Improving on a Proven Process

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Data Center Systems (DCS)

Before Structured Cabling

- Late 80's
  - Data Center connectivity
    - Copper Bus & Tag cable assemblies
- 1990
  - IBM released first Mainframe utilizing fiber optic transmitters
    - ESCON protocol
  - At the same time, IBM Introduced the first fiber optic structured cabling solution for the data center
    - Fiber Transport System (FTS)

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Fiber Transport System (FTS)

- Fiber Transport System
  - Introduced to replace point-to-point connectivity
  - Data center equipment connected to centralized fiber patch panels, also known as a Central Patching Location (CPL)

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Fiber Transport System (FTS)

- Components of FTS:
  - Central Patching Location (CPL)
  - Zone Distribution Panels
  - Harnesses
  - Patch Panels
  - Trunk Cables
  - Jumpers

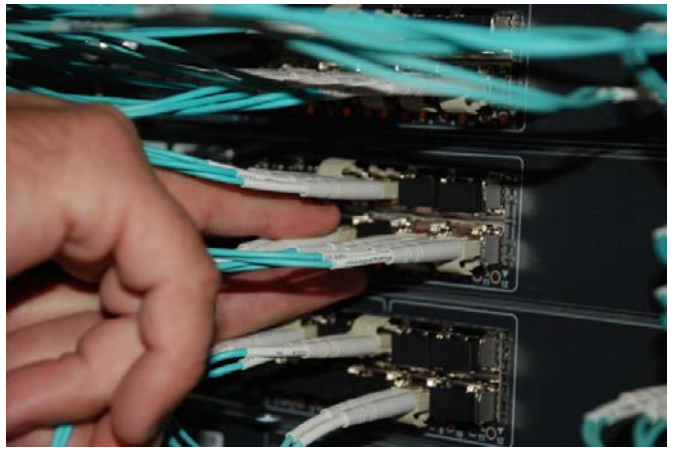
Fiber Transport System (FTS)

- Benefits:

  The actual CPU-to-Storage Device connections were “patched” using short jumpers on the front side of the patch panel at the Central Cross-Connect

Fiber Transport System (FTS)

- Benefits:
  - Relocates the ports away from the active running equipment
    - Directors
    - CPU's
    - Storage Devices
      - Disk
      - Tape



Data Center Boom

- 1995 -
  - Dot Com explosion
  - Client-server computing
  - Internet
  - Email
  - Fibre Channel protocol
- Result:
  - Storage demands soared
  - “Data Center” became a household name

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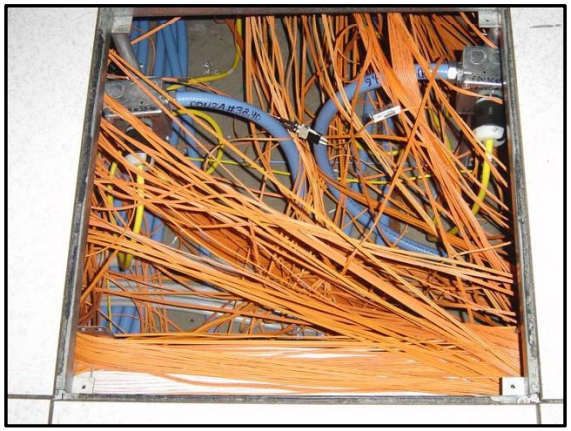
Data Center Boom

- Early 2000
  - Division in the data centers
    - Open Systems vs. Mainframe
- Connectivity standards?



