



# **Data Communications and Networking**

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# Types of Networks

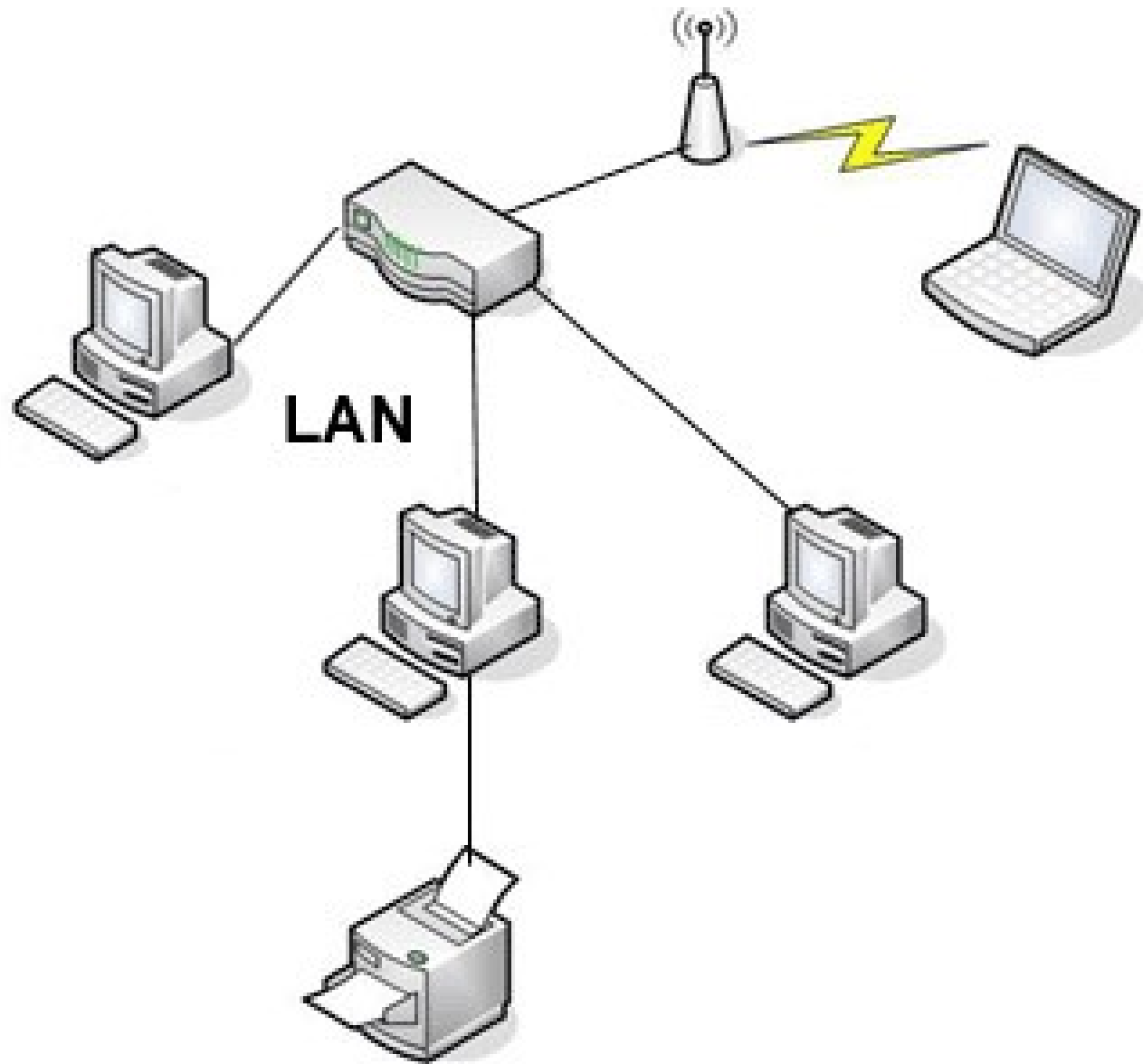
- Networks can be subdivided into three basic types according to their size and geographical location:
  - LANs
  - WANs
  - MANs
- Other classifications sometimes used are:
  - PANs
  - WLANs
  - CANs
  - DANs

# Types of Networks

- **Local Area Network** is a network that runs at one site. The computers are often tightly coupled with some depending on others to provide shared resources (disk and printer).
- **Wide Area Network** is a network spanning larger distances. Coupling is much looser and each computer can operate independently of the network.
- **Metropolitan Area Network** is a geographically small WAN, typically less than 50 miles wide. It provides faster access to other sites within the same MAN than a WAN would.

