

CompTIA Network+ Exam N10-008

Lesson 2



Deploying Ethernet Cabling

Objectives

- Summarize Ethernet standards
- Summarize copper cabling types
- Summarize fiber optic cabling types
- Deploy Ethernet cabling

Lesson 2

Topic 2A

Summarize Ethernet Standards

Network Data Transmission

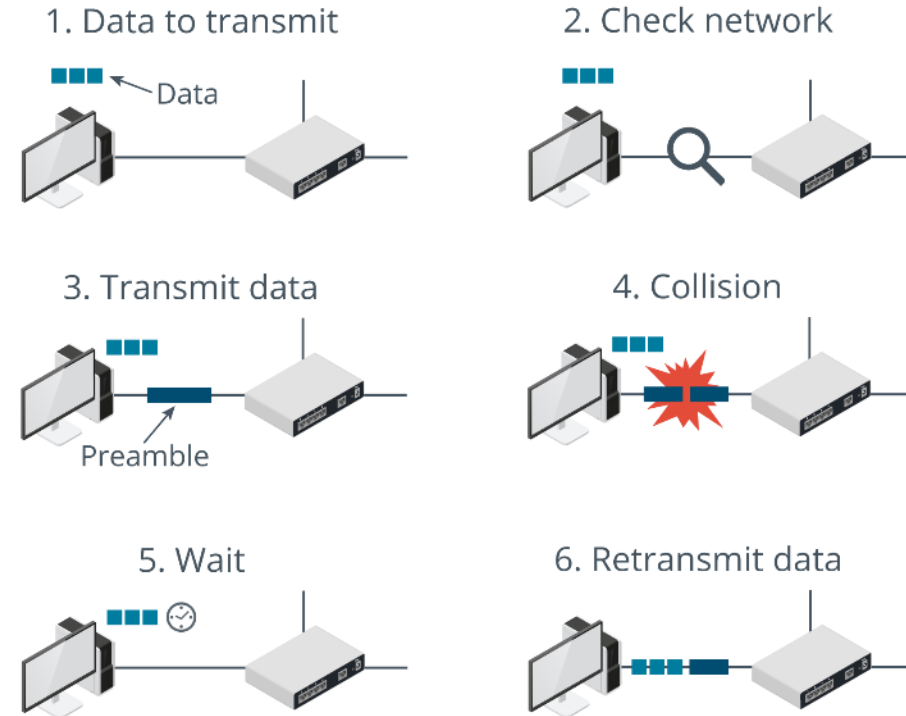
- Electromagnetic carrier wave with a range of frequencies (bandwidth)
- Modulate properties of the wave to encode digital information
- Copper cable carries electrical signals
 - Twisted pair and coaxial types
 - Attenuation (signal weakens quickly over distance)
 - Twisted pair Cat cable standards/specifications
- Fiber optic cable carries infrared light signals
 - Single Mode (SMF) and Multimode (MMF) types
 - Optical Mode (OM) category designations

Ethernet Standards

- Institute of Electrical and Electronics Engineers (IEEE) 802.3 Ethernet standards
- xBASE-y
 - Bit rate
 - Baseband signal mode
 - Media type
- 10BASE-T
 - 10 Mbps
 - -Twisted pair copper cabling

Media Access Control and Collision Domains

- Multiple access area networks
 - Contention-based media access control
 - Collisions require nodes to re-transmit
 - More nodes within collision domain reduces performance
- Carrier Sense Multiple Access with Collision Detection (CSMA/CD)
 - Detect collision by signal presence on Tx and Rx simultaneously
 - Half-duplex transmission
- 10BASE-T hubs form a single collision domain



100BASE-TX Fast Ethernet Standard

- CSMA/CD over twisted pair but at 100 Mbps
 - Cat 5 or better cable
 - Maximum link length of 100 meters (328 feet)
- Development of Ethernet switches to replace hubs
 - Isolates collision domain to switch port
 - Allows full-duplex transmission
- Speed/duplex autonegotiation protocol (fast link pulse)

