

# **NETWORKING DEVICES**

**PRESENTED BY**

**SHILPA KHURANA**

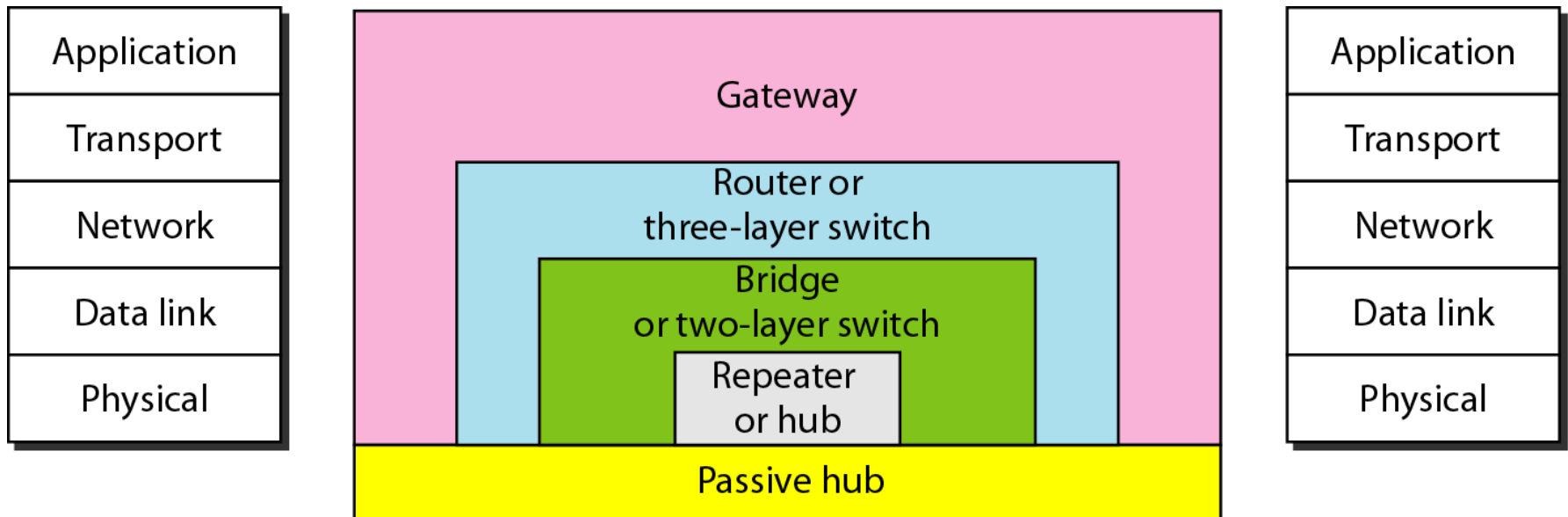
**A.P CSE DEPT**

# Introduction

- LANs do not normally operate in isolation but they are connected to one another or to the Internet.
- To connect LANs, connecting devices are needed and various connecting devices are such as bridge, switch, router, hub, repeater.

# CONNECTING DEVICES

- Connecting devices into five different categories based on the layer in which they operate in a network.





