# Unit 1- Part 2

## Introduction to Data communications and Networking

**Note:** This notes are for reference only. This is **not the only material** you need to refer for exam.

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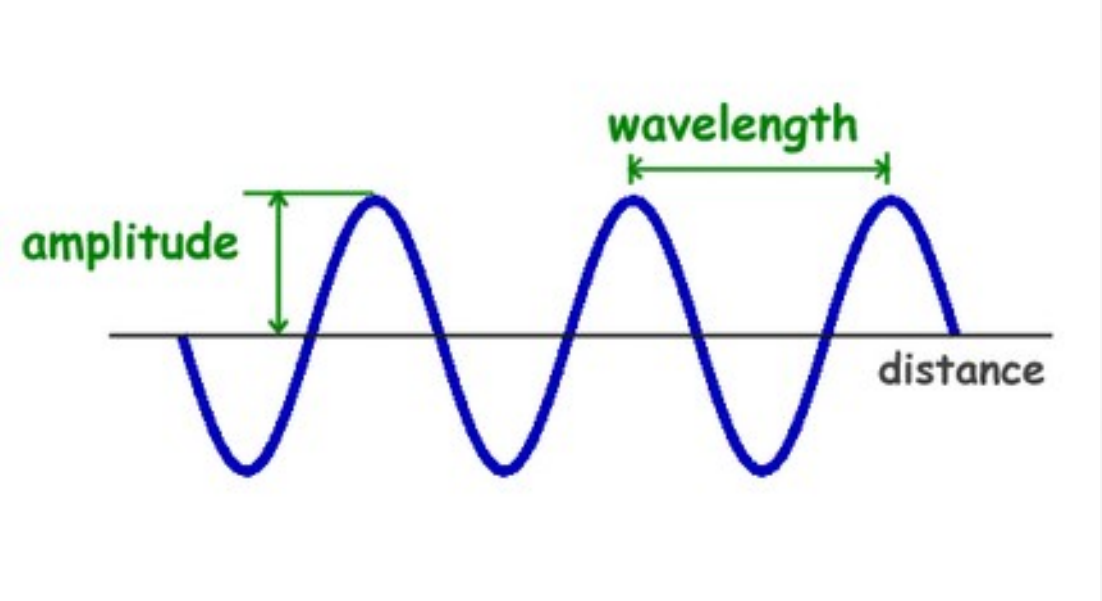
# Signal Transmission

- **Signal Transmission: Digital Signal, Analog Transmission**
- An analog is characterized by its amplitude, frequency and phase. There are three kinds of digital-to-analog conversions possible:

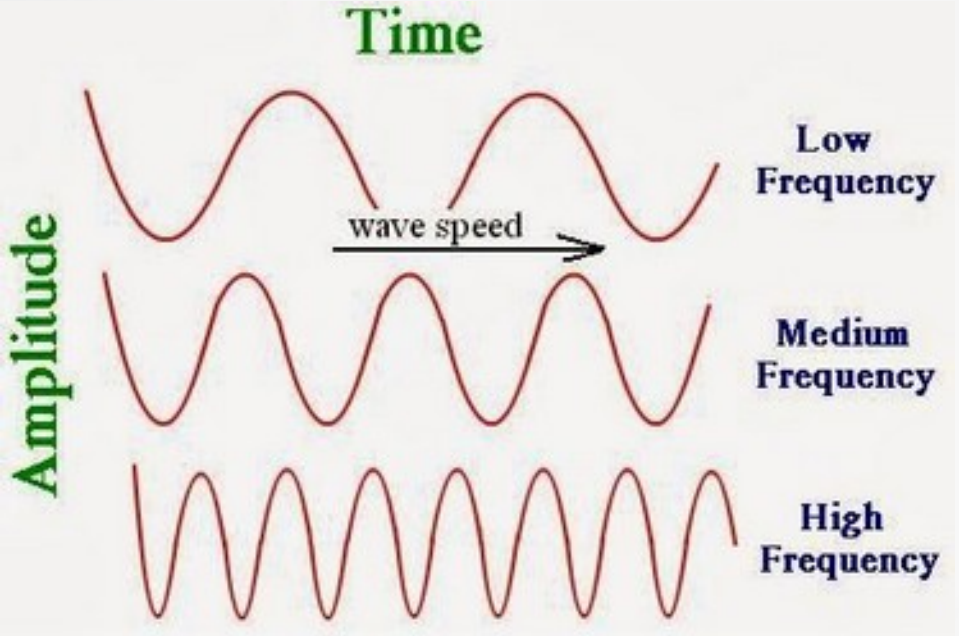
**1.Amplitude Shift Keying**
**2.Frequency Shift Keying**
**3.Phase Shift Keying**

