# Computer Network Protocols
# Physical Layer
# Lesson -1


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# Physical Layer

*Physical layer* ***is the lowest layer*** *of the OSI reference model.* ***It*** *is responsible* ***for sending bits from one computer to another.*** *Physical Layer defines* ***electrical*** *and* ***physical specifications*** *for devices. It defines the* ***relationship between a device and a transmission medium****, such as a copper or optical cable. This includes the layout of pins, voltages, cable specifications, hubs, repeaters, network adapters, host bus adapters.*

# Transmission Media

1. ***Guided***: *Data is sent via a wire or optical cable.*
   - ***Twisted Pair***: *Two copper wires are twisted together to reduce the effect of crosstalk noise.*
     a) *Unshielded Twisted-Pair (UTP) cables*
     b) *Shielded Twisted-Pair (STP) cables*

   - ***Baseband Coaxial Cable***: *A 50-ohm cable used for digital transmission. Used in 10Base2 and 10Base5.*
   - ***Broadband Coaxial Cable***: *A 75-ohm cable used for analog transmission such as TV Cable.*

   - ***Fiber Optic Cables***: *Two general types are multimode and single mode. In multimode, light is reflected internally. Light source is an LED. In single mode, the light propagates in a straight line. Light source come from expensive laser diodes. Faster and longer distances as compared to multimode. Fiber optic cables are difficult to tap (higher security) and are normally used for backbone cabling.*

# Transmission Media

***2. Unguided:*** *Data is sent through the air*

- ***Line-of-sight:*** *Transmitter and receiver must "see" each other, such as microwave system.*

- ***Communication Satellites:*** *A big microwave repeater in the sky. Data is broadcasted, and can be "pirated".*

- ***Radio:*** *Term used to include all frequency bands, such as FM, UHF, and VHF television.*

# Analog Transmission

***Modulation*** *is the process of* ***modulating*** *a sine wave carrier to convey data. The MODEM is the device that accepts digital signals and outputs a modulated carrier wave, and vice versa. There are three types of modulation, these are:*

1. ***Amplitude Modulation (AM):*** *Amplitude is increased/decreased while frequency remains constant.*

2. ***Frequency Modulation (FM):*** *Frequency is increased/decreased while amplitude remains constant.*

3. ***Phase Modulation (PM)****: Wave is shifted, while amplitude and frequency remains constant.*

# Physical Layer Standard

***RS-232***

- *20 kbps*
- *Cables up to 15 meters*
- *Unbalanced transmission (common ground)*

***RS-422***

- *2 Mbps at 60 meters*
- *1 Mbps at 100 meters*
- *Balanced transmission (a pair of wires for Tx, Rx)*

# Physical Layer Standard

***SONET\SDH Networks***

- *Synchronous Optical Networking (SONET) and Synchronous Digital Hierarchy (SDH) are standardized multiplexing protocols that transfer multiple digital bit streams over optical fiber using lasers or light-emitting diodes (LEDs).*

- *SONET\SDH, which is used as a transport network to carry loads from other WANs.*

# SONET\SDH Networks

| SDH(Synchronous Digital Hierarchy) | SONET(Synchronous Optical Network) |
|---|---|
| • Is **European** standard network.<br>• Is a standard developed by **ITU-T**.<br>• Define a **hierarchy of signals** called synchronous transfer modules (**STMs**) | • Is **American** standard network.<br>• Is a standard developed by **ANSI** for **fiber-optic networks.**<br>• Define a **hierarchy of signals** called synchronous transport signals (**STSs**) where each STS level (STS-1 to STS-192) **supports a certain data rate**. |

# End Of Lesson 1

# Thanks For Listening