# Hubs



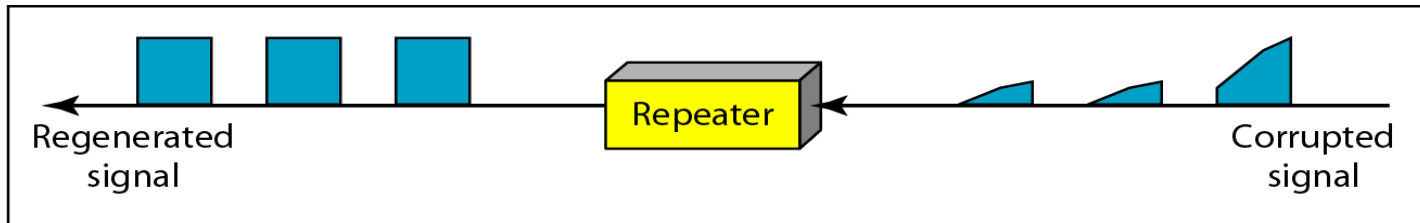
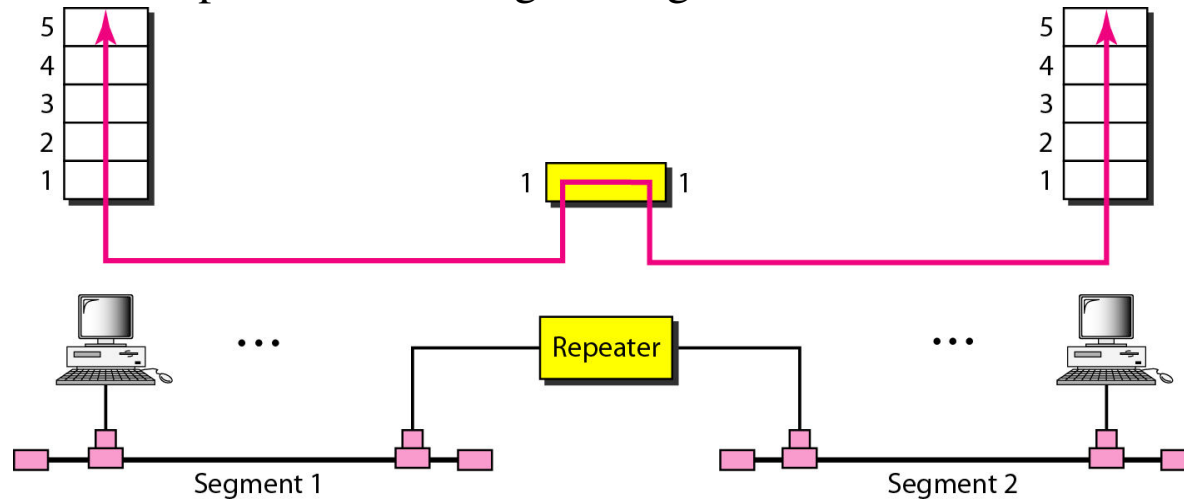
- A hub is used as a central point of connection among media segments.
- Cables from network devices plug in to the ports on the hub.
- Types of HUBS :
  - A **passive hub** is just a connector. It connects the wires coming from different branches.
  - The signal pass through a passive hub without regeneration or amplification.
  - Connect several networking cables together
  - **Active hubs or Multiport repeaters**- They regenerate or amplify the signal before they are retransmitted.

# Repeaters

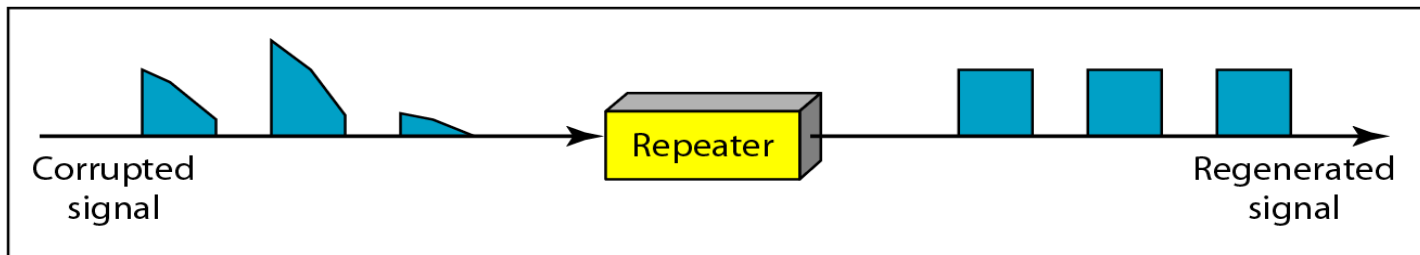
- A repeater is a device that operates only at the PHYSICAL layer.
- A repeater can be used to increase the length of the network by eliminating the effect of attenuation on the signal.
- It connects two segments of the same network, overcoming the distance limitations of the transmission media.
- A repeater forwards every frame; it has no filtering capability.
- A repeater is a regenerator, not an amplifier.
- Repeaters can connect segments that have the same access method. (CSMA/CD, Token Passing, Polling, etc.)



## Repeater connecting two segments of a LAN



a. Right-to-left transmission.