Gigabit Ethernet Standards

- 1000BASE-T (Gigabit Ethernet)
 - Requires switches
 - Supports 100 m (328 feet) links over twisted-pair
 - Mainstream choice for office networks
- 10 Gbps (10G Ethernet) and 40 Gbps (40G Ethernet)
 - Requires shielded/screened cable for longer runs
 - Used in datacenters and for workstations with high bandwidth requirements

Review Activity: Ethernet Standards

- Network Data Transmission
- Ethernet Standards
- Media Access Control and Collision Domains
- 100BASE-TX Fast Ethernet Standard
- Gigabit Ethernet Standards

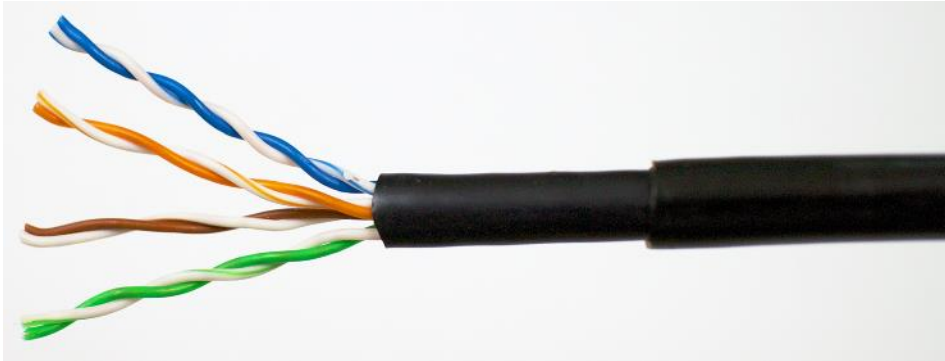
Lesson 2

Topic 2B

Summarize Copper Cabling Types

Unshielded Twisted Pair Cable

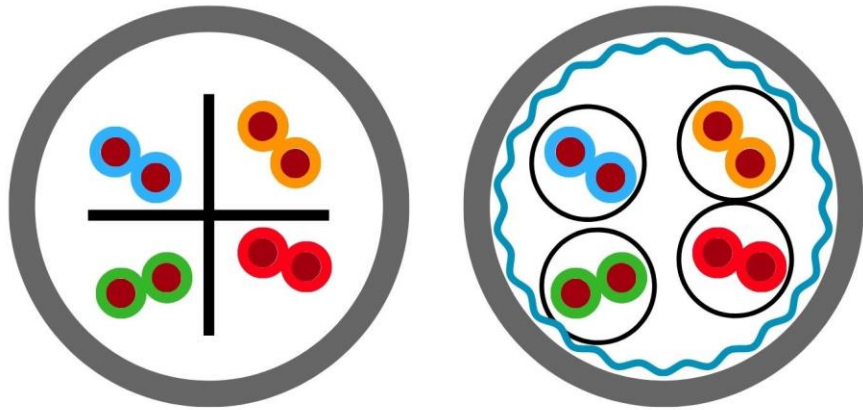
- Balanced pairs and twist rate to mitigate external interference and crosstalk
- Solid versus stranded cable
 - American Wire Gauge (AWG)
 - Higher values represent thinner wire
- Unshielded twisted pair (UTP)



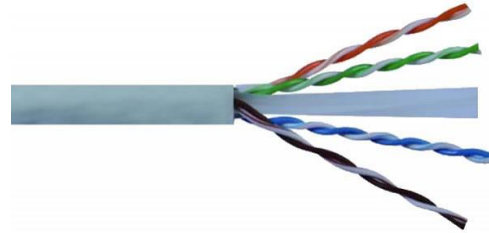
Shielded and Screened Twisted Pair Cable