TIA-942 - Telecommunications Infrastructure Standard for Data Centers

- April 2005

  Introduction of the TIA-942

  – Purpose of TIA-942:
    - Provide requirements and guidelines for the design and installation of a data center or computer rooms
    - Address the floor layout topology related to achieving the proper balance between security, rack density and manageability
    - Cabling

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TIA 942 -Telecommunications Infrastructure Standard for Data Centers

- Two Different Methods of Cabling
  - Distributed
    - Network
  - Centralized
    - Fibre Channel
    - Mainframe

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Centralized Structured Cabling
Understanding the Methodology

- 2005 TIA-942 6.5 Centralized Optical Fiber Cabling
  - Section 6.5.1 Introduction
    - Centralized cabling provides connections from equipment distribution areas to a Central Cross-Connect by allowing the use of pull-through cables, interconnects, or splice in the horizontal distribution area

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Centralized Structured Cabling

- 2005 TIA-942 6.5 Centralized Optical Fiber Cabling
  - Section 6.5.2 Guidelines
    - Centralized cabling implementations shall be located within the same building as the equipment distribution areas served.
    - The administration of moves, adds and changes shall be performed at the centralized cross-connect.

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Centralized Structured Cabling

- Components:

  Central Cross-Connect /Central Area Patching facility

  – All ports on all active devices within your Mainframe and /or SAN are represented by a port on a front side of a patch panel located at the Central Cross-Connect/ Central Area Patching facility (CAP)

Centralized Structured Cabling

- Components:

  Interconnects/Zone Access Points

  – Strategically placed cabinets or racks that contain patch panels

  – Distributes horizontal cabling to all active equipment within a defined area via jumper cables

  – Connected to the Area Patching facility via trunk cables

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Centralized Structured Cabling

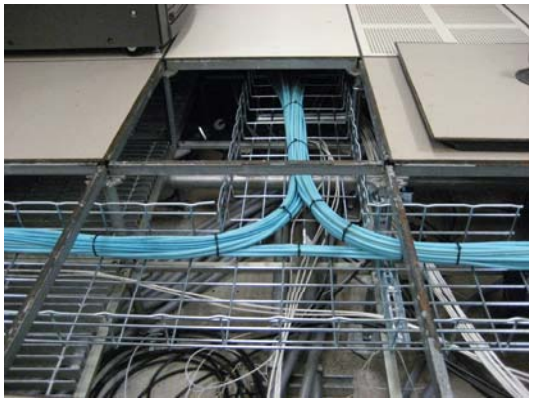
- Benefits:

  This establishes the static cable pathways used to connect:

  – Director Class Switches to the Central Area Patching facility

  – Zone Access Points to the Central Area Patching facility

  – Zone Access Points to the Servers and Storage Devices



Centralized Structured Cabling

- Benefits:

  The actual Server-to-Director Class Switch and a Director Class Switch-to-Storage Device connections are made using short jumpers at the Central Cross-Connect