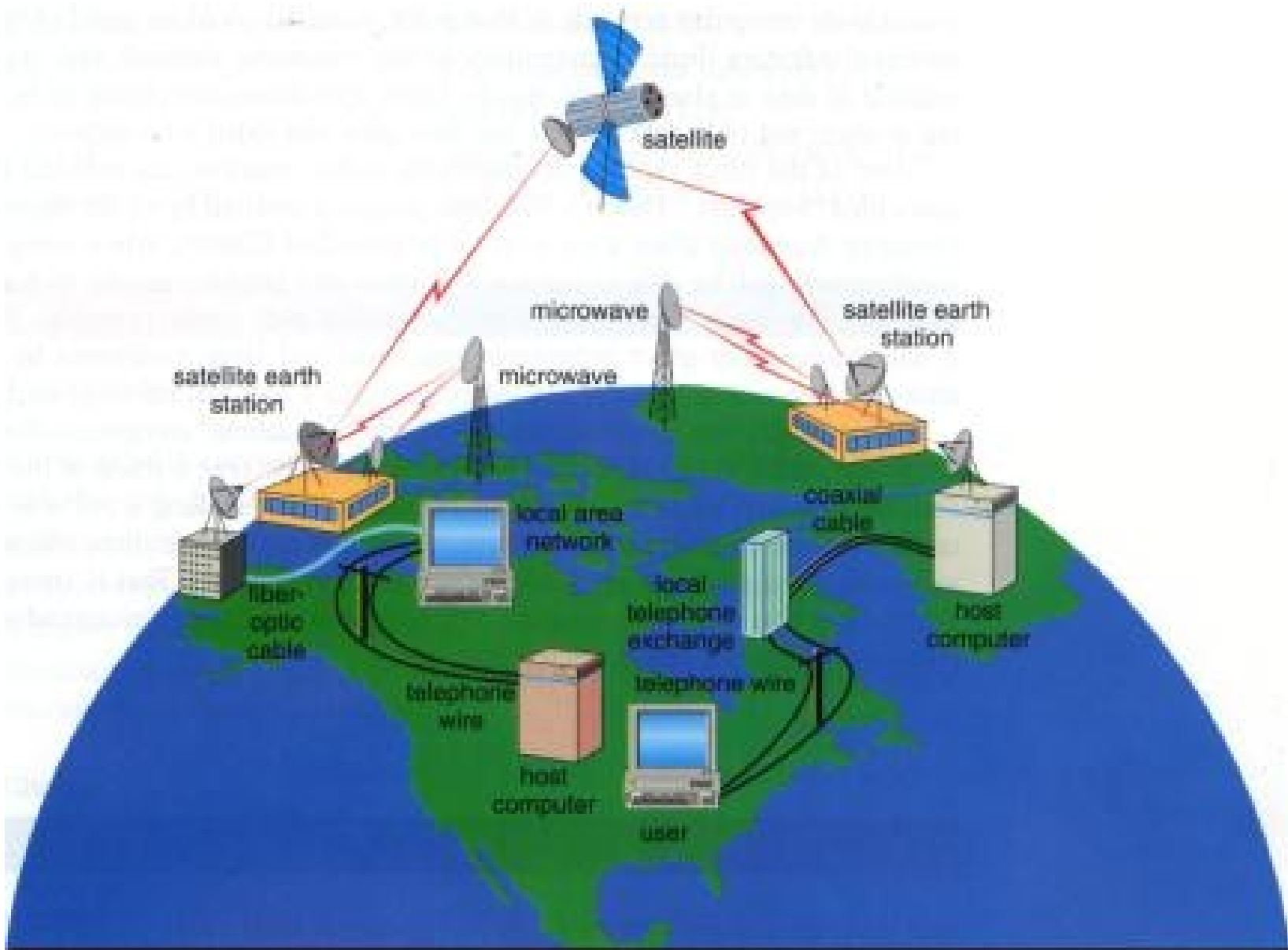
# LANs : Local Area Networks

- Developed in 1970s.
- Transmission Medium:
  - optical fibres,
  - coaxial cables,
  - twisted pair,
  - wireless.
- Low latency (except in high traffic periods).
- High speed networks (10 Mb/sec - 10GB/sec).



