

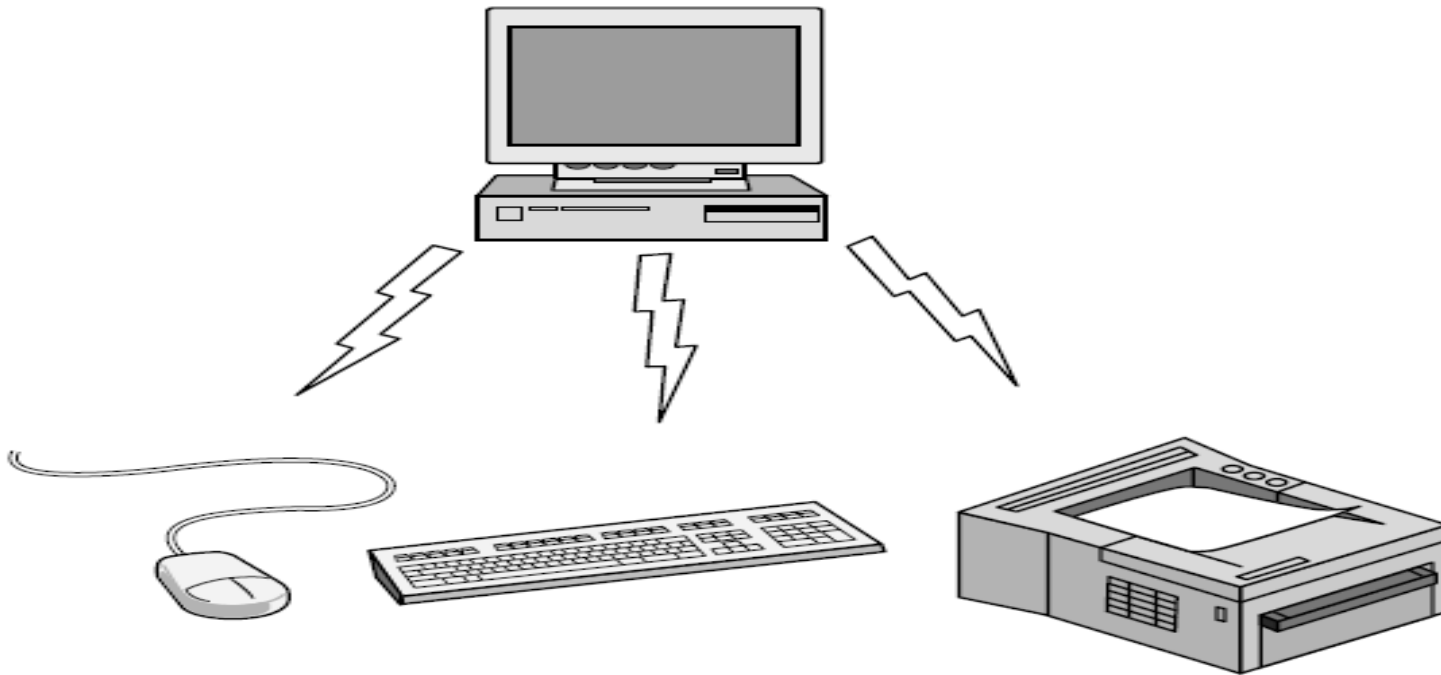
# Network Hardware and its Topologies

**CSE306**

# Categories of Networks

- Personal area networks
- Local Area networks
- Metropolitan Area networks
- Wide Area networks
- Wireless Networks
- Home Networks
- Internetworks- The Internet

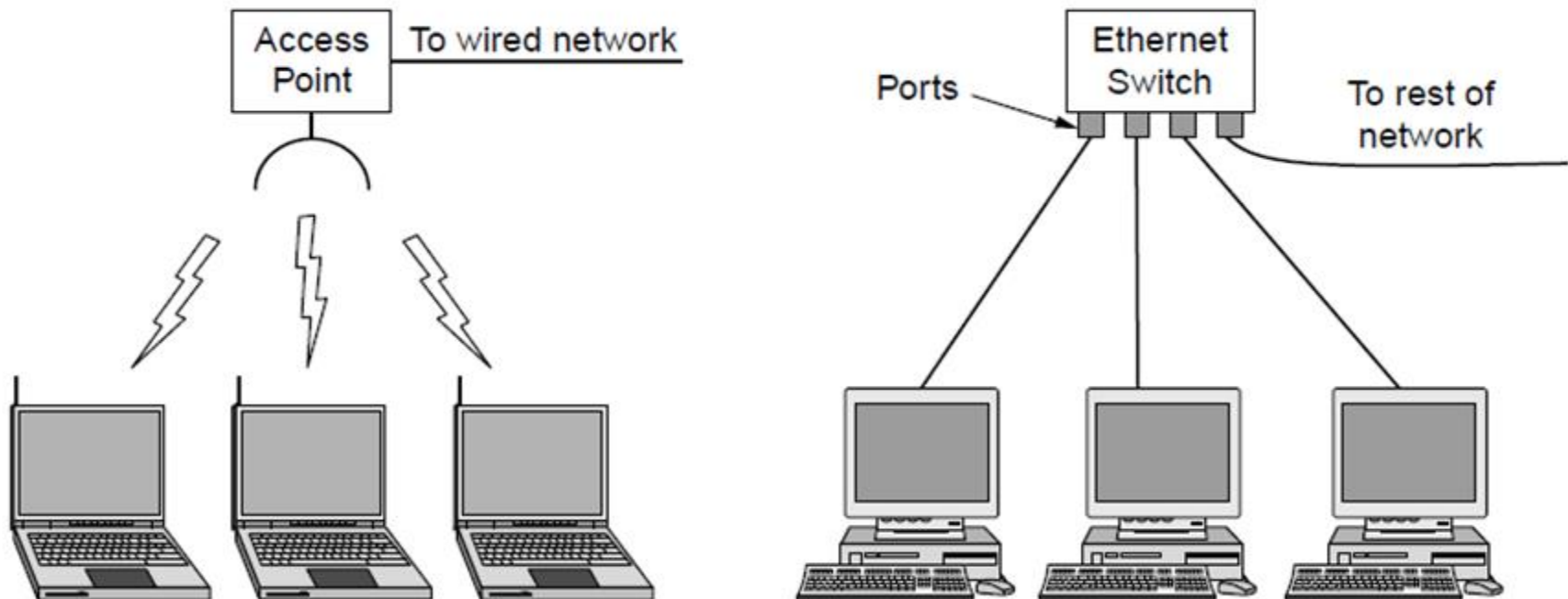
# Personal Area Network



**Bluetooth PAN configuration**

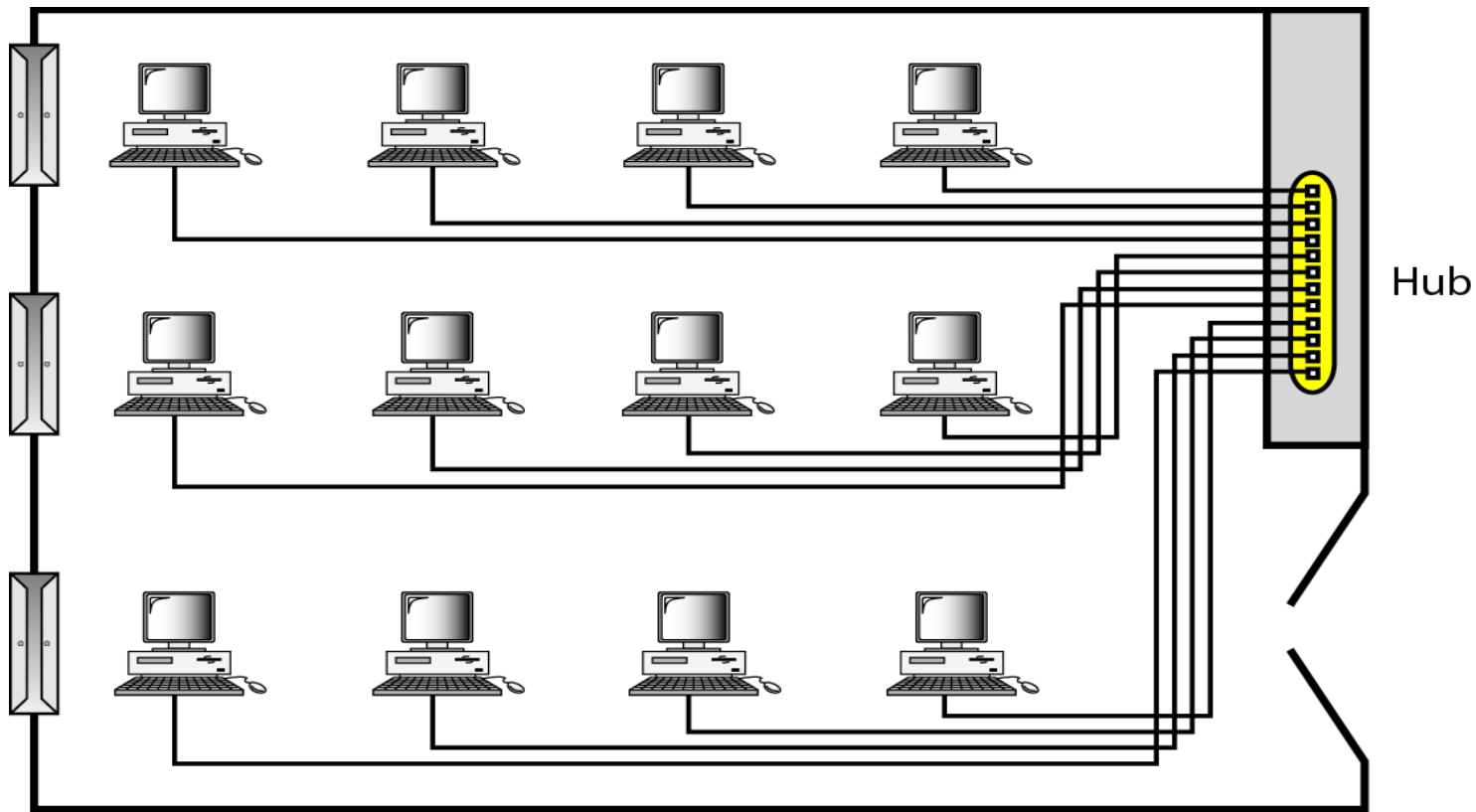
# Local Area Networks (LANs)

