

Computer Networks

- A computer network is an interconnected collection of autonomous computers.
- Users explicitly log onto one machine, explicitly submit jobs, explicitly move files around.



Distributed Systems

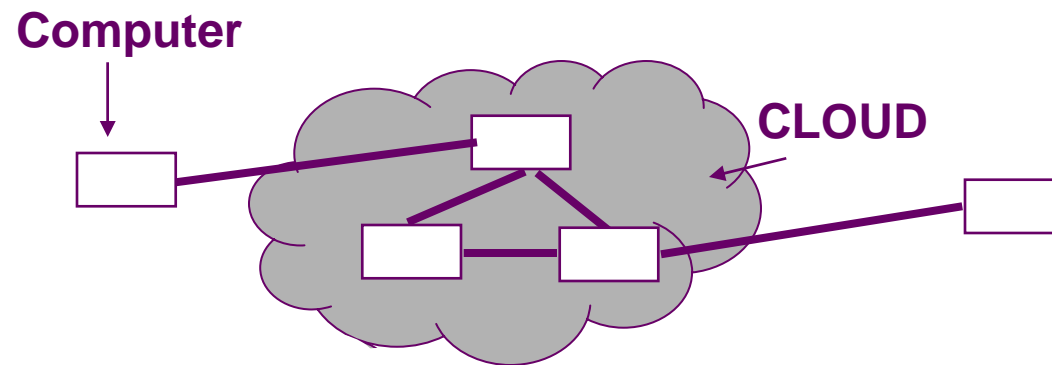
- Some confusion tends to exist about the distinction between a *computer network* and a *distributed system*.
- The primary difference between a computer network and a distributed system is that in a distributed system the existence of multiple autonomous computers is transparent.

Distributed Systems

- **Users of distributed system are not necessarily aware that they are making use of multiple computers.**
- **A distributed system is a software system built on top of a computer network. Many issues relating to computer networks also apply to distributed systems.**

Computer Network Terminology

- A computer network can be viewed as the computers on the outside of the network which use the network and the components inside the network which implement the network.



Computer Network Terminology

- The computers are referred to as *nodes*.
- The connections between nodes are referred to as *arcs*.
- The inside of the network is referred to as the *subnet*
 - the term **cloud** is also commonly used to refer to the subnet.

Categories of Communication

- *Simplex Communication*
 - one-way communication
- *Half-duplex Communication*
 - two-way non-simultaneous communication
- *Full-duplex Communication*
 - two-way simultaneous communication

Network Topologies

The number and pattern of arcs used to connect the computers together in the network is referred to as the *network topology*.

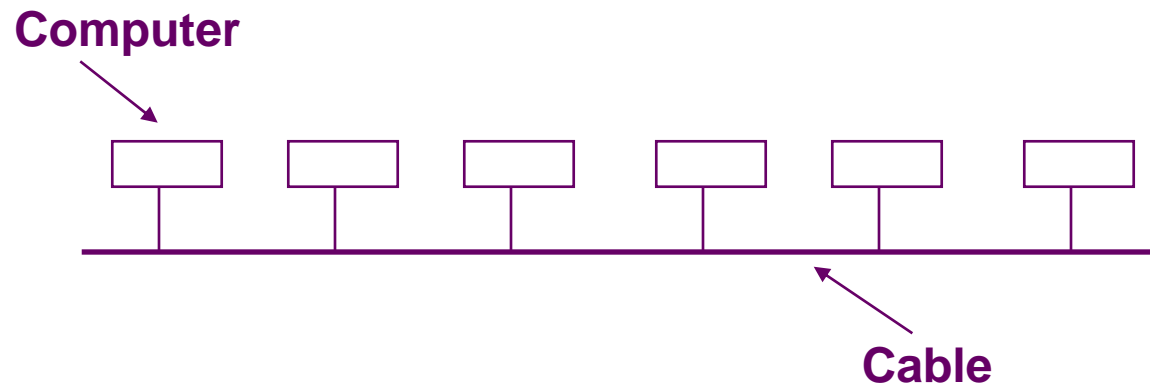
Network Topologies

The primary network topologies :

- **Bus**
- **Star**
- **Ring**
- **Tree**
- **Complete**
- **Intersecting rings**
- **Irregular**

