▶ UNIVERSIDAD FRANCISCO DE PAULA SANTANDER

DOMINIOS DE COLISION, SEGMENTACION Y VLAN

CISCO SYSTEMS

NETWORKING
ACADEMY

UFPS

EN EL FUTURO DE TODOS

Academia Local

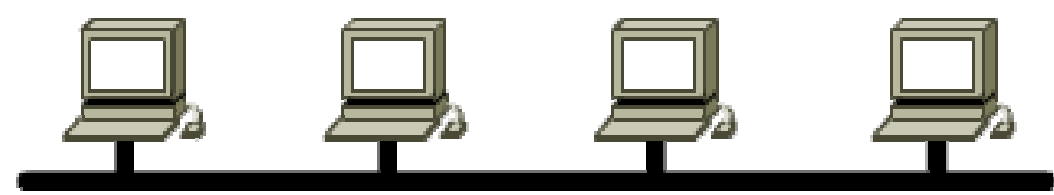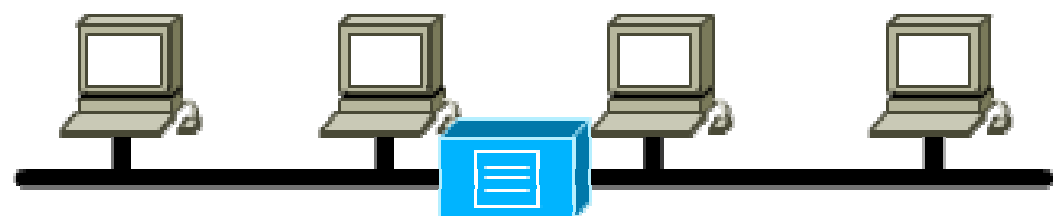Ing. José Martín Calixto Cely

COLLISIONS

AND

COLLISION DOMAINS

▶Types of Networks

Directly Connected

Shared Media (multiple access)

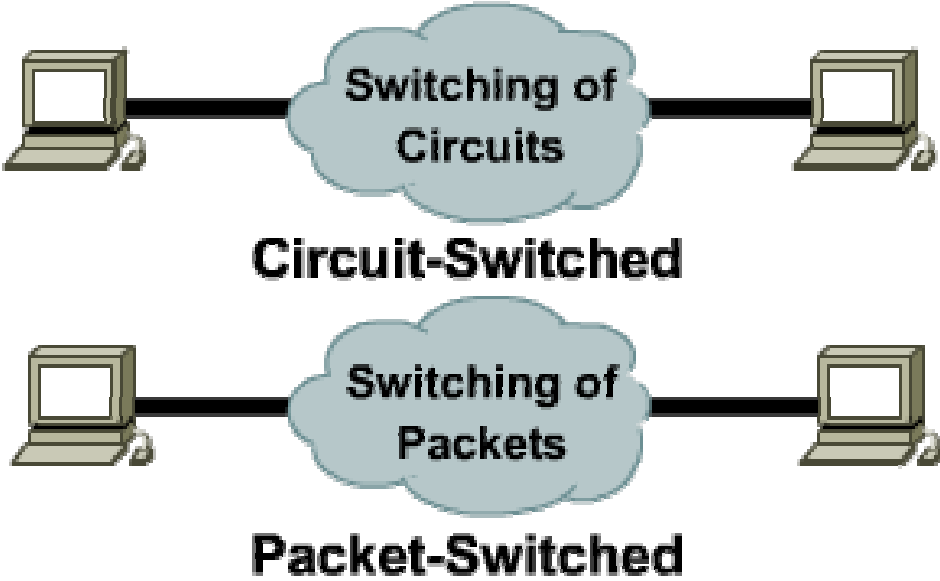Extended Media
(multiple access with layer 1 networking device)
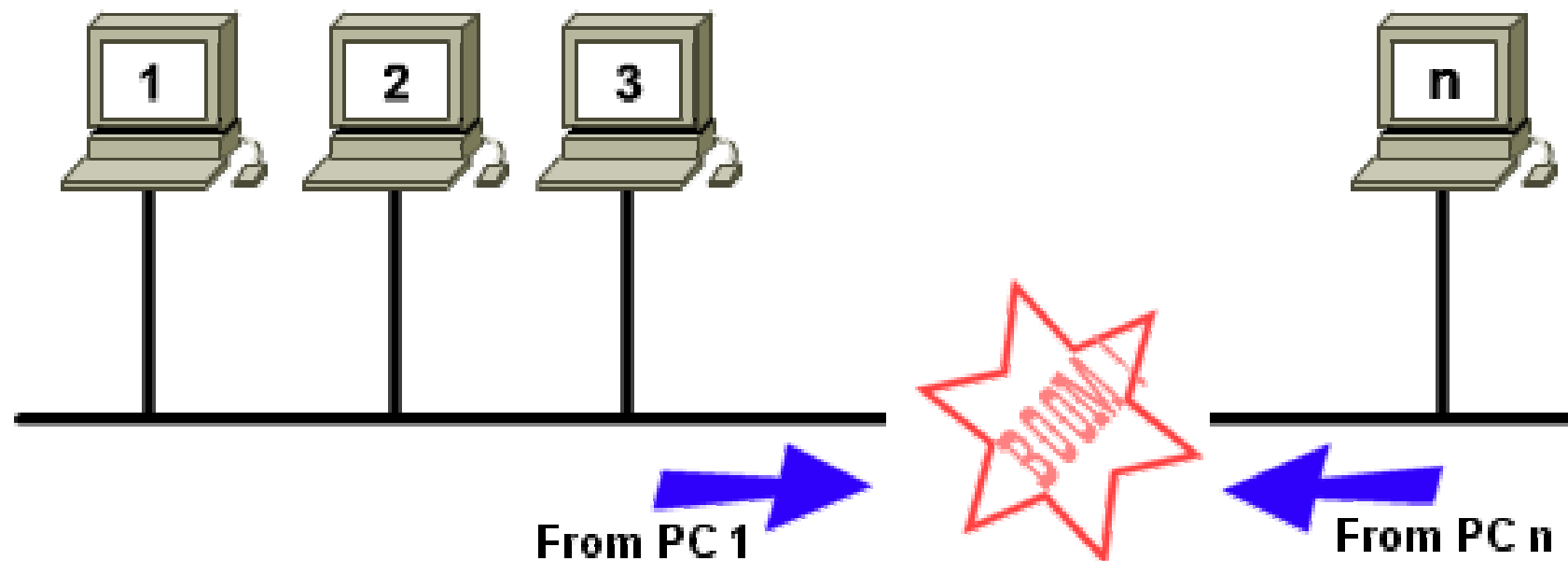
Point to Point

