Introduction

- Evolution of Data Communication systems
- Analog and Digital Data Transmission, Data Communication Terminology
- Standards Organizations, Applications

Data Communication

Communication is defined as a process in which more than one device or computers transfer information, instructions to each other and for sharing resources. Communication is a process of act at which we can send or receive data like image, video, text, file, folders etc. Data communication concerns itself with the transmission of information between two locations by means of electrical signals.

Data Transmission Techniques

A communication system is made up of following components:

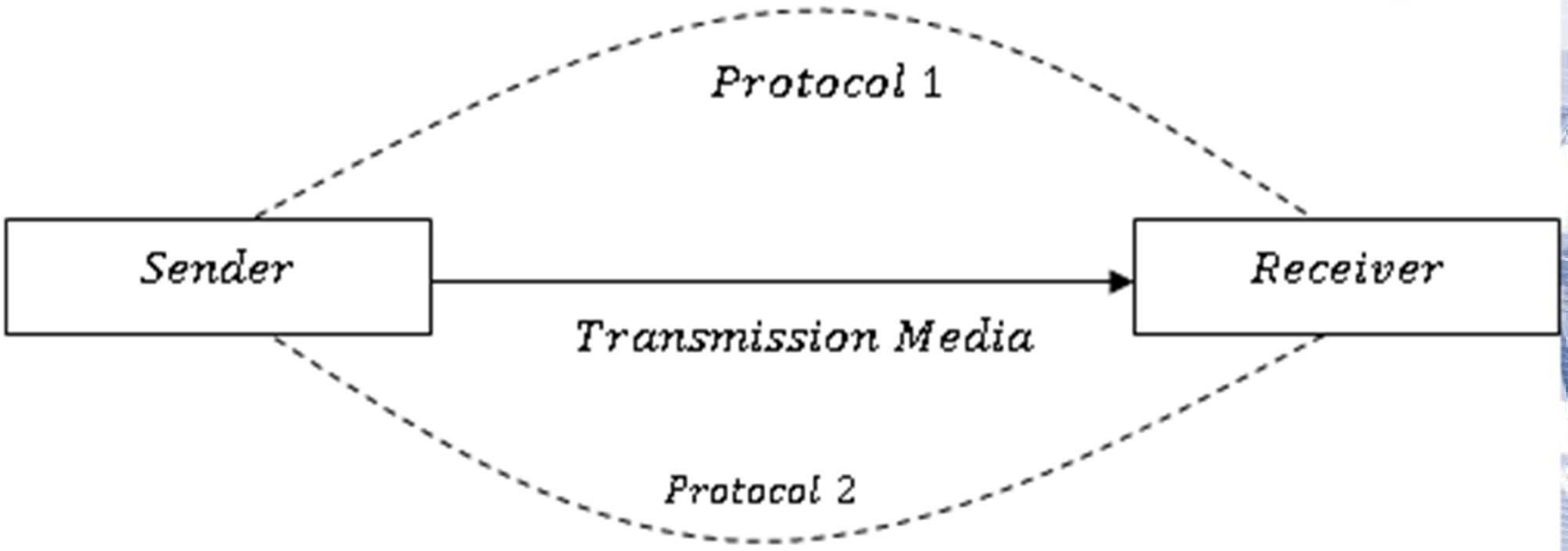

Fig: Components of Data Communicatic

Data Communication

Message

A message is a piece of information that is to be transmitted from one person to another person or one device to another device. It could be text, audio, video etc.

Frequency Sender

It is a simply a device that sends or transmits data. It can be a computer, mobile, telephone, video camera etc.

Receiver

It is a device that receives the message sent by the sender. It can be also either computer or mobile, telephone set etc. The receivers accept the signal from the transmission signal and convert it into a form that can be read or handled by the destination device or receiver. For e.g. Microphone receives analog signal, convert it into electrical form and then it converts into digital bit stream.

Transmission Medium

It is a medium or channel where signal can transmit from one device to another. They are of two types:

a. **Guided or Wired Medium**

For e.g. Twisted pair cable, Optical Fiber, Coaxial cable.

b. **Unguided of Wireless Medium**

For e.g. Satellite, Microwave, Radio, Television broadcasting etc.

Data Communication

Protocol

It is a set of rules form which the sender sends the data, it should be understandable by the receiver otherwise the data will be meaningless.

Noise

These are the signals in unwanted form which distorts or divert the transmission signal.

Evolution of Data Communication

Though, data communication may seem a relatively innovation, the history of data communication dates to the early 19th century. Through an array of technological developments that enjoyed commercial, government and military contributions, data communication evolved from simple wired connections to a robust global exchange of information.

Evolution of Data Communication

Telegraph (1830s-1860s)

Telegraph is any device or system that allows the transmission of information by coded signal over distance. Many telegraphic systems have been used over the centuries, but the term is most often understood to refer to the electric telegraph.