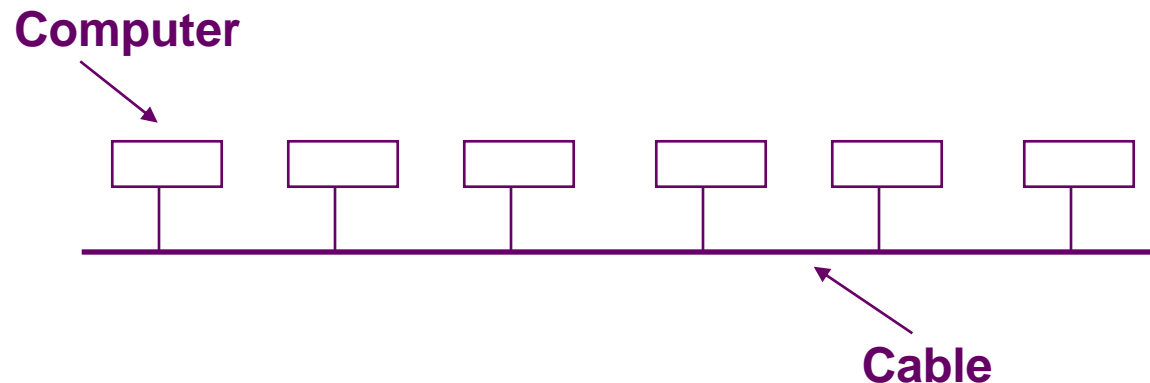
Bus Topology

- In a bus network, at any instant one machine is the master and is allowed to transmit. All other machines may only receive.



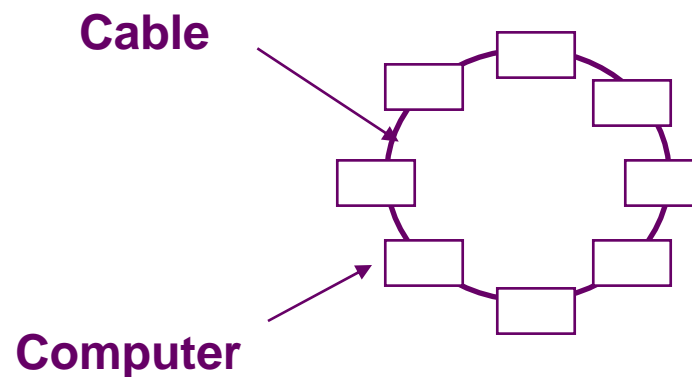
Bus Topology

- An arbitration scheme is required to resolve conflicts when more than one machine wants to transmit at the same time.
 - Ethernet is a bus-based broadcast network operating at 10 or 100 Mbps.



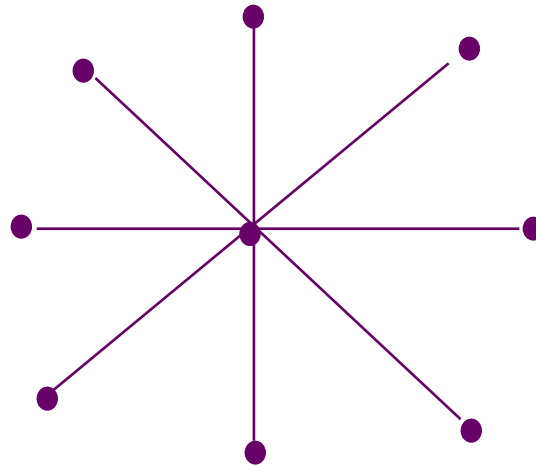
Ring Topology

- In a ring network, each bit is propagated around on its own.
- Arbitration is required to resolve simultaneous accesses to the ring.



Star Topology

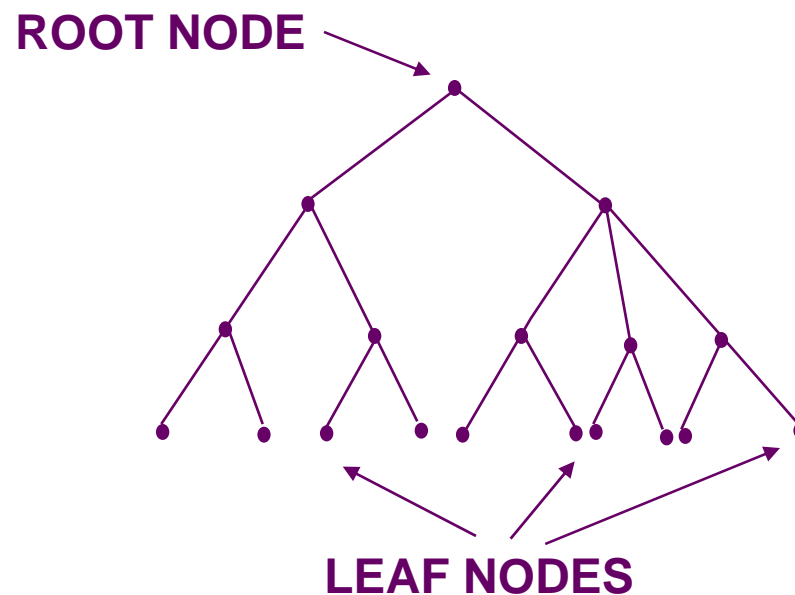
- The star networks use an intermediate central device.