Shared media environment

▶Types of Networks

Indirectly
Connected

Switching of
Circuits

Circuit-Switched

Switching of
Packets

Packet-Switched

Packet switching vs. Circuit switching

▶Collisions

From PC 1   From PC n

- **More than one node attempts to transmit at the same time.**

- **Collisions occur in broadcast topology:**
  - **Ethernet LAN technology.**

▶Collisions
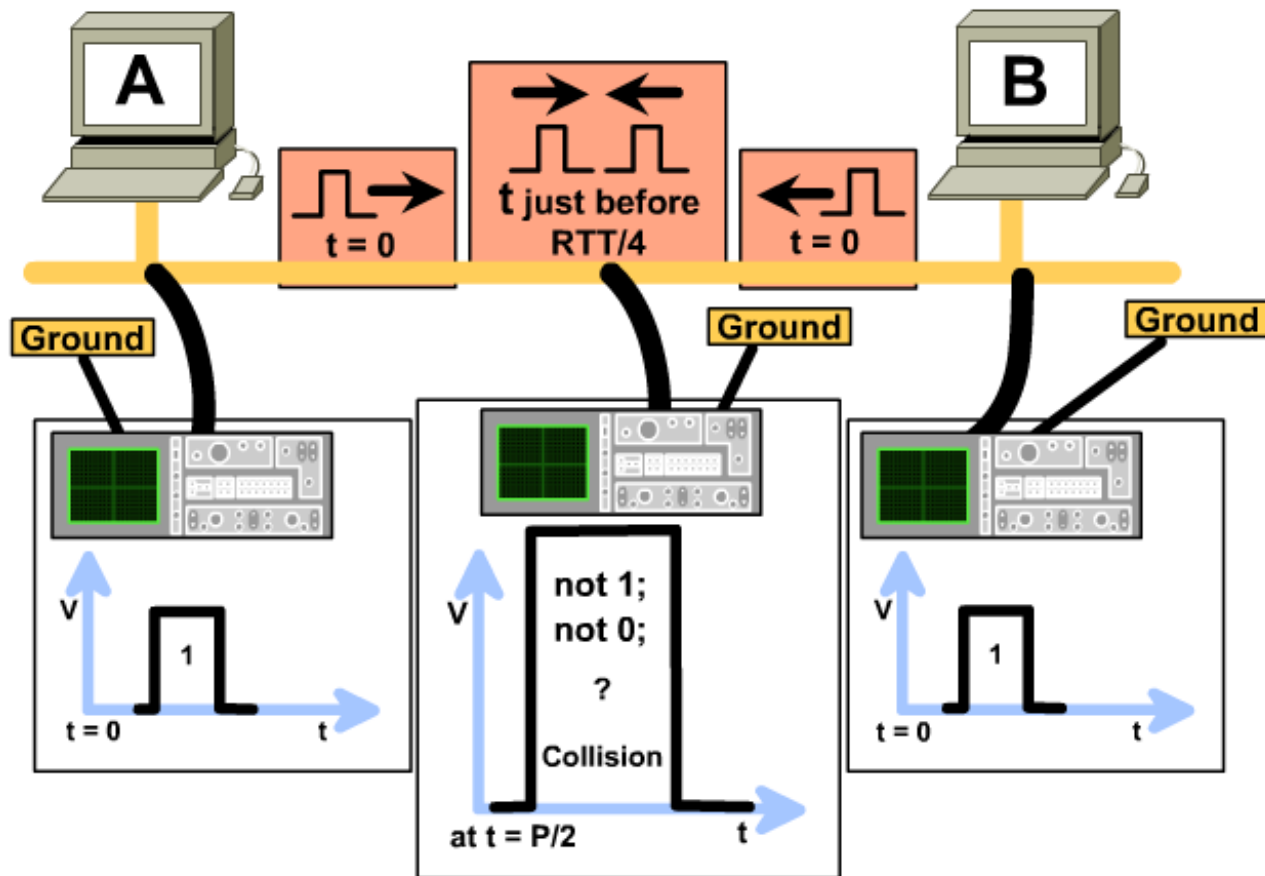
- **A collision happens when two bit are on a point of media at the same time.**
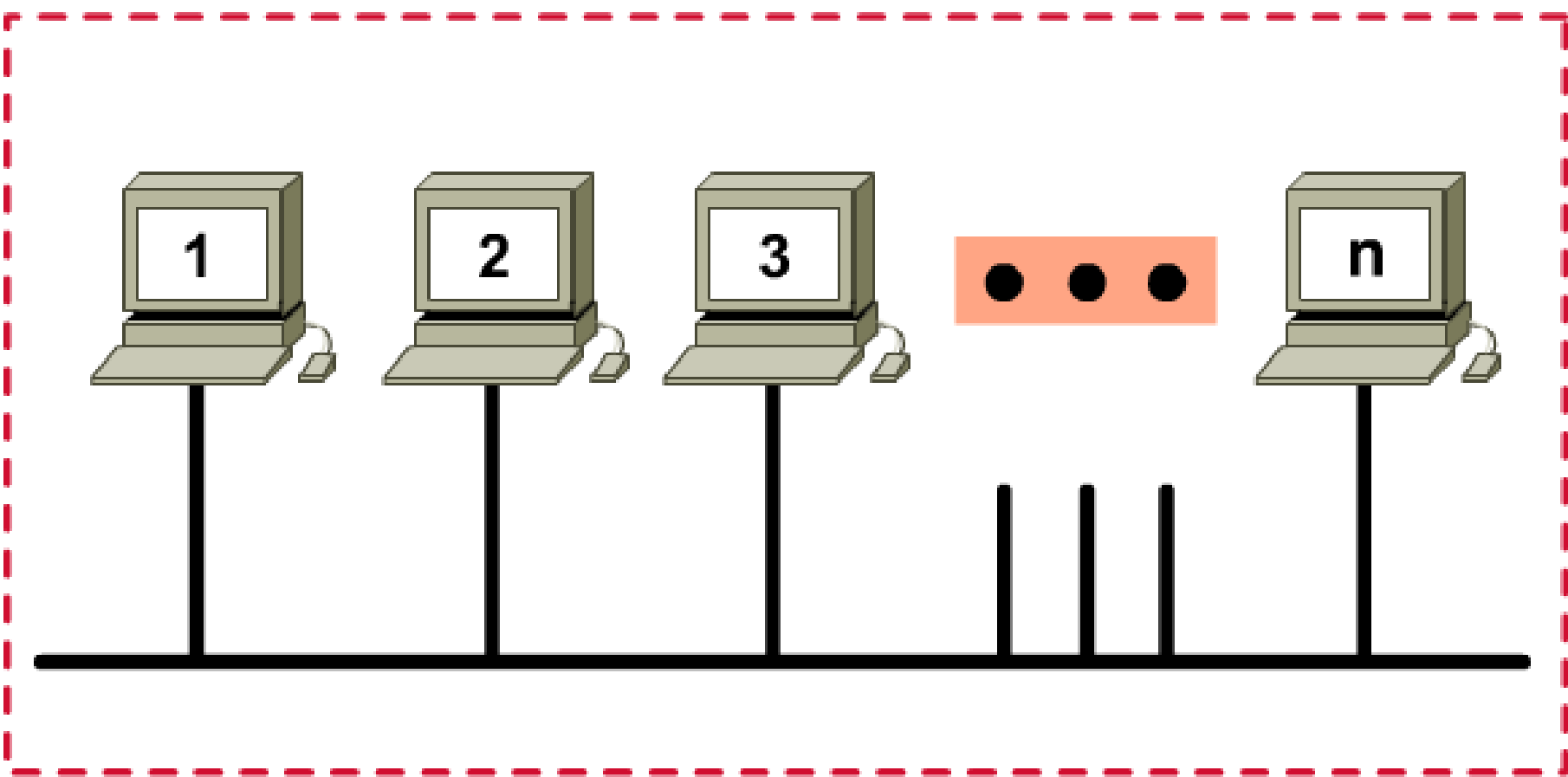
Ethernet technology: Collision Detect

