

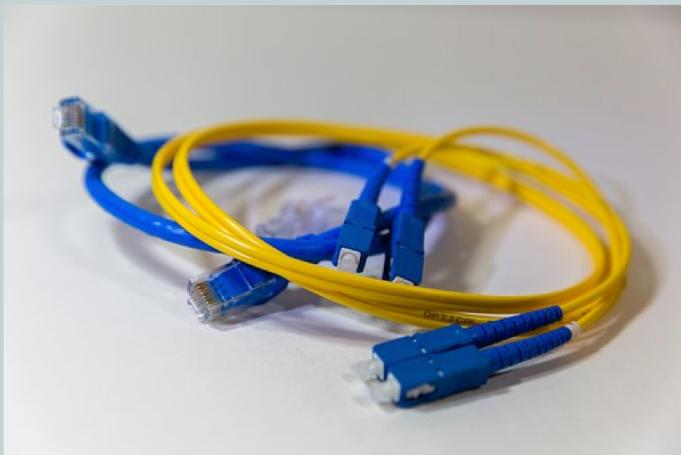


Media (Copper)

CompTIA Network+ (N10-007)

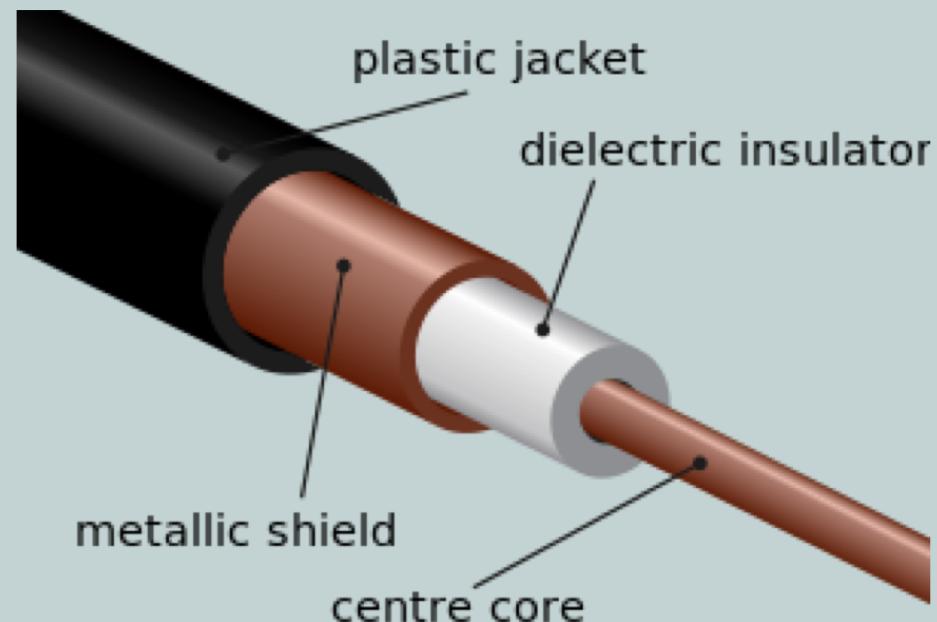
Types of Media

- Three categories:
 - Copper
 - Fiber optic
 - Wireless
- Each category is divided into subcategories
- Each has different specifications and uses
- *This lesson focuses on Copper media...*



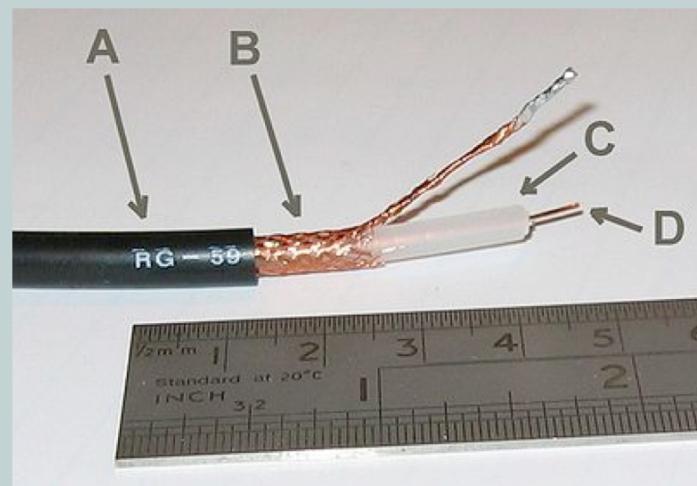
Coaxial Cable (Coax)

