Course Code: CSE3003

Course Title: Computer Networks

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Syllabus

Module No. 1	**Introduction**	**6 Hours**
Computer network and its history, progress and application, Internet, Network architecture, Networking devices. OSI Model, TCP/IP Protocol stack, Networking in different OS.		
Module No. 2	**Physical Layer**	**8 Hours**
Data communication technologies, Analog and digital communication. Encoding mechanisms, Packet Switching, Circuit Switching.		
Module No. 3	**Data Link Layer**	**8 Hours**
Framing, HDLC, PPP, Error detection, Error Correction, MAC Protocols, Reliable Transmission, Ethernet, 802.3, 802.5, 802.11, PPP,ATM.		
Module No. 4	**Network Layer**	**7 Hours**
IP addressing schemes, IPV4, Subnetting, IPV6, shift from IPV4 to IPV6, ICMP, DHCP, ARP. Routing Protocols: Distance-vector and link-state routing. RIP, OSPF, BGP Multicasting.		
Module No. 5	**Transport Layer**	**8 Hours**
Connection Oriented and connection less service, TCP and UDP, Port Addressing, Remote Proced Call, Flow Control vs Congestion Control, Quality of Service.		
Module No. 6	**Application Layer Protocols**	**8 Hours**
Application Layer Protocols: World wide web and HTTP, HTTPS, Domain names: DNS, File Transfer: FTP, Electronic mail: SMTP, Peer to peer networking, Torrent, VPN, Session managemen Data compression techniques.		

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Introduction

Computer network and its history progress and application
Internet
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OSI Model
TCP/IP Protocol stack
Networking in different OS.

Physical Layer

Data communication technologies
Analog and digital communication
Encoding mechanisms
Packet Switching
Circuit Switching

Data Link Layer

Framing
HDLC
PPP
Error detection
Error Correction

Networking Components and Devices

- Identify the purpose, features, and functions of the following network components

. Hubs

. Switches

. Bridges

. Routers

. Gateways

.

. CSU/DSU

. Network interface cards (NICs)

. ISDN adapters

. Wireless access points (WAPs)

. Modems

. Transceivers (media converters)

. Firewalls

Identify a MAC (Media Access Control) address and its part

- MAC addresses are the means by which systems communicate at a base level.
- A network administrator,
  - to understand **the purpose, function, and expression of MAC addresses**.

Repeaters

- Repeaters were once used to increase the usable length of the cable, and they were most commonly associated with coaxial network configurations

Hubs

- Hubs are simple network devices, and their simplicity is reflected in their low cost.
- Small hubs with four or five ports
- Hubs with more ports are available for networks that require greater capacity.

FIGURE 3.1 A workgroup hub.

FIGURE 3.2 A high-capacity, or high-density, hub.

- **Broadcasting**
- The method of sending data to all systems regardless of the intended recipient is referred to as broadcasting.
- On busy networks, broadcast communications can have a significant impact on overall network performance.

