

Explores the data communication and computer networking technologies to share information effectively

## Competency 6

### 6.1

A system of interconnected computers and computerized peripherals such as printers is called computer network. This interconnection among computers facilitates information sharing among them. Computers may connect to each other by either wired or wireless media.

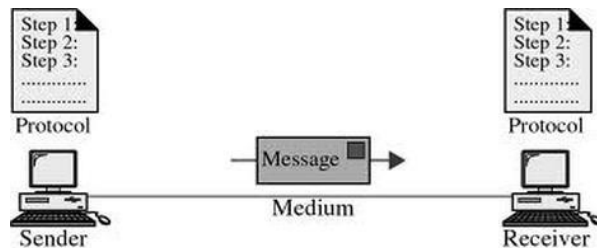
#### What is communication?

Communication can best be summarized as the transmission of a message from a sender to a receiver in an understandable manner. The importance of effective communication is immeasurable in the world of business and in personal life. From a business perspective, effective communication is an absolute must, because it commonly accounts for the difference between success and failure or profit and loss.

#### Components of a communication system

Communication is the conveying of messages by exchanging thoughts or information via Speech, visuals, signals, writing, or behavior. Communication requires a

1. Sender
2. Transmission system
3. Receiver
4. Protocol
5. Message



- **Sender**
  - Sender is a person who sends the message. A sender makes use of symbols (words or graphic or visual aids) to convey the message and produce the required response.
- **A transmission system**
  - is a system that transmits a signal from one place to another. The signal can be an electrical, optical or radio signal.
- **Receiver**
  - Is the listener, reader, or observer—that is, the individual (or the group of individuals) to whom a message is directed. The **receiver** is also called the "audience" or decoder.
- **Protocol**
  - is a system of rules that allow two or more entities of a **communications** system to transmit information via any kind of variation of a physical quantity. The **protocol** defines the rules, syntax, semantics and synchronization of **communication** and possible error recovery methods
- **Message**
  - is defined as information conveyed by words (in speech or writing), and/or other signs and symbols

## Computer network

A computer network is a set of devices connected through links. A node can be computer, printer, or any other device capable of sending or receiving the data. The links connecting the nodes are known as communication channels.

### Signals

A signal is an electronic voltage or current, which varies with time. It is used to transfer data from one end to another.

#### **Examples**

- An alarm gives a signal that it's time.
- A cooker whistle confirms that the food is cooked.
- A red light signals some danger.
- A traffic signal indicates your move.
- A phone rings signaling a call for you.

A signal can be of any type that conveys some information. This signal produced from an electronic equipment, is called as **Electronic Signal** or **Electrical Signal**.

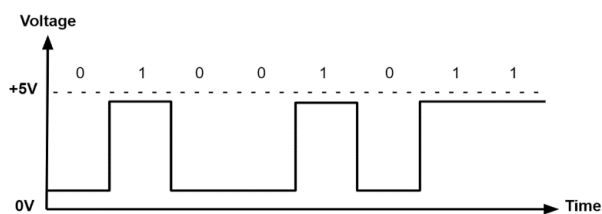
### Types of Signals

Signals can be classified depending upon their characteristics

1. Analog
2. Digital

### Digital Signal

Digital signal is a signal that represents data as a sequence of discrete values. A digital signal can only take on one value from a finite set of possible values at a given time.



### **Advantages and Disadvantages of Digital Signals**

#### **Advantages**

- The frequency of the carrier wave is usually higher
- The combined wave is transmitted
- Carry more information per second than analogue signals
- Maintain quality over long distances better than analogue signals.
- They're automatic
- Easier to remove noise
- Can be very immune to noise

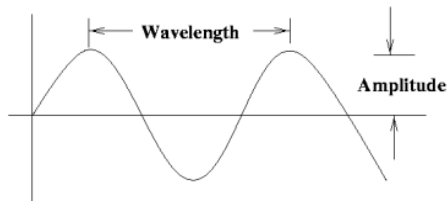
## Disadvantages

- Can be complex
- Output subject to quantity errors from sampling

## Analog signal

Analog signals are in continuous wave form in nature and represented by continuous electromagnetic waves.