- The longest path is twice the radial length.

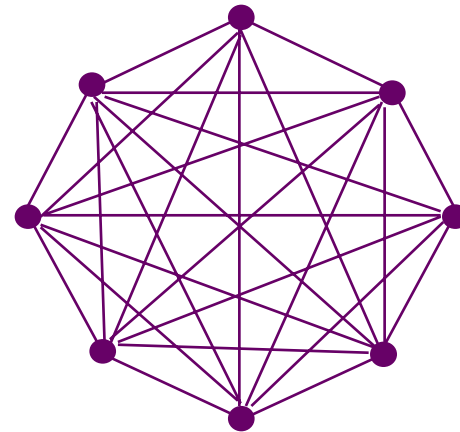
Tree Topology

- A tree network is a hierarchical structure.
- The longest path between two computers is 2 times the height of the tree.



Complete Topology

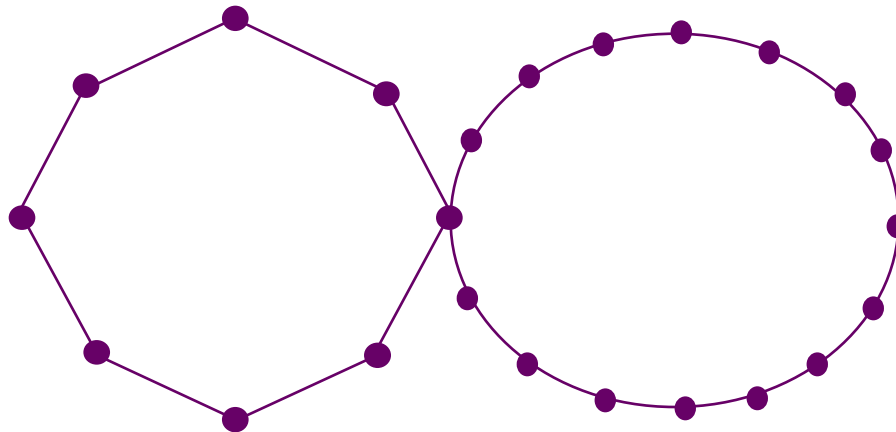
- In a complete network every computer is directly connected to every other computer in the network.



- The longest path between two computers is a constant length of 1 arc.

Intersecting Rings Topology

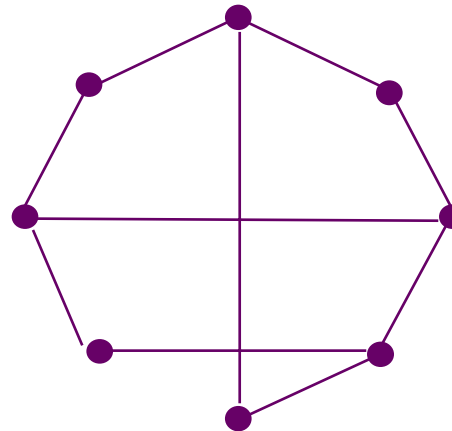
- An intersecting rings network is essentially two rings connected at an intersection point.



- The length of the longest path between two computers is the (sum of the nodes in both rings) - 1.

Irregular Topology

- An irregular network has no defined pattern of connectivity.



- The length of the longest path between two computers is unique for each irregular topology.

Categorization of Networks

There are two major areas into which computer networks can be classed. These two areas are:

- **transmission technology**
 - broadcast networks
 - point-to-point networks
- **scale**
 - data flow machines
 - multicomputers
 - local area networks
 - metropolitan area networks
 - wide area networks
 - internetworks.

Transmission Technology

- ***Broadcast networks*** use a single communication channel that is shared by all of the machines on the network.
 - Within this type of system a machine can use a special address to send a message to all other machines, and every machine will process the message. This is called *broadcasting*.