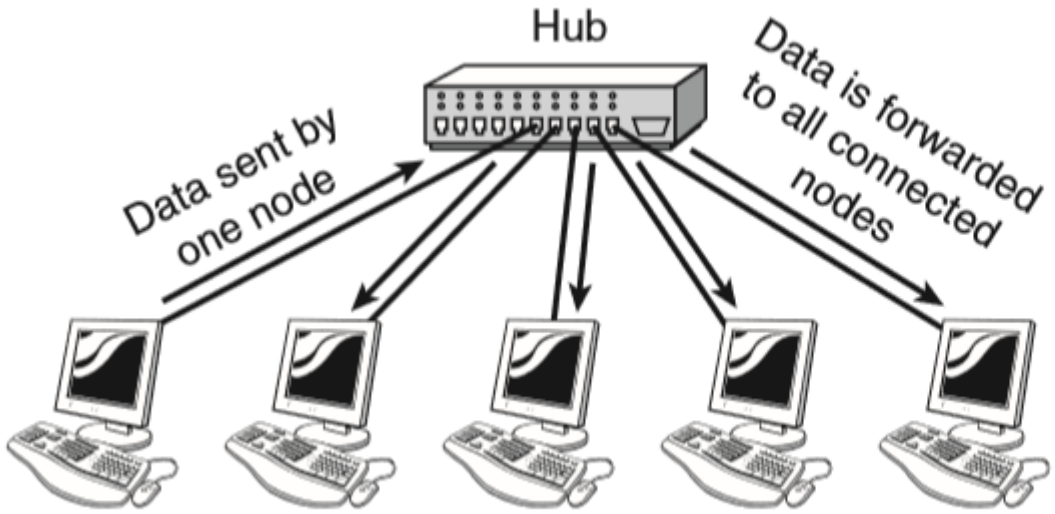


FIGURE 3.3 How a hub works.

Switches

- Switches are far more efficient than hubs and are far more desirable for today's network environments

FIGURE 3.4 A 32-port Ethernet switch. (Photo courtesy TRENDware International, www.trendware.com.)

Switches

- As with a hub, computers connect to a switch via a length of twisted-pair cable.
- Multiple switches are often interconnected to create larger networks
- Rather than forwarding data to all the connected ports, a switch forwards data only to the port on which the destination system is connected.
- It looks at the Media Access Control (MAC) addresses of the devices connected to it to determine the correct port.
- A MAC address is a unique number that is stamped into every NIC.