# Amplitude

- The greatest distance that a wave, especially a sound or radio wave, moves up and down



# Frequency

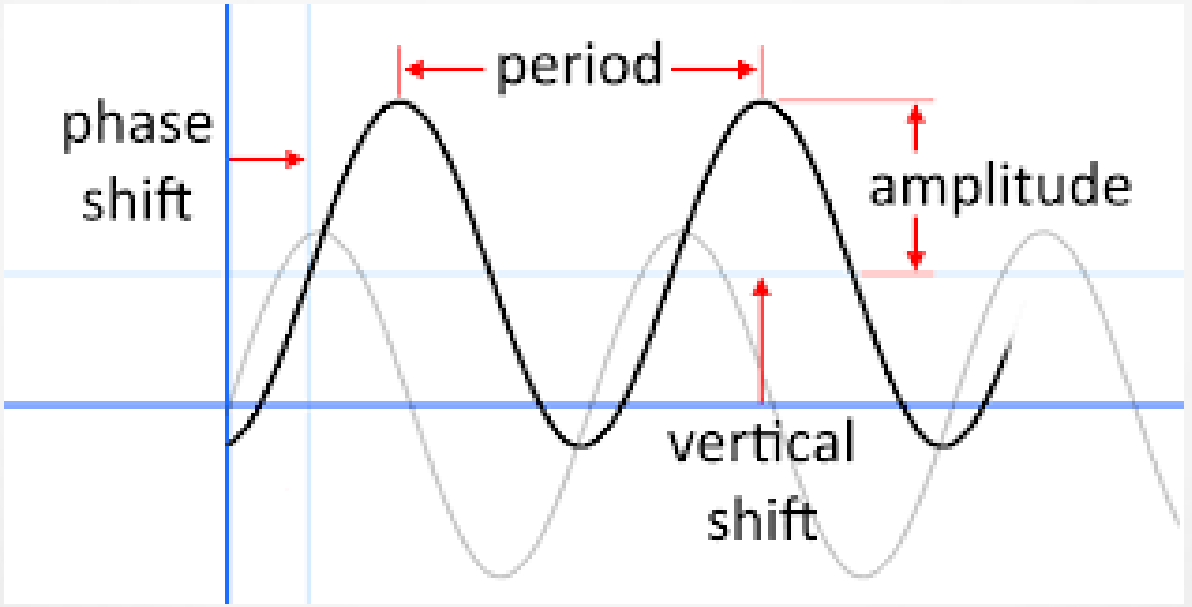



Frequency is the number of waves that pass a given point in 1 second

$\left(\frac{\text{waves}}{\text{second}} = \text{Hertz}\right)$

# Phase

The Phase Shift is how far the function is shifted horizontally or vertically from the usual position.