- Short distances
- Designed to provide local interconnectivity



Wireless and wired LANs. (a) 802.11. (b) Switched Ethernet.

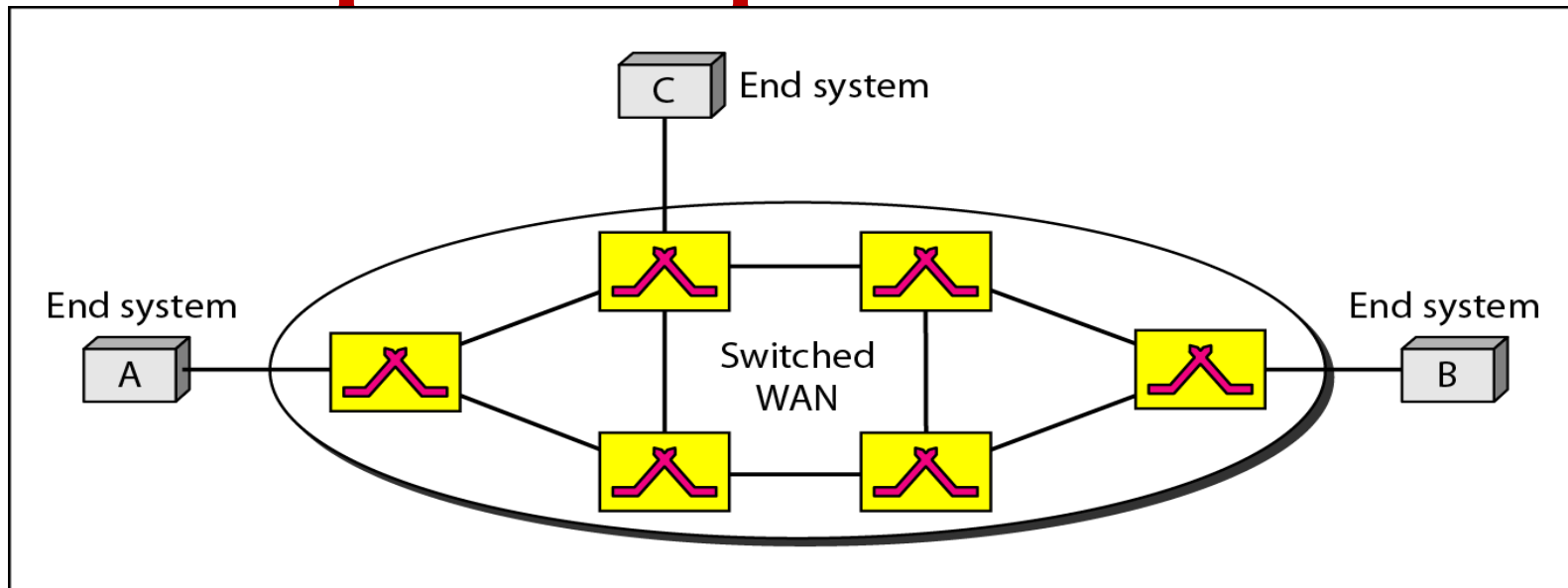
# Isolated LAN connecting 12 computers to a hub in a closet



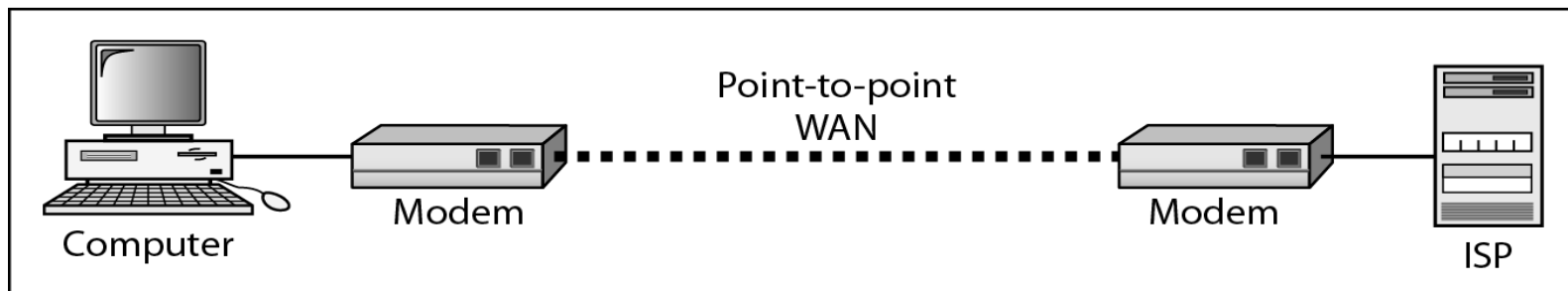
# Wide Area Networks (WANs)

