MODULE-2: PHYSICAL LAYER

Prepared by Prof. Amit K. Nerurkar

Module 2   Physical Layer

Introduction to Communication System

Data Communication is a process of exchanging data or information

In case of computer networks this exchange is done between two devices over a transmission medium.

This process involves a communication system which is made up of hardware and software.

1. The hardware part involves the sender and receiver devices and the intermediate devices through which the data passes.
2. The software part involves certain rules which specify what is to be communicated, how it is to be communicated and when. It is also called as a Protocol.
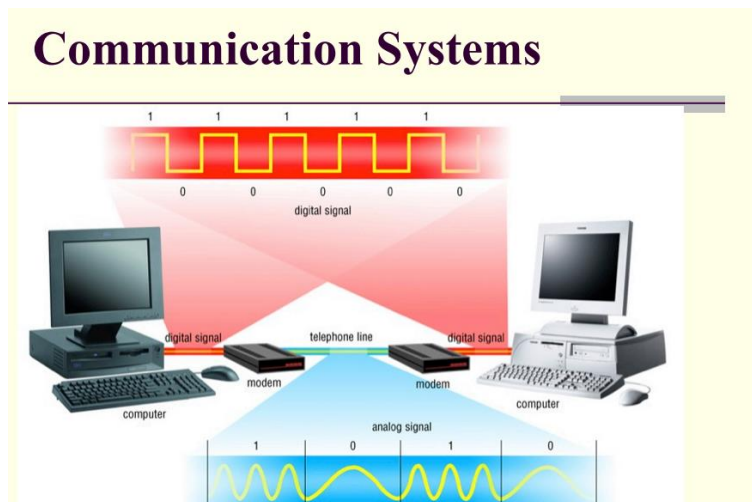
Figure: Commuication Systems

Characteristics of Data Communication

1. Delivery: The data should be delivered to the correct destination and correct user.

2. Accuracy: The communication system should deliver the data accurately, without introducing any errors. The data may get corrupted during transmission affecting the accuracy of the delivered data.

3. Timeliness: Audio and Video data has to be delivered in a timely manner without any delay; such a data delivery is called real time transmission of data.

4. Jitter: It is the variation in the packet arrival time. Uneven Jitter may affect the timeliness of data being transmitted.

Digital Communication

Definition:-
A digital is a signal that has discrete values. The signal will have value that is not continuous.
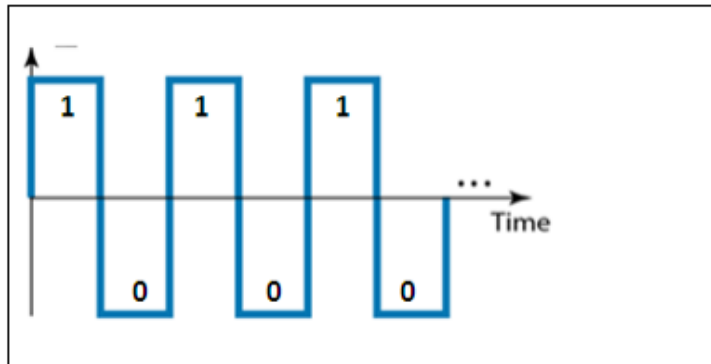
LEVEL
Information in a digital signal can be represented in the form of voltage levels. Ex. In the signal shown below, a _1' is represented by a positive voltage and a _0' is represented by a Zero voltage.
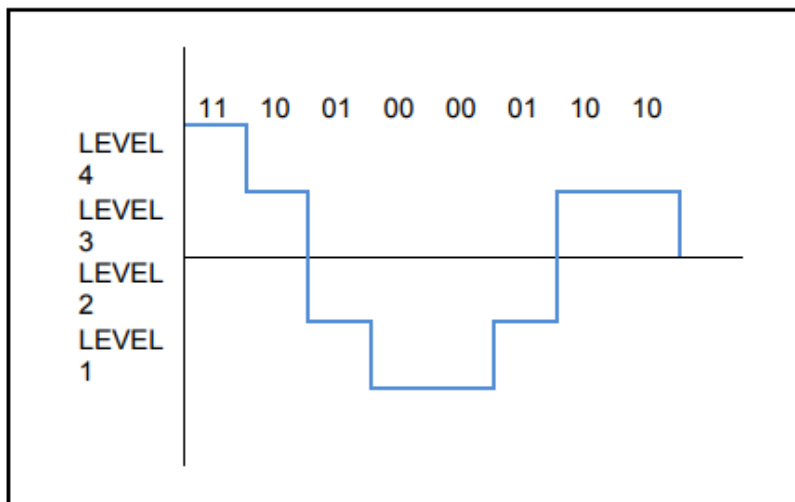
Video:
Baud Rate, Bit Rate, Bandwidth and Latency
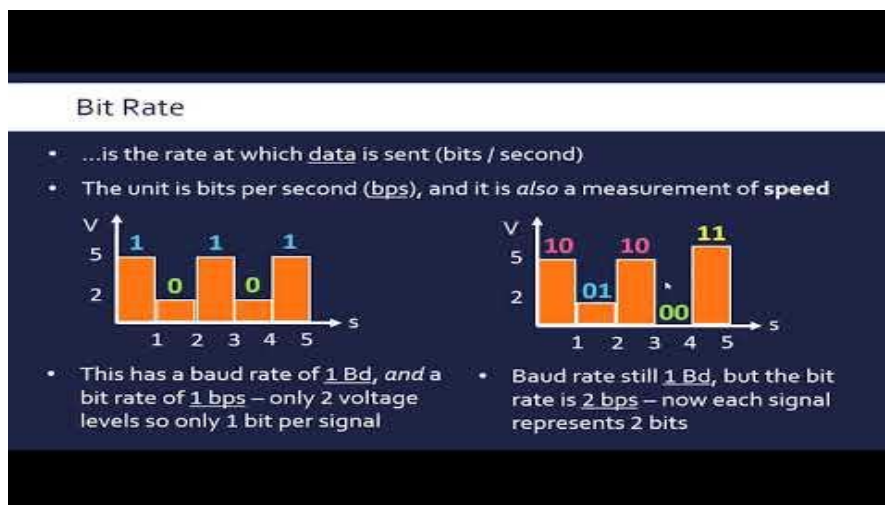
Fig: A digital signal with Two levels. '1' represented by a positive voltage and '0' represented by a negative voltage