Evolution of Data Communication

Telephone (Alexander Graham Bell in 1869)

Telephone, an instrument designed for the simultaneous transmission and reception of the human voice. The telephone is inexpensive, is simple to operate, and offers its users an immediate, personal type of communication that cannot be obtained through any other medium. As a result, it has become the most widely used telecommunications device in the world.

Evolution of Data Communication

Radio (1920s to 1945s)

Radio, a form of mass media and sound communication by radio waves, usually through the transmission of music, news, and other types of programs from single broadcast stations to multitudes of individual listeners equipped with radio receivers.

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Evolution of Data Communication

Television (Middle 20th Century)

Television (TV), a form of mass media based on the electronic delivery of moving images and sound from a source to a receiver. By extending the senses of vision and hearing beyond the limits of physical distance, television has had a considerable influence on society.

Evolution of Data Communication

Satellite

The use of artificial satellites to provide communication links between various points on Earth. Satellite communications play a vital role in the global telecommunications system. Approximately 2,000 artificial satellites orbiting Earth relay analog and digital signals carrying voice, video, and data to and from one or many locations worldwide.

Analog and Digital Transmission

The term analog and digital transmission corresponds to the continuous and discrete time signal. In data communication these two (analog and digital) transmissions are used in at least three contexts that are data signaling and transmission.

Data is an entity that conveys meaningful information. An electric or electronic representation of data is known as signal. /Signaling is a digital propagation of signal along a suitable medium.

Transmission is a combination of data by propagation from sender to receiver and the processing of signal.

Analog and Digital Transmission

Analog Data

It is a continuous type signal in the certain interval of time. For example: voice and video which continuously vary or change the pattern of intensity of the signal. Most data are collected by the sensor such as sensors, microphone, temperature, pressure sensors etc.

Digital Data

These are discrete in nature or do not change with respect to time. For example: Text and image or are an integer (0's and 1's) with changes in desired form. A message is a group of characters known as string and can be represented easily in binary form or sequence of bit.

Analog and Digital Transmission

Analog Transmission

The signals are in either analog or digital form which can be propagated by means of continuously varying electromagnetic waves i.e. analog signal can propagate over variety of medium depending upon the transmission medium used.

For long distance communication, amplifiers are used to boost the energy of voltage in signal but it also boosts the noise component which distorts the original signals.

Analog Transmission

For example: Analog voice signals are converted into analog electromagnetic signals by the telephone set. Digital data can be converted into analog form by the device known as modem. In modem, there is a property of modulation and demodulation where modulation means adding carrier frequency with the message signal and demodulation means removing carrie frequency from original signal.

Analog and Digital Transmission

Fig: Analog Transmission

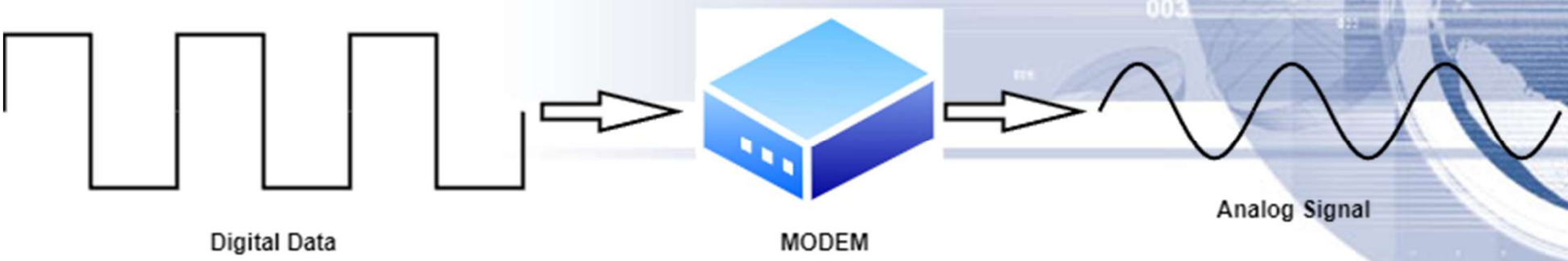

Fig: Analog Transmission (Conversion of digital to analog signal)

