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Data Communication

Outline

- Network device
- Hub operation
- Switch/Bridge operation
- Router operation
- Difference between Switch & Bridge
- Collision domain
- Broadcast domain

Network devices

- End-user Device: End-user devices include computers, printers, scanners, and other devices that provide services directly to the user.
- Hub, Switch & Bridge are network devices, they connect nodes to form a network
- Router, on the other hand, is an internetwork device, Router connect different networks together and forms an internetwork.

Hub

- Layer 1 device, because it does not understand any address
- Also called dummy or non-intelligent device.
- Can not filter data, because hub does not understand MAC or IP
- Hub environment is also call as :
  - Half duplex domain
  - Ethernet network
  - Shared bandwidth environment
  - 802.3 [an IEEE standard for ethernet network]
  - or collision domain

Hub

- In hub environment, only a single device is allowed to transmit data at the same time. if another device try to transmit data, collision occurs which discards both messages. Then a jam message generated to inform all device about the collision, after a specific time frame, each device then transmits the data in its own turn.
- When a hub receives a message then it floods the message because the hub can not read the destination MAC/IP. Flooding a message is sending a message out of all ports except the port it is received on.

Hub

- CSMA/CD: Carrier Sense Multiple Access/Collision Detect (CSMA/CD) is the protocol for carrier transmission access in Ethernet networks. On Ethernet, any device can try to send a frame at any time. Each device senses whether the line is idle and therefore available to be used. If it is, the device begins to transmit its first frame. If another device has tried to send at the same time, a collision is said to occur and the frames are discarded.
- Hub is old technology and is not used today.

Hub

- Or CSMA/CD helps devices share the bandwidth evenly while preventing two devices from transmitting simultaneously on the same network medium. CSMA/CD was actually created to overcome the problem of the collisions that occur when packets are transmitted from different nodes at the same time.
- All ports of a hub are in a single collision domain.
- A collision domain is a network segment in which only one device is allowed to transmit the data.

Switch & Bridge

- Is a layer2 device (data link layer device), because they filter data based on destination MAC address and MAC is a layer 2 address.
- The S/B environment is also called the full duplex or dedicated bandwidth environment where all devices can transmits data at the same time and each device has a dedicated bandwidth to the switch.
- Understands MAC address but not IP
- Switches keep a table of MAC addresses called MAC Table.
  - #show mac-address table

Switch & Bridge

- When a switch receives a message, the switch read the destination MAC address then:
- A. if the destination MAC is not available in the MAC Address Table, the message is flooded.
- B. if the destination MAC is available in the MAC Address Table, the message sent only to that specific Device.
- Switch is a new technology and mostly used today
- Each port of a switch is a single collision domain.

Switch & Bridge

- All ports of a switch are in a single broadcast domain.
- Broadcast domain is a network segment in which if a single device send a broadcast message, all other devices are forced to receive the message.
- Switches can be:
  - Static Switch Manageable
  - Dynamic Switch Not Manageable

Switch vs Bridge

Switch	Bridge
New technology	Old Technology
Mostly used today	Not used today
More Ports	Less Ports
Hardware Based (Uses ASIC Chip)	Software Based

Router

- Router is a layer 3 or Network Layer device because Router filters data based on the destination IP address.
- Routers understand both IP and MAC addresses
- Routers connect networks to form internetwork
- When a router receives a packet, it reads the destination IP addresses and forwards the packet to that specific Network.
- If the destination IP is not available in the Routing table of the Router, then the message is discarded.
- Routing table keeps information about all networks.

Router

- Each port of a router is a separate network or separate broadcast domain.
- Each interface of a router takes an IP address from a separate network class.
- Unlike Hub, Switch & Bridge, the routers block a broadcast message by default. If the router does not block broadcast, a single broadcast must reach to all internet connected devices and the traffic may cause the entire internet down.