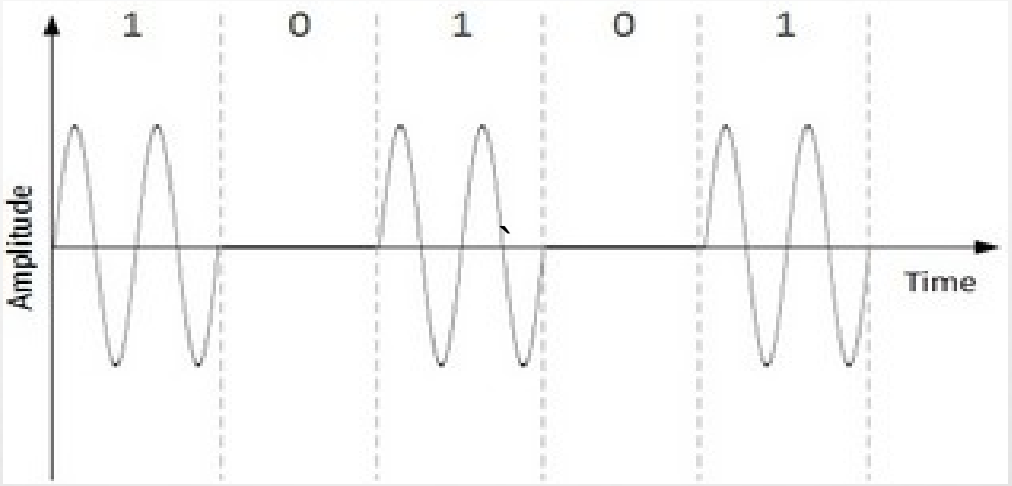


# Signal Transmission

- **Signal Transmission: Digital Signal, Analog Transmission**

**Amplitude Shift Keying:**

- A bit string 10011010011 modulated as an analog signal.
- Only the amplitudes of the signal change as per the values 0 and 1, but the phase and frequency are same.
- The frequency is between 0 to 4000 Hz. So the signal can be send over telephone line.
- When binary data represents digit 1, the amplitude is held otherwise it is set to 0. Both frequency and phase remain same as in the original carrier signal.

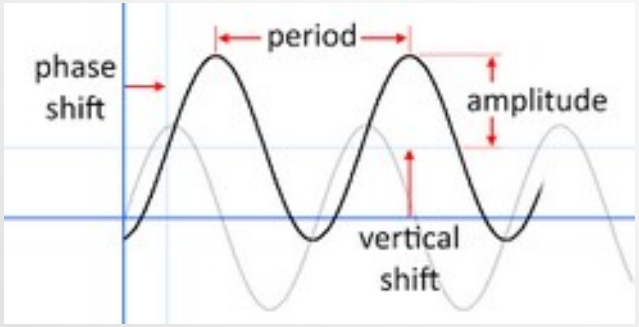


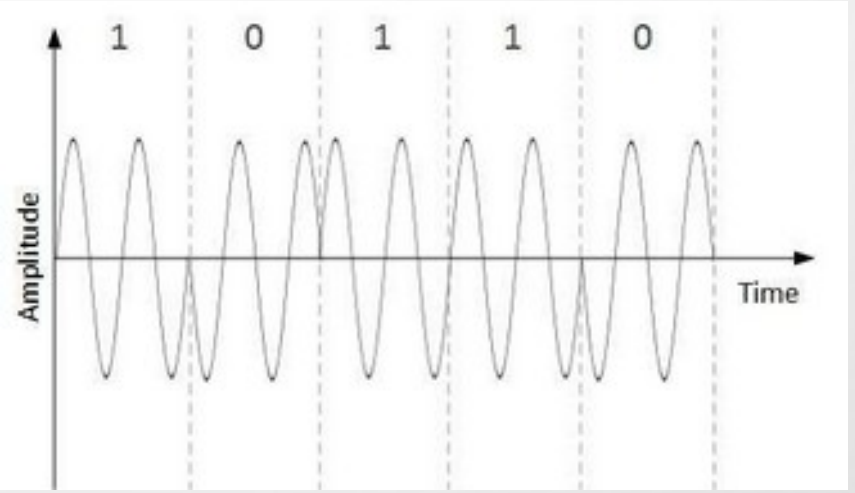
# Signal Transmission

- **Signal Transmission: Digital Signal, Analog Transmission**

**Phase Shift Keying:**

- The amplitude and the frequency of the carrier signal unchanged.
- Only change the phase to denote 0s and 1s.
- i.e. Start with a phase of 0 degrees to represent binary 1 and then change the phase to 180 degrees to represent binary 0.