- Screened cable
 - Outer foil shield around all pairs
 - Screened twisted pair (ScTP), foiled/unshielded twisted pair (F/UTP), foiled twisted pair (FTP)
- Shielded and screened cable
 - Outer braid around all pairs
 - Foil around each pair
 - Shielded/foiled twisted pair (S/FTP)
- Termination issues (bonding shield to connectors)

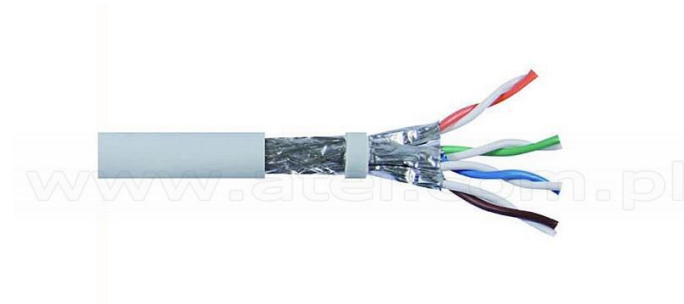
U/UTP vs S/FTP



U/UTP



S/FTP



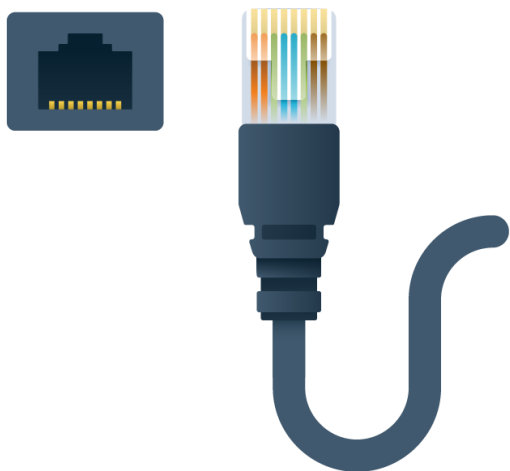
Cat Cable Standards

- Cat 5
 - Legacy installations only
- Cat 5e
 - Better performance characteristics to support 1 Gbps over 100 m
- Cat 6
 - 10 Gbps over reduced range (55 m)
- Cat 6A
 - 10 Gbps over 100 m
- “Cat 7”
 - Screened/shielded type using special connectors
- Cat 8
 - 40 Gbps over reduced lengths (top-of-rack datacenter applications)