- Inner
 - Insulated conductor or center wire passes data
- Outer
 - Braided metal shield used to help shield and protect the data transmission
 - Provides EMI resistance due to shielding



Coaxial Cables

- RG-6
 - Commonly used by local cable companies to connect individual homes
- RG-59
 - Typically used to carry composite video between two nearby devices
 - Example:
 - TV to the cable box



Coaxial Connectors

- BNC
 - Termed Bayonet Neill-Concelman or British Naval Connector
 - Was used for 10BASE2 Ethernet networks

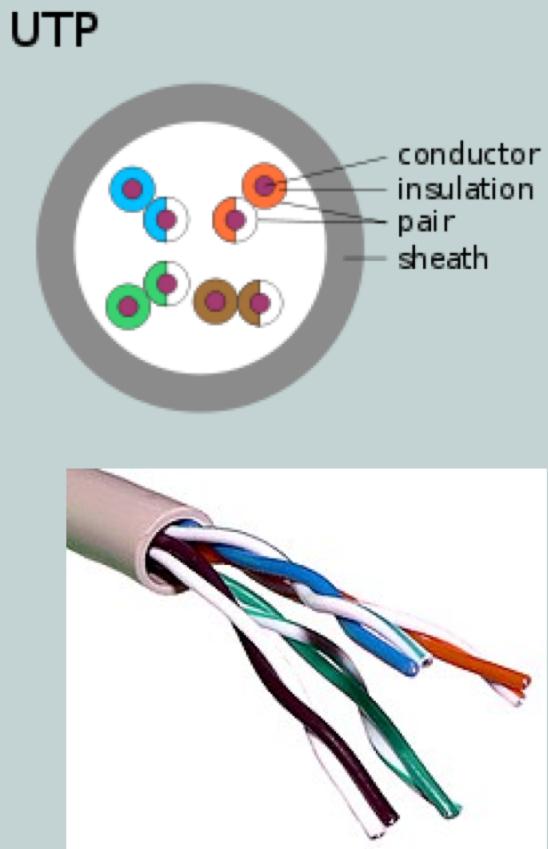


- F-connector
 - Typically used for cable TV and cable modem connections



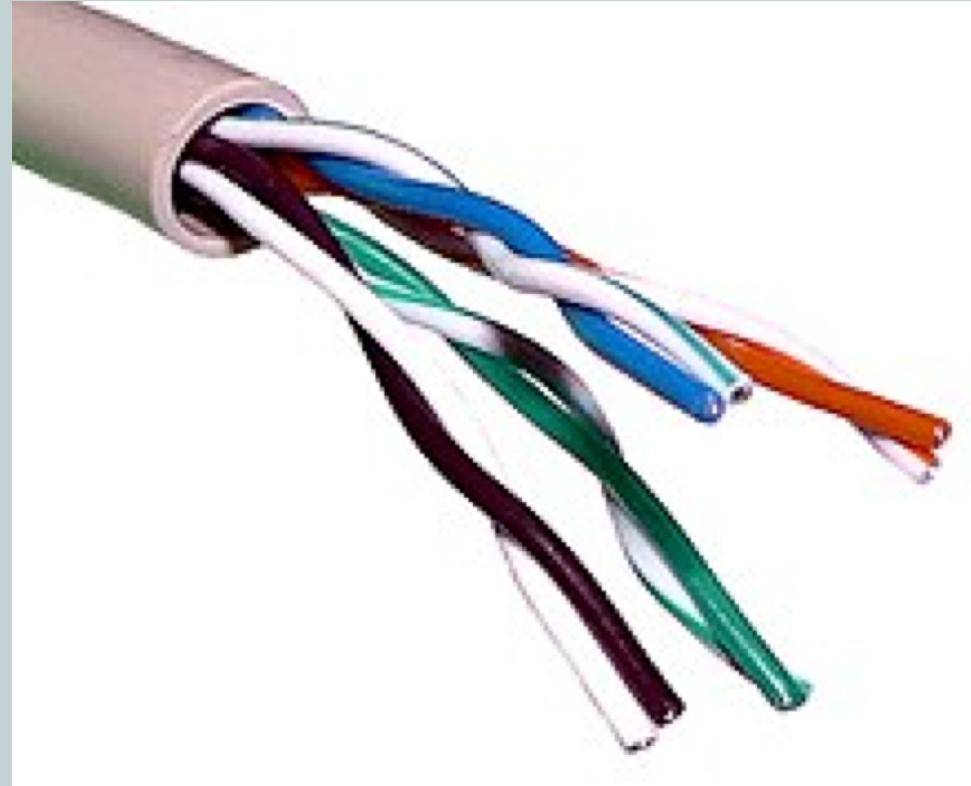
Twisted Pair Cables

- Most popular physical LAN media type
- Eight individually insulated strands of copper wire inside each cable
- Each pair twisted together to reduce EMI
 - Tighter twists = less EMI
- Types:
 - Unshielded Twisted Pair (UTP)
 - Shielded Twisted Pair (STP)



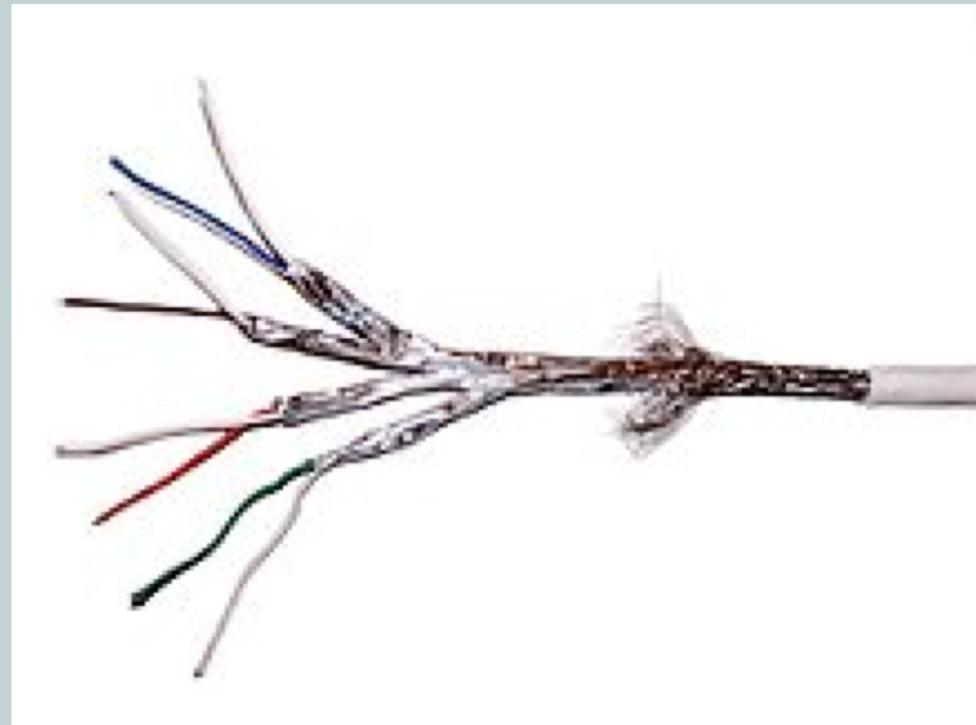
