



Ministry of Higher Education and Scientific Research

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College Of Engineering & Technology

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Computer Networks Fundamentals

Lecture 1:

Introduction To Networks

A network is a set of devices (nodes) connected by communication links, each node is capable of sending and/or receiving data generated by other nodes on the network.

1.1- Data Communication:

When we communicate, we are sharing information. This sharing can be **local** or **remote**. *Local communication* usually occurs face to face, while *remote communication* takes place over distance.

The term *Telecommunication*, which includes telephony and television, means *communication at a distance*.

Data communication is the exchange of *data* (in the form of 0's and 1's) between two *devices* via some form of *transmission medium* (such as a wire cable).

❖ The effectiveness of a data communications system depends on three fundamental characteristics:

1: Delivery, 2: Accuracy 3: Timeliness.

1. **Delivery.** The system must deliver data to the correct destination. Data must be received by the intended device or user.

2. **Accuracy.** The system must deliver the data accurately. Data that have been altered (delay) in transmission and left uncorrected are unusable.

3. **Timeliness.** The system must deliver data in a timely manner. Data delivered late are useless. In the case of video and audio, timely delivery means delivering data as they are produced, in the same order that they are produced, and without significant delay. This kind of delivery is called *real-time* transmission.

1.2- Components:

A data communication system is made up of five components (see Figure 1).

1. **Message**: The message is the information (data) to be communicated. It can consist of text, numbers, pictures, sound, or video or any combination of these.
2. **Sender**: The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on.
3. **Receiver**: The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on.
4. **Medium**: The transmission medium is the physical path by which a message travels from-sender to receiver. It can consist of twisted pair wire, coaxial cable, fiber- optic cable, laser, or radio waves.
5. **Protocol**: A protocol is a set of rules that govern data communication. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but not communicating; just as a person who speaks, only Japanese cannot understand a person speaking French.

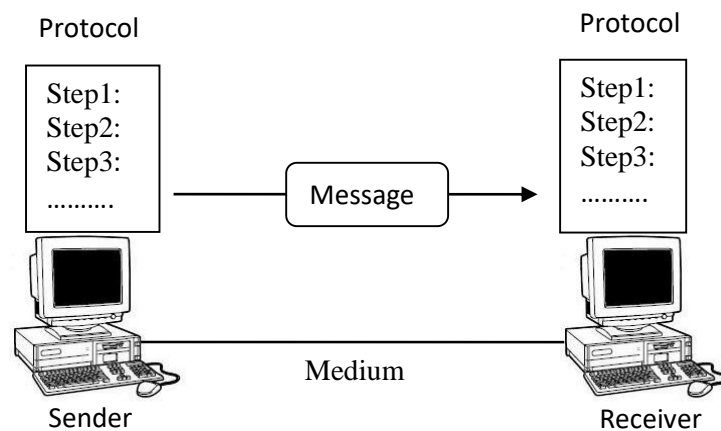


Figure (1) Components of a Data Communication System

1.3 Network Criteria:

To be considered effective and efficient, a network must meet a number of criteria. The most important of these are *performance*, *reliability*, and *security*.

(A) Performance:

Performance can be measured in many ways, including *transit time* and *response time*.

Transit time is the amount of time required for a message to travel from one device to another.

Response time is the elapsed time between an inquiry and a response.

The performance of a network depends on a number of factors:

- *Number of users:*

Having a large number of concurrent users can slow response time in a network not designed to coordinate heavy traffic loads. The design of a given network is based on an assessment of the average number of users that will be communicating at any one time. How a network responds to loading is a measure of its performance.

- *Type of transmission medium:*

The medium defines the speed at which data can travel through a connection (the data rate). Today's networks are moving to faster and faster transmission media, such as fiber optic cabling. A medium that can carry data at 100 megabits per second is ten times more powerful than a medium that can carry data at only 10 megabits per second. Today transmission speeds have increased to 1Gps and 10Gps

- *Hardware:*

The types of hardware included in a network affect both the speed and capacity of transmission.

A higher speed computer with greater storage capacity provides better performance.

- ***Software:***

The software used to process data at the sender, receiver, and intermediate nodes also affects network performance. Moving a message from node to node through a network requires processing to transform the raw data into transmittable signals, to route these signals to the proper destination, and to recast the signals into a form the receiver can use. The software that provides these services affects both the speed and the reliability of a network link. Well-designed software can speed the process and make transmission more effective and efficient.

(B) Reliability:

In addition to accuracy of delivery, network reliability is measured by frequency of failure, the time it takes a link to recover from a failure, and the network's robustness.

- ***Frequency of failure:***

All networks fail occasionally. A network that fails often, however, is of little value to a user.

- ***Recovery time of a network after a failure:***

How long does it take to restore service? A network that recovers quickly is more useful than one that does not.

- ***Catastrophe:***

Networks must be protected from catastrophic events such as fire or theft. One protection against unforeseen damage is a reliable system to back up network software.

(C) Security:

Network security issues include protecting data from unauthorized access and viruses.

- ***Unauthorized access:***

For a network to be useful, sensitive data must be protected from unauthorized access. Protection can be accomplished at a number of levels. At the lowest level are user identification codes and passwords. At a higher level are encryption techniques.

- **Viruses:**

Because a network is accessible from many points, it can be susceptible to computer viruses. A virus is an illicitly introduced code that damages the system. A good network is protected from viruses by hardware and software designed specifically for that purpose.