Examples of such signals are sound, light and temperature etc.



### Advantages to using analog signals,

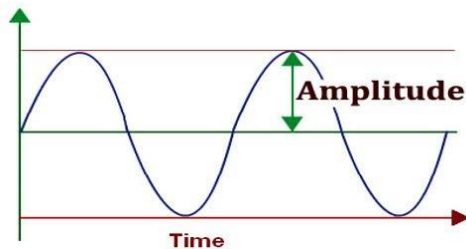
- Analog signals are easier to process.
- Analog signals best suited for audio and video transmission.
- Analog signals are much higher density, and can present more refined information.
- Analog signals use less bandwidth than digital signals.

### Disadvantages to using analog signals,

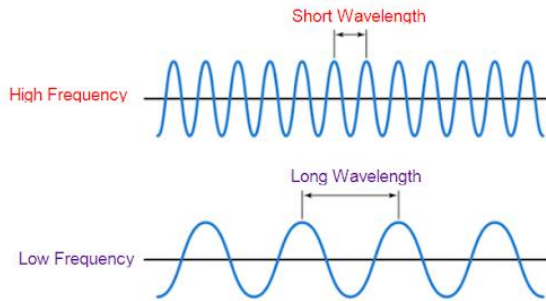
- Data transmission at long distances may result in undesirable signal disturbances.
- Analog signals are subject to noise and distortion, as opposed to digital signals which have much higher immunity.
- Analog signals are generally lower quality signals than digital signals.

### Properties of signals

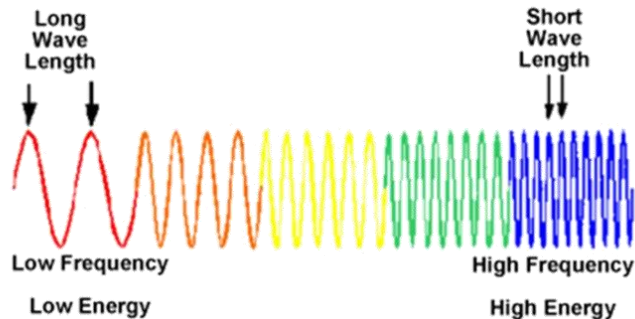
- Amplitude: The height of the wave measured in meters



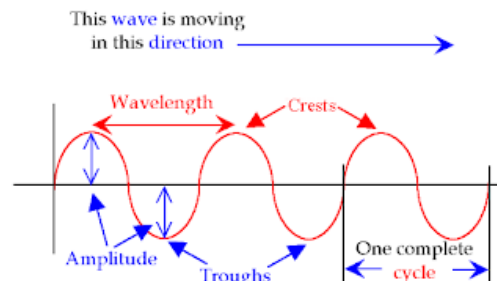
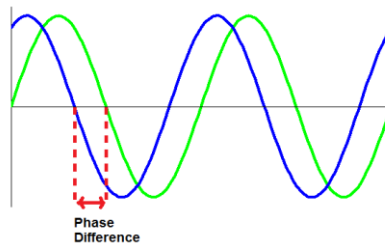
- **Frequency:** The number of complete waves that pass a point in one Second, Measured in Hertz (Hz)



- **Wavelength:** The distance between adjacent crests, measured in meters



- **Phase** : phase is a position of a point in time (instant) on



- **A waveform cycle.**

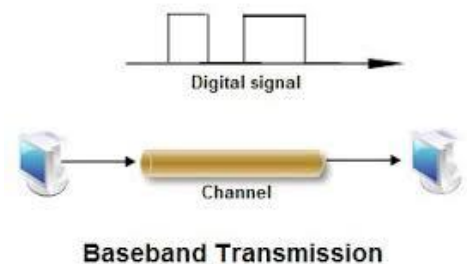
The period of a **wave** is the amount of time it takes to complete one **cycle**. Frequency is the number of complete **cycles** that a **wave** completes in a given amount of time. Usually measured in Hertz (Hz), 1 Hz being equal to one complete **wave cycle** per second.