- Long distances
- Provide connectivity over large areas

# WANs: a switched WAN and a point-to-point WAN

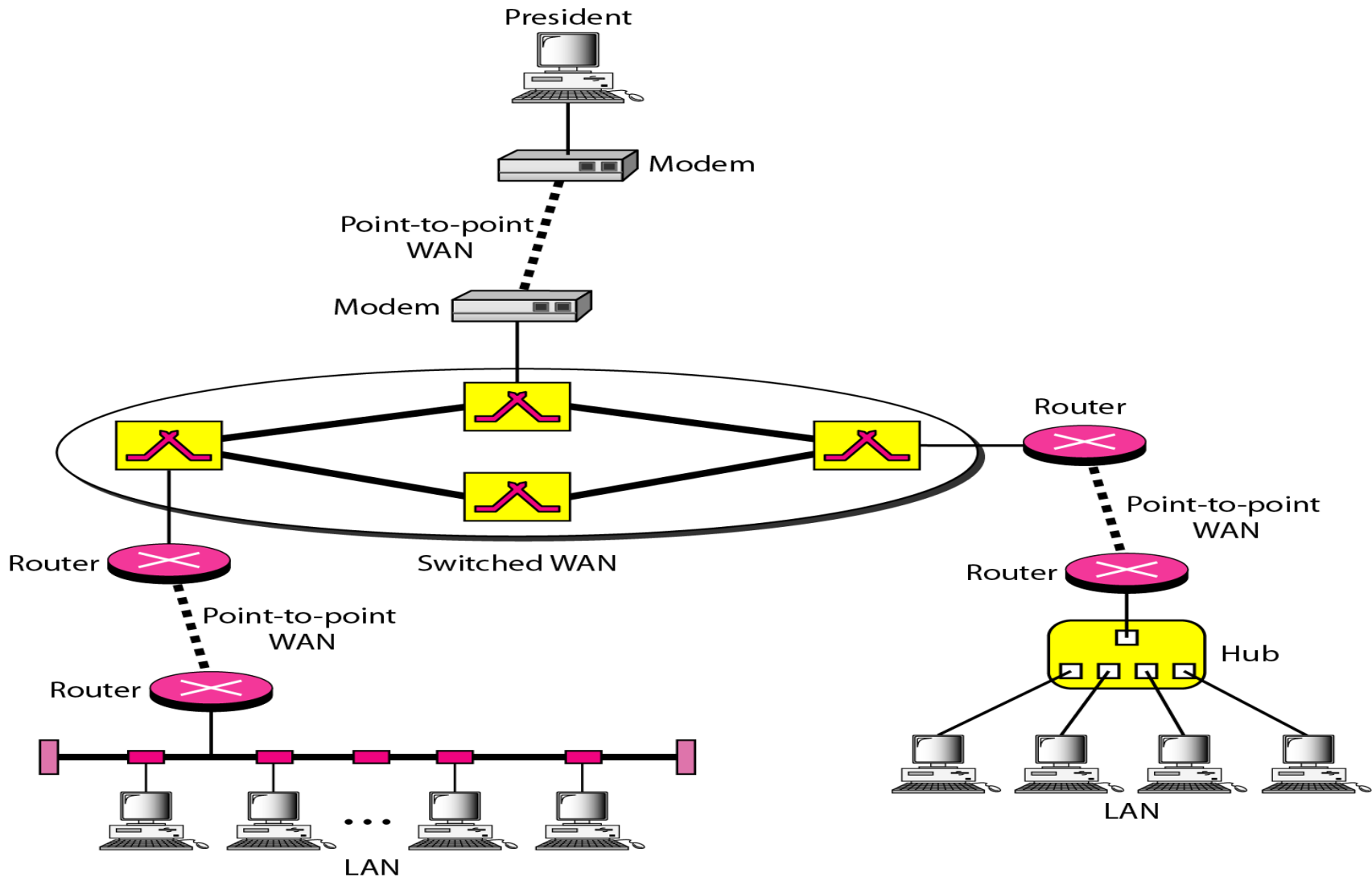


a. Switched WAN



b. Point-to-point WAN

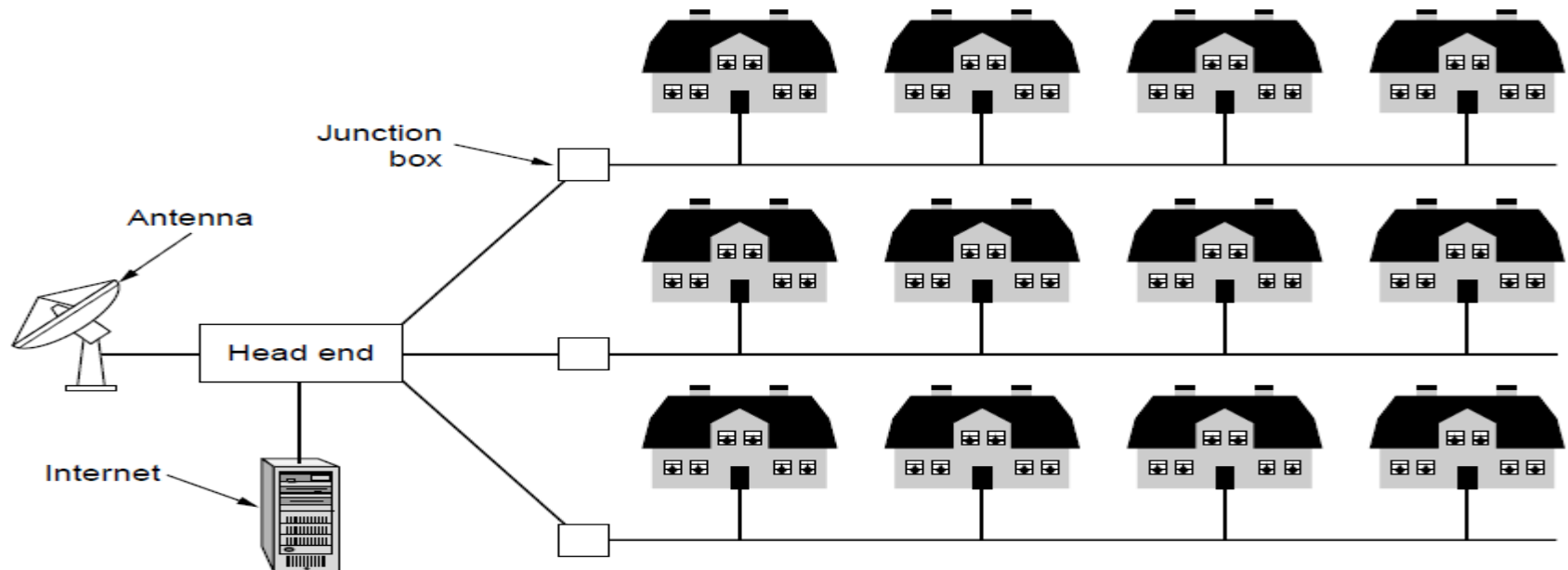
# A heterogeneous network made of four WANs and two LAN



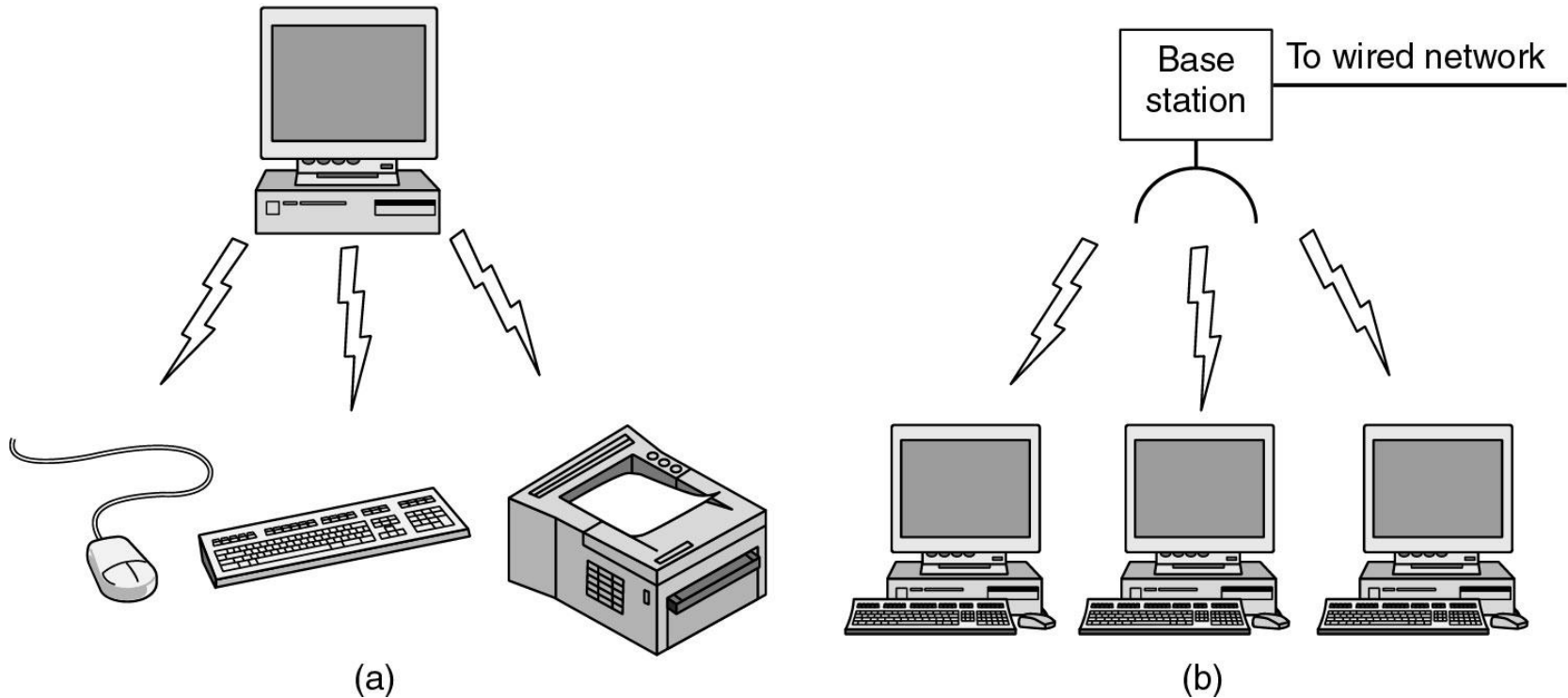


# Metropolitan Area Networks (MANs)

- Provide connectivity over areas such as a city, a campus
- A metropolitan area network based on cable TV or telephone cable using DSL