Twisted Pair Connector Types

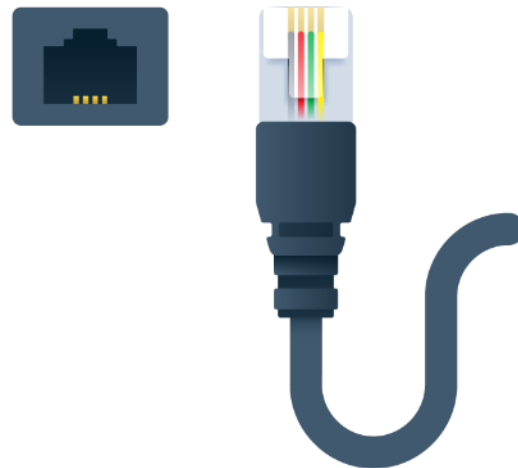
- RJ-45 connectors

- 4-pair cable
- 8-position/8-contact (8P8C)
- Used for Ethernet

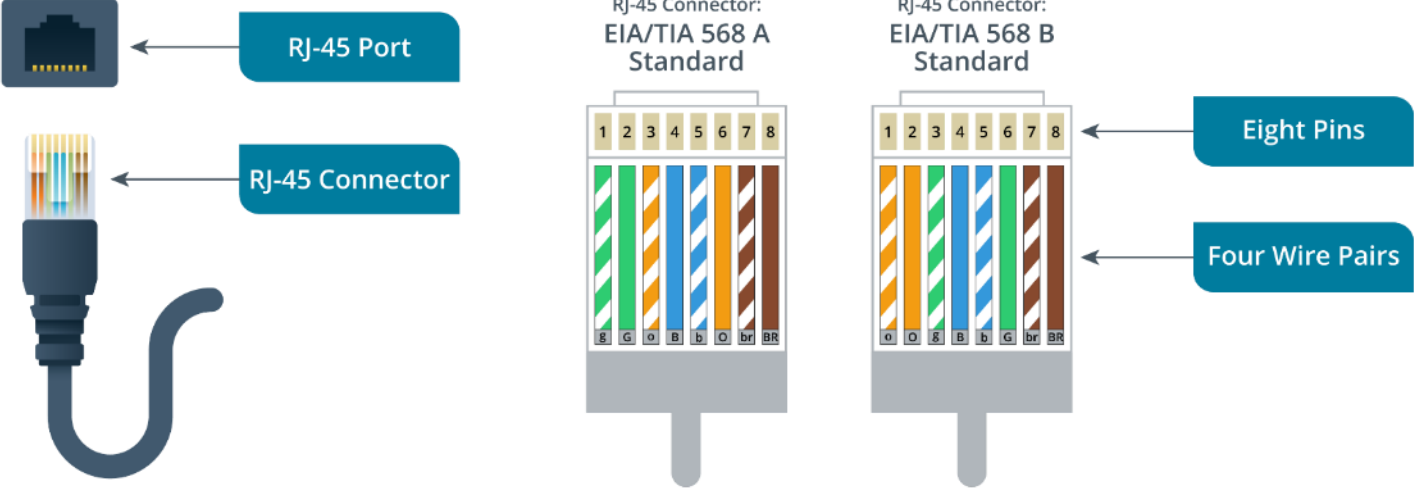


- RJ-11 connectors

- 2-pair cable (6P2C)
- Used in telephone systems



Copper Termination Standards



Plenum- and Riser-rated Cable

- Plenum space for heating, ventilation, and air conditioning (HVAC) systems
- Fire stops and regulations
- Plenum-rated cable
 - Emits minimal smoke
 - Self-extinguishing
 - CMP/MMP
- Riser space (between two floors)
 - CMR/MPR



Coaxial and Twinaxial Cable and Connectors

- Coaxial

- Core and mesh conductors
- Radio Grade designations
- Used with cable broadband
- F-type connectors



- Twinaxial

- Two core conductors plus mesh conductor
- Used in datacenters
- Direct Attach Copper (DAC) transceivers



Review Activity: Copper Cabling Types

- Unshielded Twisted Pair Cable
- Shielded and Screened Twisted Pair Cable
- Cat Cable Standards
- Twisted Pair Connector Types
- Copper Termination Standards
- Plenum- and Riser-rated Cable
- Coaxial and Twinaxial Cable and Connectors