Analog and Digital Transmission

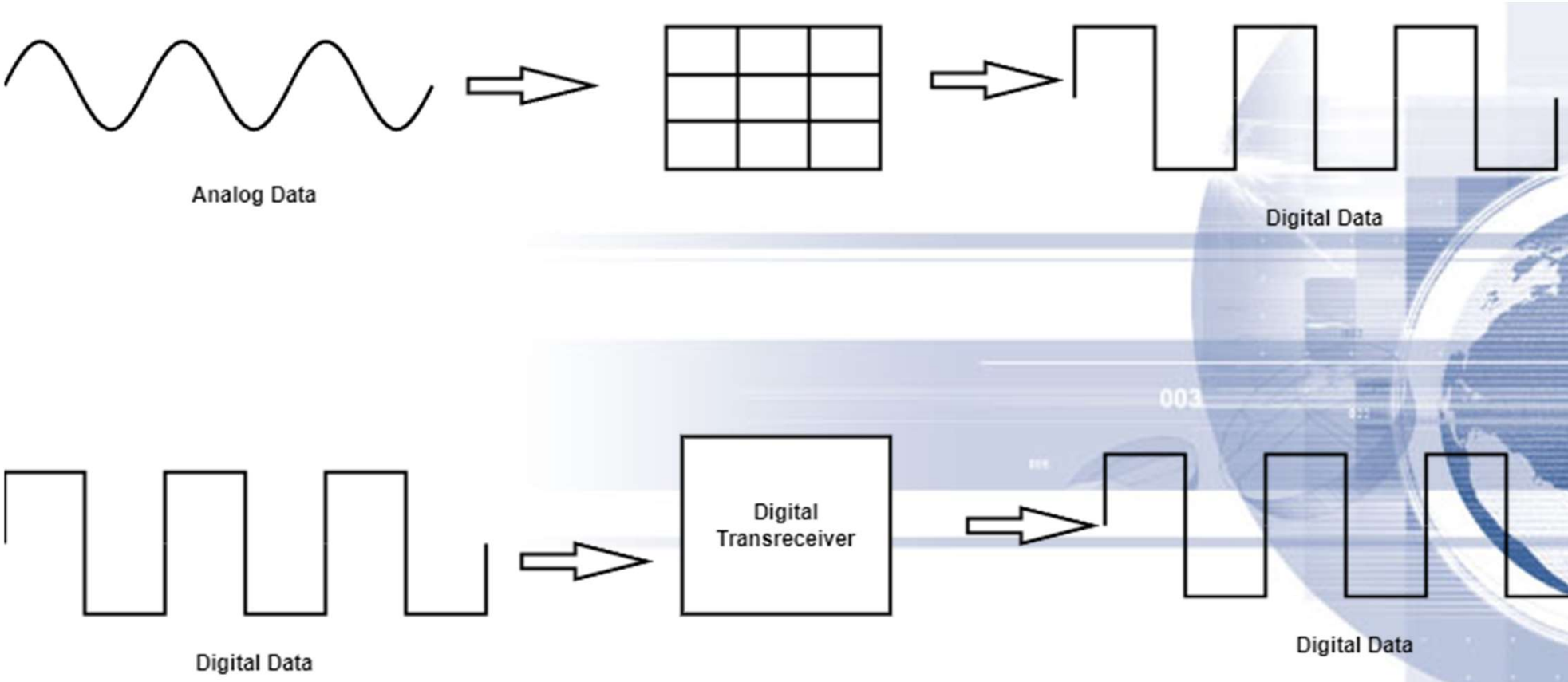

Fig: Digital Transmission

Analog and Digital Transmission

In digital transmission, sequence of voltage pulse i.e. digital signal is transmitted over a guided or unguided medium. Analog system can be converted into digital form by using a converter named as CODEC or analog to digital converter, which takes analog signal directory and represents the corresponding data and approximates that signal by a digital bit stream.

Application of Data Communication

- Education and Information Technology
- Financial Services
- Marketing and Sales
- Cyber Security and Hacking
- Manufacturing Industries
- ATM, Credit Card
- E-mail
- Telephony
- Cable Television
- Networking etc.

Standard Organization

Standard are developed by the cooperation among standard creation committee, forums and governments, regulatory agency. The standard creation committees are:

Standard Organization

1. International Standard Organization (ISO)

The ISO is an organization dedicated to worldwide agreement on international standard in a variety of fields such as education, communication, broadcasting, food production, electrical and electronic equipment's, medical council, engineering council etc

Standard Organization

2. International Telecommunication Union Telecommunication (IT-UT)

It is also international standard organization related to the United States that develops standard for telecommunication such as frequencies, bandwidth, different telecommunication equipment etc.

Standard Organization

3. Institute of Electrical and Electronics Engineering (IEEE)

It is the largest national professional group involved in developing standard for computation, communication, electrical and electronics engineering, computer and networking all related branches of engineering.

Standard Organization

4. American National Standard Institute (ANSI)

It is a non-profit organization in the United States which only standardizes education sector and related field, it is completely private organization.

Standard Organization

5. Electronics Industries Association (EIA)

It is an association of electronics manufacturer which is responsible for developing hardware standard such as VGA cable, HDMI, different ports of the devices, EIA 232D and EIA 530 standard.

Standard Organization

6. Nepal Telecommunication (NTA)

It is an authority of Nepal government which is responsible for frequency distribution to the different service providers. It regularly maintains the service provided and if unauthorized activities are transmitted or shared, NTA can block or terminate the whole system, Under NTA different telecommunication services, Nepal Telecom, Ncell, Smart Cell and different FM stations etc.

Standard Organization

7. Forums

It is the telecommunication standard committee which is formed by many persons or group for working, modeling agreement, process.

Standard Organization

8. Regulatory Agencies

It is also based on communication technology regulated by government bodies or agencies. The purposes of these agencies are to protect the public interest or organizations by regulating radio, television broadcasting, mobile and PSTN communication as well as ISA, cable network providers etc.