# WANs : Wide Area Networks

- Developed in 1960s.
- Generally covers large distances (countries, continents).
- Transmission Medium : communication circuits connected by routers.
- Routers forwards packets from one to another following a route from the sender to the receiver.
- LANs connected together.
- Typical latencies : 100ms - 500ms.
- Problems with delays if using satellites.



# MANs : Metropolitan Area Networks

- Generally covers towns and cities (50 kms)
- Developed in 1980s.
- Transmission Medium : optical fibres, cables.
- Typical latencies : < 1 msec.
- Message routing is fast.

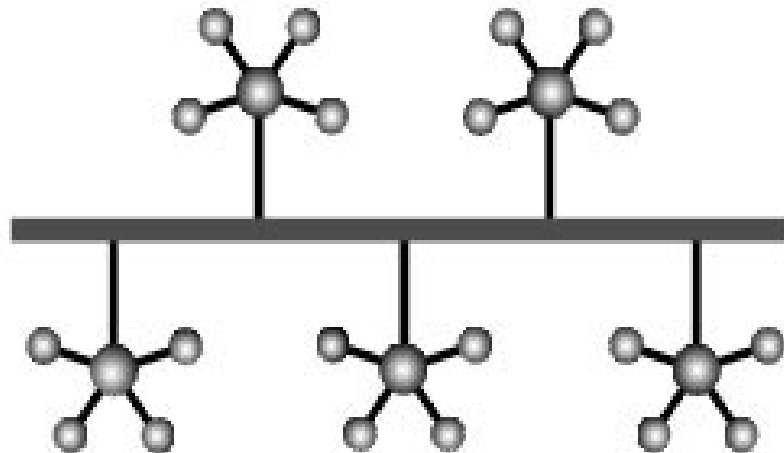
There is an overlap between LANs MANs and WANs.

# Other Network Subdivisions

- CANs – Campus Area Networks
- PANs – Personal Area Networks
- WLANs – Wireless Local Area Networks
- DANs – Desk Area Networks

# Network Topology

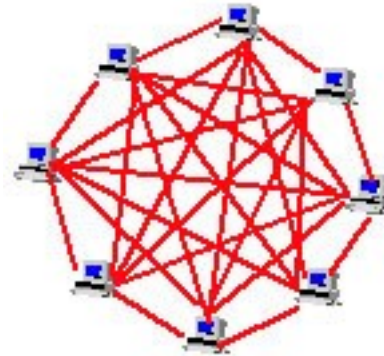
- Network topology describes how the network is connected together.
- Topology is viewed as a simple layout plan of the devices and cables.
- Topology may look very different from the actual/physical layout of the network.



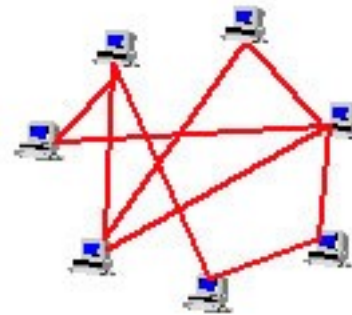
# Network Topology

Networks can be either:

- Fully connected



- Partially connected

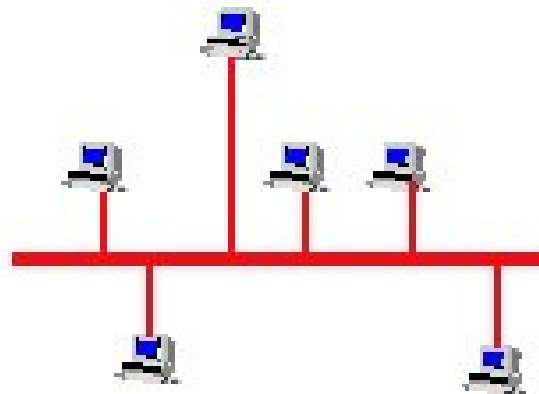


# Network Topologies

- Network topologies are divided into the following types:
  - Bus
  - Ring
  - Star
  - Tree
  - Mesh
- More complex networks can be built as hybrids of the basic topologies.