Lesson 2

Topic 2C

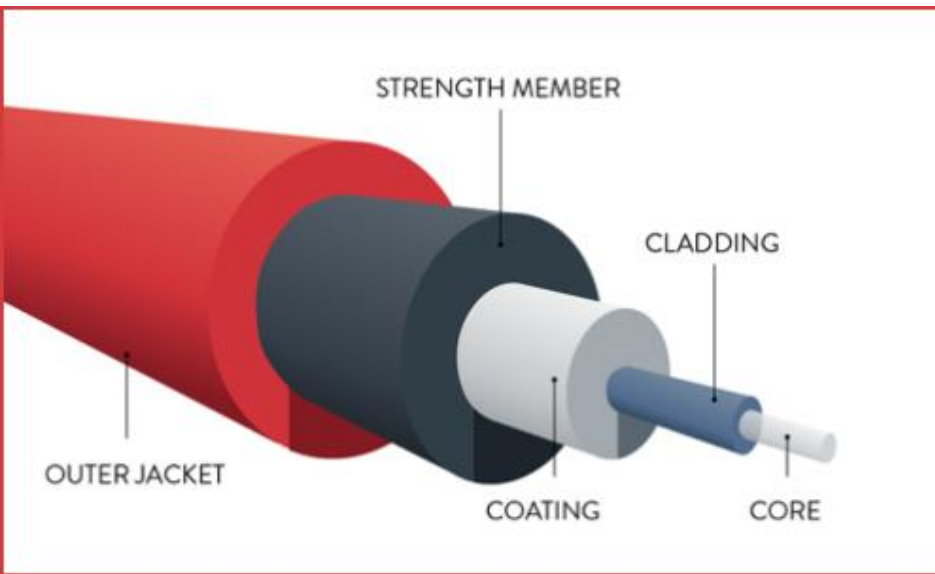
Summarize Fiber Optic Cabling Types

Fiber Optic Cable Considerations

- Infrared signaling less prone to interference and attenuation
- Fiber optic cable construction
 - Core, cladding, and waveguide
 - Buffer and sheath
- Multi-strand cable
- Outer jacket materials

Single Mode Fiber and Multimode Fiber

- Single Mode Fiber (SMF)
 - 8-10 micron core
 - 1310 / 1550 nm wavelength
 - Laser optics
 - OS1 (indoor) and OS2 (outdoor)
 - Long distance and short range (datacenter) applications
- Multimode Fiber (MMF)
 - 50 / 62.5 micron core
 - 850 / 1300 nm wavelength
 - Optical Multimode (OM) categories
 - OM1/OM2 support 1 Gbps using LED transmitters or 10 Gbps over shorter range
 - OM3/OM4 laser optimized MMF (LOMMF)
 - Mostly short range applications



- Coating: Protects cladding from damage
- Cladding: It keeps light in the core
- Core: It carries the light signals

Fiber Optic Connector Types

- Straight Tip (ST)
 - Legacy installations
- Subscriber Connector (SC)
 - Push/pull design
 - Very widely used
- Local Connector (LC)
 - Smaller form factor than SC
 - Also very widely used
- Mechanical Transfer Registered Jack (MTRJ)
 - Small form factor snap-in design

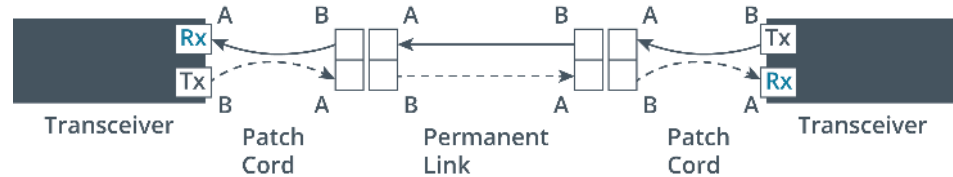


Fiber Ethernet Standards

- 100BASE-FX and 100BASE-SX
 - 100 Mbps over 2 km (FX) and 550 m (SX)
- 1000BASE-SX and 1000BASE-LX
 - 1 Gbps over short ranges (SX) and long ranges (LX)
- 10GBASE-SR and 10GBASE-LR
 - 10 Gbps over short range (SR) and long range (LR)
- Datacenter versus WAN applications

Fiber Optic Cable Installation

- Duplex strand pairs
- Patch cord polarity
- Finishing types
 - Physical Contact (PC)
 - Ultra Physical Contact (UPC)
 - Angled Physical Contact (APC)
- Jacket and connector color-coding



