

PHYSICAL LAYER

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.
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)

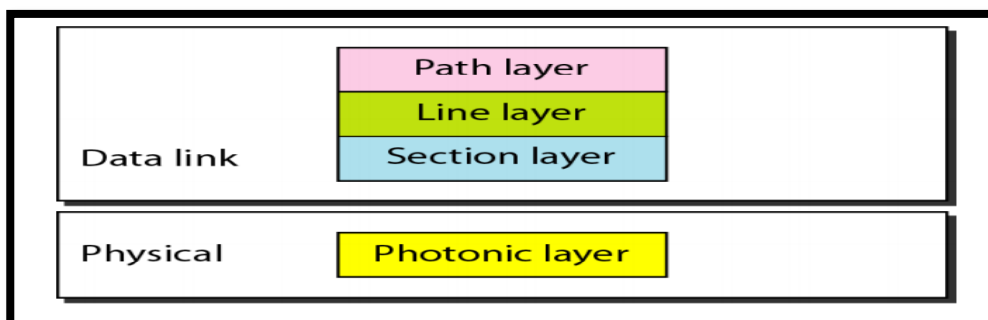
SONET\SDH Networks

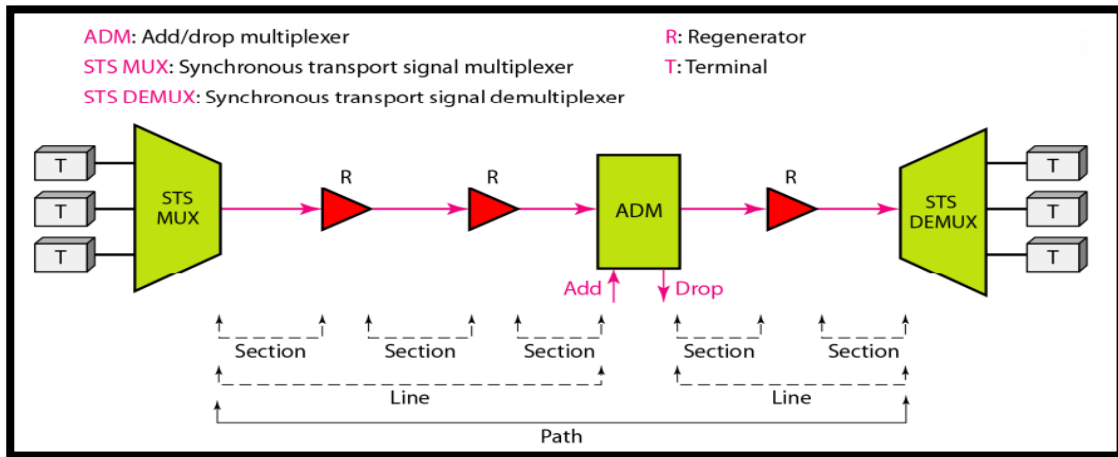
- **Synchronous Optical Networking (SONET)** and **Synchronous Digital Hierarchy (SDH)** are standardized **multiplexing protocols** that transfer multiple digital bit streams over **optical fiber using lasers or light-emitting diodes (LEDs)**.
- SONET\SDH, which is used as a **transport network to carry loads from other WANs**.

SDH(Synchronous Digital Hierarchy)	SONET(Synchronous Optical Network)
<ul style="list-style-type: none"> • Is European standard network. • Is a standard developed by ITU-T. • Define a hierarchy of signals called synchronous transfer modules (STMs) 	<ul style="list-style-type: none"> • Is American standard network. • Is a standard developed by ANSI for fiber-optic networks. • Define a hierarchy of signals called synchronous transport signals (STSs) where each STS level (STS-1 to STS-192) supports a certain data rate.

The SONET standard includes **four functional layers** they correspond to both the physical and the data link layers shown in figure below.

- ❖ **Path layer** is responsible for the movement of a signal from its optical source to its optical destination.
- ❖ **Line layer** is for the movement of a signal across a physical line.
- ❖ **Section layer** is for the movement of a signal across a physical section, handling framing, scrambling, and error control.
- ❖ **Photonic layer** corresponds to the physical layer of OSI model





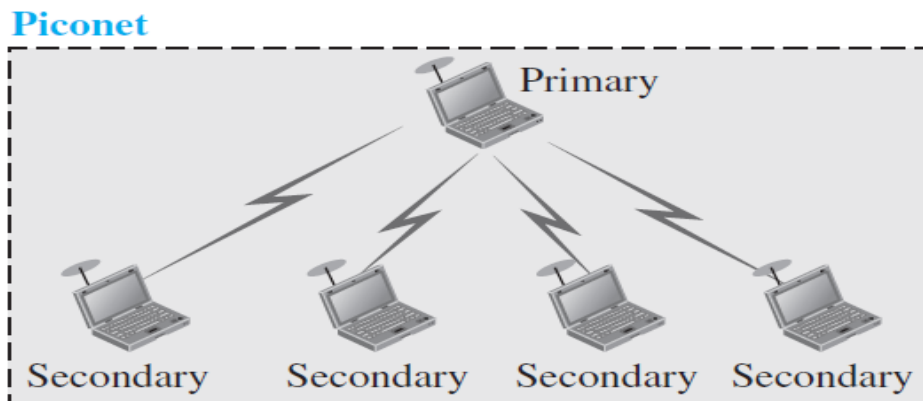
BLUETOOTH

- Bluetooth is a wireless LAN technology designed to connect devices of different functions such as telephones, notebooks, computers (desktop and laptop), cameras, printers, and even coffee makers when they are at a short distance from each other.

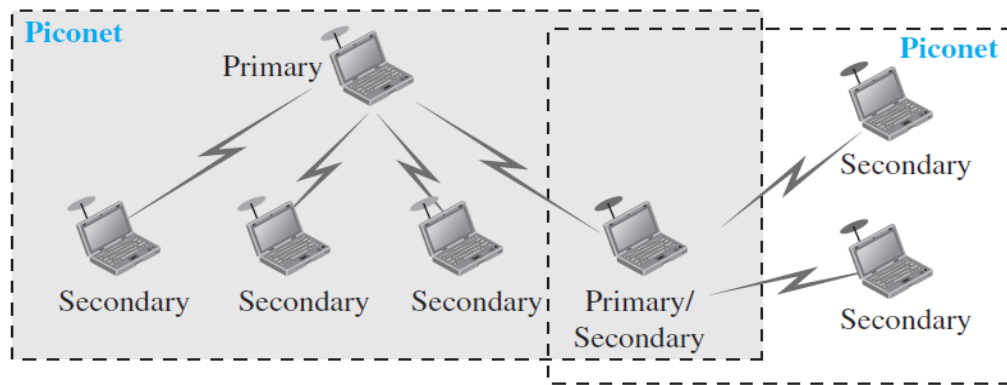
Architecture of Bluetooth:

- Bluetooth defines two types of networks: **piconet** and **scatternet**.
- A Bluetooth network is called a *piconet*, or a *small net*. A *piconet* can have up to eight stations, one of which is called the *primary*; the rest are called *secondaries*.

Piconet Network



Scatternet Network



Piconet	Scatternet
In this bluetooth network, device can function either as master or slave.	In this bluetooth network, device can function as master or slave or (master+slave)
It serves smaller coverage area.	It serves larger coverage area.
It supports maximum 8 nodes.	It supports more than 8 nodes.
It allows less efficient use of available bluetooth channel bandwidth.	It allows more efficient use of available bluetooth channel bandwidth.