

Network Devices

Functions of network devices

- **Separating (connecting) networks or expanding network**
 - e.g. repeaters, hubs, bridges, routers, switches.
- **Remote access**
 - e.g. Modems

Network Devices

a. Repeater

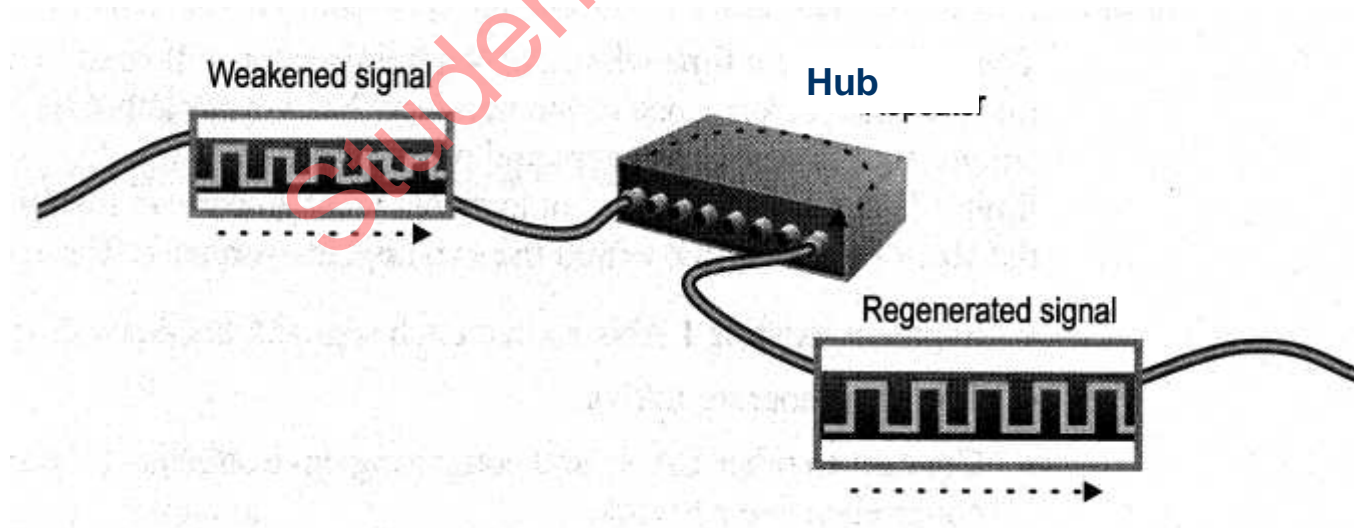
- A repeater is a simple device that amplifies all incoming electromagnetic signals on a communication channel and transmits them on the communication channel.
- This device is useful where signal become weaker over the transmission medium after a certain distance.



- A Repeater operates on only physical layer of the OSI model.
- A Repeater is used to connect two or more cable segments & retransmits any incoming signal to all other segments.