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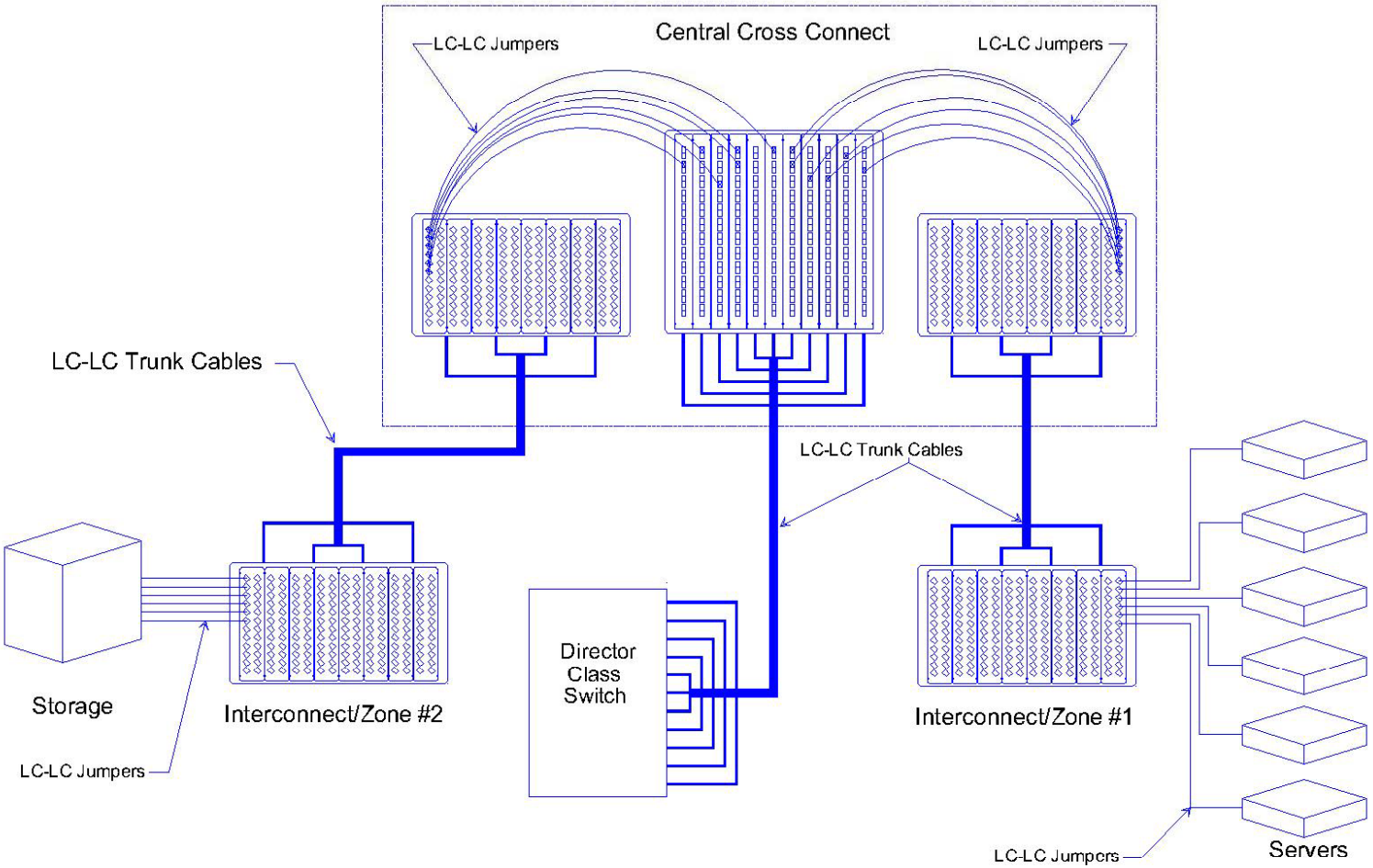
Centralized Structured Cabling



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Centralized Structured Cabling

- Benefits:

  When additional Director Class Switches are added to the system they are connected via trunk cables to a new patch panel located at the Central Area Patching facility

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Centralized Structured Cabling

- Benefits:

  When servers or storage devices are added to the system they are connected, via jumper cables, to the nearest Zone Access Point

  As additional capacity is needed at a Zone Access Point, new patch panels and associated trunk cables are installed
  - One at the Zone Access Point
  - One at the Central Area Patching facility

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Improving the Process

Our goal is not to reinvent the wheel. It is to provide products and services…

- with unique features and benefits that work within an existing methodology
- easily document and manage connections

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DCS Products

- Unique Products

  DCS designs, manufactures and installs the best solution to meet the customers needs.

  We don't force the customer to use products not suited for the environment.