- **Allow only one data packet to access the cable at any one time.**
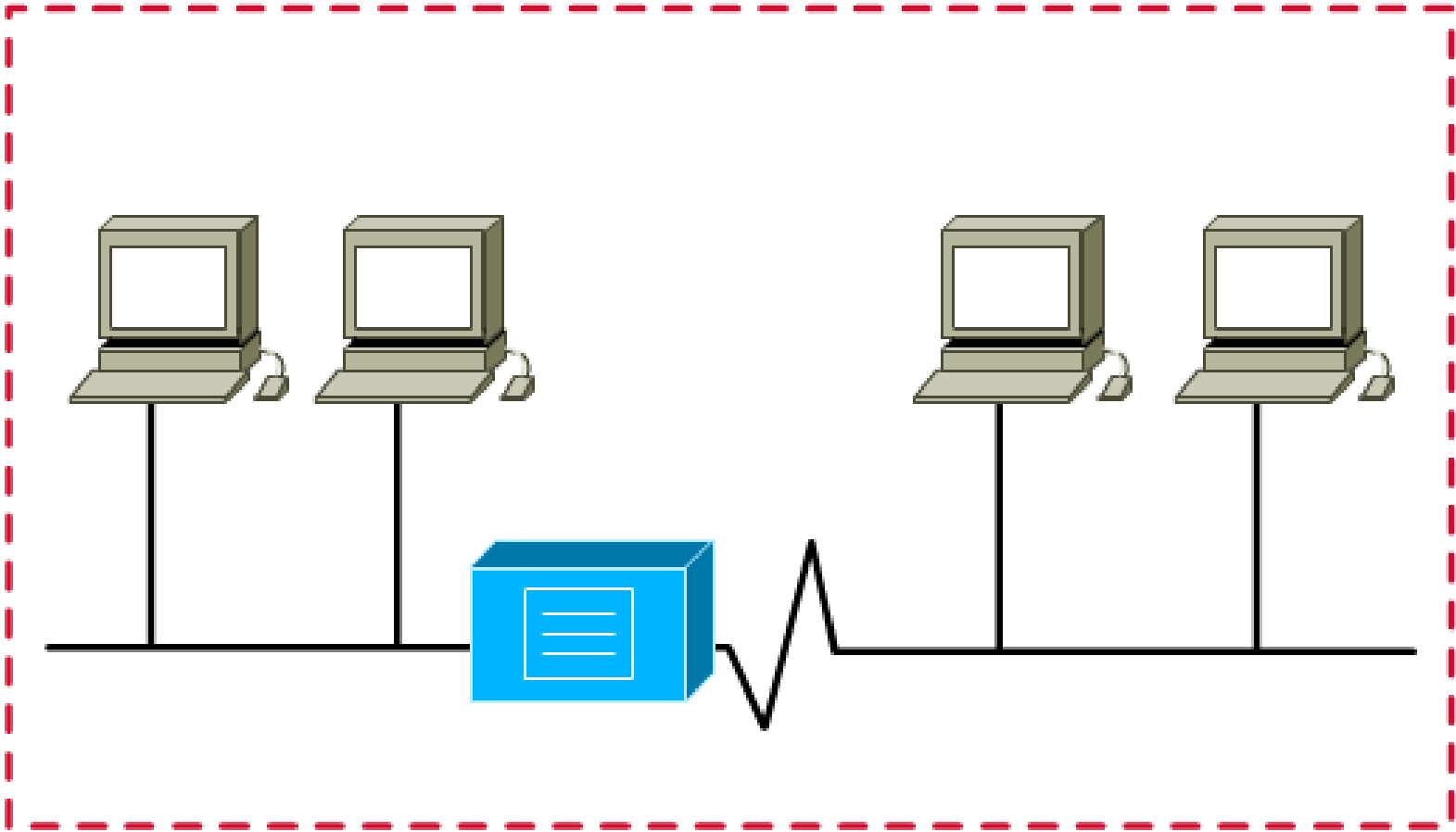
▶Collisions domain