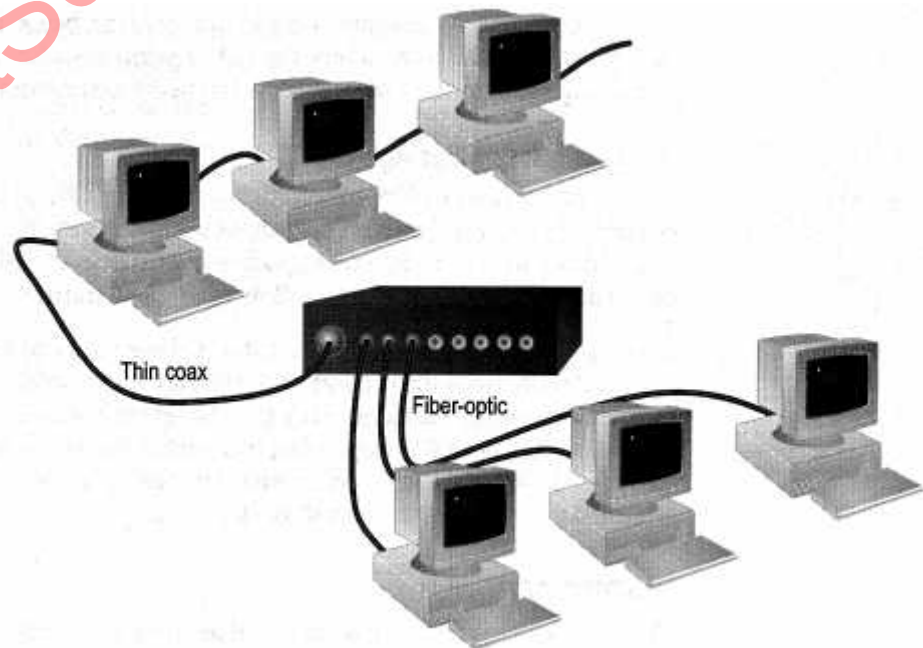
b. Hubs

- A hub is a central network device that connects network nodes, such as workstations & servers in a star topology.
- Hubs work at the OSI **physical layer** to **regenerate the network's signal** and resend them to other segments
- Primitive hub can be viewed as a multiport repeater
 - It regenerates data and broadcasts them to all ports



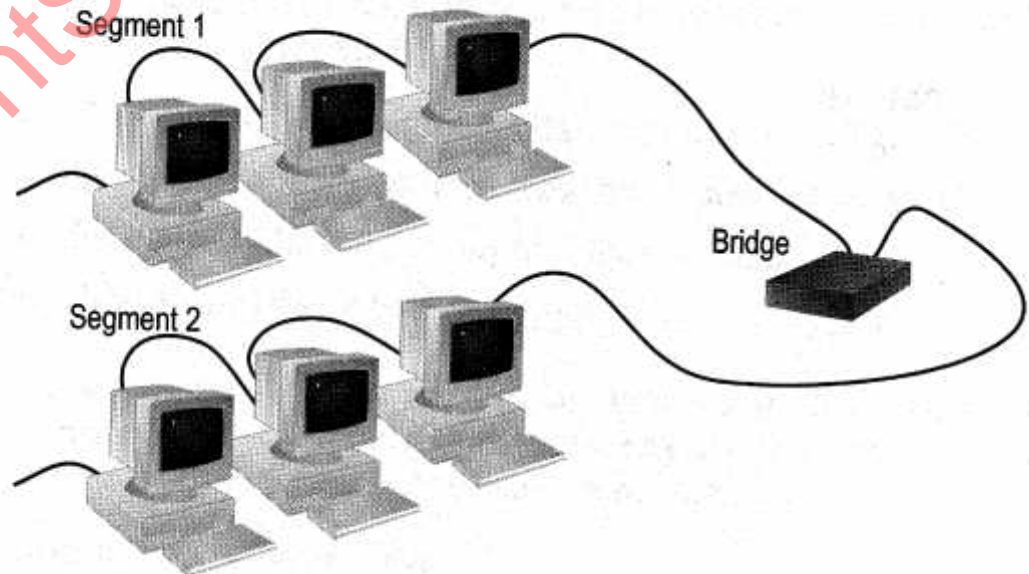
Limitations and Features

- **Cannot** link unlike segments
- **Do not** isolate and filter packets
- **Can** connect different types of media
- The most **economic** way of expanding networks



b. Bridges

- Has one input and one output
- Used to **isolate network traffic** and computers
- Has the intelligence to examine incoming packet source and destination addresses
- But **cannot** interpret higher-level information
- Hence **cannot** filter packet according to its protocol