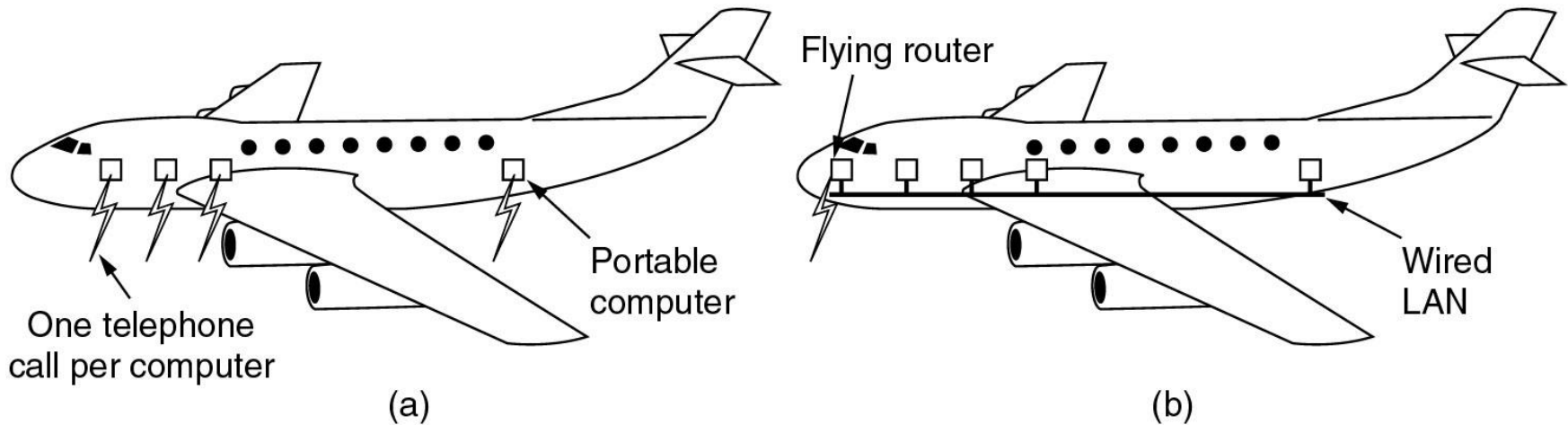


# Wireless Networks



- (a) Bluetooth configuration
- (b) Wireless LAN

# Wireless Networks



- (a) Individual mobile computers
- (b) A flying LAN



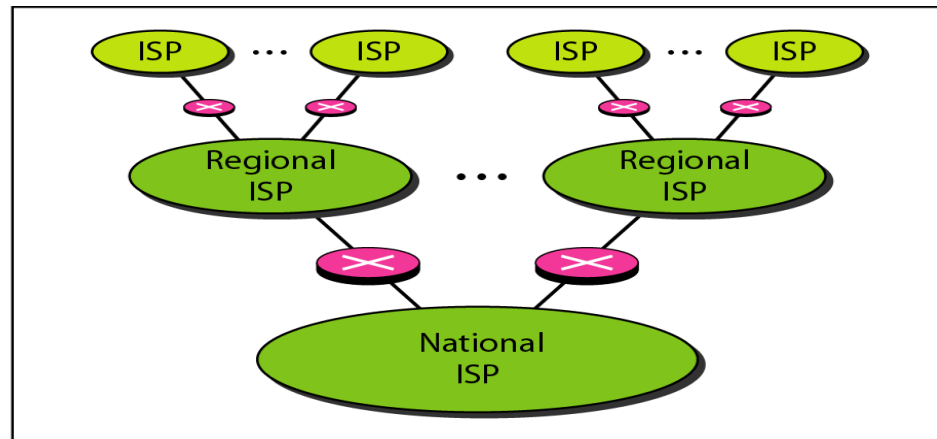
# Home Network Categories

- Computers (desktop PC, PDA, shared peripherals)
- Entertainment (TV, DVD, VCR, camera, stereo, MP3)
- Telecomm (telephone, cell phone, intercom, fax)
- Appliances (microwave, fridge, clock, furnace, airco)
- Telemetry (utility meter, burglar alarm, babycam).

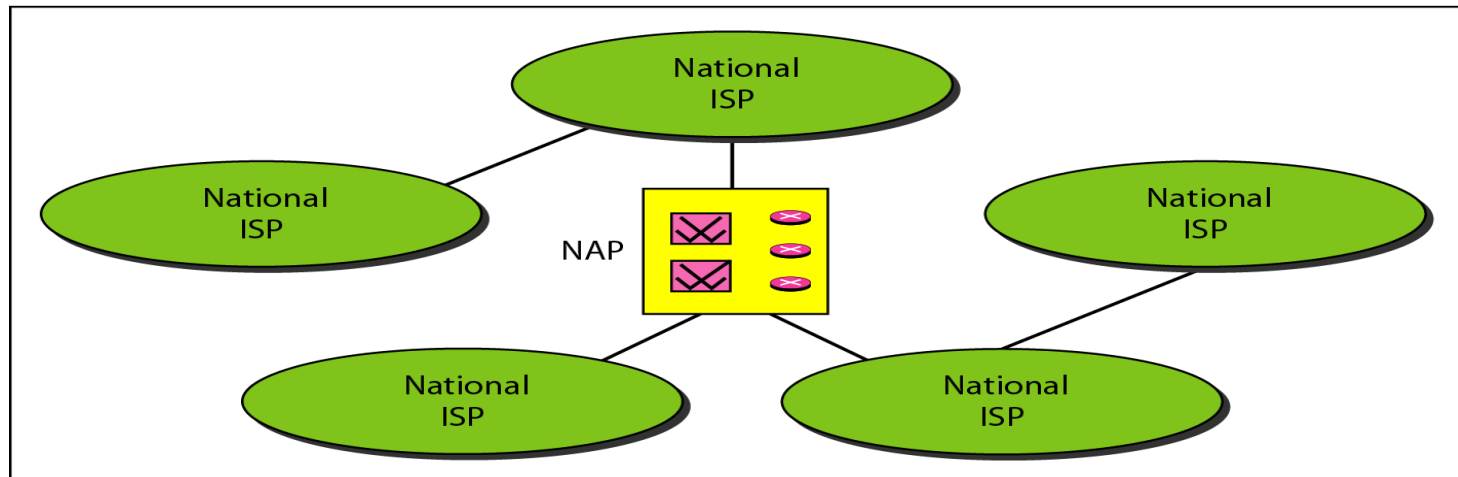
# THE INTERNET

- Inter connection of two or more networks become an internet.
- The Internet has revolutionized many aspects of our daily lives. It has affected the way we do business as well as the way we spend our leisure time.
- The Internet is a communication system that has brought a wealth of information to our fingertips and organized it for our use.

# Hierarchical organization of the Internet



a. Structure of a national ISP



b. Interconnection of national ISPs

# Broadcast Networks

- Classification of interconnected processors by scale.

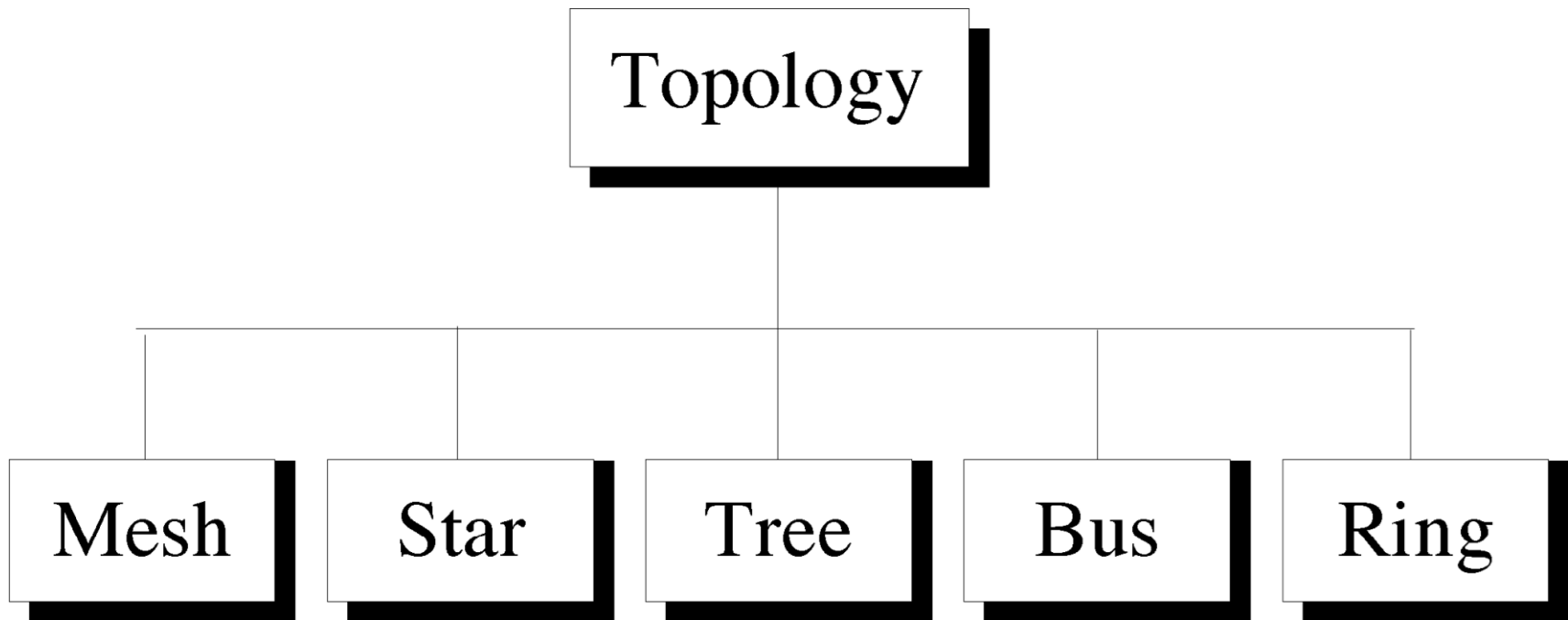
Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

# Network Topology

- The topology of a network defines how the nodes of a network are connected.
- The shape of the cabling layout used to link devices is called the **physical topology** of the network.
- The **logical topology**, in contrast, is the way that the signals act on the network media, or the way that the data passes through the network from one device to the next without regard to the physical interconnection of the devices.