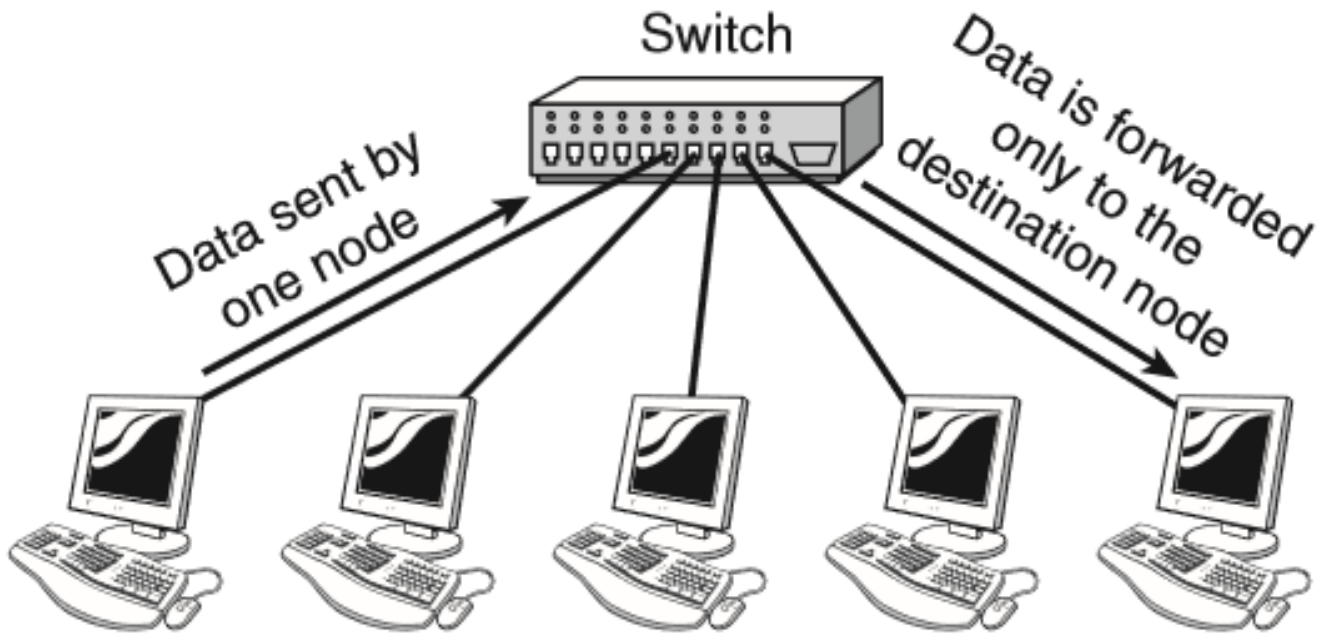


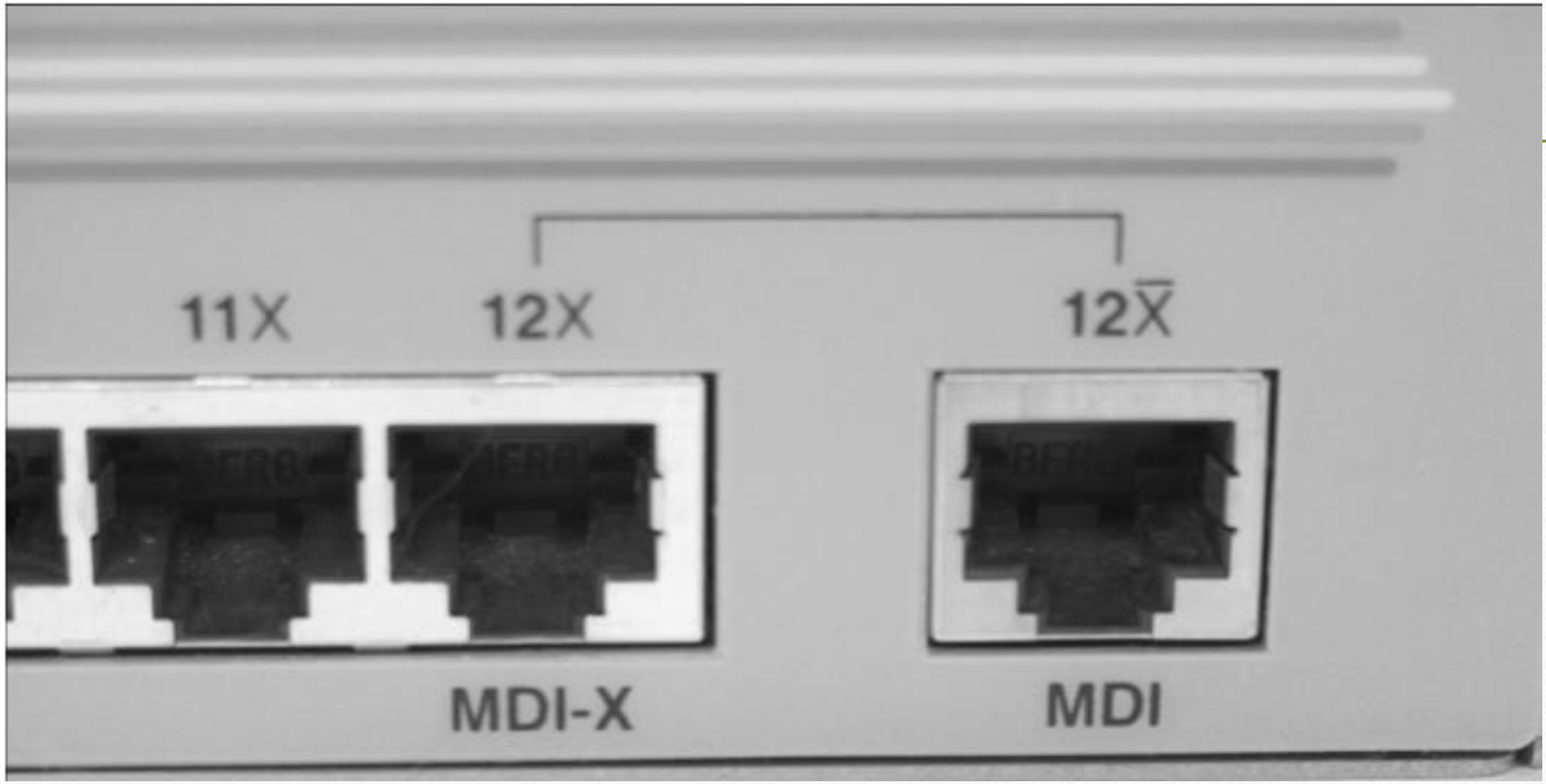
FIGURE 3.5 How a switch works.