Differences Between Bridges and Repeaters

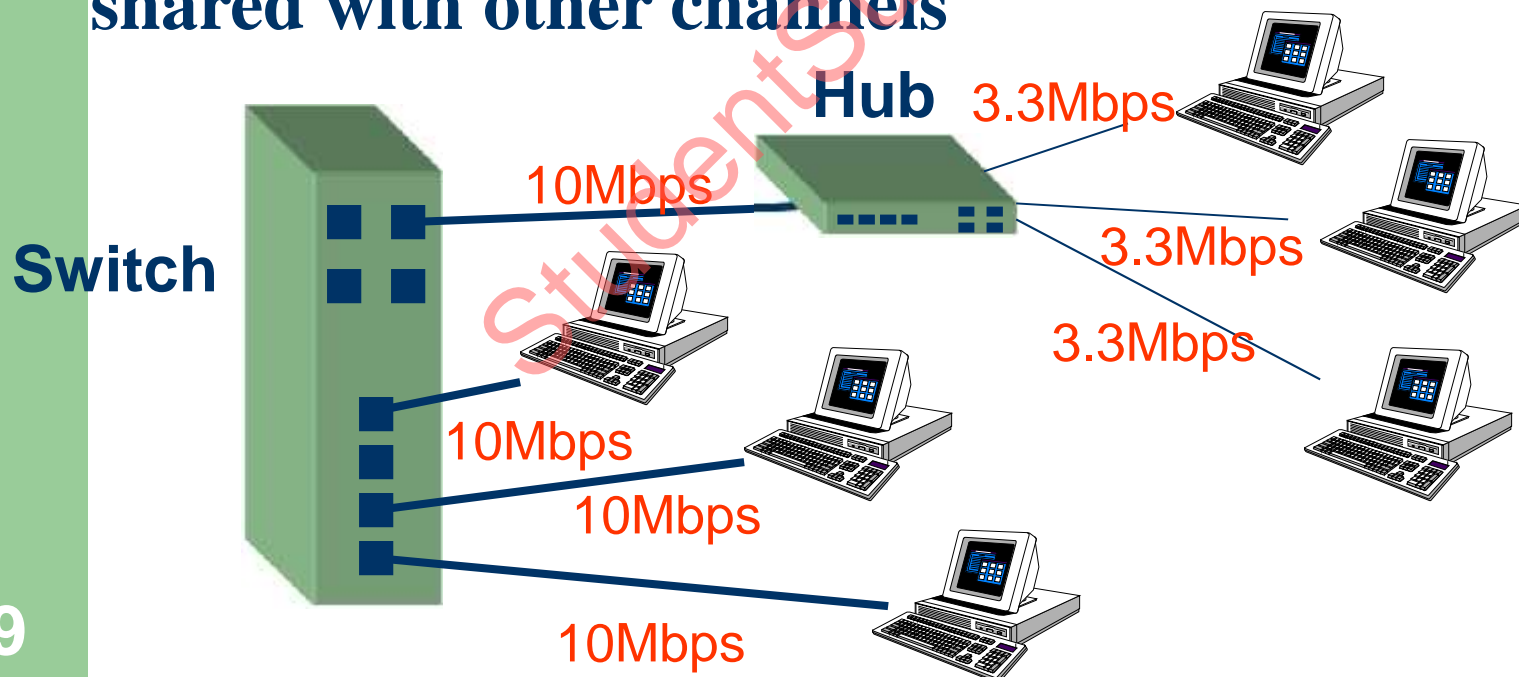
	<i>Repeaters</i>	<i>Bridges</i>
<i>OSI layer</i>	Physical layer	Data link layer
<i>Data regeneration</i>	Regenerate data at the signal level	Regenerate data at the packet level
<i>Reduce network traffic</i>	No	Yes

c. Switches

- Switches operate at the **Data Link layer** (layer 2) of the OSI model
- Can interpret address information
- Switches resemble bridges and can be considered as **multiport bridges**
- By having multiports, can better use limited bandwidth and prove more cost-effective than bridge



- Switches divide a network into several isolated channels
- Packets sending from 1 channel will not go to another if not specify
- Each channel has its own capacity and need not be shared with other channels