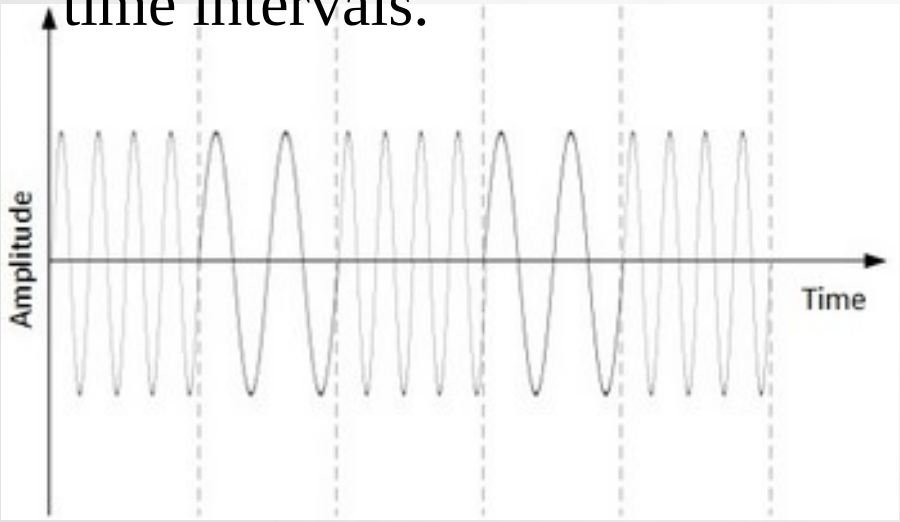



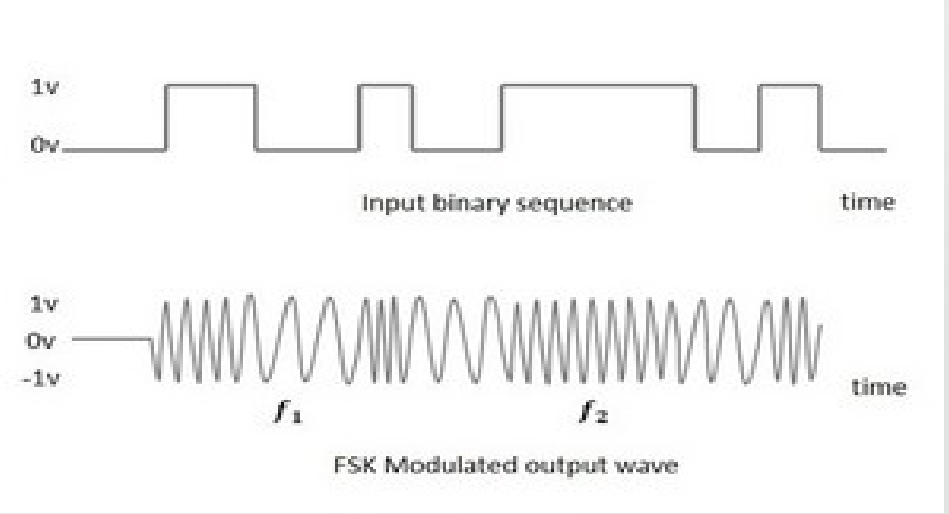
# Signal Transmission

## Digital Signal, Analog Transmission

**Frequency Shift Keying:**

- The amplitude and the phase of the carrier signals are kept unaltered.
- A certian frequency *f1* to denote 1 and *f2* to denote 0 is assigned.
- The frequency of the carrier signal is varied to represent binary 1 (using f1) and binary 0(f2).
- The signal component with slower cycle is *f1* and the signal component that shows rapid cycle portions if *f2*.
- The modem at the destination *decodes* these signals into 0s and 1s by measuring the frequencies of the received signals at regular predefined time intervals.