Unshielded Twisted Pair (UTP)

- Number of twists determines how much EMI can be blocked
 - CAT 6 has more twists per inch than CAT 5
- UTP is cheaper than STP
- Media of choice in most LANs



Shielded Twisted Pair (STP)

- Wires are twisted in pairs and surrounded in a metallic shielding to minimize EMI
- Outer shielding minimizes EMI, but makes STP cost more than UTP



Twisted Pair Connectors

- RJ-45
 - 8-pin connector in Ethernet networks
 - Most Ethernet use only 4-pins



- RJ-11
 - 6-pin connector
 - Commonly only 2 or 4 pins are used
 - Commonly found in telephone systems



- DB-9 or DB-25 (RS-232)
 - 9-pin or 25-pin D-subminiature
 - Used for asynchronous serial communications and connecting to an external modem



Twisted-Pair Cable Throughput

<u>Category</u>	<u>Maximum Throughput</u>	<u>Maximum Distance</u>
Cat 3	10 Mbps	100 meters
Cat 5	100 Mbps	100 meters
Cat 5e	1,000 Mbps (1 Gbps)	100 meters
Cat 6	1,000 Mbps (1 Gbps)	100 meters
Cat 6a	10,000 Mbps (10 Gbps)	100 meters
Cat 7	10,000 Mbps (10 Gbps)	100 meters