Advantages of Switches

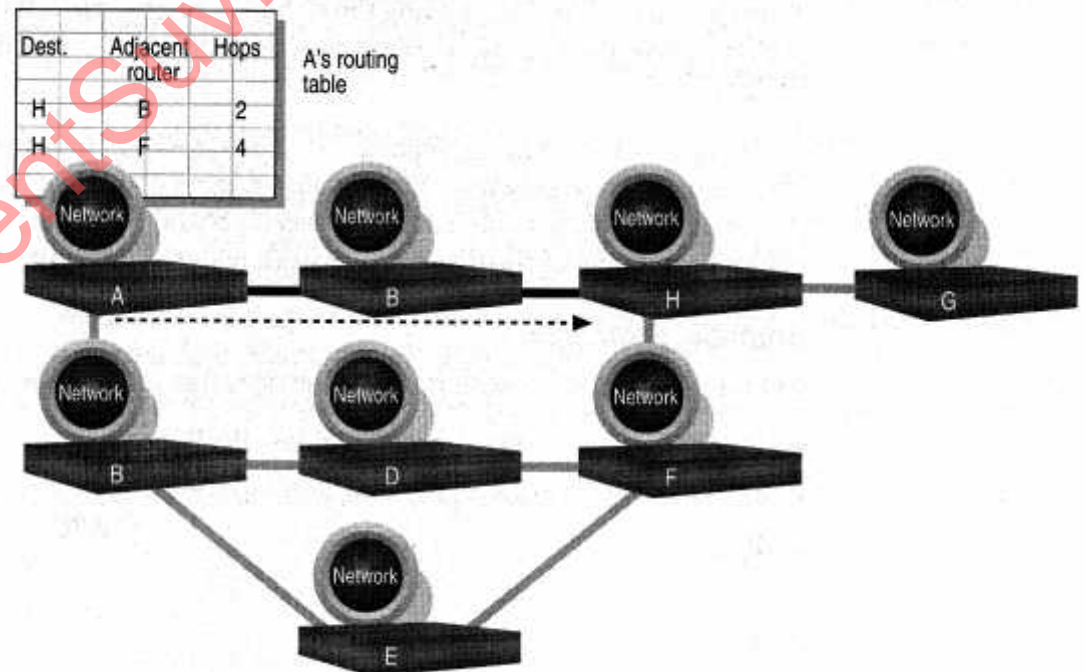
- Switches divide a network into several isolated channels (**or collision domains**)
 - **Reduce the possibility of collision**
 - Collision only occurs when two devices try to get access to one channel
 - Can be solved by buffering one of them for later access
 - **Each channel has its own network capacity**
 - Suitable for real-time applications, e.g. video conferencing
 - **Since isolated, hence secure**
 - Data will only go to the destination, but not others

Limitations of Switches

- Although contains buffers to accommodate bursts of traffic, can become overwhelmed by heavy traffic
 - **Device cannot detect collision when buffer full**
 - Some higher level protocols do not detect error
 - E.g. UDP
 - Those data packets are continuously pumped to the switch and introduce more problems

d. Routers

- Layer 2 Switches cannot take advantage of multiple paths
- **Routers** work at the OSI layer 3 (**network layer**)
- They use the “**logical address**” of packets and routing tables to determine the best path for data delivery



How Routers Work

- As packets are passed from routers to routers, Data Link layer source and destination addresses are stripped off and then recreated
- Enables a router to route a packet from a TCP/IP Ethernet network to a TCP/IP token ring network
- **Only packets with known network addresses will be passed** - hence reduce traffic
- Routers can listen to a network and identify its busiest part
- **Will select the most cost effective path for transmitting packets**