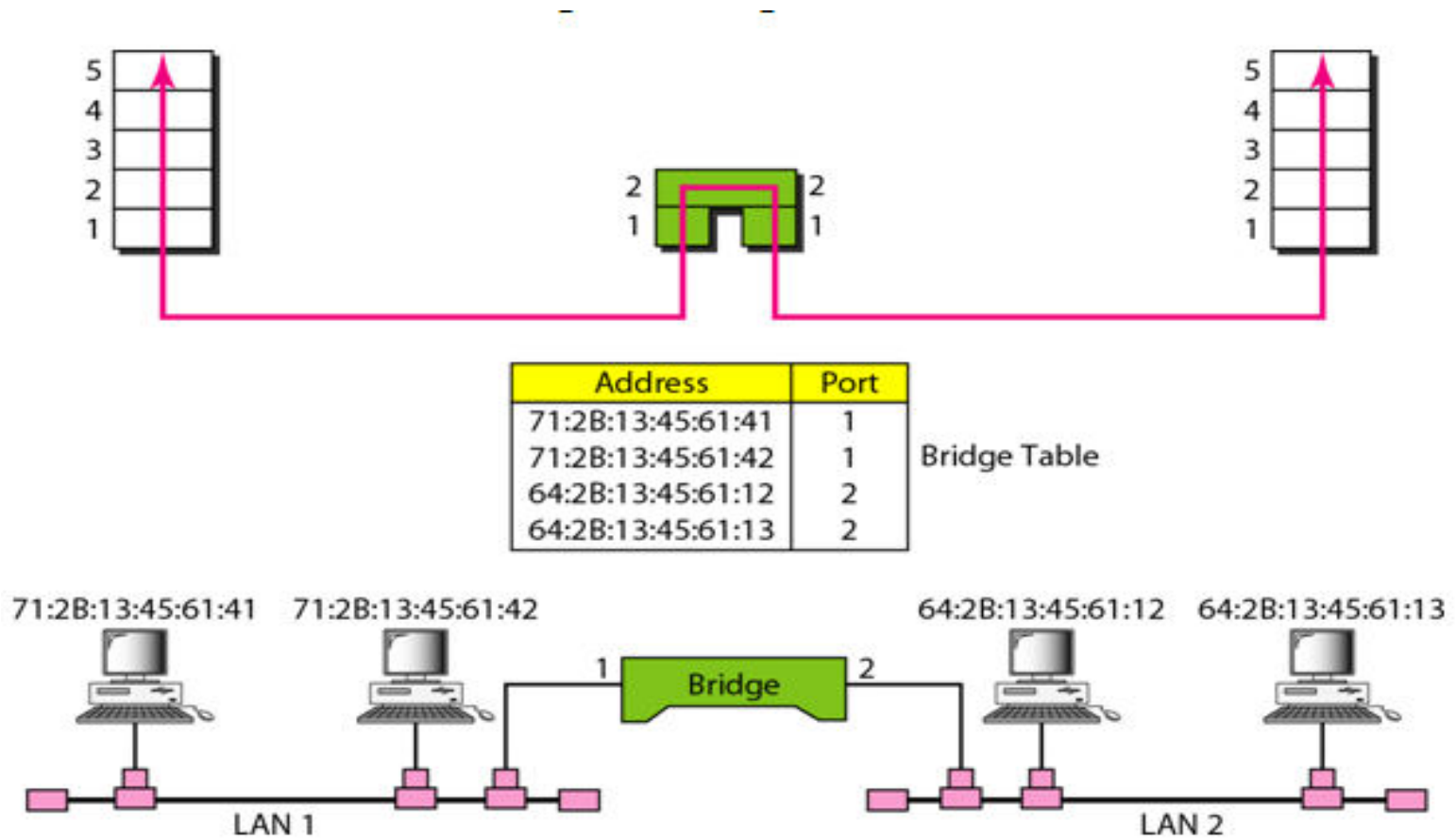
b. Left-to-right transmission.

*Function of a repeater*

# Bridges

- Operates in both the PHYSICAL and the data link layer.
- As a PHYSICAL layer device, it regenerates the signal it receives.
- As a data link layer device, the bridge can check the PHYSICAL/MAC addresses (source and destination) contained in the frame.
- A bridge has a table used in filtering decisions.
- It can check the destination address of a frame and decide if the frame should be forwarded or dropped.
- If the frame is to be forwarded, the decision must specify the port.
- A bridge has a table that maps address to ports.
- Limit or filter traffic keeping local traffic local yet allow connectivity to other parts (segments).