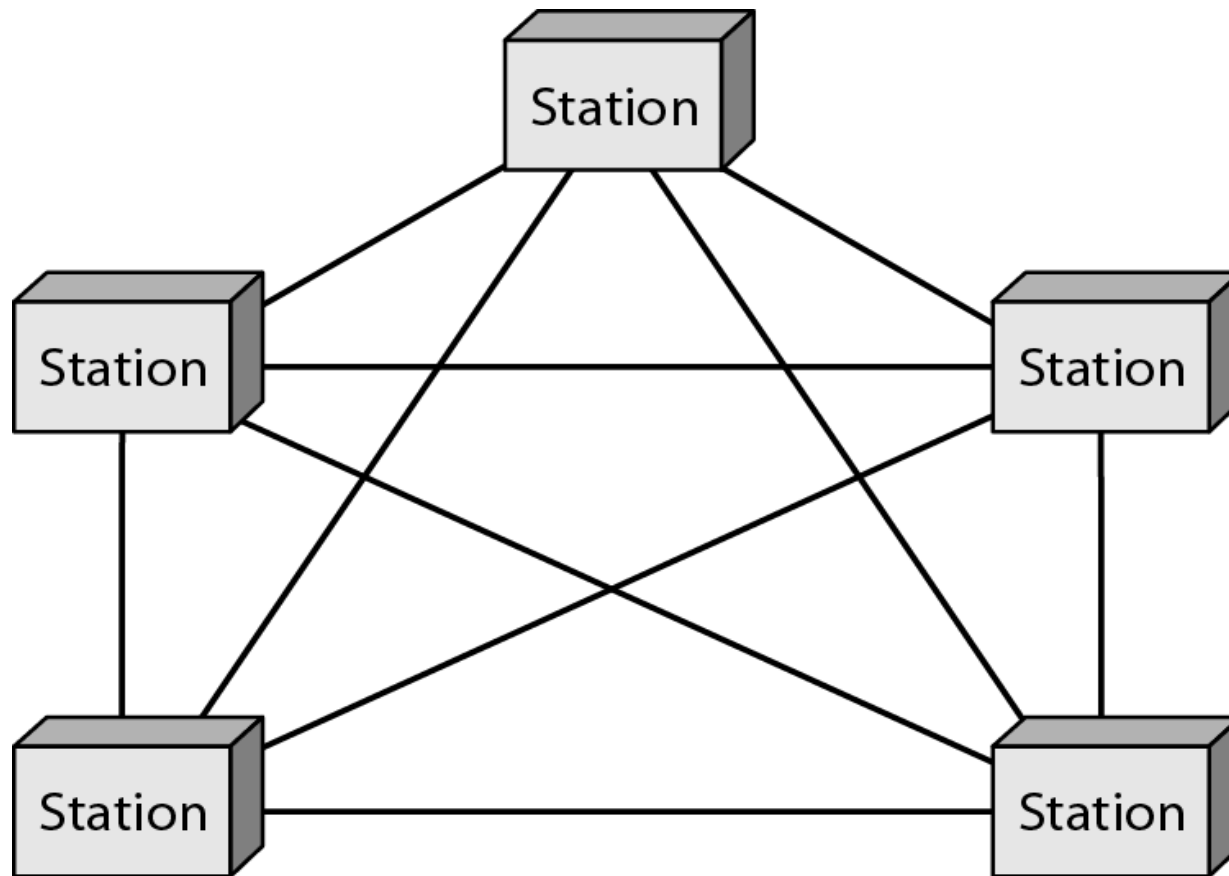
# Categories of Physical Topology



# Mesh Topology

- Here every device has a **point to point** link to every other device.
- Node 1 node must be connected with **n-1** nodes.
- A fully connected mesh can have  **$n(n-1)/2$**  physical channels to link **n** devices.
- It must have **n-1** I/O ports.

## A fully connected mesh topology (five devices)



# Advantages of Mesh

1. They use dedicated links so each link can only carry its own data load. So **traffic problem** can be avoided.
2. It is robust. If **any one link get damaged** it cannot affect others.
3. It gives privacy and security.(Message travels along a dedicated link)
4. Fault identification and fault isolation are easy.

# Disadvantages of Mesh

1. The amount of **cabling** and the number of **I/O ports** required are very large. Since every device is connected to each devices through dedicated links.
2. The sheer bulk of wiring is larger then the available space.
3. Hardware required to connected each device is highly expensive.



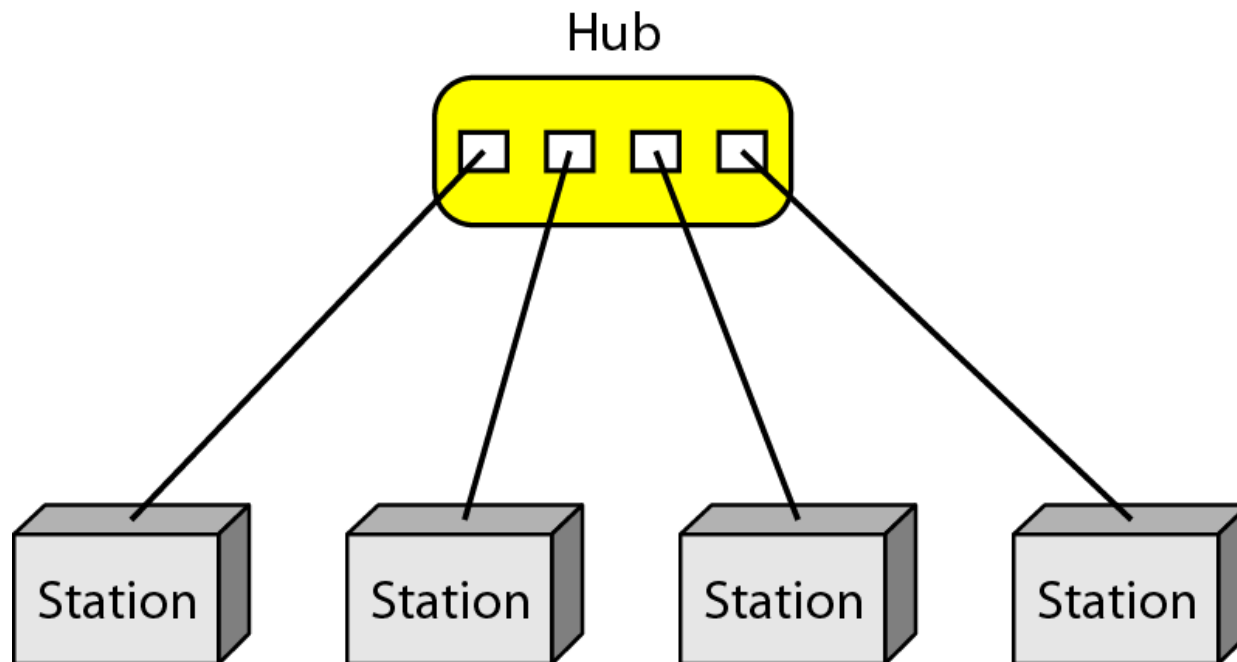
# Applications of Mesh

1. Telephone Regional office.
2. WAN.(Wide Area Network).

# Star Topology

- Here each device has a dedicated point-to-point link to the central controller called “Hub”(Act as a Exchange).
- There is no direct traffic between devices.
- The transmission are occurred only through the central “hub”.
- When device 1 wants to send data to device 2; First sends the data to hub. Which then relays the data to the other connected device.

# Star Topology







# Advantages of Star Topology

1. Less expensive than mesh since each device is connected only to the hub.
2. Installation and configuration are easy.
3. Less cabling is needed than mesh.
4. Robustness.(if one link fails, only that link is affected. All other links remain active)
5. Easy to fault identification & to remove parts.
6. No disruptions to the network when connecting(or) removing devices.

# Disadvantages of Star Topology

1. Even it requires less cabling than mesh when compared with other topologies it is still large. (Ring or bus).
2. Dependency (whole n/w dependent on one single point (hub)). When it goes down, the whole system is dead.