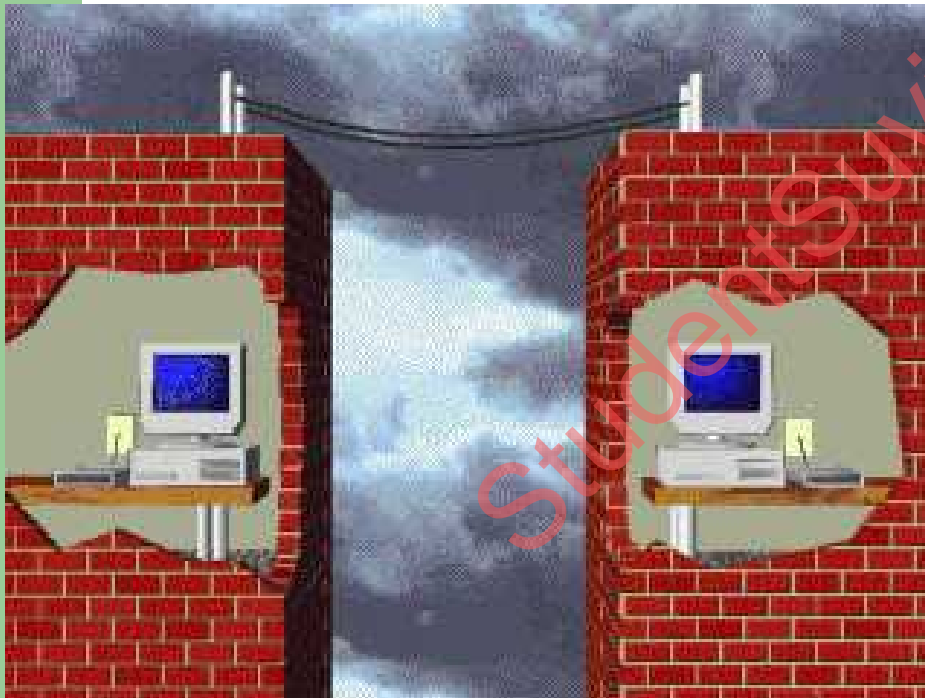
13

Summary

- **Repeaters** are the least expensive way to expand a network, but they are limited to connecting two segments
- **Bridges** function similar to repeaters, but can understand the node addresses
- **Switches** can be considered as multiport bridges, can divide a network into some logical channels
- **Routers** interconnect networks and provide filtering functions. They can determine the best route

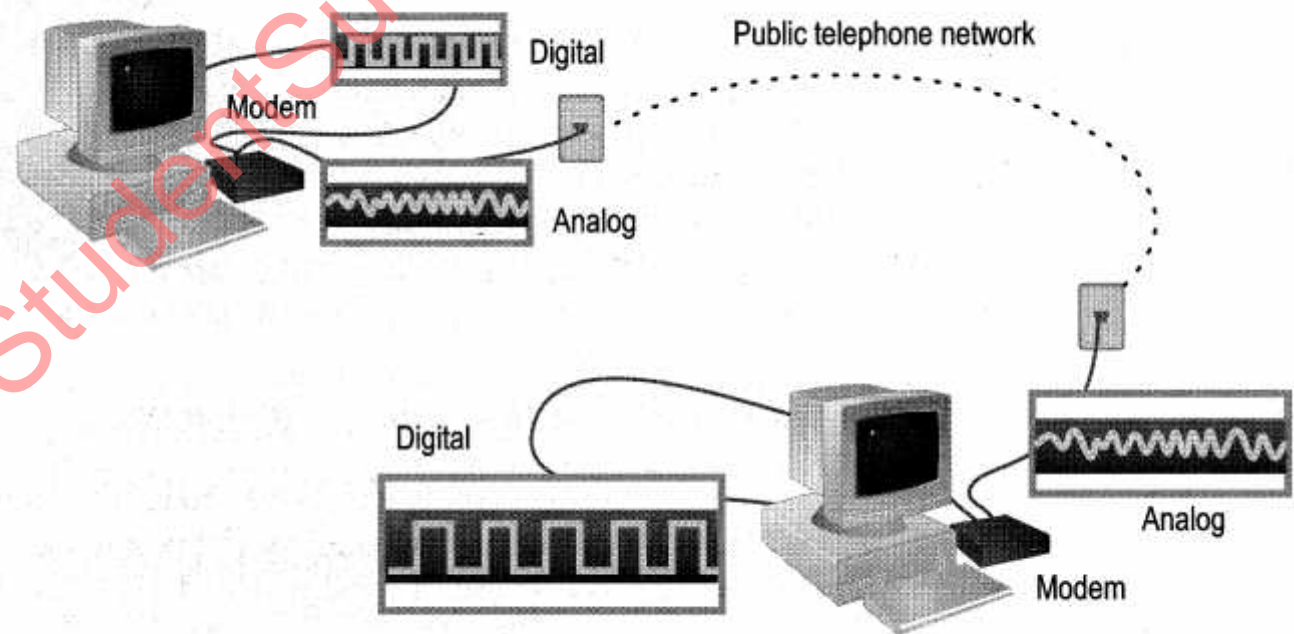
B. Remote Access Devices

1. Modems



- Allow computers to communicate over a telephone line
- Enable communication between networks or connecting to the world beyond the LAN

- Cannot send digital signal directly to telephone line
- Sending end: **MOD**ulate the computer's digital signal into analog signal and transmits
- Receiving end: **DEM**odulate the analog signal back into digital form



- **Modems typically have the following I/O interface:**
 - **A serial RS-232 communication interface**
 - **An RJ-11 telephone-line interface (a telephone plug)**



RS-232

RJ-11

Assignment

- Differentiate between bridge and router.