- **Collision Domains are the area where collisions occur.**

- **Layer 1 devices will not solve collision problems.**

- **Layer 1 devices simply extend collision domains.**

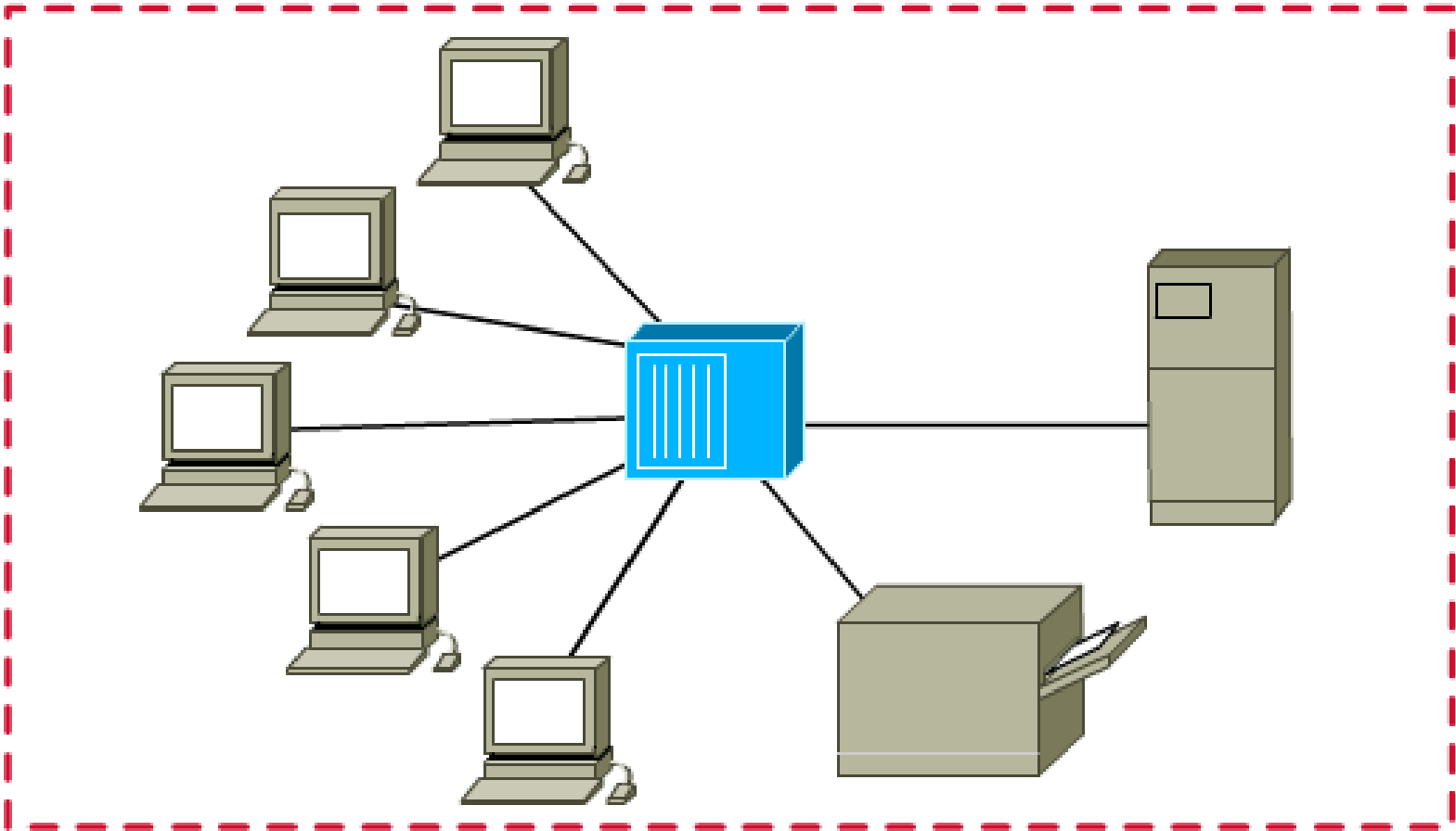# ▶Collisions domain: Share access

• **Limits the number of computers**

Collisions domain: Repeater

- **Propagate collisions**

Collisions domain: HUB

- **Propagate collisions**
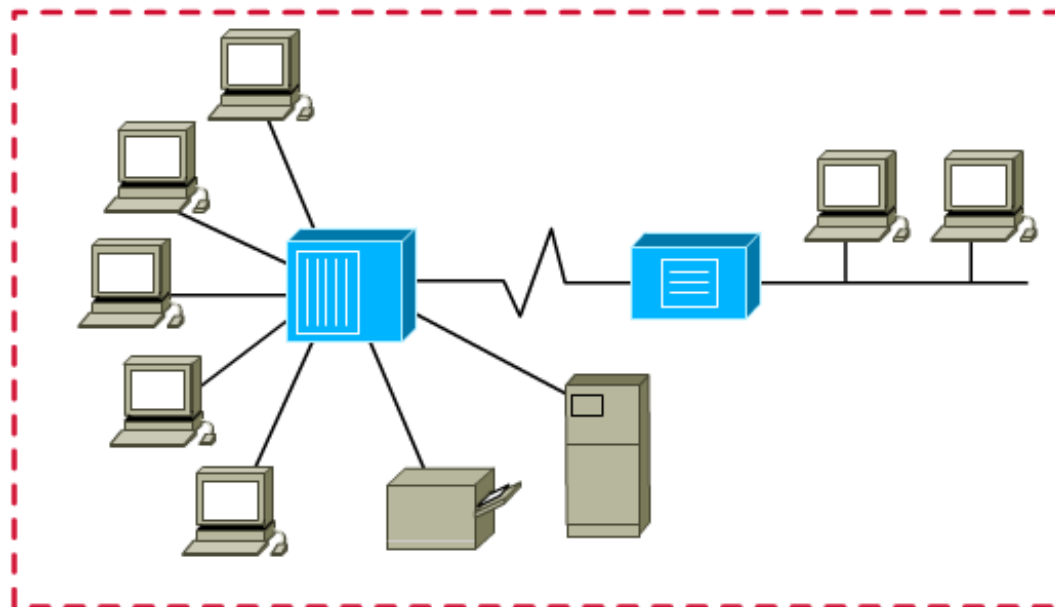
Collisions domain

- **All of layer 1 interconnections are part of the collision domain.**

- **Extending a network with a repeater or a hub, results in a larger collision domain.**

▶4 repeater rule

- **Ethernet technology.**

- **No more than 4 repeaters or hubs can be between any two computers on collision domain.**