## A bridge connecting two LANs

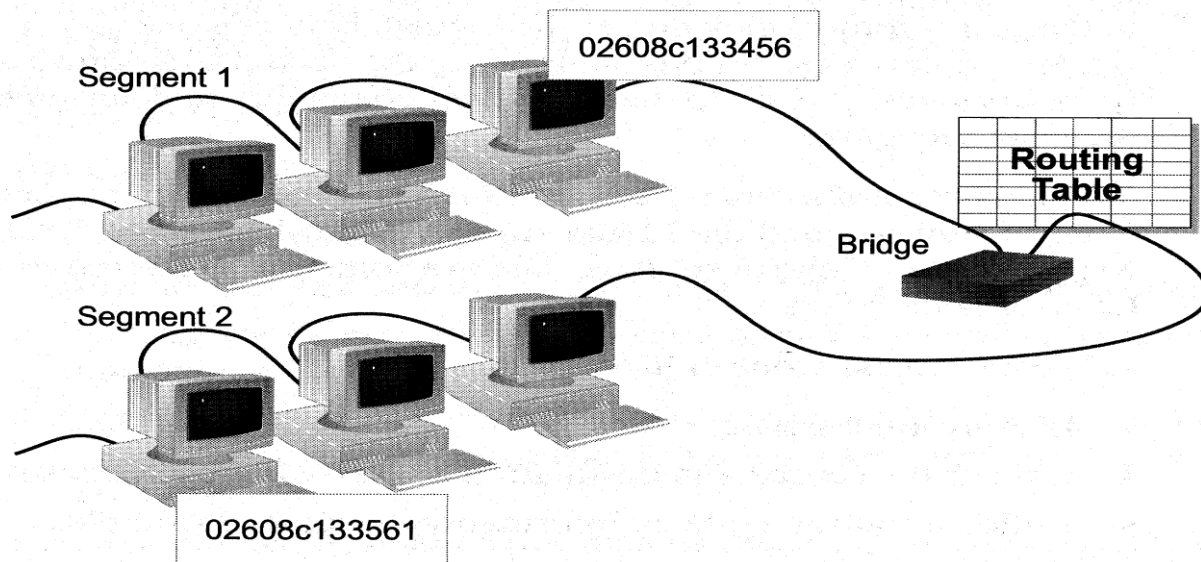


A bridge does not change the physical (MAC) addresses in a frame.