Review Activity: Fiber Optic Cabling Types

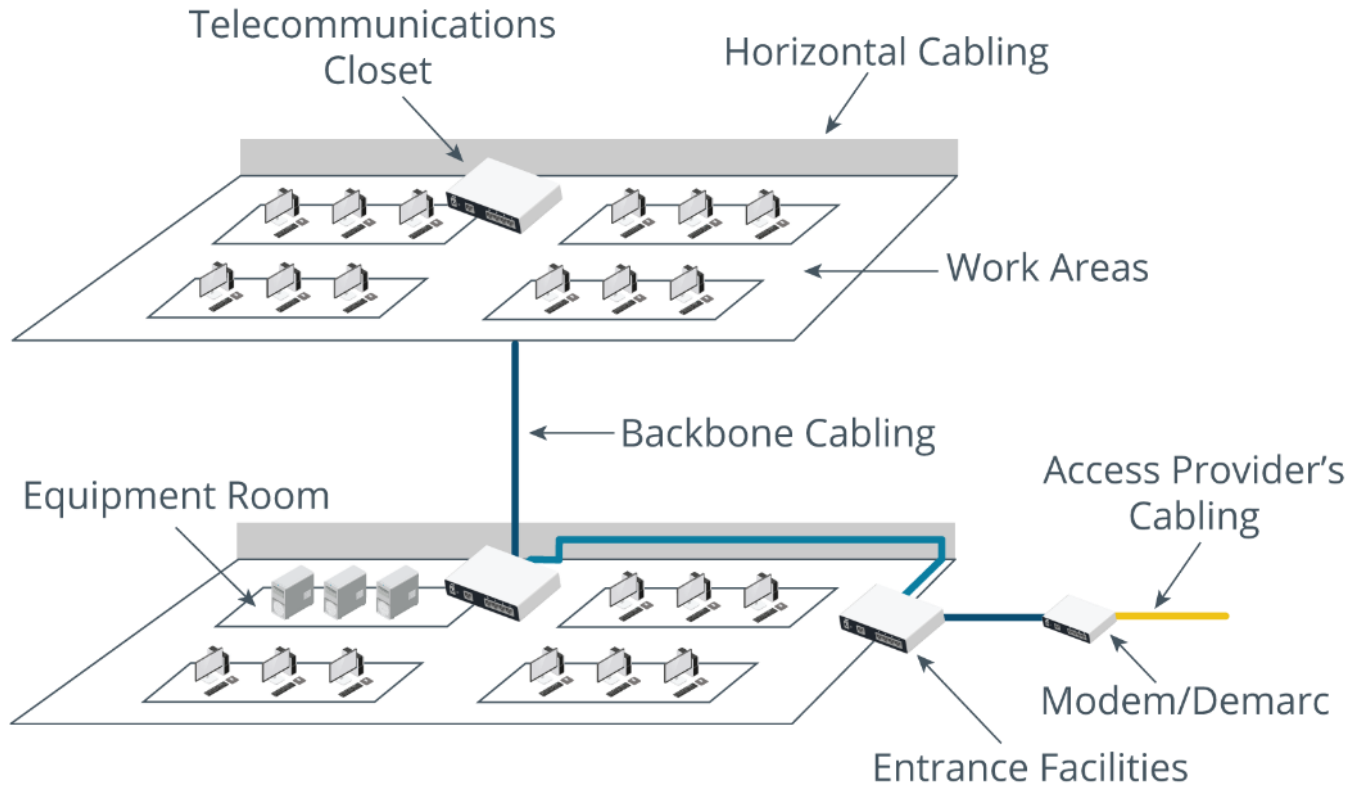
- Fiber Optic Cable Considerations
- Single Mode Fiber and Multimode Fiber
- Fiber Optic Connector Types
- Fiber Ethernet Standards
- Fiber Optic Cable Installation