Switching Methods

- **Cut-through**—In a cut-through configuration, the switch begins to forward the packet as soon as it is received.
  - No error checking is performed on the packet, so the packet is moved through quickly. The downside of cut-through is that because the integrity of the packet is not checked, the switch can propagate errors. .
- **Store-and-forward**—In a store-and-forward configuration, the switch waits to receive the entire packet before beginning to forward it. It also performs basic error checking. .
- **Fragment-free—**Building on the speed advantages of cut-through switching,
  - fragment-free switching works by reading only the part of the packet that enables it to identify fragments of a transmission.

- **Latency**
  - The time it takes for data to travel between two locations is known as the latency. The higher the latency, the bigger the delay in sending the data.

- Hubs and switches have two types of ports: medium dependent interface (MDI) and medium dependent interface crossed (MDI-X).
- The two types of ports differ in their wiring.
- As the X implies, an MDI-X port's wiring is crossed;
- this is because the transmit wire from the connected device must be wired to the receive line on the other
- In the absence of an uplink port, you can connect two hubs or switches together by using MDI-X ports, but you must use a crossover cable to do so.


11X
12X
12X̄
MDI-X
MDI

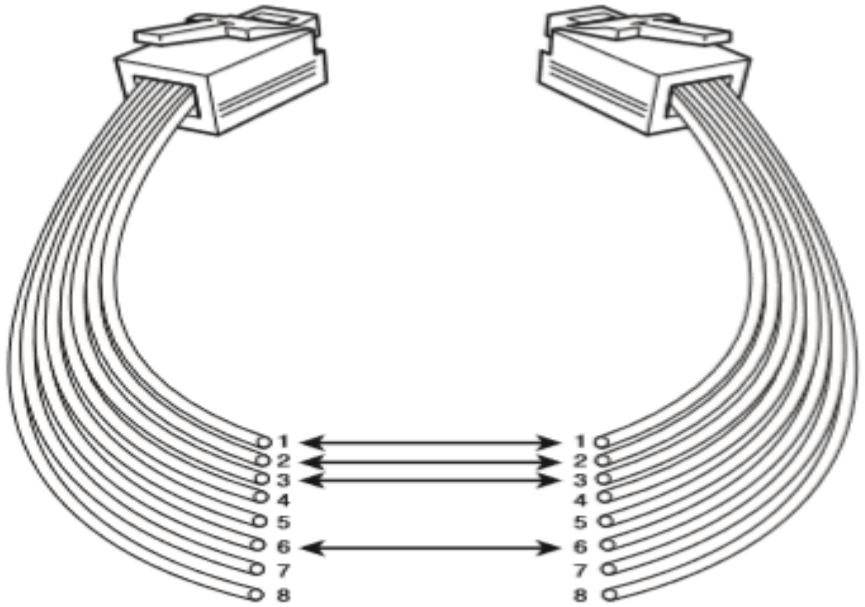


FIGURE 3.7 Pinouts for a straight-through twisted-pair cable.