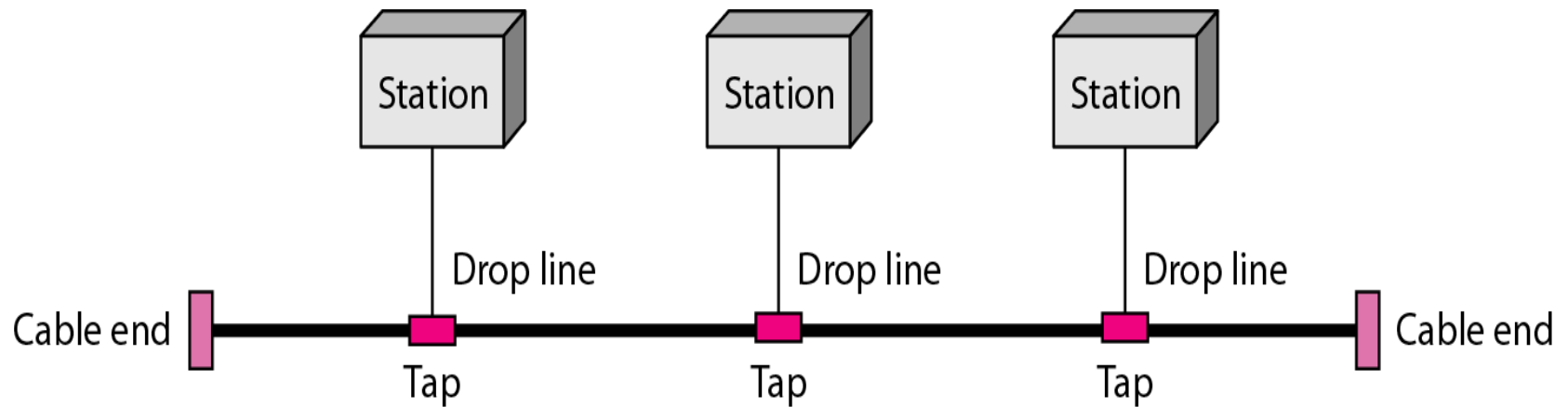
# Applications of Star Topology

- Star topology used in Local Area Networks(LANs).
- High speed LAN often used STAR.

# Bus Topology

- A bus topology is multipoint.
- Here one long cable act as a backbone to link all the devices are connected to the backbone by drop lines and taps.
- **Drop line-** is the connection b/w the devices and the cable.
- **Tap-** is the splitter that cut the main link.
- This allows **only one device to transmit at a time.**

# Bus Topology



- When a device sends a message, it is broadcast down on the cable in both directions. Terminators at the end of the cable prevent the signal from reflecting back to the sender.
- All devices on the cable constantly monitor for messages meant to them. When a device detects a message meant for it, it reads the message from the cable and the other devices will ignore it.
- Since all devices are sharing the same cable, some form of control is needed to make sure which device will transmit when, otherwise there will be a collision.



# Advantages of Bus Topology

1. Ease of installation.
2. Less cabling.
3. less expensive.



# Disadvantages of Bus Topology

1. Difficult reconfiguration and fault isolation.
2. Difficult to add new devices.
3. Signal reflection at top can degradation in quality.
4. If any fault in backbone can stops all transmission.





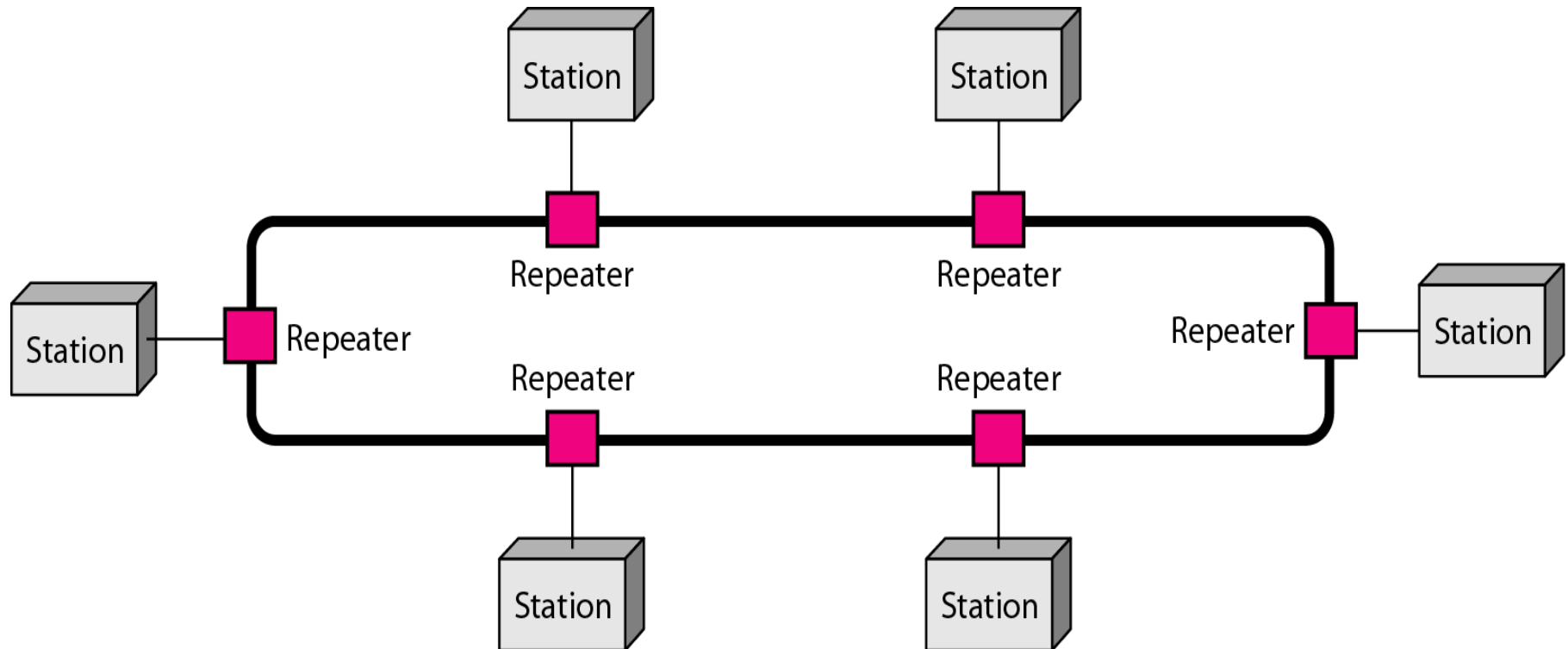
# Applications of Bus Topology

- Most computer motherboard.

# Ring Topology

- Here each device has a dedicated connection with two devices on either side.
- The signal is passed in one direction from device to device until it reaches the destination and each device have **repeater**.
- When one device received signals instead of intended another device, its repeater then **regenerates** the data and passes them along.
- To add or delete a device requires changing only two connections.

# Ring Topology



# Ring Topology

## Advantages:

1. Easy to install.
2. Easy to reconfigure.
3. Fault identification is easy.

## Disadvantages:

1. Unidirectional traffic.
2. Break in a single ring can break entire network.

# Ring Topology

## *Applications:*

- Ring topologies are found in some office buildings or school campuses.
- Today high speed LANs made this topology **less popular**.

# Tree Topology

- Alternatively referred to as a **star bus** topology.
- Tree topology is one of the most common network setups that is similar to a bus topology and a star topology.
- A tree topology connects multiple star networks to other star networks. Below is a visual example of a simple computer setup on a network using the star topology.

