

1. Introduction

Communication is required for sharing information. When communication is local, it happens face to face, when the communication has to take place remotely distance communication is required. Data communication is basically exchange of data between devices. The main components of data communication include:

1. Data- The information that is to be shared. For example: text, audio, video and images.
2. Sender and receiver- The device that is capable of sending and receiving of messages. It could be a computer, workstation mobile devices etc.
3. Protocol- It is the set of rules that govern the data communications. It is basically an agreement between two communicating devices. In absence of a protocol, the devices are connected but they will not be able to communicate with each other.
4. Transmission Medium- The path by which the data is exchanged between the devices.

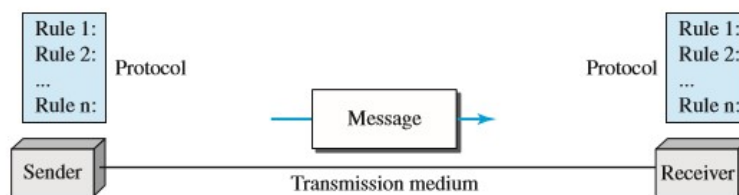


Figure 1. Components of data communications system

1.1 Networks and network types

Definition: Networks is interconnection of set of devices that are able to communicate and interact with other devices. The device could be an end node or a connecting device. The example for the former is a computer system, mobile device, laptop, desktop, security system etc and example for latter is a switch, router, gateways etc.. The devices in the network are connected using a wired or wireless connections.

1.1.1 Network Criteria

A network must be able to meet a certain number of criteria such as performance, reliability and security.

Performance can be measured in 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, including the number of users, the type of transmission medium, the capabilities of the connected hardware, and the efficiency of the software.

Performance is often evaluated by two networking metrics: throughput and delay. We often need more throughput and less delay. However, these two criteria are often contradictory. If we try to send more data to the network, we may increase throughput but we increase the delay because of traffic congestion in the network.

Reliability is measured by the frequency of failure, the time it takes a link to recover from a failure, and the network's robustness in a catastrophe.

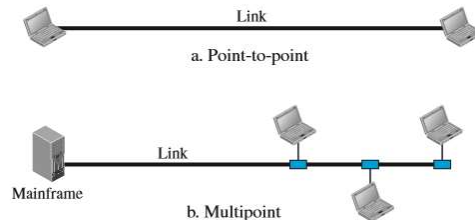
Security include protecting data from unauthorized access, protecting data from damage and development, and implementing policies and procedures for recovery from breaches and data losses.

1.1.2 Physical Structures

Network is formed by connecting various devices. These devices can be connected in:

Point to point connection: provides a dedicated link between two devices. The entire capacity of the link is reserved for transmission between those two devices. Most point-to-point connections use an actual length of wire or cable to connect the two ends, but other options, such as microwave or satellite links, are also possible.

Multipoint connection: A multipoint (also called multidrop) connection is one in which more than two specific devices share a single link.

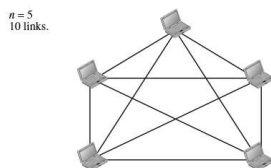


1.2 Network Topologies

The term physical topology refers to the way in which a network is laid out physically. Two or more devices connect to a link; two or more links form a topology. The topology of a network is the geometric representation of the relationship of all the links and linking devices (usually called nodes) to one another. There are four basic topologies possible: mesh, star, bus, and ring.

1.2.1 Mesh Topology

In a mesh topology, every device has a dedicated point-to-point link to every other device.



Properties

1. A dedicated link carries data between two devices only, thus provides high reliability.
2. A mesh topology is robust- If one link becomes unusable, it does not incapacitate the entire system.
3. Provides privacy and data security- When every message travels along a dedicated line, only the intended recipient sees it.
4. Point-to-point links make fault identification and fault isolation easy.

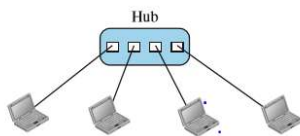
5. Requires more amount of cabling and I/O ports.
6. Hence laying down the network in mesh topology is expensive.

Applications

Used in backbone networks, for example- connection of telephone regional offices in which each regional office needs to be connected to every other regional office.

1.2.2 Star topology

In a star topology, each device has a dedicated point-to-point link only to a central controller, usually called a hub.



Properties

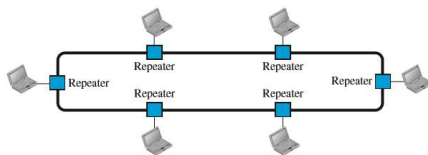
1. Does not allow direct data transfer between devices, the central controller acts as an exchange.
2. Less expensive than mesh topology and it is easy to install and reconfigure.
3. The topology is robust, if one link fails only that device/link is affected hence easy to identify faults and fault isolation.
4. Since central controller controls the entire network, if it goes down the entire network is affected.

Applications

Used in Local Area networks(LAN)

1.2.3 Ring topology

In a ring topology, each device has a dedicated point-to-point connection with only the two devices on either side of it. A signal is passed along the ring in one direction, from device to device, until it reaches its destination. Each device in the ring incorporates a repeater. When a device receives a signal intended for another device, its repeater regenerates the bits and passes them along.



Properties

1. Relatively easy to install and reconfigure as each device is linked to only its immediate neighbours (either physically or logically) addition or deletion requires changing only two connections.
2. Signal is circulating in a ring at all times, if one device does not receive a signal within a specified period, it can issue an alarm which alerts the network operator to the problem and its location.
3. The breakage of the link may disable the entire network, this is overcome by using a dual ring or a switch capable of closing off the break.