# Signal Transmission

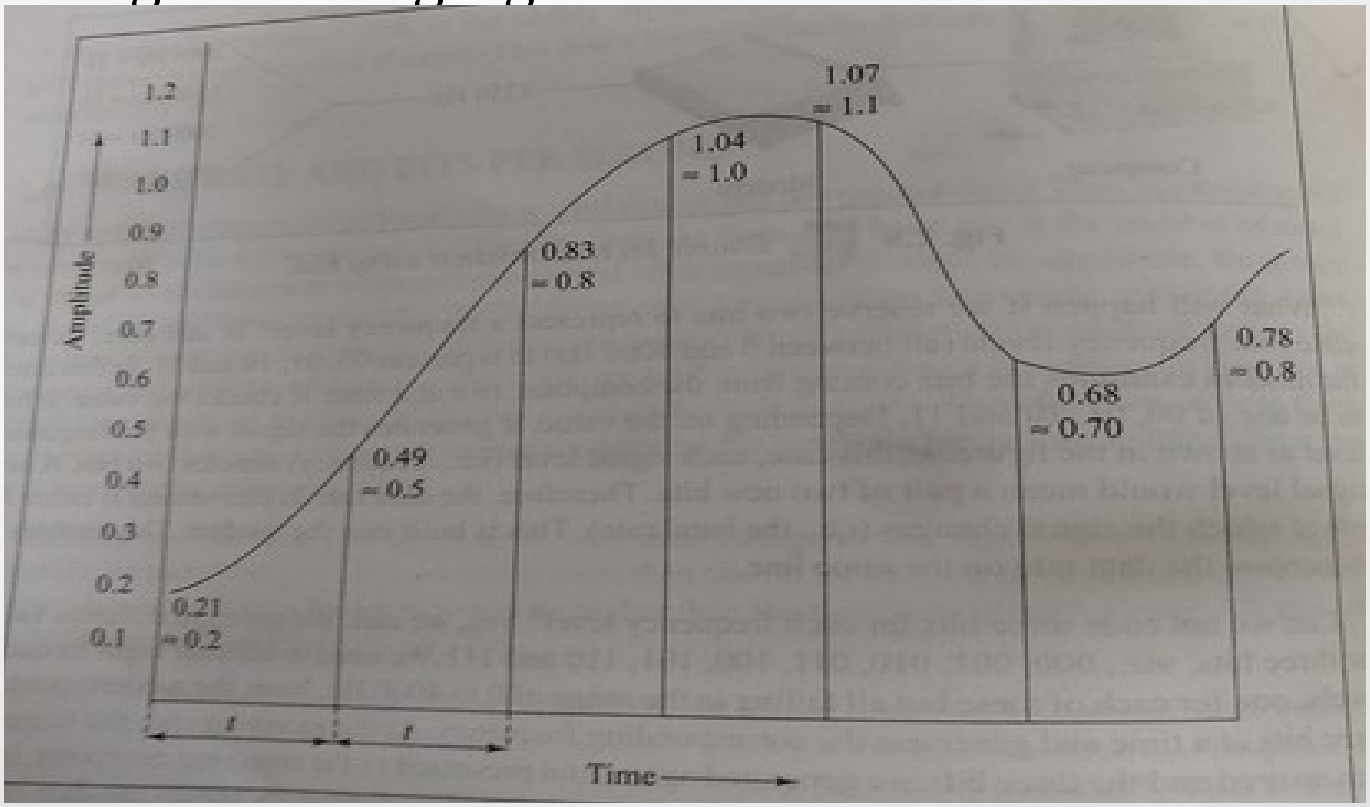
**Signal Transmission: Analog Signal, Digital Transmission**