- A Signal can have more than two levels

Fig: A digital signal with four levels

BIT LENGTH or Bit Interval (Tb) It is the time required to send one bit. It is measured in seconds

BIT RATE It is the number of bits transmitted in one second. It is expressed as bits per second (bps). Relation between bit rate and bit interval can be as follows Bit rate = 1 / Bit interval

Baud Rate It is the rate of Signal Speed, i.e the rate at which the signal changes. A digital signal with two levels _0' & _1' will have the same baud rate and bit rate & bit rate. The diagram below shows three signal of period

(T) 1 second a) Signal with a bit rate of 8 bits/ sec and baud rate of 8 baud/sec b) Signal with a bit rate of 16 bits/ sec and baud rate of 8 baud/sec c) Signal with a bit rate of 16 bits/ sec and baud rate of 4 baud/sec
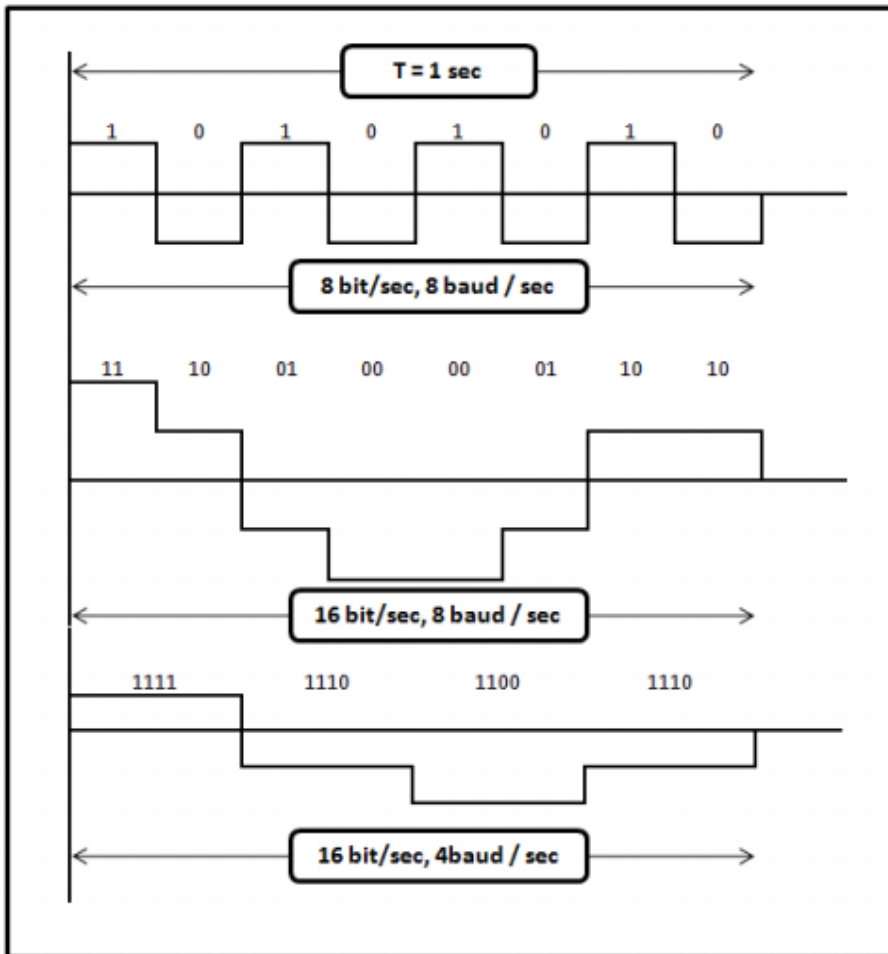
Fig: Three signals with different bit rates and baud rates

Electromagnetic Spectrum

The **electromagnetic spectrum** is made up of radio waves, microwaves, infrared waves, visible light, ultraviolet light, and even X-rays and gamma rays! All of these electromagnetic waves are similar in a lot of important ways. First, all electromagnetic waves can travel through empty space. Unlike sound waves or waves in water, electromagnetic waves do not require a medium to travel through. This is pretty important, because if electromagnetic waves could not travel through empty space, then the light and heat from the Sun would not be able to reach us here on Earth!