Straight-Through Patch Cables

- Both ends of the cable have matching pin outs
- T-568B is the preferred standard for wiring a building if no pre-existing pattern is used
- Data Terminating Equipment (DTE) to Data Communications Equipment (DCE)
 - Computer to switch
 - Router to modem

Pin	Color
1	white/orange
2	orange
3	white/green
4	blue
5	white/blue
6	green
7	white/brown
8	brown



Crossover Cables

- Send and receive pins of the cable are swapped in the end pin outs
- Use to connect a workstation to a workstation
- Used to connect a switch to a switch
 - Not required if switch support MDIX



Pinouts (S68A/S68B)

- TIA/EIA-568A and TIA/EIA-568B are standard
- Orange and Green pairs swap

T-568B		T-568A	
Pin	Color	Pin Name	Color
1	Orange Stripe	Tx+	Green Stripe
2	Orange	Tx-	Green
3	Green Stripe	Rx+	Orange Stripe
4	Blue	Not Used	Blue
5	Blue Stripe	Not Used	Blue Stripe
6	Green	Rx-	Orange
7	Brown Stripe	Not Used	Brown Stripe
8	Brown	Not Used	Brown



Plenum and Non-Plenum Cable

- Plenum Cable
 - Special UTP/STP cable that has a fire-retardant outer insulator
 - Minimizes dangerous fumes if cable on fire
 - Safe for use in ceilings, walls, and raised floors
- Non-plenum Cable
 - Also known as PVC
 - Normal UTP/STP rated cable
 - Cannot be used in raised floors, ceilings, or walls





Media (Fiber)

CompTIA Network+ (N10-007)

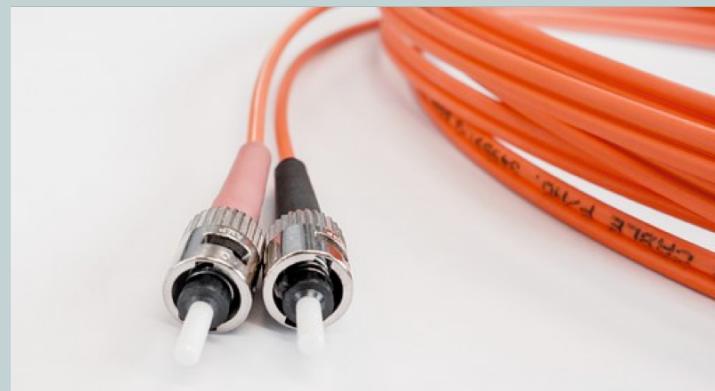
Fiber Optic Cables

- Uses light from an LED or laser to transmit information through a glass fiber
 - Immune to EMI
 - Uses light instead of electricity
- Benefits:
 - Greater range (many miles)
 - Greater data-carrying capacity (measured in Tbps)
- Types:
 - Multimode Fiber (MMF)
 - Single-mode Fiber (SMF)



Multimode Fiber (MMF)

- Shorter distances than single-mode fiber
- Larger core size allows for multiple modes of travel for the light signal
- Core size: 62.5 microns
- Common uses:
 - Routers to switches
 - Switches to switches
 - Servers to switches



Single-Mode Fiber (SMF)

- Longer distances than multimode fiber
- Smaller core size allows for only a single mode of travel for the light signal
- Core size: 10 microns
- Common uses:
 - Routers to switches
 - Switches to switches