- Pulse-code modulation (PCM) is a method used to digitally represent sampled analog signals.
- The idea is to represent an analog signal into digital bits and then transmit as a digital signal.
- PCM - Pulse Code Modulation is one of the most commonly used method to convert analog data into digital form.
- The basic steps in PCM are as given below:
- **At Source:**
  - Sample the analog signal at regular interval Say t
  - Convert the analog signal into some discrete values.
  - Convert thse values into binary numbers by assigning a fixed number of bits for each value.
  - Convert the binary numbers as a digital signal by concatenating all these binary numbers.

# Signal Transmission

**Signal Transmission: Analog Signal, Digital Transmission**

- **At Destination:**
  - Convert the digital signal into binary numbers.
  - Seperate out the discrete values of signals by using the number of bits for each discrete value.
  - Reconstruct the original analog signal.



# Bit Rate & Baud Rate

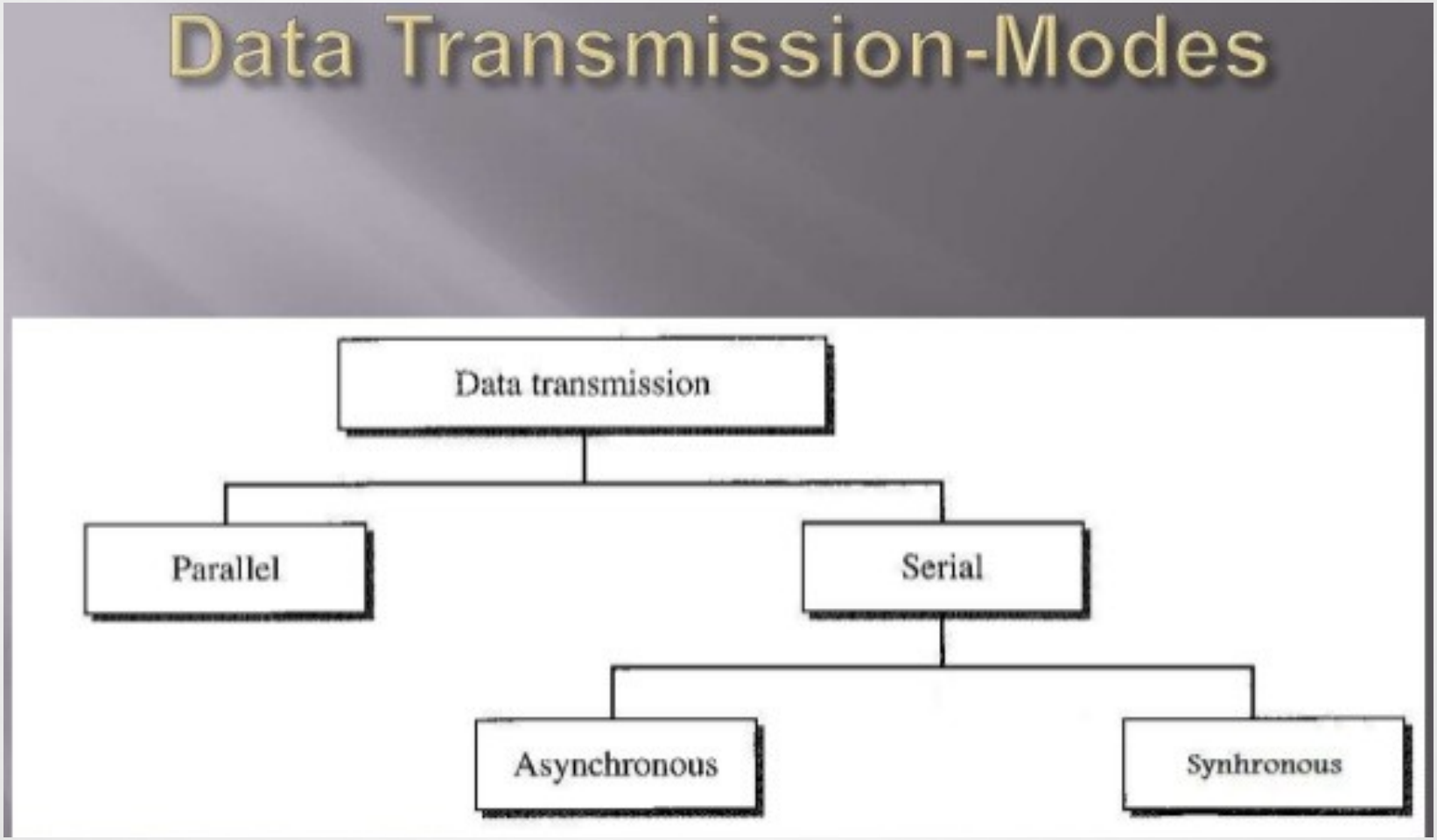