- **Base band signals**

- A baseband signal or low pass signal is a signal that can include frequencies that are very near zero, by comparison with its highest frequency Baseband refers to the original frequency range of a transmission signal before it is converted, or modulated, to a different frequency range.

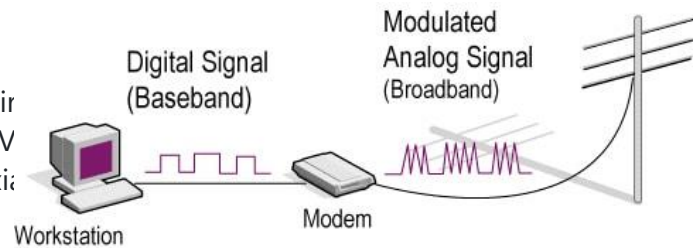
Example,

A sound waveform can be considered as a baseband signal, whereas a radio signal or any other modulated signal is not



- **Broadband signals**

- Broadband is typically used in an environment where multiple signals are transmitted simultaneously. For example, Cable TV companies. Usually radio waves, coaxial cables, and fiber-optic cables are used for transmission.



### Key differences between baseband and broadband transmissions

Baseband transmission	Broadband transmission
<ul style="list-style-type: none"> <li>• Transmit digital signals</li> </ul>	<ul style="list-style-type: none"> <li>• Transmit analog signals</li> </ul>
<ul style="list-style-type: none"> <li>• To boost signal strength, use repeaters</li> </ul>	<ul style="list-style-type: none"> <li>• To boost signal strength, use amplifiers</li> </ul>
<ul style="list-style-type: none"> <li>• Can transmit only a single data stream at a time</li> </ul>	<ul style="list-style-type: none"> <li>• Can transmit multiple signal waves at a time</li> </ul>
<ul style="list-style-type: none"> <li>• Support bidirectional communication simultaneously</li> </ul>	<ul style="list-style-type: none"> <li>• Support unidirectional communication only</li> </ul>
<ul style="list-style-type: none"> <li>• Support TDM based multiplexing</li> </ul>	<ul style="list-style-type: none"> <li>• Support FDM based multiplexing</li> </ul>
<ul style="list-style-type: none"> <li>• Use coaxial, twisted-pair, and fiber-optic cables</li> </ul>	<ul style="list-style-type: none"> <li>• Use radio waves, coaxial cables, and fiber optic cables</li> </ul>
<ul style="list-style-type: none"> <li>• Mainly used in Ethernet LAN networks</li> </ul>	<ul style="list-style-type: none"> <li>• Mainly used in cable and telephone networks</li> </ul>

### Propagation speed in a media

- The **speed** at which a wave propagates through a given **medium**. The propagation speed also varies from medium to medium depending on the properties of the medium.

### Data transmission modes

There are three modes of transmission,

1. Simplex,
2. Half duplex,
3. Full duplex.

The transmission mode defines the direction of signal flow between two connected devices. Data transmission methodologies

### Simplex

- In simplex transmission mode, the communication between sender and receiver occurs in only one direction. The sender can only send the data, and the receiver can only receive the data. The receiver cannot reply to the sender.

Example, the keyboard

## Half Duplex

- The communication between sender and receiver occurs in both directions in half duplex transmission, but only one at a time. The sender and receiver can both send and receive the information, but only one is allowed to send at any given time.

Example, in walkie-talkies,

## Full Duplex

- In full duplex transmission mode, the communication between sender and receiver can occur simultaneously. The sender and receiver can both transmit and receive at the same time

Example, telephone conversation

## Data transmission methodologies

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:

- Serial transmission
- Parallel transmission.

### serial transmission

- When data is sent or received using serial data transmission, the data bits are organized in a specific order, since they can only be sent one after another. The order of the data bits is important as it dictates how the transmission is organized when it is received. It is viewed as a reliable data transmission method because a data bit is only sent if the previous data bit has already been received.



### Parallel transmission?

- When data is sent using parallel data transmission, multiple data bits are transmitted over multiple channels at the same time. This means that data can be sent much faster than using serial transmission methods.