Fiber Optic Connectors



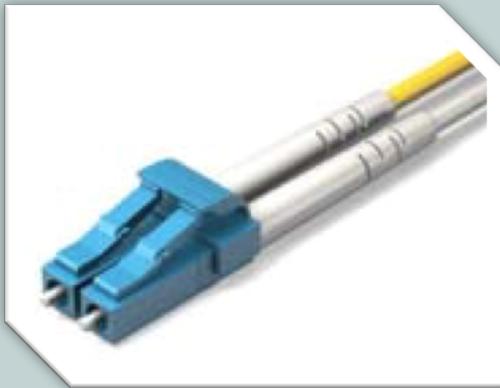
SC

Subscriber Connector



ST

Straight Tip Connector



LC

Lucent Connector



MTRJ

*Mechanical Transfer-
Registered Jack*



Specialized SC Connectors



SC

Subscriber Connector



MTRJ

*Mechanical Transfer-
Registered Jack*

Angled Physical Contact Connector



APC

Angled Physical Connector

Ultra Physical Contact Connector



UPC

Ultra Physical Contact





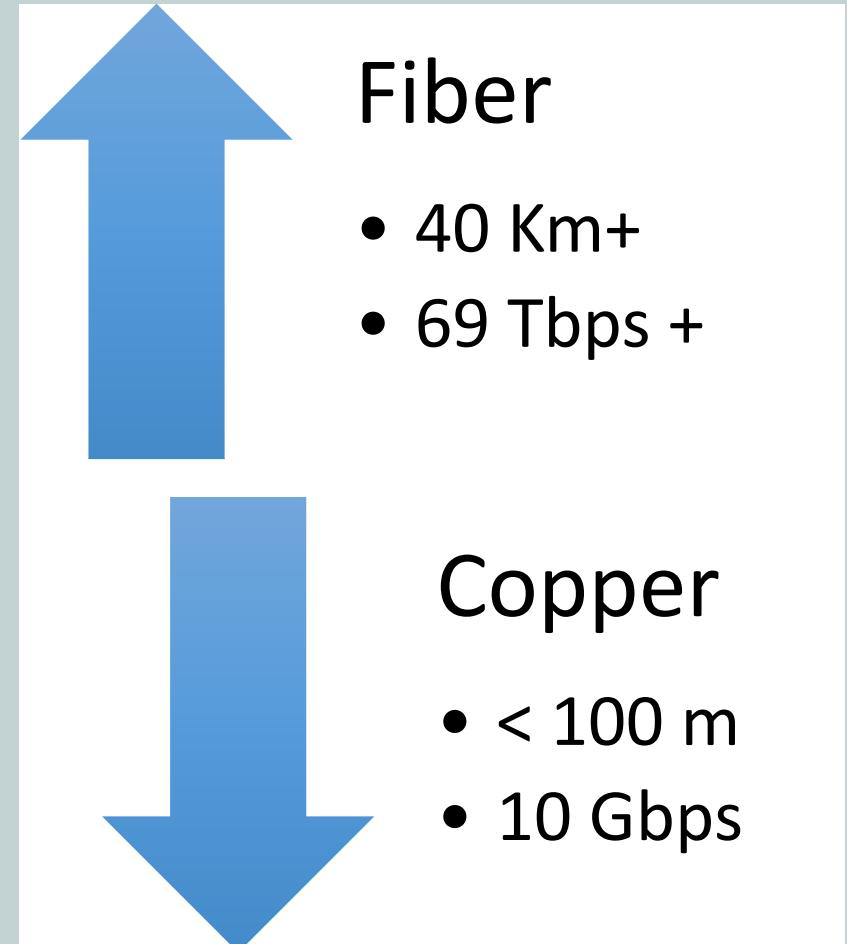
Transceivers

CompTIA Network+ (N10-007)

Copper vs Fiber Optic Cables

- Fiber-Optic Advantages

- Higher bandwidth
- Longer distances
- Immune to EMI
- Better security



Media Converters

- Convert media from one format to another
- Layer 1 device
 - Physical conversion of signal only
- Examples:
 - Ethernet to Fiber Optic
 - Fiber Optic to Ethernet
 - Coaxial to Fiber
 - Fiber to Coaxial



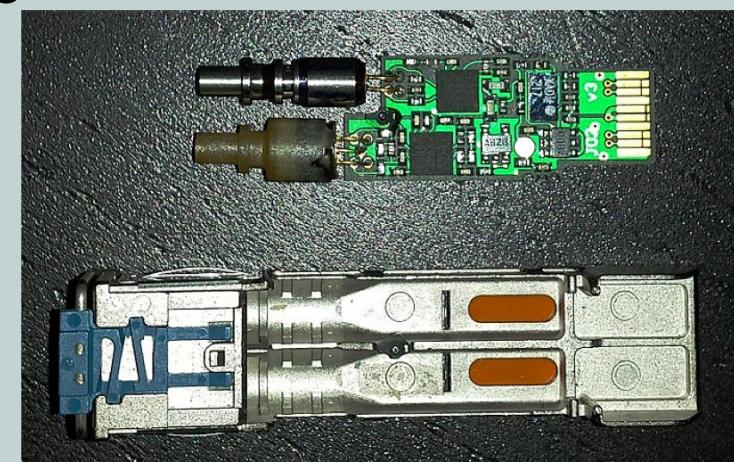
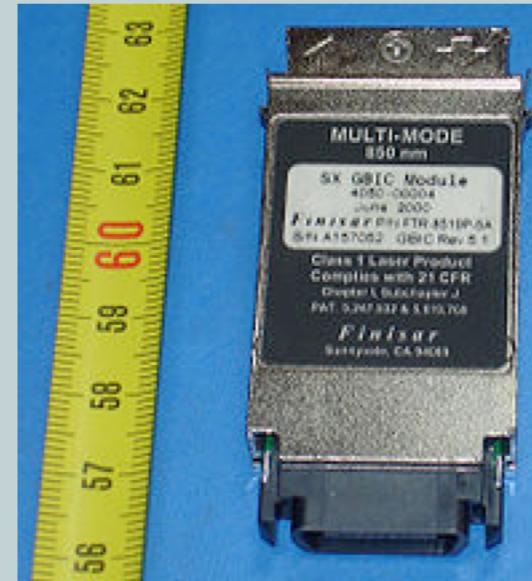
Transceivers