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Director Class Switch Patching Solutions

Cisco 9513

DCS offers an 11-slot, 10U Director patch panel to “mimic” the 9513 configuration

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Director Class Switch Patching Solutions

Brocade DCX Backbone

DCS's offers an 8-slot, 10U Patch panel configured to "mimic" the DCX configuration

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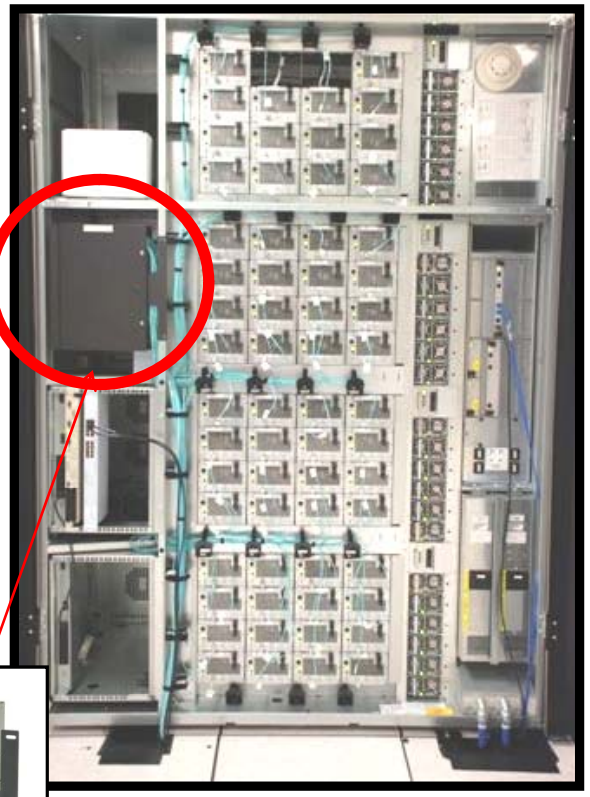
SL8500 Modular Fiber Terminal

- DCS developed a Modular Fiber Terminal that mounts inside the rear of the SUN/Storage Tek SL8500.
- This scalable solution allows the user to install up to (12) 6 channel LC Cassettes with front MTP access as needed.



SL 8500

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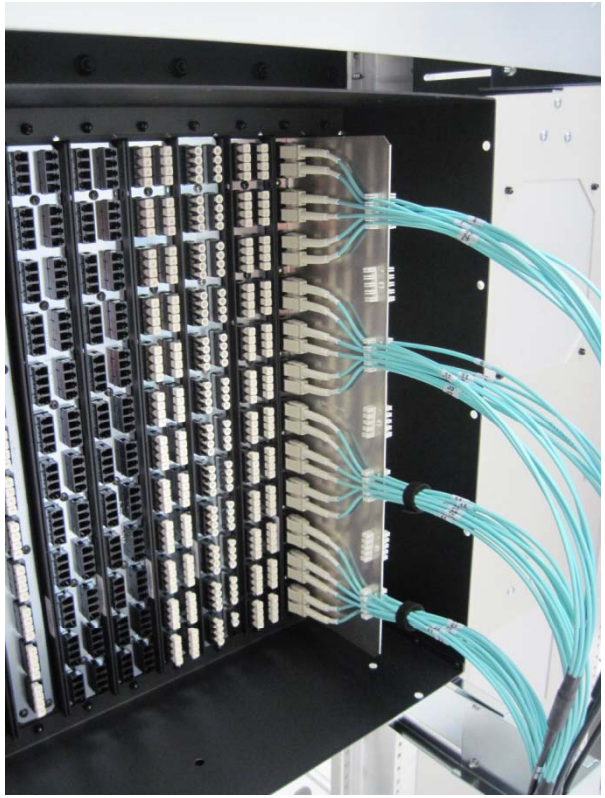
Rear-Cable Management Plate

- Provides additional support for fiber and organizes high-port density panel strips