Transmission Technology

- *Point-to-point networks* consist of many connections between individual pairs of machines.
 - A message sent by one machine may pass through 0 or more intermediate machines before it arrives at its destination.
 - Often multiple alternative routes exist between machines on the network which means that routing algorithms are an important part of these systems.

Network Scale

<u>Network Type</u>	<u>Distance</u>	<u>Geography</u>
Data flow machines	0.1 m	Circuit Board
Multicomputers	1 m	System
Local Area Networks	10 m	Room
	100 m	Building
	1 km	Campus
Metropolitan Area Networks	10 km	City
Wide Area Networks	100 km	Country
	1000 km	Continent
The Internet	10,000 km	Planet

Local Area Networks (LAN)

- **LANs are distinguished by three characteristics:**
 - **their size**
 - up to a few kilometers in size
 - **their transmission technology**
 - often use a single cable
 - **their topology**
 - such as a bus or ring

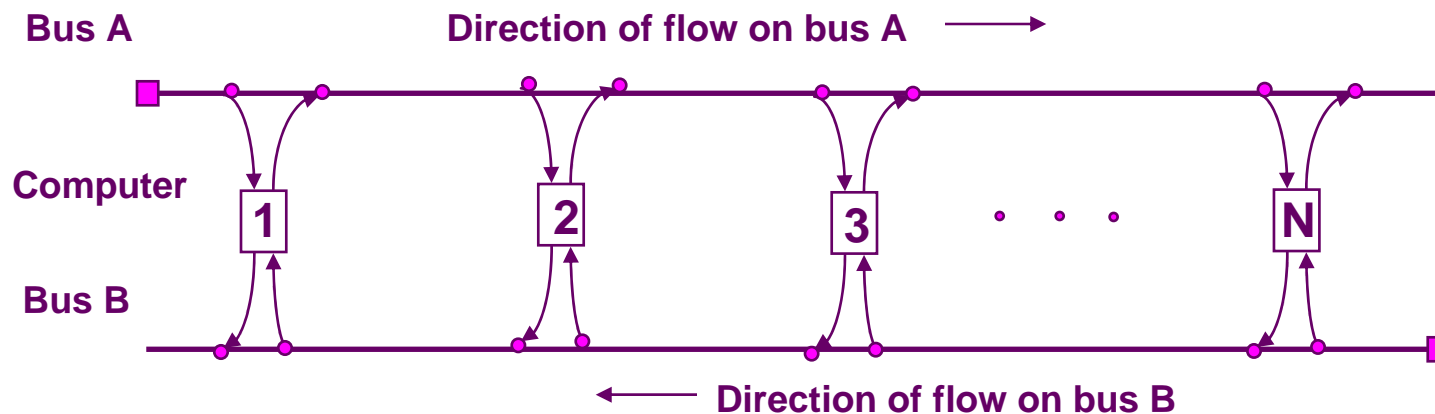
Local Area Networks (LAN)

- A LAN is a privately-owned network usually within a single building or campus up to a few kilometers in size.
- LANs typically have some type of symmetrical topology.
- LANs generally use the broadcast transmission technology, and various topologies are possible for broadcast LANs.

Metropolitan Area Networks (MAN)

- A MAN is essentially a bigger version of a LAN and uses similar technology.
- A MAN has just one or two cables.

Architecture of the Distributed Queue Dual Bus (DQDB) MAN



- The standard for a MAN is called **Distributed Queue Dual Bus (DQDB)**.

Wide Area Networks (WAN)

- **A WAN spans a large geographical area which can include a whole country or continent.**
- **A WAN contains a collection of machines intended for running user programs.**
- **WANs typically have a type of irregular topology.**

Wide Area Networks (WAN)

- **In most WANs the subnet consists of:**
 - **transmission lines**
 - **switching elements**
 - **also referred to as routers, packet switching nodes, intermediate systems or data switching exchanges.**

Wide Area Networks (WAN)

- **Most WANs contain numerous cables or telephone lines, each one connecting a pair of routers.**
- **Nearly all WANs have store-and-forward subnets, which means that routers collect and store the entire packet before forwarding it to another node in the network.**

Internetworks

- An **internetwork** (or internet) is a collection of interconnected networks.
- The term internet refers to a generic internetwork, while the term **Internet** (capitalized) will refer to a specific world wide internetwork.
- A common application of an internet is a collection of LANs connected by a WAN.

Internetworks

- **Gateways** are machines that are used to connect and translate between two different and possibly incompatible networks.
 - Gateways may provide both hardware and software translations.

Whoa there

End of lesson