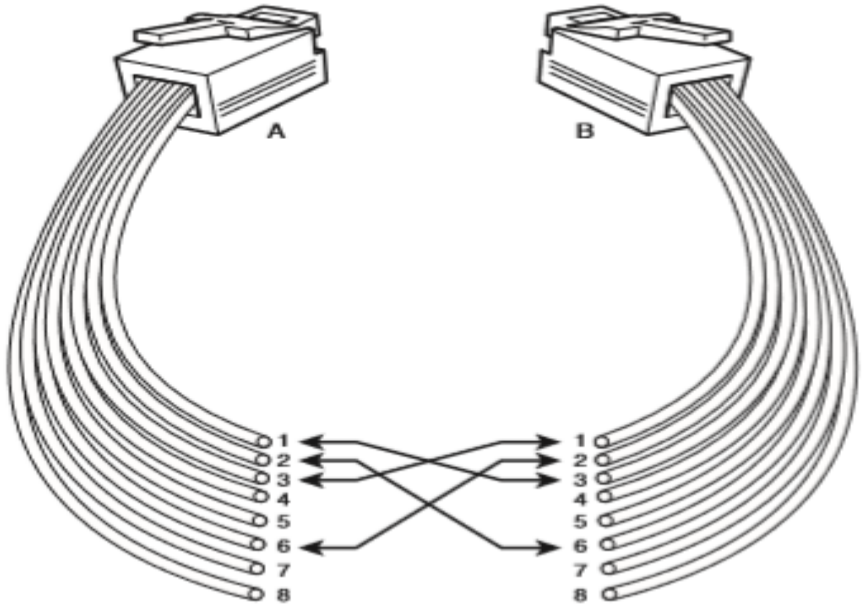


FIGURE 3.8 Pinouts for a crossover twisted-pair cable.

Bridges

- Bridges are networking devices that connect networks
- Sometimes it is necessary to divide networks into subnets to reduce the amount of traffic on each larger subnet or for security reasons.
- Once divided, the bridge connects the two subnets and manages the traffic flow between them.
- Today, network switches have largely replaced bridges.

- A bridge functions by blocking or forwarding data, based on the destination MAC address written into each frame of data.
- If the bridge believes the destination address is on a network other than that from which the data was received,
- it can forward the data to the other networks to which it is connected

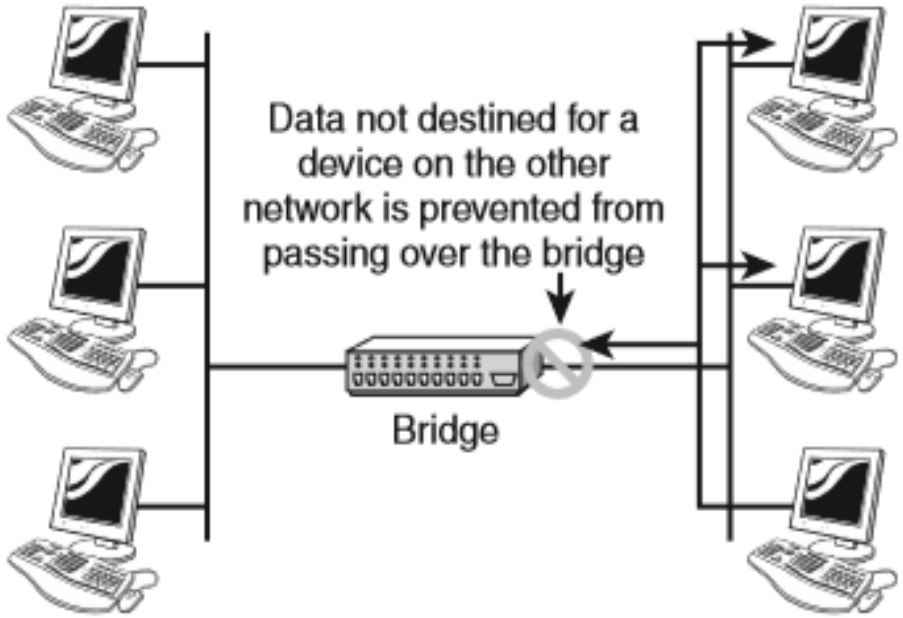


FIGURE 3.9 How a bridge works.

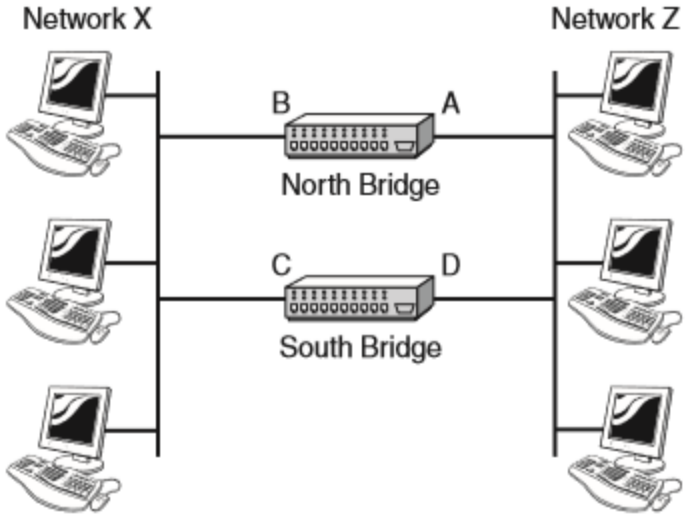


FIGURE 3.10 A network with two bridges.