- Device that sends and receives data
- Bidirectional
 - Devices take turns communicating
 - Known as half-duplex
- Duplex
 - Devices can both communicate at the same time (full duplex)



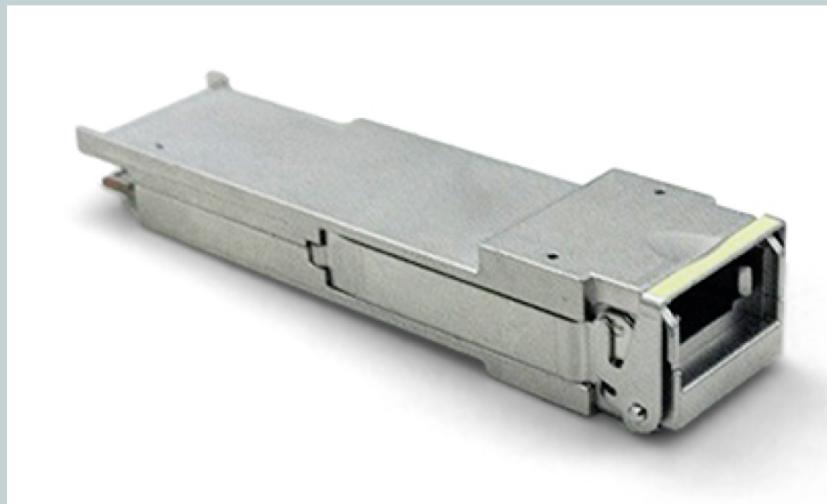
Transceivers

- GBIC
 - Standard, hot-pluggable gigabit Ethernet transceiver (copper or fiber)
- Small Form-factor Pluggable (SFP)
 - Compact, hot-pluggable optical module transceiver
 - Support up to 4.25 Gbps
 - Known as Mini-GBIC



Transceivers

- SFP+
 - Enhanced SFP
 - Support up to 16 Gbps
- Quad Small Form-factor Pluggable (QSFP)
 - Compact, hot-pluggable optical module transceiver
 - Supports up to 100 Gbps