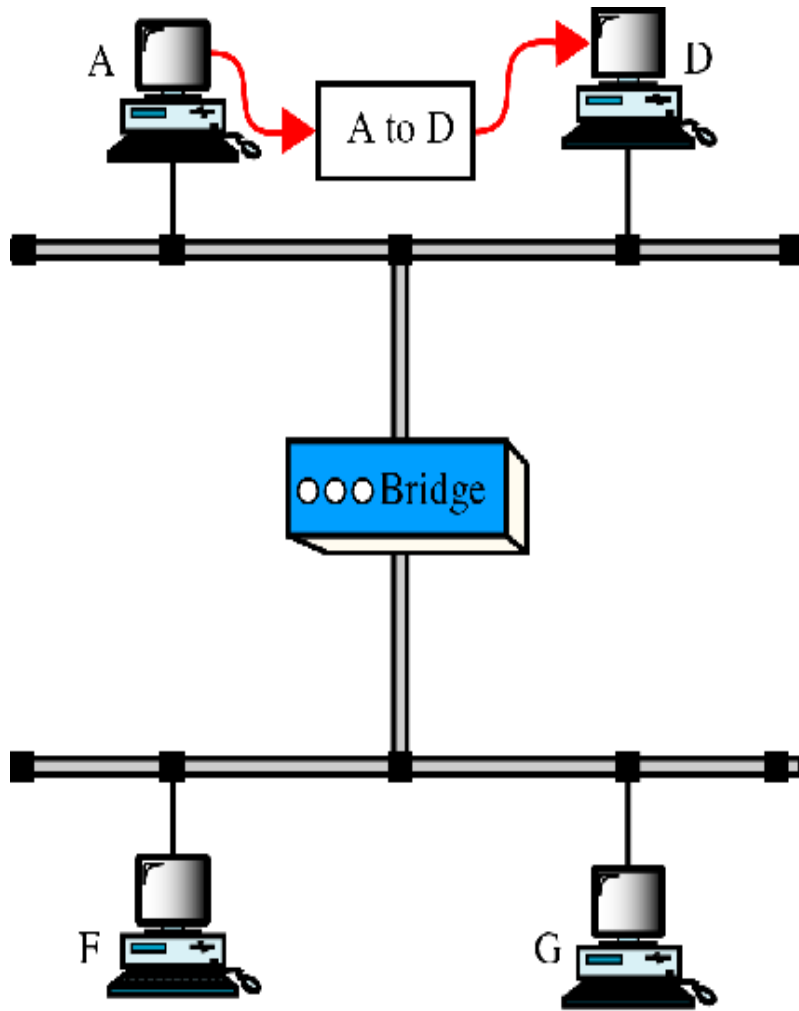


# How Bridges Work

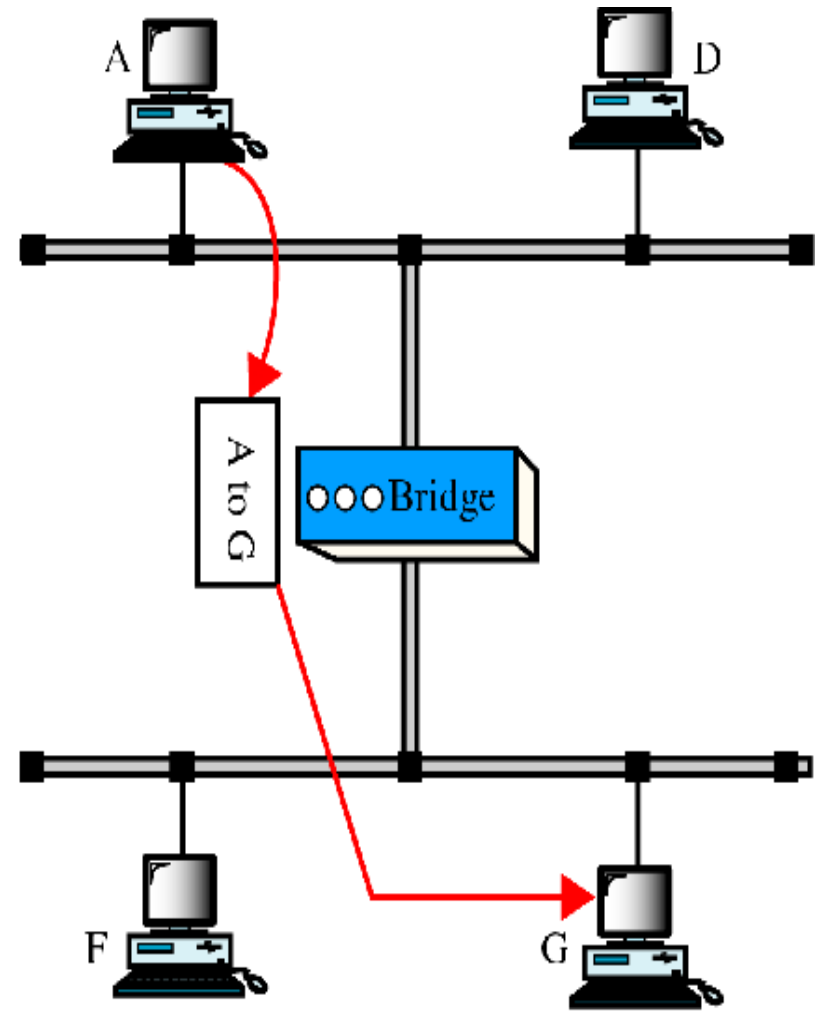
- Bridges work at the Media Access Control Sub-layer of the OSI model.
- Routing table is built to record the segment no. of address.
- If destination address is in the same segment as the source address, stop transmit.
- Otherwise, forward to the other segment



# Function of Bridge



a. A packet from A to D



b. A packet from A to G

# Characteristics of Bridges

- **Routing Tables**

- Contains one entry per station of network to which bridge is connected.
- Is used to determine the network of destination station of a received packet.

- **Filtering**

- Is used by bridge to allow only those packets destined to the remote network.
- Packets are filtered with respect to their destination and multicast addresses.

- **Forwarding**

- the process of passing a packet from one network to another.

- **Learning Algorithm**

- the process by which the bridge learns how to reach stations on the internetwork.

# Types of Bridges

- Transparent Bridge
  - Also called learning bridges
  - Build a table of MAC addresses as frames arrive
  - Ethernet networks use transparent bridge
  - Duties of transparent bridge are : Filtering frames, forwarding and blocking
- Source Routing Bridge
  - Used in Token Ring networks
  - Each station should determine the route to the destination when it wants to send a frame and therefore include the route information in the header of frame.
  - Addresses of these bridges are included in the frame.
  - Frame contains not only the source and destination address but also the bridge addresses.