- **Maximum round trip time:**

  – **Max RTT = 512 bit time = 51.2μs.**

- **Max RTT = wait for next transmission.**

▶4 repeater rule
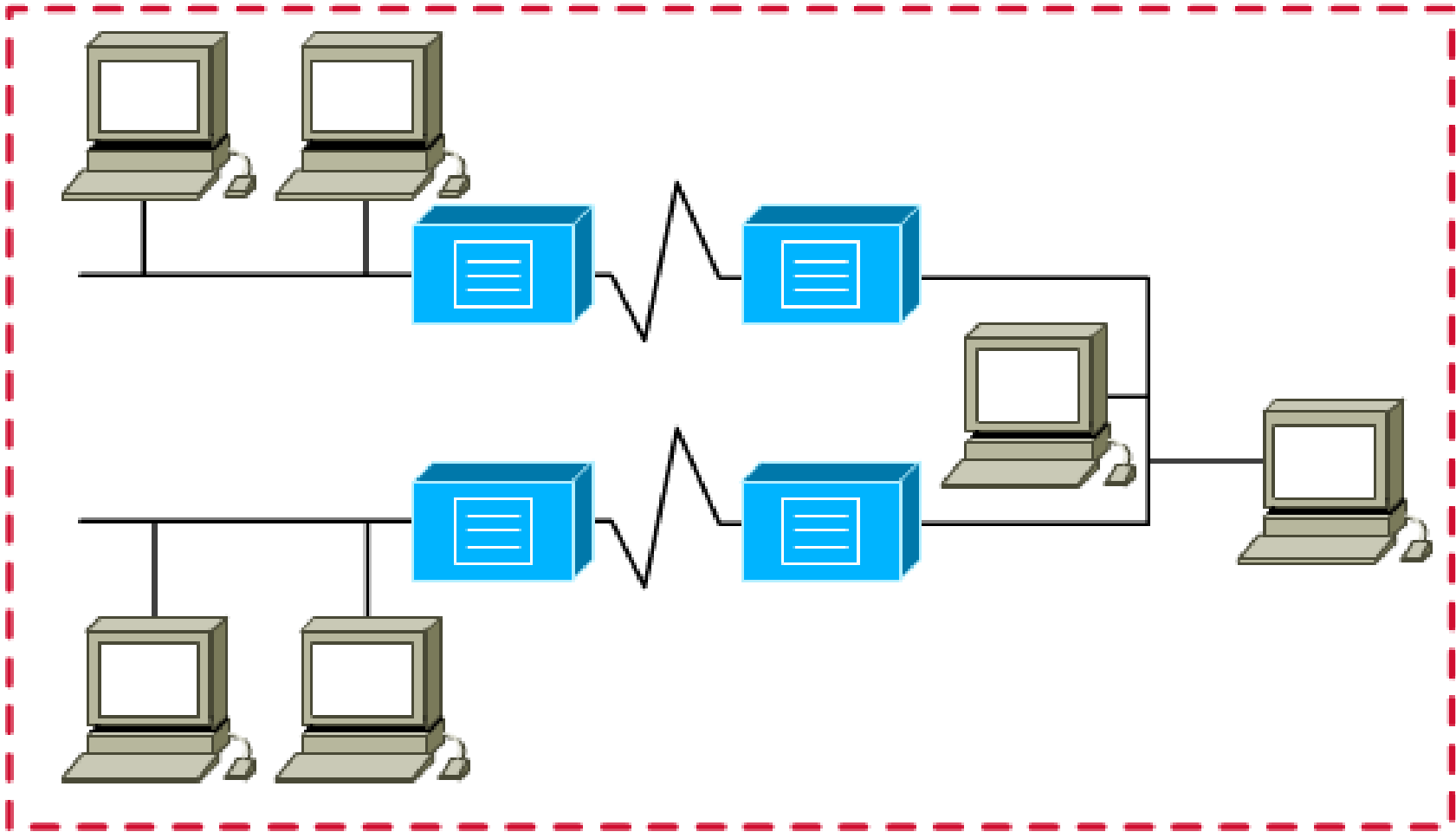
- **5.4.3.2.1 Rule**

▶5-4-3-2-1 rule

- **5** sections of the network.

- **4** repeaters or hubs.

- **3** sections of the network are "mixing" sections (with hosts).

- **2** sections are link sections (for link purposes).

- **1** large collision domain.

Collision Domain Segmentation

- **Layer 1 devices will not segment a collision domain. Why?**

- **Segmentation is the process of dividing a collision domain into two or more collision domains.**

- **The only way to segment a collision domain is to use a device that can filter network traffic.**