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Unique Products

- ECO-Friendly Multi-Bay with built-in conveyance system

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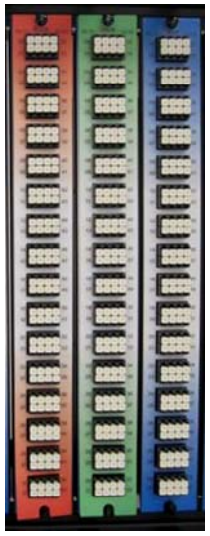
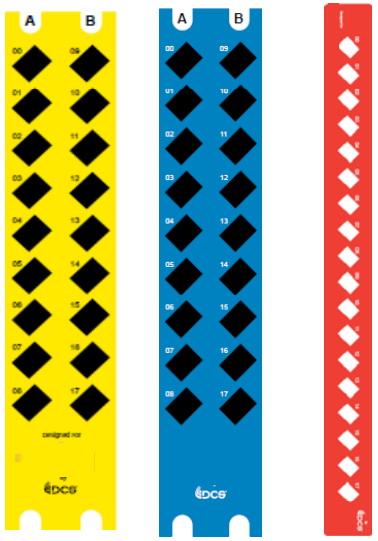
Unique Products

- Custom overlays





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10U Patch Panel

Custom Overlays

SL8500 Modular Fiber Terminal

Custom Trunk Cable Fanouts

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DCS Services

- Technical Expertise

  Experienced, technical professionals that work hand in hand with data center managers; our Technical Architects understand equipment protocol as well as fiber infrastructure

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Design and Production

- Texas-based Manufacturing

  We take great pride in the design and manufacturing of DCS products. Products can be designed, manufactured and installed to meet your timeframe.

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Installation Services

- The DCS installation team will install your solution within the stated time frame.
  - All products are tested and the results are provided to the data center manager before the team leaves the site.

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Improving the Process

- Products developed by listening to our customers
- Technical Architects that know equipment, protocol and connectivity; work directly with customers to develop a solution that meets their needs
- Texas-based manufacturing facility
- Experienced Installation Team
- DCS is your “One Stop Shop”

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Distributed Equipment/Cabling

- Network Connections
- Fibre Channel over Ethernet (FCoE)

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Data Center Storage Technologies

- When discussing convergence in the data center, many talk about the various storage technologies as replacement for one another.
- That is a narrow viewpoint, because technologies, while they may overlap in certain aspects, always find scenarios where they fit best.
- FCoE, iSCSI and FC are no different for each has its own unique capabilities and can benefit data center operations.

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Fibre Channel Roadmap

Fibre Channel Roadmap

Product Naming	Throughput (MBps)	Line Rate (GBaud)†	T11 Spec Technically Completed (Year) ‡	Market Availability (Year) ‡
1GFC	200	1.0625	1996	1997
2GFC	400	2.125	2000	2001
4GFC	800	4.25	2003	2005
8GFC	1600	8.5	2006	2008
16GFC	3200	14.025	2009	2011
32GFC	6400	28.05	2012	2014
64GFC	12800	TBD	2015	MARKET DEMAND
128GFC	25600	TBD	2018	MARKET DEMAND
256GFC	51200	TBD	2021	MARKET DEMAND
512GFC	102400	TBD	2024	MARKET DEMAND

- *"FC" used throughout all applications for Fibre Channel infrastructure and devices, including edge and ISL interconnects. Each speed maintains backward compatibility at least two previous generations (I.e., 8GFC backward compatible to 4GFC and 2GFC.*
- *†Line Rate: All "FC" speeds are single-lane serial stream*
- *‡Dates: Future dates estimated*

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FCoE Roadmap

Product Naming	Throughput (MBps)	Equivalent Line Rate (GBaud)†	T11 Spec Technically Completed (Year) ‡	Market Availability (Year) ‡
10GFCoE	2400	10.3125	2008	2009
40GFCoE	9600	41.225	2010*	MARKET DEMAND
100GFCoE	24000	103.125	2010*	MARKET DEMAND

Fibre Channel over Ethernet tunnels FC through Ethernet. For compatibility all 10GFCoE FCFs and CNAs are expected to use SFP+ devices, allowing the use of all standard and non standard optical technologies and additionally allowing the use of direct connect cables using the SFP+ electrical interface. FCoE ports otherwise follow Ethernet standards and compatibility guidelines.