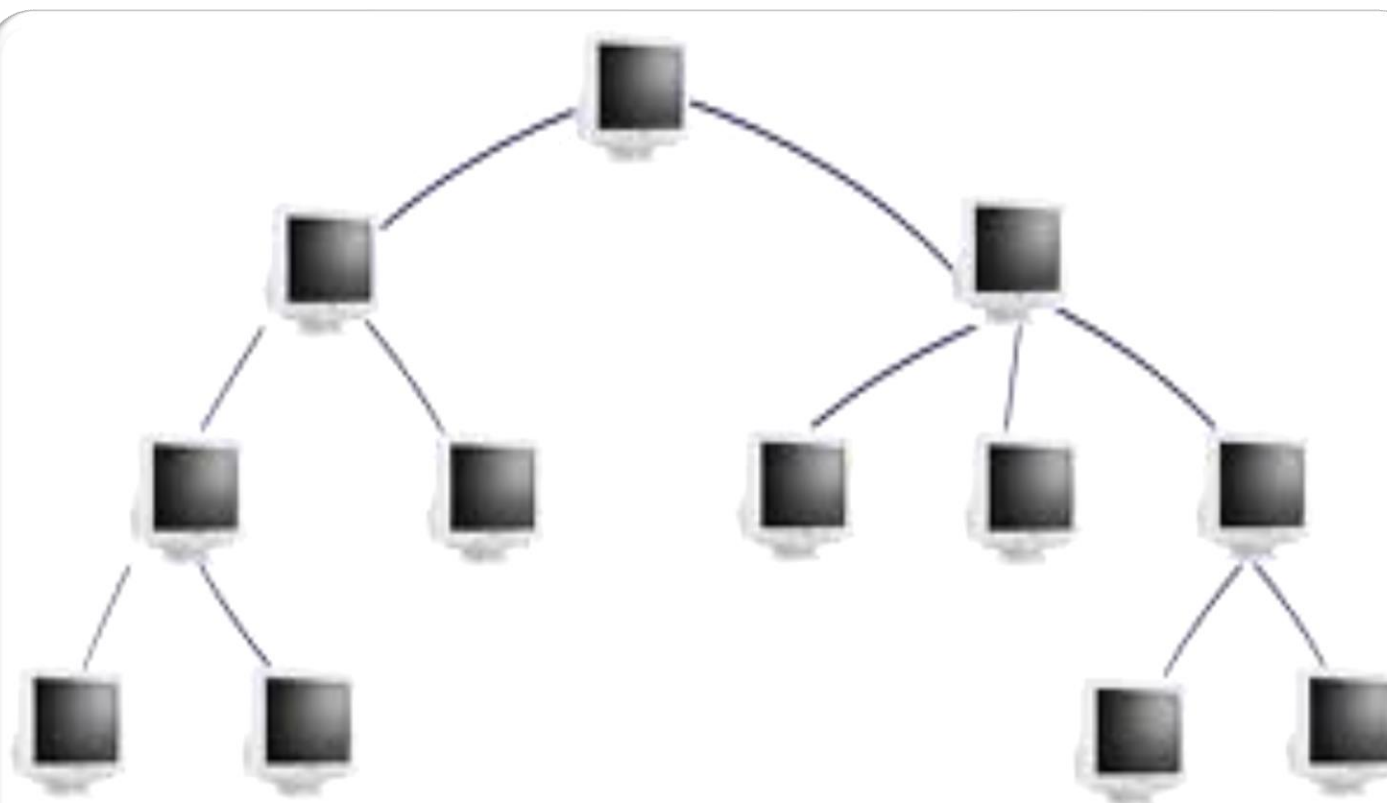


Diagram - Tree Topology

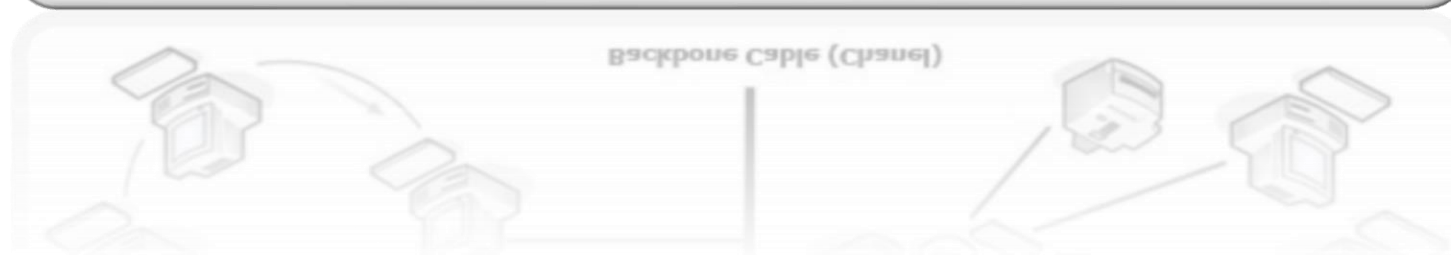
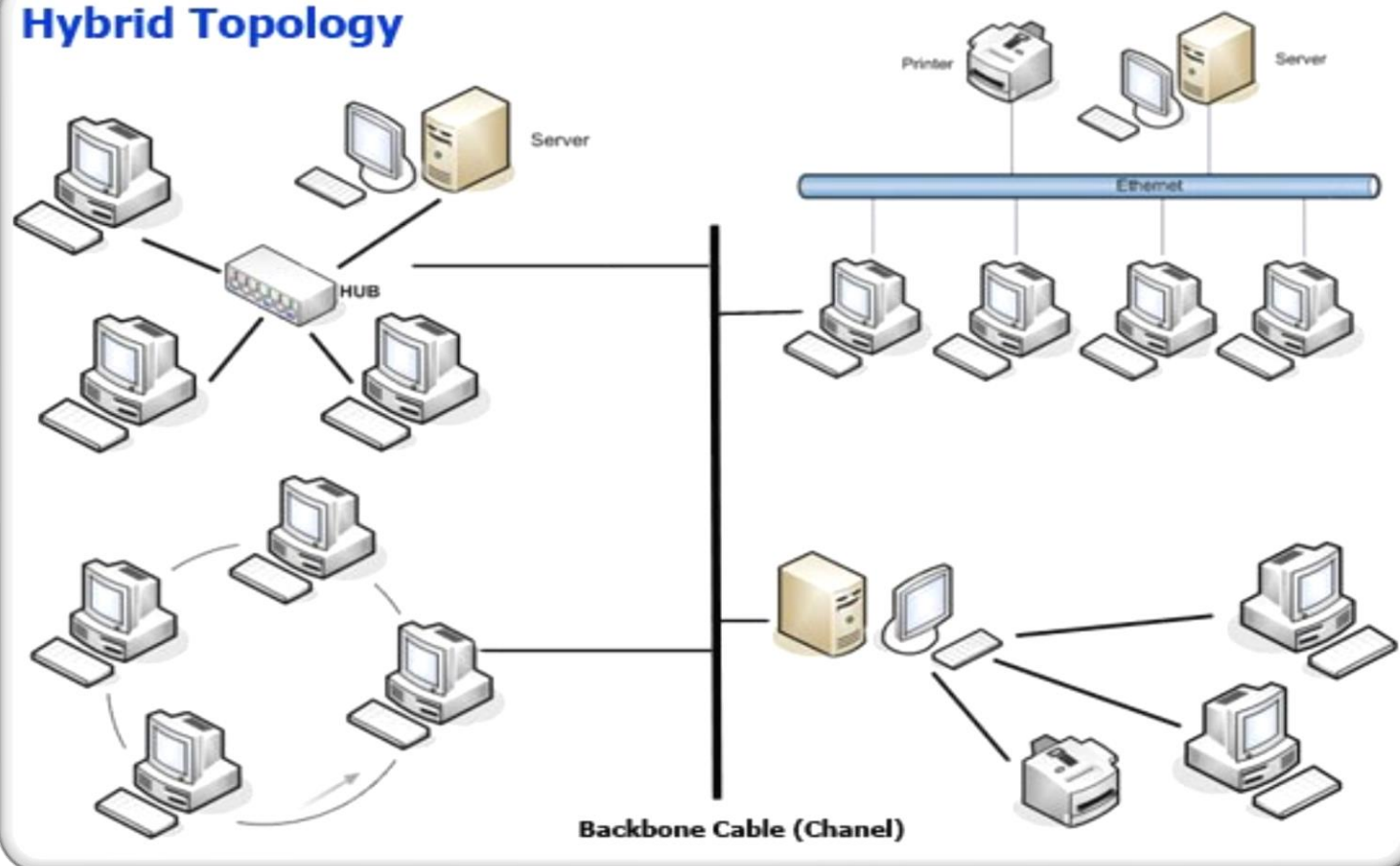
Diagram - Tree Topology