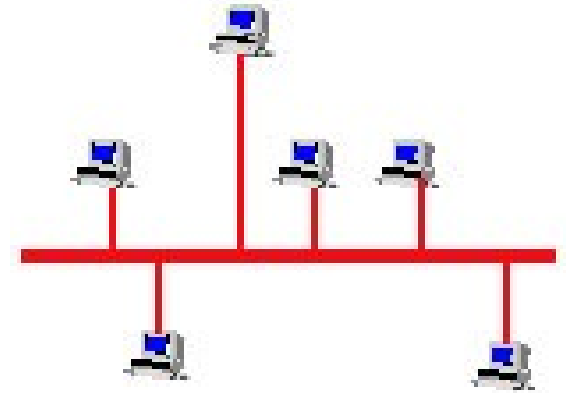
# Bus Topology

- A single cable functions as a shared communication medium. A device wanting to communicate with another device on the network sends a broadcast message onto the wire that all other devices see.



- Coaxial cable: 10Base-2 (ThinNet) and 10Base-5 (ThickNet) were popular cabling options many years ago for bus topologies.

# Bus Topology



## Advantages:

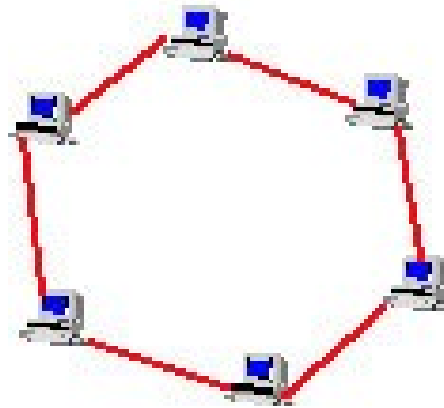
- Easy to install
- Small amount of cable (relative to other topologies)

## Disadvantages;

- Usable with 20 or less computers (bandwidth).
- If the cable fails – the entire network stops.

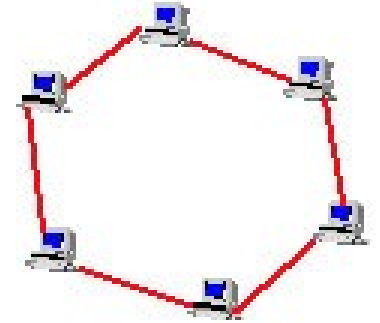
# Ring Topology

- Every device is connected to two others in a logical ring.



- All messages travel through a ring in the same direction.
- Each computer takes a turn in passing the message to the next computer in the ring.
- Uses FDDI, SONET, or Token Ring technology.

# Ring Topology



## Advantages:

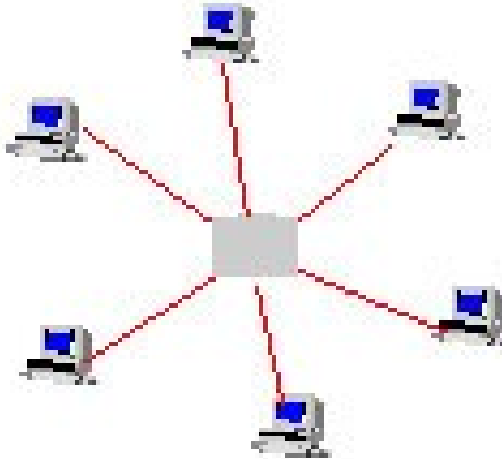
- Provides a fair way to share the network in a “round-robin” style.

## Disadvantages:

- A failure in any cable or device breaks the loop and will stop the network from working.
- Generally difficult to quickly add and remove computers from the ring while it is being used.

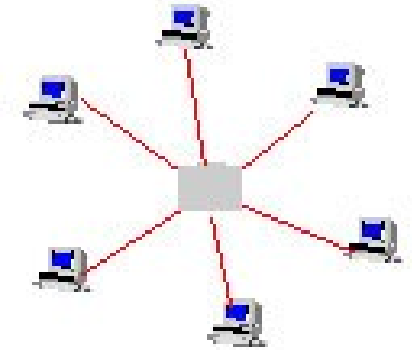
# Star Topology

- A Star topology has a central connection point called a "hub" (nowadays either a hub, switch or router).



- Each computer connects individually to the hub with Unshielded Twisted Pair (UTP) Ethernet cable.

