

Structured Cabling Scalable Campus Network Design Workshop, 2023

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Transforming learning research and working environments with ICT

Agenda

- Physical Infrastructure (Cabling & Cable Installation)
- Fiber Optics



Physical Layer



Optical Fiber/Copper wire/Electromagnetic waves





- Bad cabling/ unstructured No support for high bandwidth
- Unmanaged devices "the enemy" Cheap is expensive!
- Daisy Chains (Cascades) violating STP device limit
- NO Monitoring (Network Management Systems)
- Frequent Power outages

Campus Networks Challenges



Components of Structured Cabling

- 1. Horizontal Cabling
- 2. Backbone Cabling
- 3. Work Area
- 4. Telecommunication closet/ enclosure
- 5. Equipment Room
- 6. Entrance Facility

Physical Layer Functions

 Provides means to transport the bits

 Encodes bits as series of signals and transmits onto local media

Characteristics

- Bandwidth
- Throughput



Copper Cabling -Characteristics

- Transmitted as electrical pulses
- Attenuation the longer the signal travels, the more it detoriates
- Strict distance limitations 80m (practical)
- Electromagnetic interference (EMI) or Radio Frequency Interference (RFI) – distorts and corrupts data signals being transmitted (to counter copper cables are wrapped in shielding)
- Crosstalk disturbance caused by electromagnetic fields of a signal on one wire to the signal in an adjacent wire (to cancel crosstalk opposing circuit wire pairs are twisted together)



Copper Cabling - UTP

Unshielded Twisted-Pair Cable

- UTP cabling is the most common networking media.
- Terminated with RJ-45 connectors.
- · Used for interconnecting network hosts with networking devices such as switches.
- Consists of four pairs of color-coded wires that have been twisted together to help protect against signal interference from other wires.
- · Color codes aid in cable termination.



Copper Cabling - STP

Shielded Twisted-Pair (STP) Cable

- STP provides better noise protection than UTP.
- STP cable is significantly more expensive and difficult to install.
- Uses an RJ-45 connector.
- Combines the techniques of shielding to counter EMI and RFI, and wire twisting to counter crosstalk.
- Uses four pairs of wires, each wrapped in a foil shield, which are then wrapped in an overall metallic braid or foil.



Copper Cabling Components



Inside a Network Cabinet

- A. Rack Mount UPS atleast 1kVA
- B. Network Switch
- C. Patch Panel
- D. Cable Manager
- E. 1m Patch Cords
- F. ODF (if fiber terminates here)





Copper Cabling Installation Don'ts

Safety

Don't Run Cables in unsafe places

EMI & Crosstalk minimization

• Don't bundle wires too tightly

Don't overload

Don't overload the cable racks

Don't overlay

• Don't layer two types of Cables

Copper Cabling Do's

- Do cross cables at right angles
- Do use labels
- Do test cables (testing & certification)
- Do measure cable length carefully
- Do document the cable plant
- Do consult an expert (Certified Cable installer)



Power over Ethernet – PoE IEEE 802.3af/t



Introduction to Fiber Optics

Total internal reflection



How Fiber Works



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Advantages of using Fiber Optics

- A. Long distance transmission with low latency
- B. Higher bandwidth
- C. Protection against crosstalk, EMI & RFI interference

Fiber Plant Components



Optical Fiber Cable Design Considerations

- A. Plan the Cable route work with internal estates department
- B. Trenches 1.2m depth (warning tapes to be buried 0.5m above duct)
- C. Install fiber cable inside HDPE ducts
- D. Warning tapes to be buried 0.5m above ducts
- E. Manholes Rectangular 1200m x 600m x 1200m
- F. Fiber Termination (Splicing) Optical Distribution Frames (ODF) – No Media Converters



G. Use Appropriate SFPs

Scalable Campus Network Training - 2023 Campus Networks Designs Operations *H. Test cable plant using OTDR, label and document*







Core Network Design (Server room/Data Centre)

Reliability is the GOAT! - Remember the whole network relies on the core

MUST Haves...

- 1. Stable Electrical Power Supply AVR for voltage stabilization
- **2. UPS backup** (redundant UPSes as your network evolves)
- 3. Generator / Solar backup
- 4. Proper grounding /earthing
- 5. Lightning arrestor for lightning prone areas
- 6. Reliable air conditioning repair faulty ACs
- 7. Network/ Server Cabinets
- 8. Fire Suppression minimum hand-held fire extinguisher





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