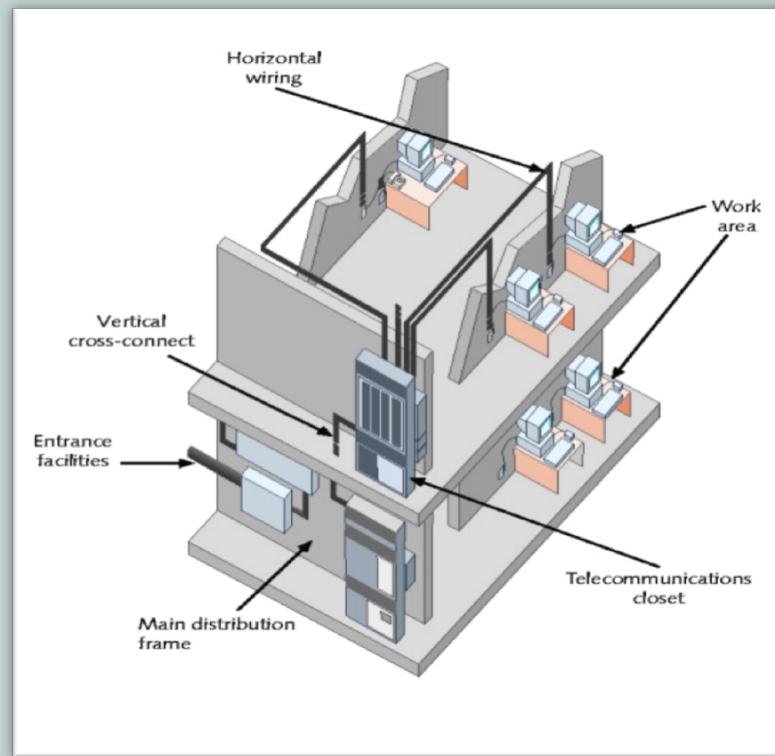


Cable Distribution

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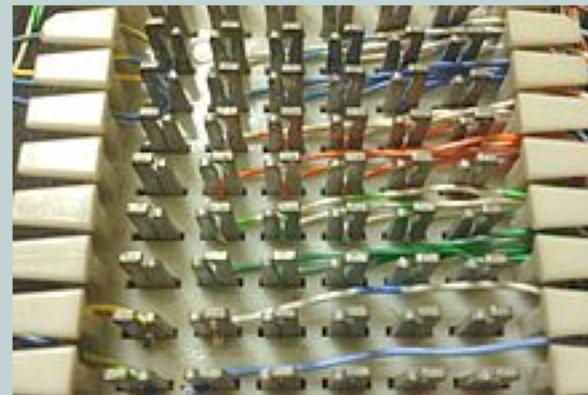
Cable Distribution System

- Use an organized system that is hierachal
- Components
 - Entrance facilities
 - MDF
 - Cross-connect facilities
 - IDF
 - Backbone wiring
 - Telecommunications closet
 - Horizontal wiring
 - Patch Panels
 - Work area



Punch Down Blocks

- 66 block
 - Used for phones and older LAN wiring
 - Causes crosstalk due to proximity of cables
 - Bad choice for higher-speed LAN wiring
 - Do not use for CAT 5 or above
- 110 block
 - Used for higher-speed network wiring
 - Required for CAT 5 or above cabling



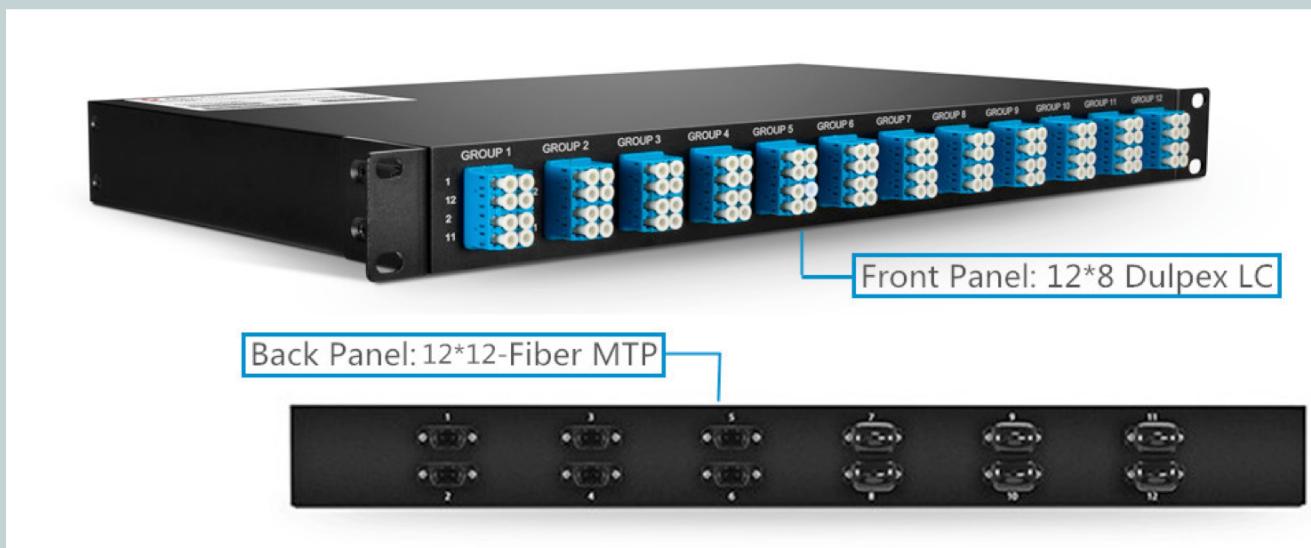
Patch Panels (Copper)