# Star Topology



## Advantages:

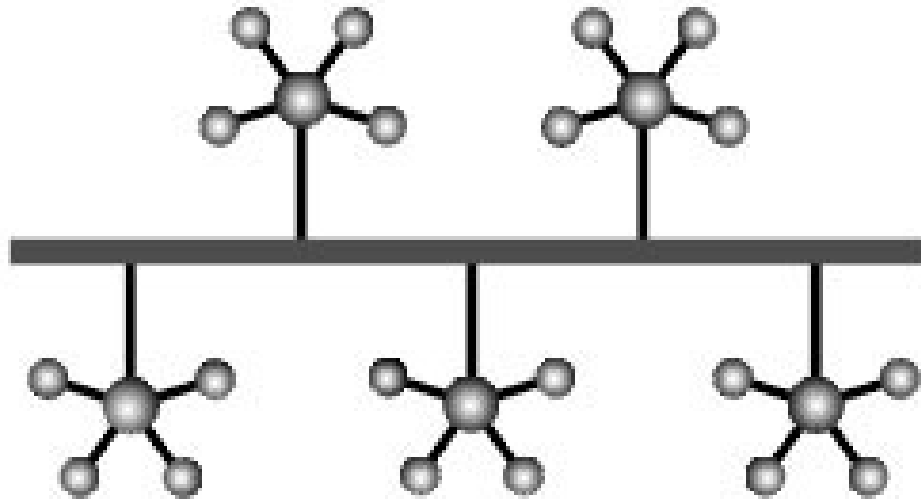
- A failure in any network cable will only take down one computer.
- Easy to add and remove computers.
- Unshielded Twisted Pair (UTP) cable is more flexible than coaxial or optical fiber.

## Disadvantages:

- Requires more cable to connect the same number of devices.
- If the hub fails, the entire network stops.

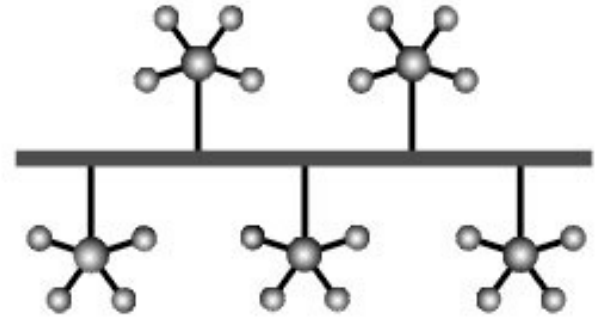
# Tree Topology

- Tree topologies integrate multiple star topologies together onto a bus.



- This is really a bus/star hybrid approach to making a network.

# Tree Topology

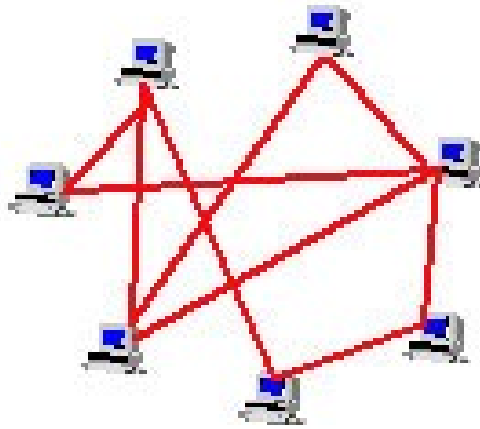


## Advantages:

- This bus/star hybrid approach supports future expandability of the network much better than a bus
  - (limited in the number of devices due to the broadcast traffic it generates)
- or a star
  - (limited by the number of hub connection points)

# Mesh Topology

- Unlike each of the previous topologies, messages sent on a mesh network can take any of several possible paths from source to destination.



- WANs, for example the Internet, employ mesh routing.

# Networking Terms

- **Transmission Medium** – type of cable/wire/etc.
- **Latency** - the minimum time required to move data from one point to another.
- **Router** - A device that connects to and receives data from outer networks and sends data only to network nodes meant to receive them.
- **Topology** - The logical arrangement of devices in a network, usually shown graphically.
- **Bandwidth** - the amount of data that can be transmitted via a given communications channel.
- **Round-robin** - A scheme for controlling action in which all the devices in a circle take turns sequentially.
- **Ethernet** – A protocol and cabling specifications for LANs.