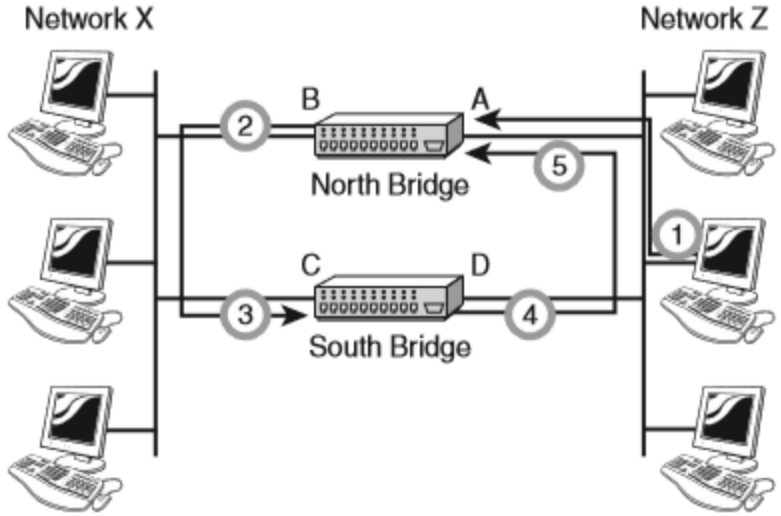
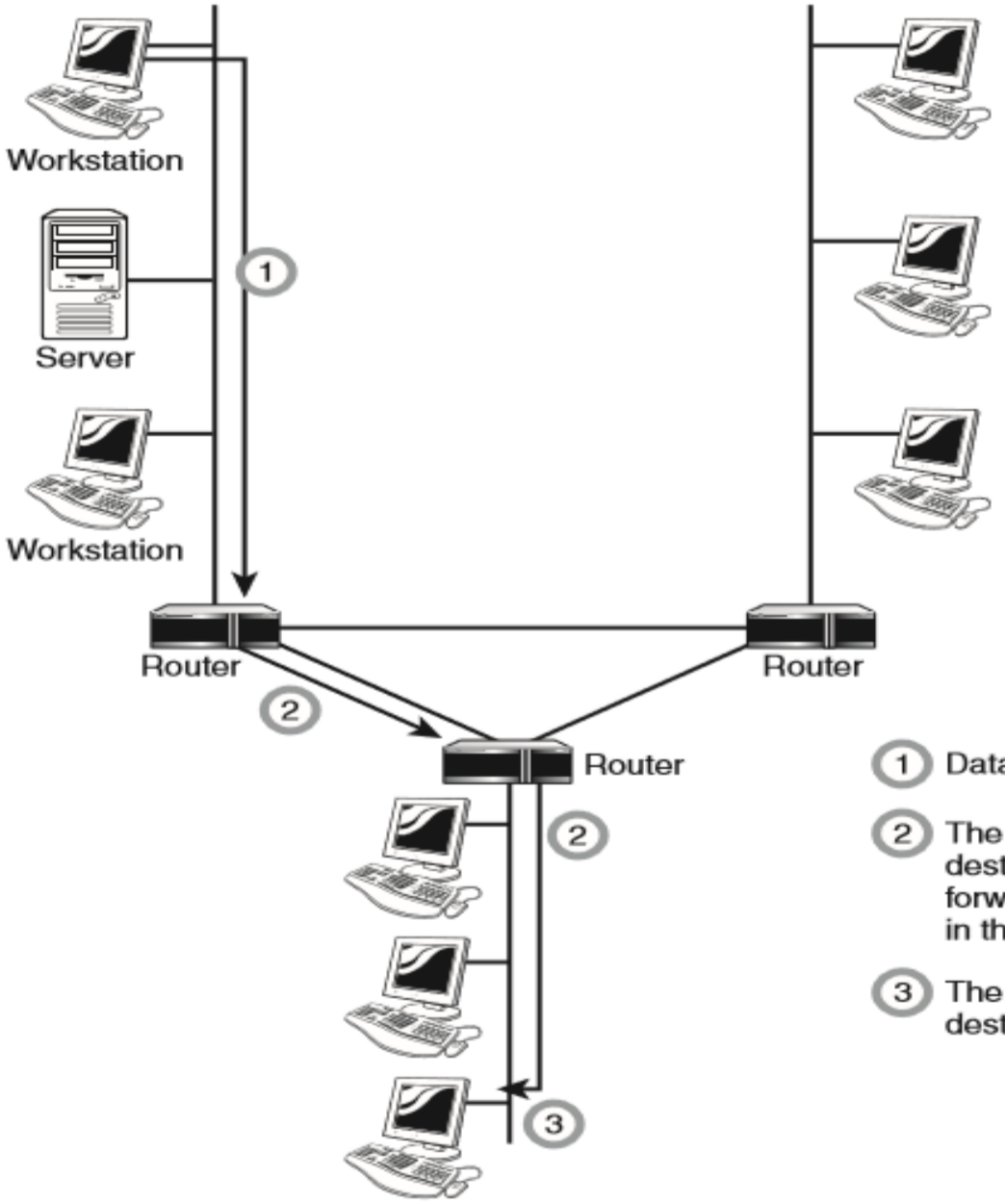