Lesson 2

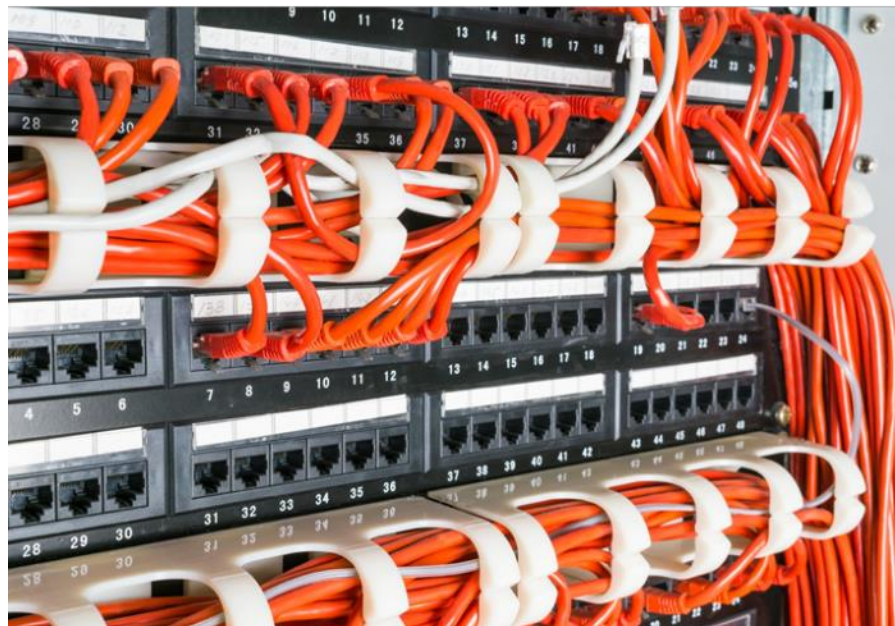
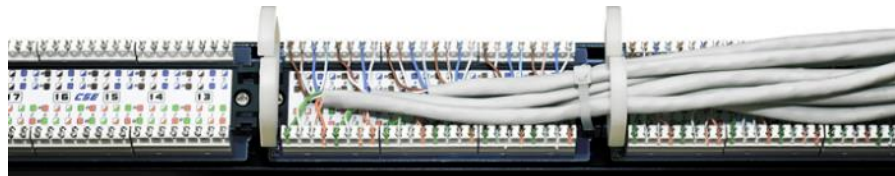
Topic 2D

Deploy Ethernet Cabling

Structured Cabling System



Cable Management



- Ensure reliability and ease of management/changes
- Cross-connect/distribution frames
 - Terminate structured cabling (permanent links)
- Patchdown block
 - Insulation-displacement connection (IDC)
 - 66 block
 - 110 block
 - BIX and Krone formats
- Patch panel/patch bay

Wiring Tools and Techniques

- Pulling cable from telecommunications room to work area (distribution frame to wall port)
- Permanent link versus patch cords
- Drops to wall port
 - Service loop
 - Snips and cable strippers to remove jacket and insulation without damaging wires



Termination Tools

- Punchdown tool
 - Fix structured cable to insulation displacement connector
 - Use correct blade type (110, BIX, Krone)
 - Block tools to terminate multiple wires on distribution frames
- Cable crimper
 - Fix jack connectors to patch cables
- Unshielded versus shielded termination



Fiber Distribution Panels and Fusion Splicing



- Fiber distribution panel supports moves, adds, changes between optical links
- Splicing strands minimizes loss from connectors
 - Mechanical splice
 - Fusion splicing machine
 - Pigtails
 - Supporting tray to protect splice

Transceivers

- Modular format for installing port types to network switches and routers
 - 1 Gbps Gigabit Interface Converter (GBIC) and Small Form Factor Pluggable (SFP)
 - 10 Gbps Enhanced SFP (SFP+)
 - 4 x 1 Gbps Quad small form-factor pluggable (QSFP)
 - 4 x 10 Gbps Enhanced quad small form-factor pluggable (QSFP+)



Wavelength Division Multiplexing

- Bidirectional (BiDi) Wavelength Division Multiplexing
 - Transmit and receive over same strand using separate wavelengths
- Coarse Wavelength Division Multiplexing (CWDM)
 - Typically use of 16 wavelengths to implement 8 full duplex channels
- Dense Wavelength Division Multiplexing (DWDM)
 - 20, 40, 80, or 160 channels
 - Multiplexer/demultiplexers and optical add/drop multiplexers (OADM)

Review Activity: Ethernet Cabling

- Structured Cabling System
- Cable Management
- Wiring Tools and Techniques
- Termination Tools
- Fiber Distribution Panels and Fusion Splicing
- Transceivers
- Wavelength Division Multiplexing

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Summary