# Advantages And Disadvantages Of Bridges

- Advantages of using a bridge
  - Extend physical network
  - Reduce network traffic with minor segmentation
  - Creates separate collision domains
  - Reduce collisions
  - Connect different architecture
- Disadvantages of using bridges
  - Slower than repeaters due to filtering
  - Do not filter broadcasts
  - More expensive than repeaters

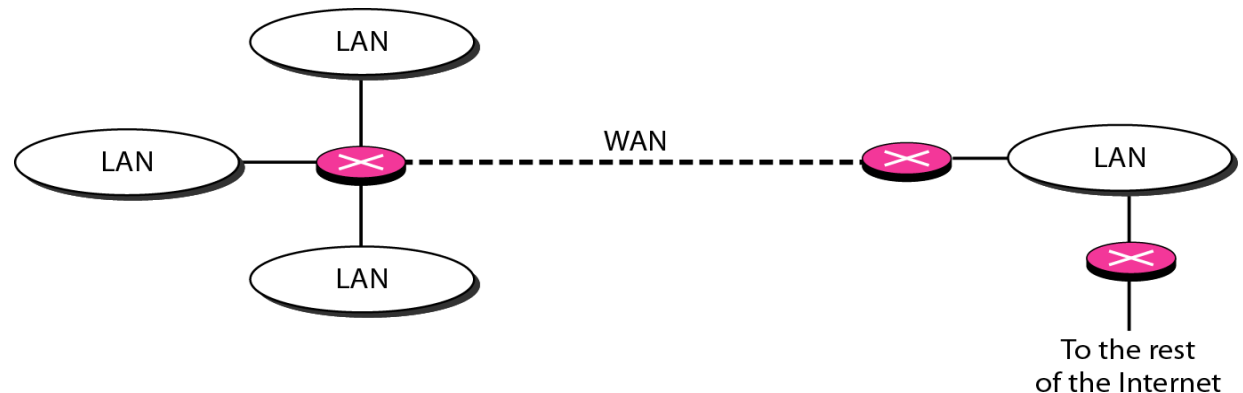
# Two and Three layer switches

- Two layer switch operate at PHY and data link layer
- Three layer switch operates at network layer
- Bridge is an example of two-layer switch.
- Bridge with few port can connect a few LANs
- Bridge with many port may be able to allocate a unique port to each station, with each station on its own independent entity. This means no competing traffic (no collision as we saw in Ethernet)

# 3-layer switches

- E.g. router.
- Routes packets based on their logical addresses (host-to-host addressing)
- A router normally connects LANs and WANs in the Internet and has a routing table that is used for making decision about the route.
- The routing tables are normally dynamic and are updated using routing protocols.

*Routers connecting independent LANs and WANs*



# Advantages and Disadvantages of Routers

- Advantages
  - Routers
    - provide sophisticated routing, flow control, and traffic isolation
    - are configurable, which allows network manager to make policy based on routing decisions
    - allow active loops so that redundant paths are available
- Disadvantages
  - Routers
  - are protocol-dependent devices that must understand the protocol they are forwarding.
  - can require a considerable amount of initial configuration.
  - are relatively complex devices, and generally are more expensive than bridges.



# Routers versus Bridges

- Addressing
  - Routers are explicitly addressed.
  - Bridges are not addressed.
- Availability
  - Routers can handle failures in links, stations, and other routers.
  - Bridges use only source and destination MAC address, which does not guarantee delivery of frames.
- Message Size
  - » Routers can perform fragmentation on packets and thus handle different packet sizes.
  - » Bridges cannot do fragmentation and should not forward a frame which is too big for the next LAN.
- Forwarding
  - » Routers forward a message to a specific destination.
  - » Bridges forward a message to an outgoing network.

- Priority
  - » Routers can treat packets according to priorities
  - » Bridges treat all packets equally.
- Error Rate
  - » Network layers have error-checking algorithms that examines each received packet.
  - » The MAC layer provides a very low undetected bit error rate.
- Security
  - » Both bridges and routers provide the ability to put “security walls” around specific stations.
  - » Routers generally provide greater security than bridges because
    - they can be addressed directly and
    - they use additional data for implementing security

# Brouters: Bridging Routers

- Combine features of bridges and routers.
- Capable of establishing a bridge between two networks as well as routing some messages from the bridge networks to other networks.
- Are sometimes called (Layer 2/3) switches and are a combination of bridge/router hardware and software.

# Gateway

- Interchangeably used term router and gateway
- Connect two networks above the network layer of OSI model.
- Are capable of converting data frames and network protocols into the format needed by another network.
- Provide for translation services between different computer protocols.
- **Transport gateways** make a connection between two networks at the **transport layer**.
- **Application gateways** connect two parts of an application in the **application layer**, e.g., sending email between two machines using different mail formats
- Broadband-modem-router is one e.g. of gateway