# Hybrid Topology

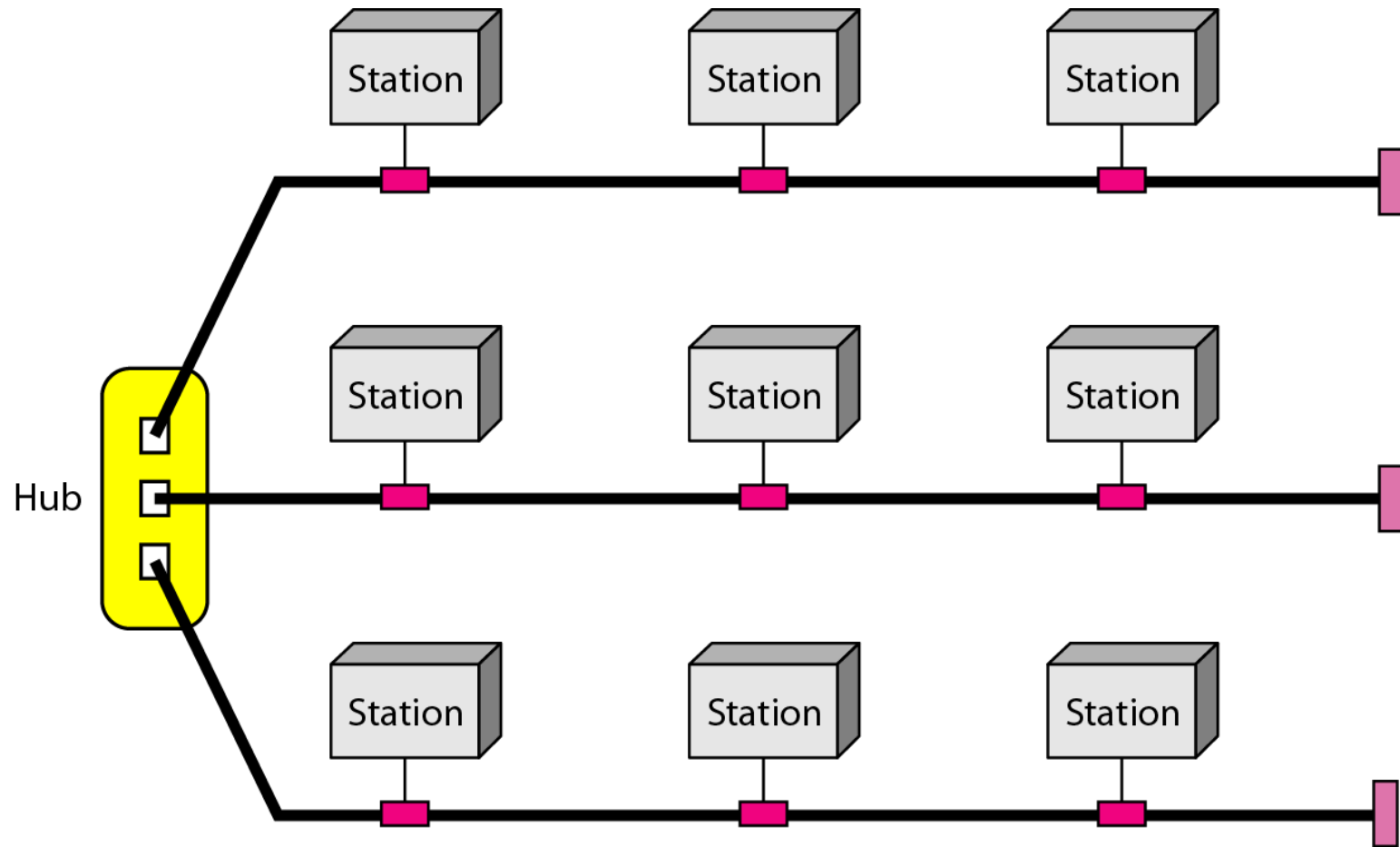
- A network which contain all type of physical structure and connected under a single backbone channel.



## Hybrid Topology



# Hybrid Topology



# Considerations for Choosing Network Topology

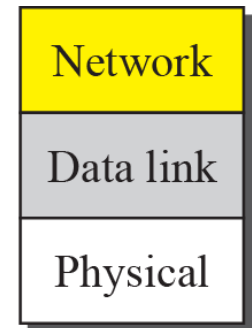
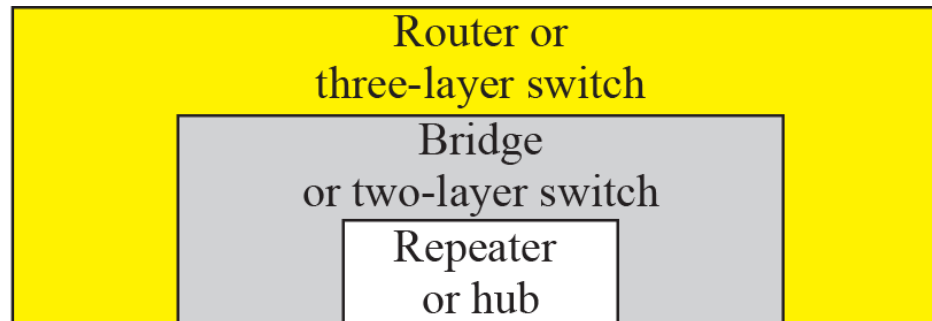
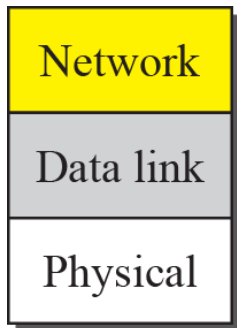
- **Money**-Bus n/w may be the least expensive way to install a n/w.
- **Length**-of cable needed- the linear bus n/w uses shorter lengths of cable.
- **Future growth**-with star topology, expanding a n/w is easily done by adding another devices.
- **Cable type**-most common used cable in commercial organization is twisted pair. Which is often used with star topologies.

- Full mesh topology is theoretically the best since every device is connected to every other device.(thus maximizing speed and security. however, it quite expensive to install)
- Next best would be tree topology , which is basically a connection of star.

# Backbone Networks: Serial Backbone

- Daisy chain: linked series of devices
  - Hubs and switches often connected in daisy chain to extend a network
- Hubs, gateways, routers, switches, and bridges can form part of backbone
- Extent to which hubs can be connected is limited

# Connecting devices



# Repeater or hub

A repeater forwards every bit; it has no filtering capability.

**A router is a three-layer (physical, data link, and network) device.**

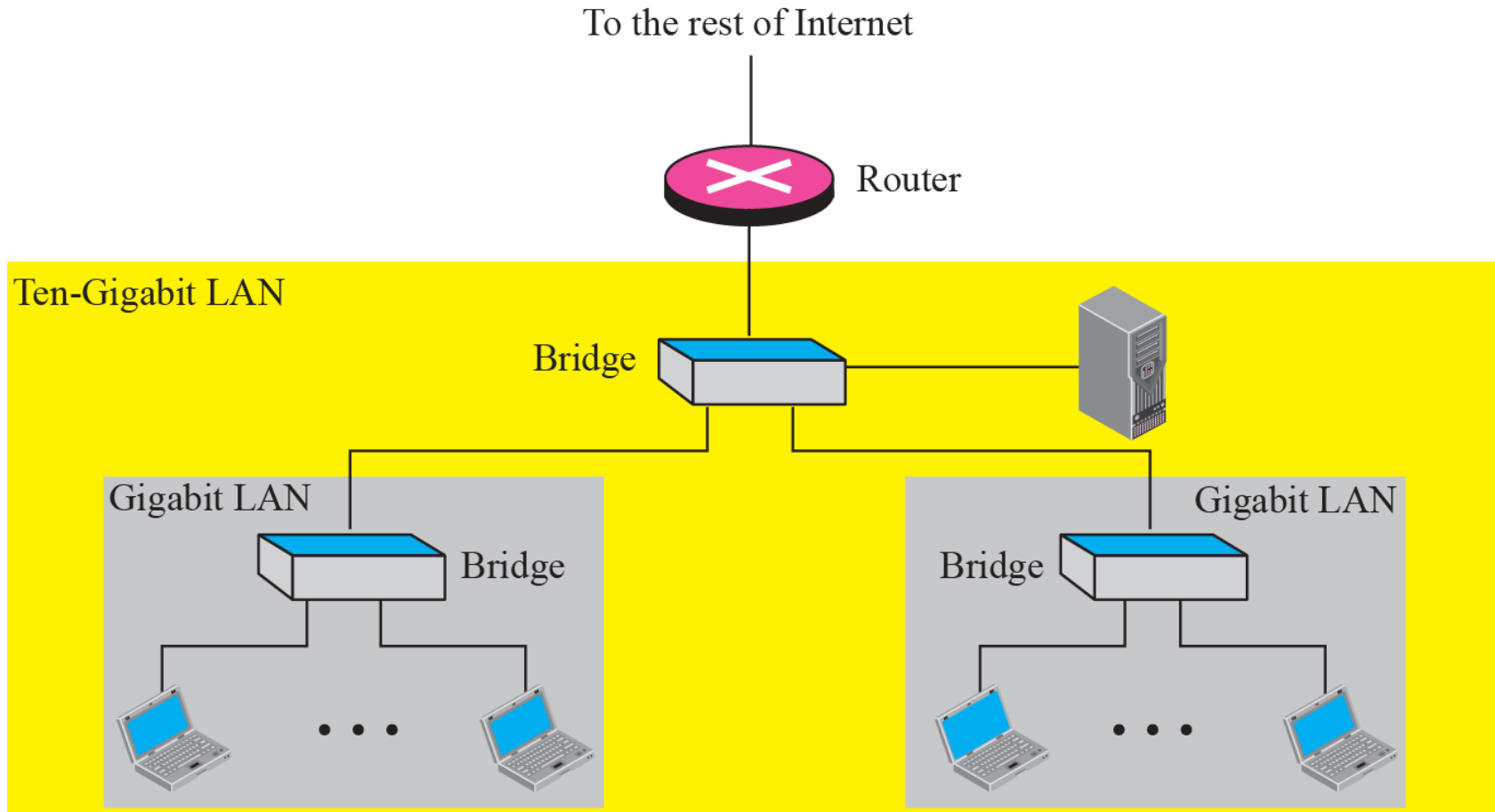


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**A repeater or a bridge connects segments of a LAN.  
A router connects independent LANs or WANs to  
create an internetwork (internet).**

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# Routing example



# Hub

- Broadcast
- More collision
- Connect same networking device

# Switch

- Switch is intelligent device
- Learning the address
- Forwarding
- Work on mac address

# Router

- Connect different networks
- Routing