Main Functions of a Router

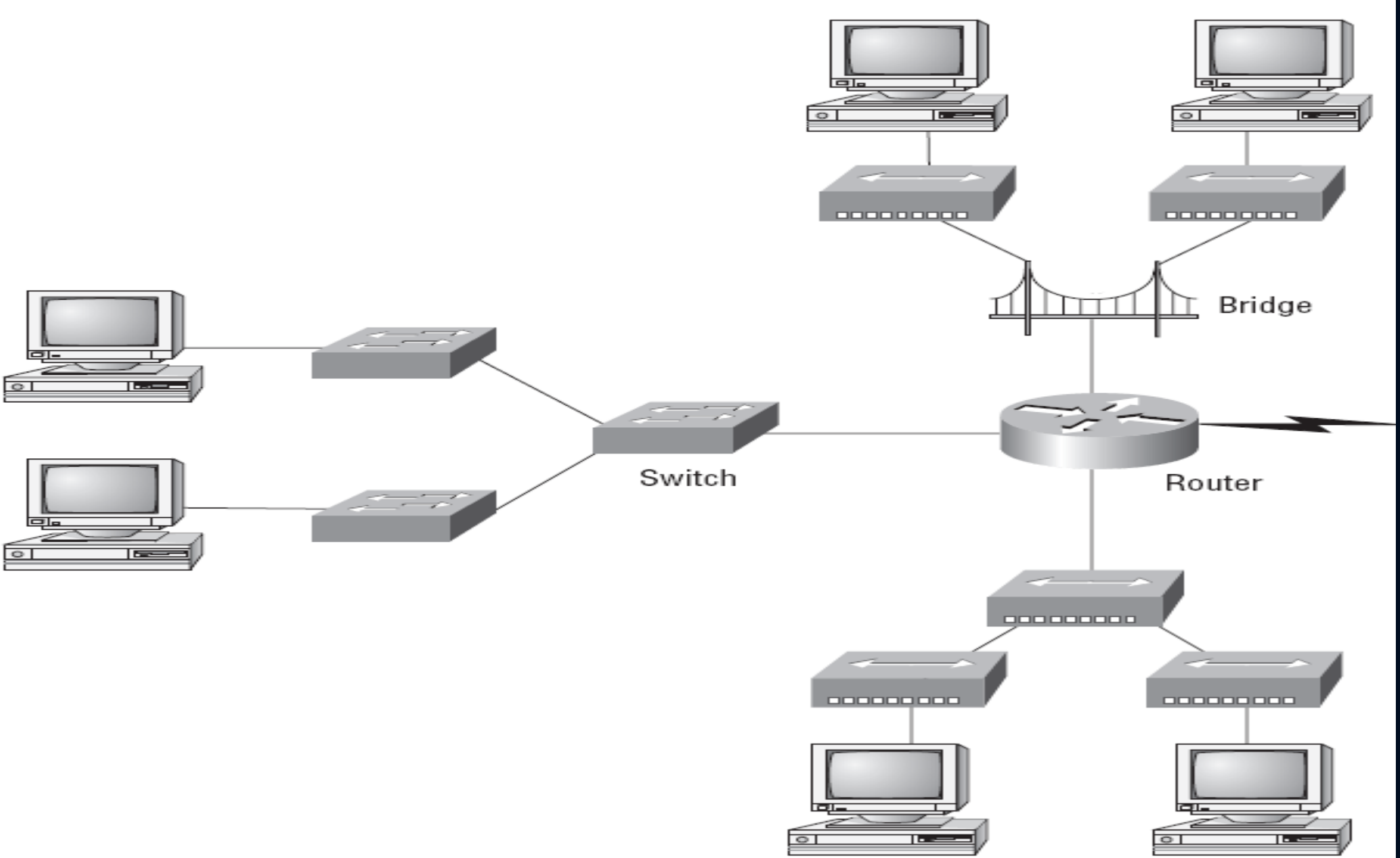
- Packet switching
- Packet filtering
- Best path selection
- Internetwork communication
- Blocks broadcast by default

Collision Domain

- A collision domain is a network segment in which only one device is allowed to transmit the data.
- While determining the number of collision domains in a topology, we must count the number of Switch/Bridge ports used.

Broadcast Domain

- Broadcast domain is a network segment in which if a single device send a broadcast message, all other devices are forced to receive the message.
- While determining the number of broadcast domains (Networks) in a topology, we must count the number of router ports used.


Bridge
Switch
Router

References

- Chapter 01 & 02 of Cisco CCNA book: CCNA Routing and Switching Study Guide - Lammle, Todd

THANK YOU