- **What devices are capable of filtering?**

▶Segmenting Collision Domain

OR

OR
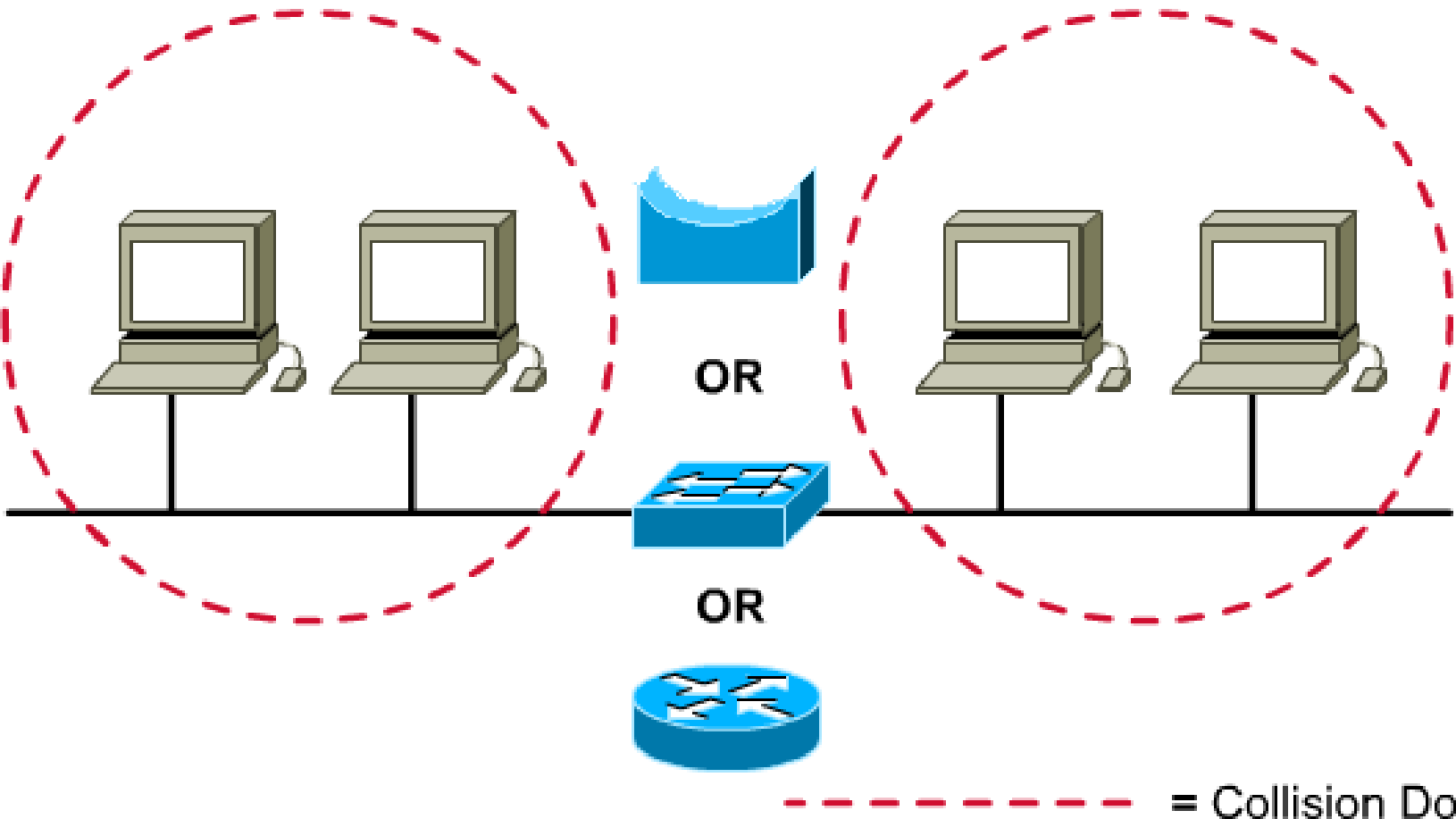
- - - - - - - - - - - - - - = Collision Domain

▶Packet Flow: Layer 2 Device

End Node		End Node
