

# Transmission Media

## Characteristics to consider for Media

### Selection

- Throughput
- Cost
  - Installation
  - Maintenance
  - Obsolescence vs bleeding edge
    - Support
    - Life expectancy
  - Size and scalability
  - Environmental considerations

### Media to consider

- Twisted pair
  - Unshielded
  - Shielded
- Fiber optic
- wireless

### Twisted Pair Characteristics

- Color coded pairs of insulated copper wires
- Wires twisted around each other to form pairs
- Crosstalk – signals from adjacent pairs infringe or interfere with signals on other wiring pairs
- More twists – reduces noise & crosstalk potential BUT increases attenuation

### Two Types of Twisted Pair Cable

- Unshielded Twisted Pair
- Shielded Twisted Pair
- Differences
  - Cost – the extra shielding around the pairs in STP typically is more expensive cabling
  - Environmental considerations – STP more noise resistant than UTP
  - Throughput – same
  - Size & Scalability – same; 100 m segment length
  - 1024 nodes per logical segment

### Unshielded Twisted Pair (UTP)

- Insulated wire pairs; encased in plastic sheath

- Telecommunications Industry Association (TIA) designated standards and refers as categories
  - CAT 5 – 4 wire pairs; supports 100 Mbps throughput; 100 MHz signal rate; supports fast Ethernet ; most common deployment of LANs

## **UTP Characteristics**

- CAT 5e – enhanced CAT 5 with higher twist ratio; can double CAT 5 from 100 MHz signal rate to 200 MHz signal rate
- CAT 6 – new; more insulation; greater throughput than CAT 5
- CAT 7 – standards not finalized according to T. Dean

## **Shielded Twisted Pair**

- Twisted pair cable which has additional insulation covering all twisted wire pairs within the cable
- More able to withstand EMI noise as well as reduce ability to snoop or sniff signals being transmitted

## **Networking Standards Using Twisted Pair**

- Several networking standards
  - 10BaseT
  - 100BaseT
    - 100BaseT4
    - 100BaseTX
- First number – maximum throughput in Mbps
- Base – indicates baseband transmission
- Last character – transmission medium employed; T – twisted pair & F - fiberoptic

### **10BaseT**

- Full duplex
  - One pair used to transmission
  - One pair used for reception
- Ethernet network connect to a central hub or repeater in star topology
- Maximum segment distance – 100 m

### **100BaseT**

- Fast Ethernet
  - IEEE 802.3u
- Star topology
- RJ45 data connectors (same as 10BaseT)
  - Connector same for UTP & STP

- Maximum segment length as measured from end node to hub is 100m
- Support maximum of 3 segments connected via hubs

## **Two Specifications for 100BaseT**

- 100BaseTX
  - Full duplexing
  - CAT 5 required
  - Two pair for receiving
  - Two pair for transmitting
  - Sends signal faster and reduces time between signal generation

## **100BaseT4 Specifications**

- Can use CAT 3
- Breaks data stream into thirds
- Doesn't support full duplexing
  - Uses all four wiring pairs for transmission

## **Fiber Optic Cable**

- Transmission non electrical
- Pulsing light (laser or LED technology)
- Glass cladding around optical fiber core
- Two categories:
  - Single mode fiber
  - Multimode fiber

## **Single Mode Fiber**

- Single mode fiber
  - Backbone of network; high bandwidth over long distances ; laser generated signal transmitting over one long path

## **Multimode Fiber**

- Core is larger than single mode
- Multiple pulses of light
  - LED generated
  - Travel at different angles
- Suitable for shorter distances
- Used for risers and connections on network not backbone or long distances

## **Fiber Characteristics**

- Throughput – 1 gigabit (must have two fiber strands to support transmission in two directions)
- Cost – expensive; maintenance high and devices expensive – overall most expensive type of cable; requires special tools; requires trained technicians; requires planning due to bend radius supported
- Environmental Considerations – secure; reliable; can be placed in corrosive locations (no metal); EMI not a problem (no electricity)

## **Fiber Specifications**

- 10BaseF – old standard; star topology, full-duplex (requires two strands) repeaters connected through a bus
- 100BaseFX – maximum segment length 400 m; maximum of two repeaters to connect segments; star topology connecting repeaters through bus; fast Ethernet; full duplex (two strands)

## **Wireless Media**

- Infrared Transmission
  - Direct
  - Indirect
- Radiofrequency Transmission (RF)
  - Narrowband
  - Spread spectrum

## **Infrared Transmission**

- Direct
  - Line of sight
  - Secure – must be line of sight
  - Light signals
  - 100 Mbps
  - 1000 m span
- Indirect
  - Bounce signal – less secure
  - Throughput and span same as direct

## **RF Transmission**

- Signals broadcast over specific frequencies
- Not line of sight – can penetrate walls, etc.
- Typical wireless implementation
- Security weak
- Environmental conditions – highly susceptible to interference
- Spread spectrum implementation highly secure; uses multiple frequencies for signal

## **Summation of Considerations for Cable Choice**

- EMI or RFI potential emissions
- Corners & confined or small spaces
- Distance
- Security
- Growth
- Existing infrastructure – adding to it or disbanding altogether