FIGURE 3.11 A bridging loop.

Routers

- Routers are network devices that literally route data around the network.
- By examining data as it arrives,
  - The router can determine the destination address for the data;
  - then, by using tables of defined routes,
  - the router determines the best way for the data to continue its journey.
  - Unlike bridges and switches, which use the hardware-configured MAC address
  - To determine the destination of the data, routers use the software-configured network address to make decisions.

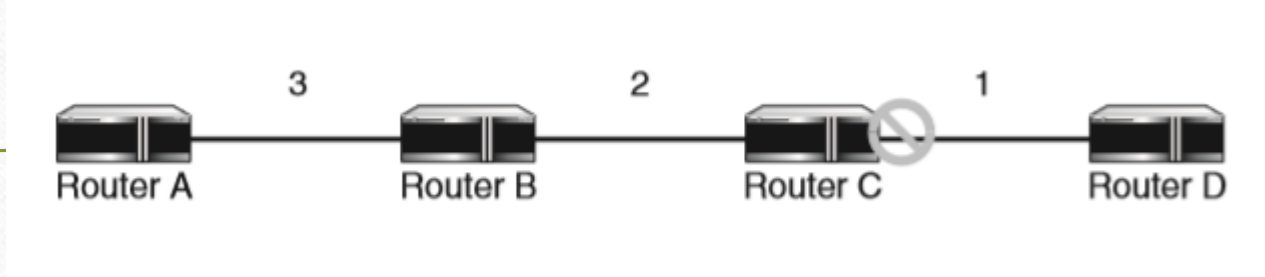


1. Data is sent to the router.
2. The router determines the destination address and forwards it to the next step in the journey.
3. The data reaches its destination.

FIGURE 3.12 The basic function of a router.

- When a change does occur on the network, it may take some time for all the routers to learn of the change.
- The process of each router learning about the change and updating its routing tables is known as convergence.
- Each time the route is added to the table, the hop count for the route increases—a problem known as **the count to infinity**.

How routing loops occur



- **Split horizon—**The split horizon algorithm **addresses the problem of routing loops** by not advertising routes back on the interface from which they are learned.
- **Split horizon with poison reverse—**With this strategy, also known simply as **poison reverse**, routers do advertise routes back on the interfaces from which they were learned, but **they do so with a hop count of infinity**.