- Device with jacks to connect wiring from the jack to a network switch in a flexible manner
- Back has punch downs like a 110 block to connect wiring to wall jacks in building
- Front has RJ-45 jacks

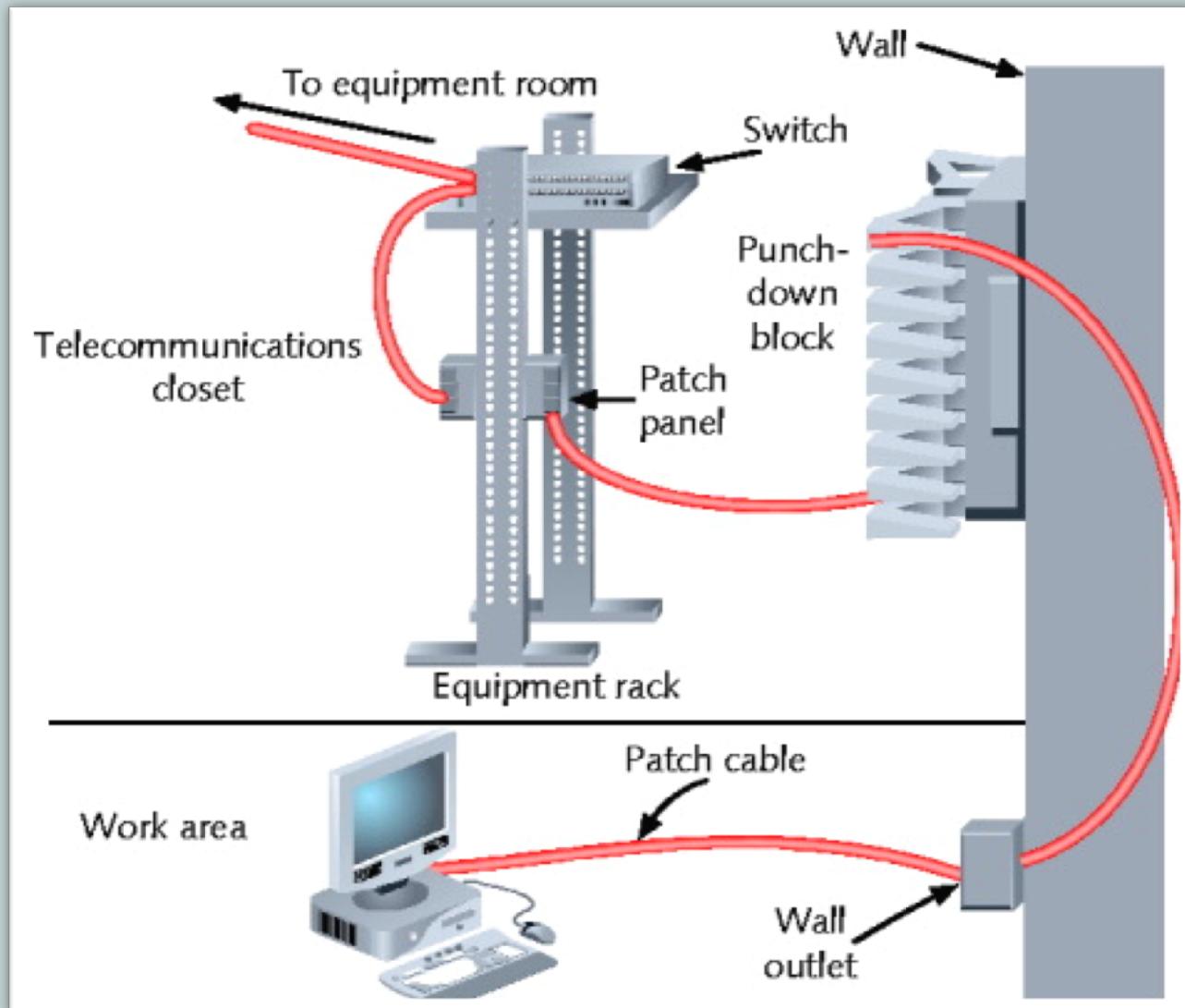


Patch Panels (Fiber)

- Connect fiber jacks throughout building to a single patch panel in network closet
- Front uses patch cables to connect to different wall jacks and switch ports



Example of Cable Distribution



Typical Copper Cable Installation