Electromagnetic waves also travel very, very quickly. In fact, nothing in the universe has ever been shown to move faster than an electromagnetic wave.
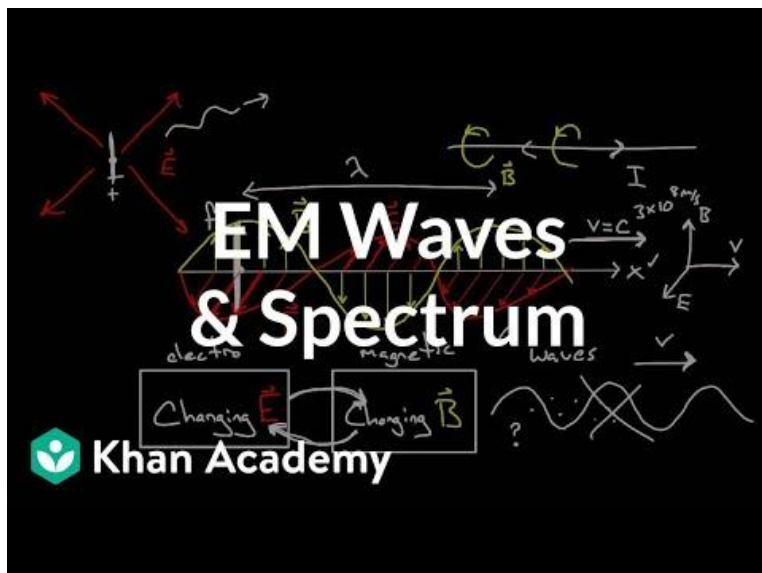
Examples of Waves on the Electromagnetic Spectrum

**Radio waves**

Microwaves

Infrared signals

Video
The Electromagnetic Spectrum

References
1. TCP/IP Protocol Suite by Fourozan
2. Computer Networks by Tanenbaum
3. https://web.sonoma.edu/users/f/farahman/sonoma/courses/es465/lectures/es465_fall2010/introduction.pdf
4. http://datacombyfloyd.blogspot.com/2010/07/wireless-communication-and.html

[Subscribe to my YouTube Channel Amit Nerurkar](#)
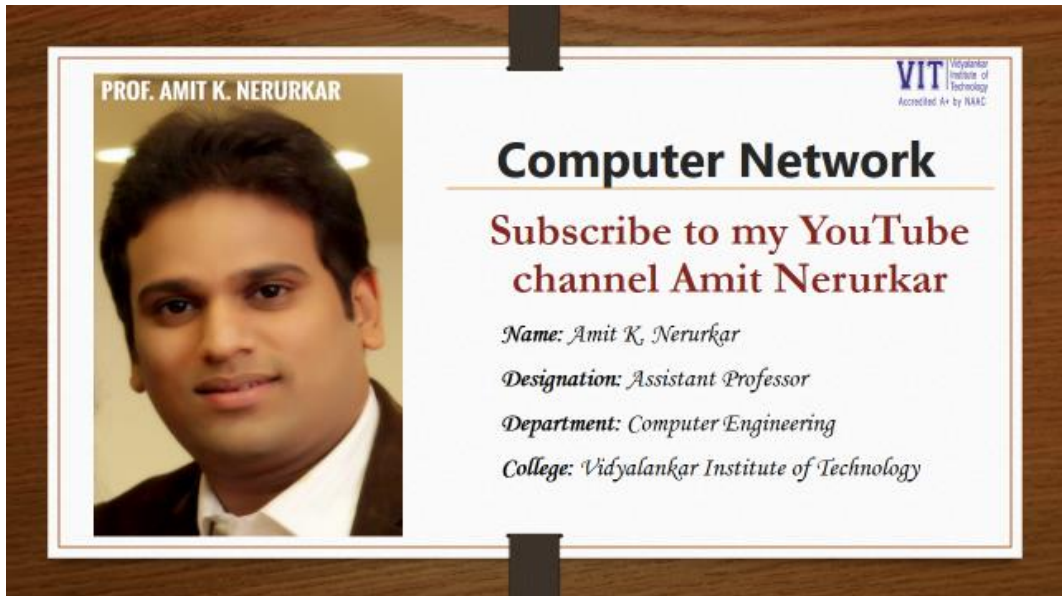
Subjects Taught by Amit K. Nerurkar

1. **C programming**
2. **Data Structure**
3. **Computer Network**
4. **Network Security**
5. **Artificial Intelligence**
6. **Soft Computing**
7. **Distributed Systems**
8. **Internet of Things**
9. **Linux Administration**
10. **Database Management System**