†Line Rate: All "FC" speeds are single-lane serial stream
‡Dates: Future dates estimated

It is expected that 40GFCoE and 100GFCoE based on 2010 standards will be used exclusively for Inter-Switch Link cores, thereby maintaining 10GFCoE as the predominant FCoE edge connection

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Deployment in the Data Center

- FCoE is a newer technology that enterprises will initially deploy for applications where some risk can be tolerated before they expand the deployment to other areas
- In the near term, FCoE will find a home in new server deployments in Windows and Linux environments with virtualized tier three and some tier two applications.

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Deployment in the Data Center

- Many of such applications service customer's needs and therefore have no tolerance for latency of disruptions. It is natural for businesses to deploy mature and reliable technologies for tier one servers and applications.

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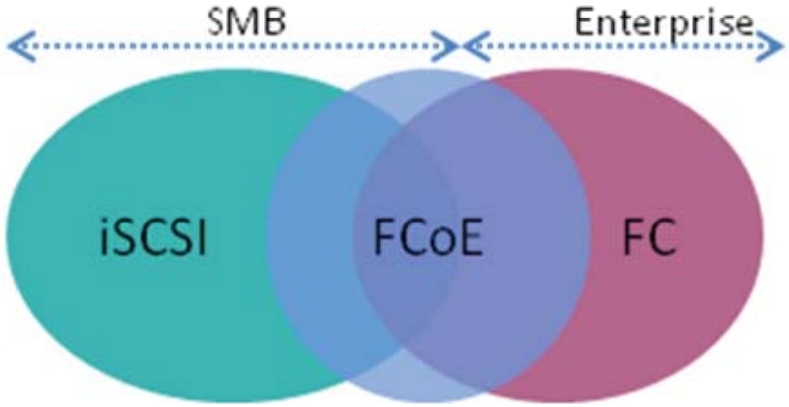
Deployment in the Data Center



One way to appreciate where the different storage technologies may be deployed in enterprise environments is to look at three tiered data center.

Model Tiered Data Center and Sample Applications

Tier 1	Tier 2	Tier 3
Database Servers	Business Logic Applications	Web Access Servers

Model Tiered Data Center

Sample Applications	Tier 1	Tier 2	Tier 3
Billing System	X		
Inventory Systems	X		
Research	X	X	
Email		X	X
Test/Development		X	X

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Data Center Storage Technologies

- The migration to 10GbE is a double edged sword for it increases the cost of deploying iSCSI, while giving it a faster transport.
- Fibre Channel remains the dominant storage technology in large enterprise data centers. Enterprise SANs continue to rely on the high performance and reliability of FC to run demanding database and transaction heavy applications.

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IEEE Standard for Information Technology

- 86.10.2.2.1 Connection Insertion Loss

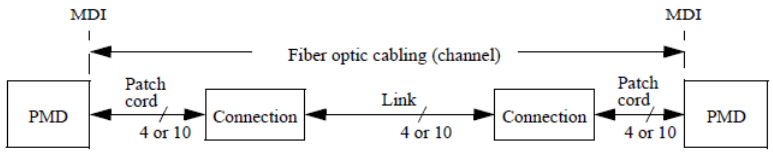

Figure 86–5—Fiber optic cabling model

Table 86–13—Fiber optic cabling (channel) characteristics at 850 nm

Description	Type	OM3	OM4	Unit
Operating distance	Max	100	150	m
Cabling Skew	Max	79		ns
Cabling Skew Variation[a]	Max	2.5		ns
Channel insertion loss	Min	0		dB
Channel insertion loss[b]	Max	1.9[c]	1.5[d]	dB

[a] An additional 300 ps of Skew Variation could be caused by wavelength changes, which are attributable to the transmitter not the channel.
[b] These channel insertion loss values include cable, connectors, and splices.
[c] 1.5 dB allocated for connection and splice loss.
[d] 1 dB allocated for connection and splice loss.