**Bit Rate:**

- Bit Rate is how many data bits are transmitted per second. Bit rates measure the number of data bits (that is 0′s and 1′s) transmitted in one second in a communication channel. A figure of 2400 bits per second means 2400 zeros or ones can be transmitted in one second.

**Baud Rate:**

- Baud rate refers to the number of signal or symbol changes that occur per second. A baud rate is the number of times a signal in a communications channel changes state or varies. For example, a 2400 baud rate means that the channel can change states up to 2400 times per second. The term “change state” means that it can change from 0 to 1 or from 1 to 0.
- An analog signal carries 4 bits in each signal unit. If 1000 signal units are sent per second, find the baud rate and the bit rate.
- Baud rate = 1000 bauds per second
- Bit rate = 1000 * 4 =4000 bps

# Modes of Data Transmission

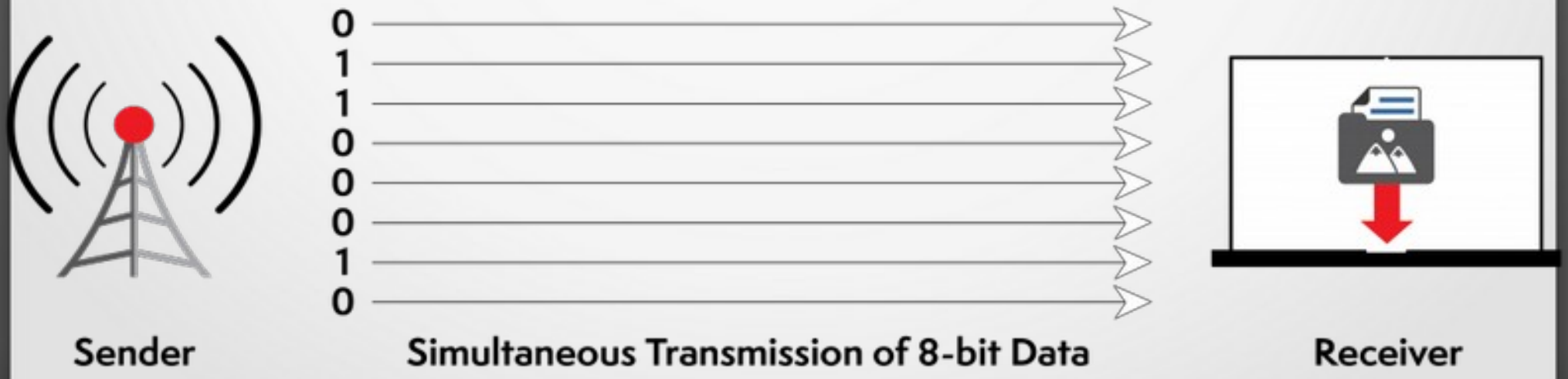


# Modes of Data Transmission

- Data Transmission refers to the process of transferring data between two or more digital devices.
- Data is transferred in the form of bits between two or more digital devices.
- There are two methods used to transmit data between digital devices:
  - **Parallel transmission**
  - **Serial transmission.**