Gateways

- The term gateway is applied to
  - Any device,
  - System, or
  - Software application
- that can perform the function of translating data from one format to another.
- The key feature of a gateway is that **it converts the format of the data**, not the data itself.

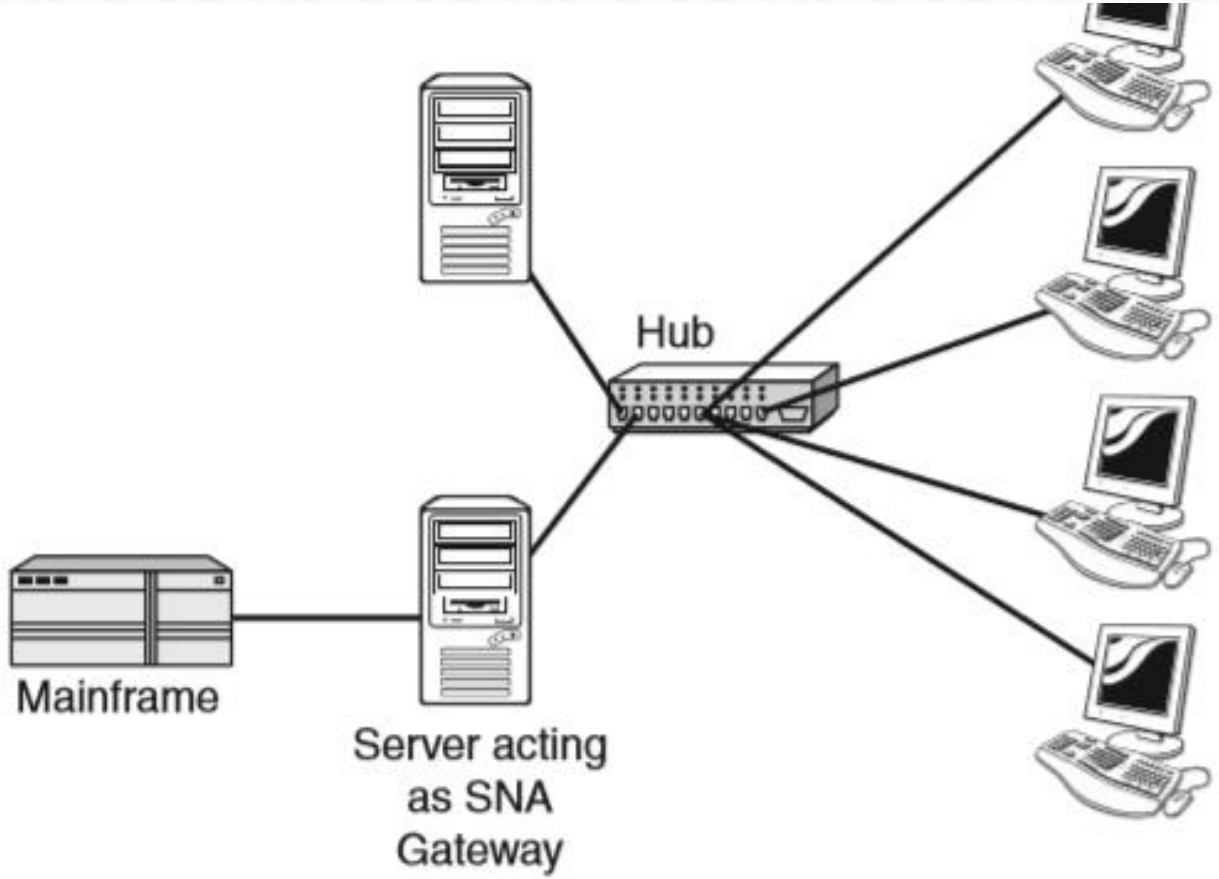


FIGURE 3.15 An SNA gateway.

- These systems transmit mail internally in a certain format.
- When email needs to be sent across the Internet to users using a different email system,
- The email must be converted to another format,
  - usually to Simple Mail Transfer Protocol (SMTP).
- This conversion process is performed by a software gateway.