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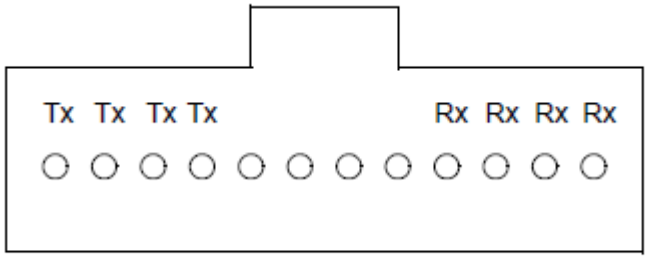
86.10.3.1 Optical lane Assignments for 40GBASE-SR4

- The transmit optical lanes occupy the leftmost four positions. The receive optical lanes occupy the rightmost four positions. The four center positions are unused.



40GBASE-SR4 optical lane assignments

86.10.3.2 Optical Lane Assignments for 100GBASE-SR10

- The ten transmit and ten receive optical lanes of 100GBASE-SR10 shall occupy the positions depicted in Figure 86-7 when looking into the MDI optical receptacle(s) with the connector keyway feature(s) on top. The single-receptacle Option A is recommended, the two-receptacle Option B and Option C are alternatives.

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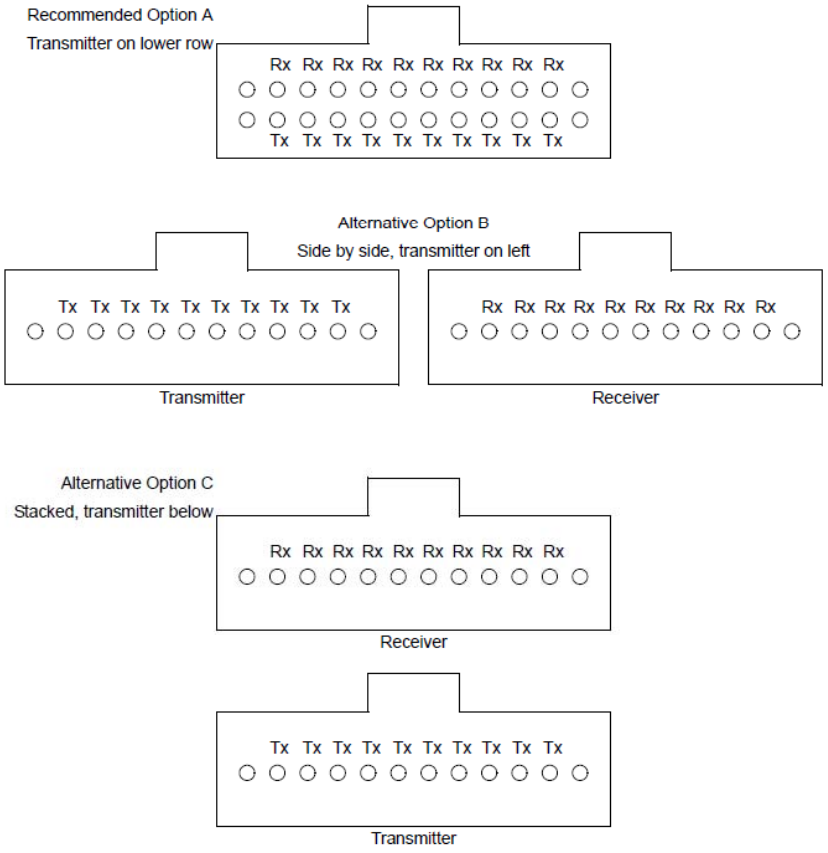
100GBASE-SR10 Optical Lane Assignments



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Improving the Process

DCS delivers state-of-the-art products that provide manageability, scalability and flexibility.

The DCS Fiber Management System (FMS) is not a collection of parts, it is the solution.

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Thank you for your time.

Questions?

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