thermal and cable management to provide capacity for two Cisco MDS 9513 directors (Figure 4)
- Cable management to ensure optimal bend radius and access to vertical pathways
- Fully integrated electrically bonded structure to ensure protection for active equipment

Figure 4. Computational Fluid Dynamic (CFD) Testing Showing Proper Thermal Management of Two Cisco MDS 9513 Switches in One Panduit NetAccess Cabinet



Using Panduit physical infrastructure hardware solutions within a combined Cisco-Panduit pod topology helps ensure:

- Faster build, install, deploy, and commission time frames
- Efficient use of data center footprint
- Scalability for future growth
- Agility to interchange network architectures with limited impact to the data center infrastructure
- Greater uptime and availability

Connectivity and Cabling Impact

The choice of connectivity and cabling has a direct impact on overall storage networking performance. Key factors that the network designer must take into account include:

- Performance features:
 - Bandwidth and throughput
 - Reach and distance
 - Loss characteristics
 - Future-readiness for faster data rates
- Physical features:
 - Patching density and connector form factor
 - Cabling form factor
 - Installation time and ease
 - Scalability for future network growth
- Serviceability:
 - Agility for moves-adds-changes
 - Maintenance and repair requirements
 - Labeling and administration needs

Summary

Cisco-Panduit data center infrastructure topologies provide enterprises with a series of templates to quickly deploy robust, flexible, and scalable storage architectures to maximize return on technology investment. These topologies support the rapidly evolving and fast-growing physical infrastructure demands of mission-critical data centers across multiple industries. As part of the larger Unified Physical InfrastructureSM vision, these storage networking solutions reduce risk and deliver the highest reliability and performance.

For More Information

- For Cisco solutions: www.cisco.com/go/datacenter
- For Panduit solutions: www.panduit.com/datacenter
- For Unified Physical InfrastructureSM solutions featuring Cisco and Panduit: www.panduit.com/upi