Application		Application
Presentation		Presentation
Session		Session
Transport		Transport
Network		Network
Data Link		Data Link
Physical		Physical
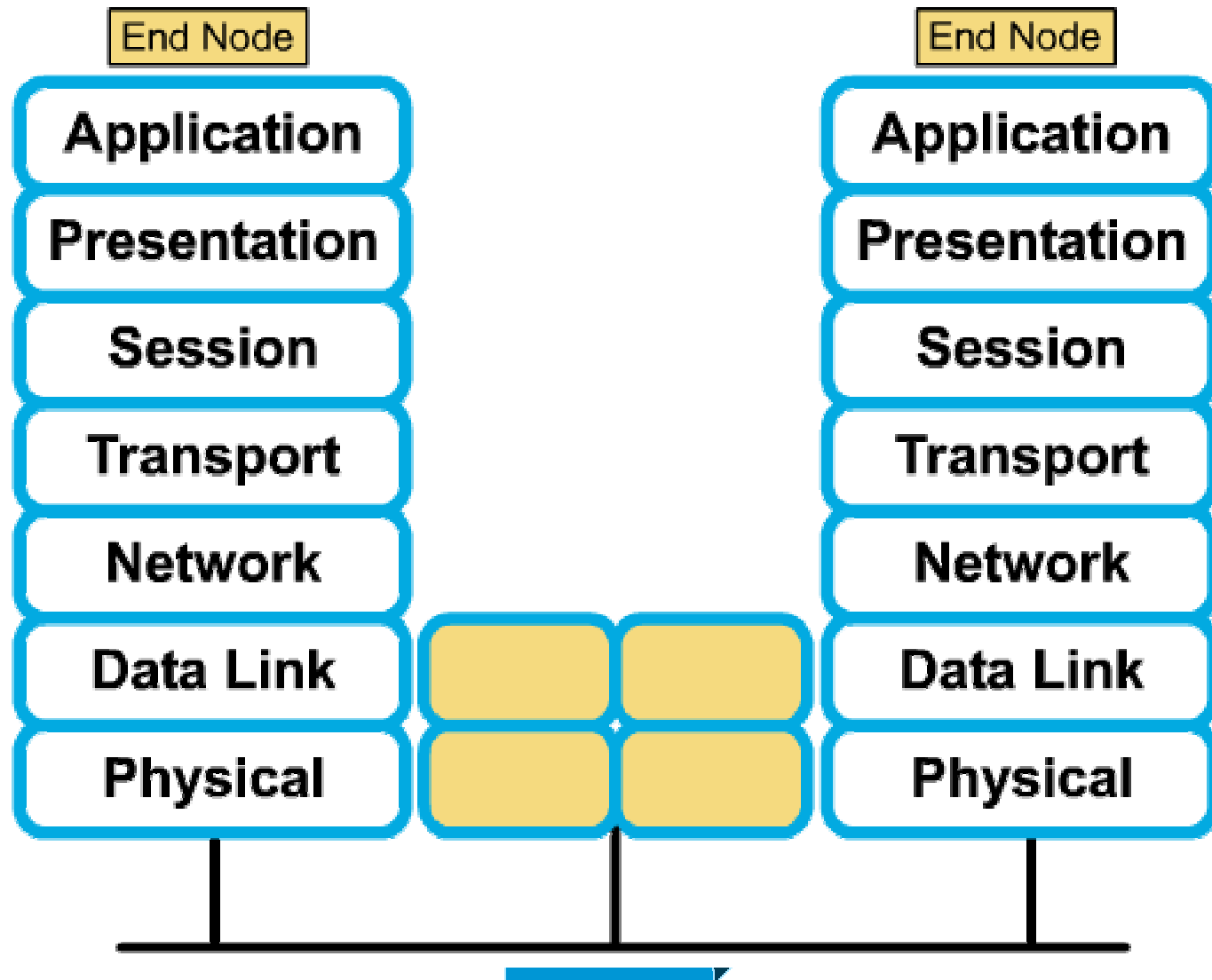
▶Packet Flow: Layer 3 Device

