Chapter 1

Introduction to computer networks

Computer networks nowadays have become indispensable, practically, in all areas of life: banks, insurance, security, internet, health, administration, transport, ...

The needs for digital data exchange between distant systems are multiple: transmission of messages (messaging), sharing of resources (printer, hard disk, Internet), file transfer (FTP), Access to databases, management of transactions, fax ...

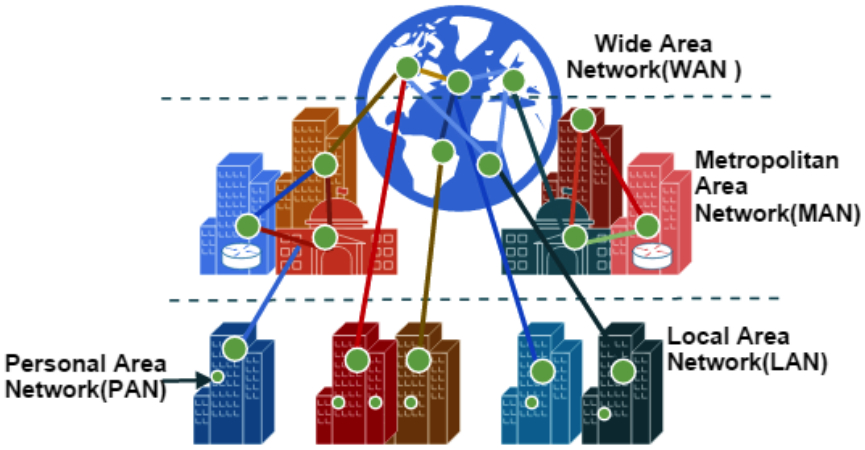
1.1 Definition of a computer network

It is a set of interconnected computers and autonomous devices that are located in a certain geographical area.

1.2 Types of networks

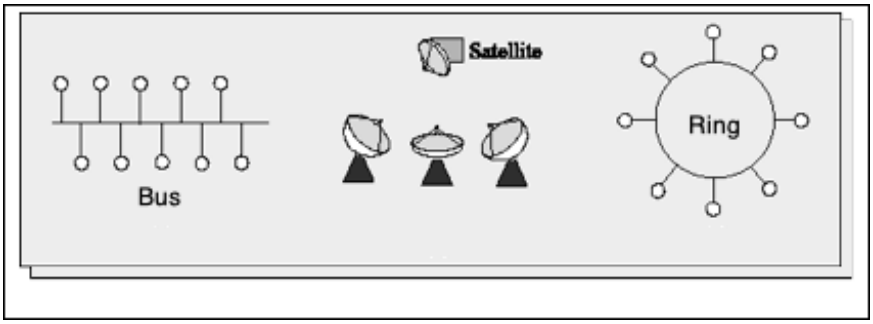
- Bus: Communication between components < 1m
- PAN: personnel Area Networks < 10m
- Parallel architectures (interconnect networks) >10m
- Local area networks (LAN): correspond in size to intra - company networks. The wiring distance is a few hundred meters
- Metropolitan Networks (MAN): Corresponds to an interconnection of several buildings located in a city (Campus).
- Wide Area Networks (WANs) intended to transport data across a country. These networks can be terrestrial (Use of infrastructure at the level: cable, fibre, etc.) or

satellite (Installation of spacecraft to retransmit signals to the earth).

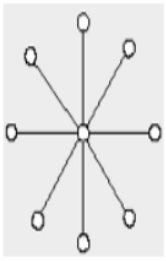


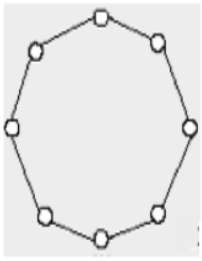
1.3 Communication modes

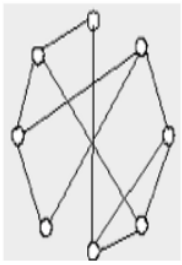
- Broadcast mode: One sender ⇒ Multiple receivers



- Point-to-point mode: A transmitter ⇒ A receiver


Star


Ring


Mesh

1.4 Communications Operation

Whatever the architecture, communication works in one of the following two ways:

- **With connection** (permanent) ⇒ connection request

  1. Sender request,
  2. If receiver refuses ⇒ no communication.
  3. Otherwise virtual circuit,
  4. Data transfer,
  5. Release connection
  6. Heavy if little information (network waste)
  7. Difficulty of multiple communications.

- **Without connection** (Without connection request)

  1. Without checking that the receiver is active: mailboxes.
  2. The organs of the network manage the communications.
  3. Uses of buffers if the receiver is not active

1.5 Switching techniques

The network have to allow the exchange of messages between subscribers regardless of their location.

Definition: Switching brings together all the techniques that put any 2 subscribers into contact.

There are 4 switching techniques:

- **Circuit switching** (eg the telephone): A physical path is established at the initialization of the communication between the sender and the receiver and remains the same for the duration of the communication. If the two parties have no data to transmit for a certain period of time, the link will remain unused.

- **Message switching:** A message is a logical set of information forming a whole (file, mail) which is sent from the sender to the receiver by transiting node to node through the network. We have one logical path per message sent. The message cannot be

sent to the next node until it is received completely and without error by the current node.

- **Packet switching:** optimization of message switching which consists of splitting messages into several packets which can be routed faster and independently of each other. This technique requires setting up packet numbering.
- **Cell switching:** particular packet switching. All packets have a fixed length (1 packet = 1 cell of 53 bytes in ATM). A path is determined for the transmission of the cells. Cell switching = superimposition of 2 types of switching: circuit switching and packet switching.