# Modes of Data Transmission

- **Parallel transmission:**
- **Multiple data bits are transmitted over multiple channels at the same time.**
- Data can be sent much faster than using serial transmission.
- It requires those many wires parallel to each other, each carrying a single bit. E.g. 8 wires are needed to pass 01100010 in parallel communication.



# Modes of Data Transmission

- **Parallel transmission:**
- **It is very expensive method because it requires several wires as well as various sending and receiving equipment.**
- It demands extraordinary accuracy, which is not guaranteed over long distances.
- Digital pulses may not traverse at the same speed, This rise to the problem of **Skew**.
- To avoid skew problem, parallel transmission is used only for a short distance. E.g. Data transmission from CPU registers to memory or vice versa

# Modes of Data Transmission

- **Serial transmission:**
- **Serial data transmission sends data bits one after another over a single channel.**
- The data bits are organized in a specific order, since they can only be sent one after another. There is some hardware equipment involved in converting the data from parallel to serial.
- At the destination, all the bits are collected, measured and put together as bytes in the memory. This requires conversion from serial to parallel.

# Modes of Data Transmission

- **Serial transmission:**
  - **Serial transmission is normally used for long-distance data transfer.**
  - It is also used in cases where the amount of data being sent is relatively small.
  - Serial transmission has two classifications: asynchronous and synchronous.

# Modes of Data Transmission

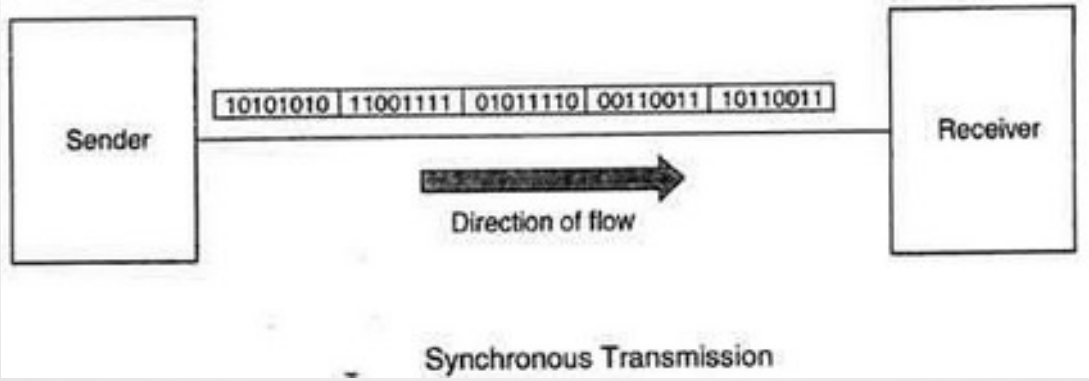
**Asynchronous Serial Transmission**

- **Data bits can be sent at any point in time.**
- Stop bits and start bits are used between data bytes to synchronize the transmitter and receiver and to ensure that the data is transmitted correctly.
- The time between sending and receiving data bits is not constant, so gaps are used to provide time between transmissions.
- It is also a more cost effective method.
- data transmission can be slower, but this is not always the case.

# Modes of Data Transmission

**Synchronous Serial Transmission**

- **Data bits are transmitted as a continuous stream in time with a master clock.**
- The data transmitter and receiver both operate using a synchronized clock frequency; therefore, start bits, stop bits, and gaps are not used.
- The data moves faster and timing errors are less frequent because the transmitter and receiver time is synced.
- In comparison with asynchronous serial transmission, this method is usually more expensive.




Synchronous Transmission