End Node

| Application |
| Presentation |
| Session |
| Transport |
| Network |
| Data Link |
| Physical |

End Node

| Application |
| Presentation |
| Session |
| Transport |
| Network |
| Data Link |
| Physical |
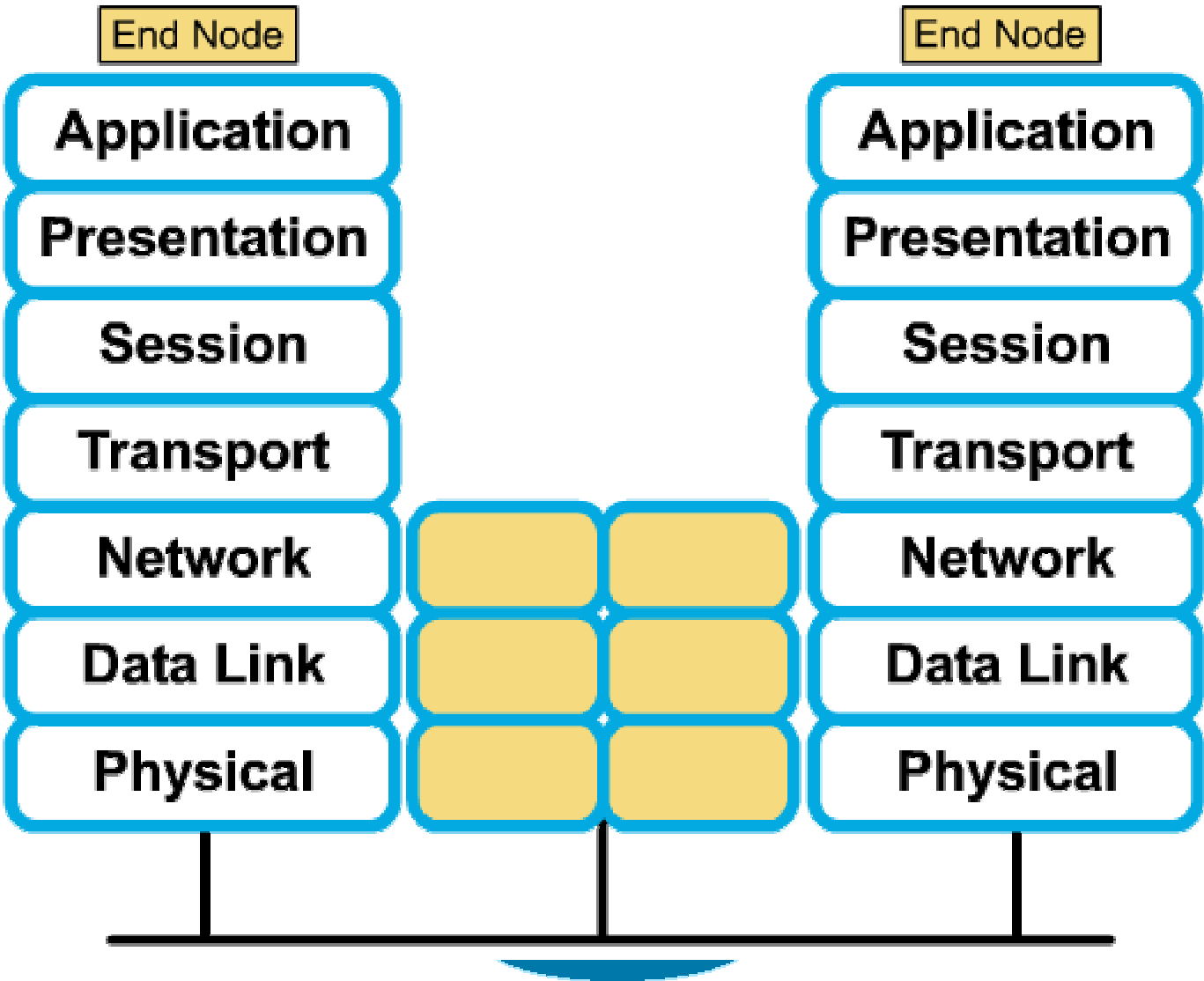
Segmenting Collision Domain
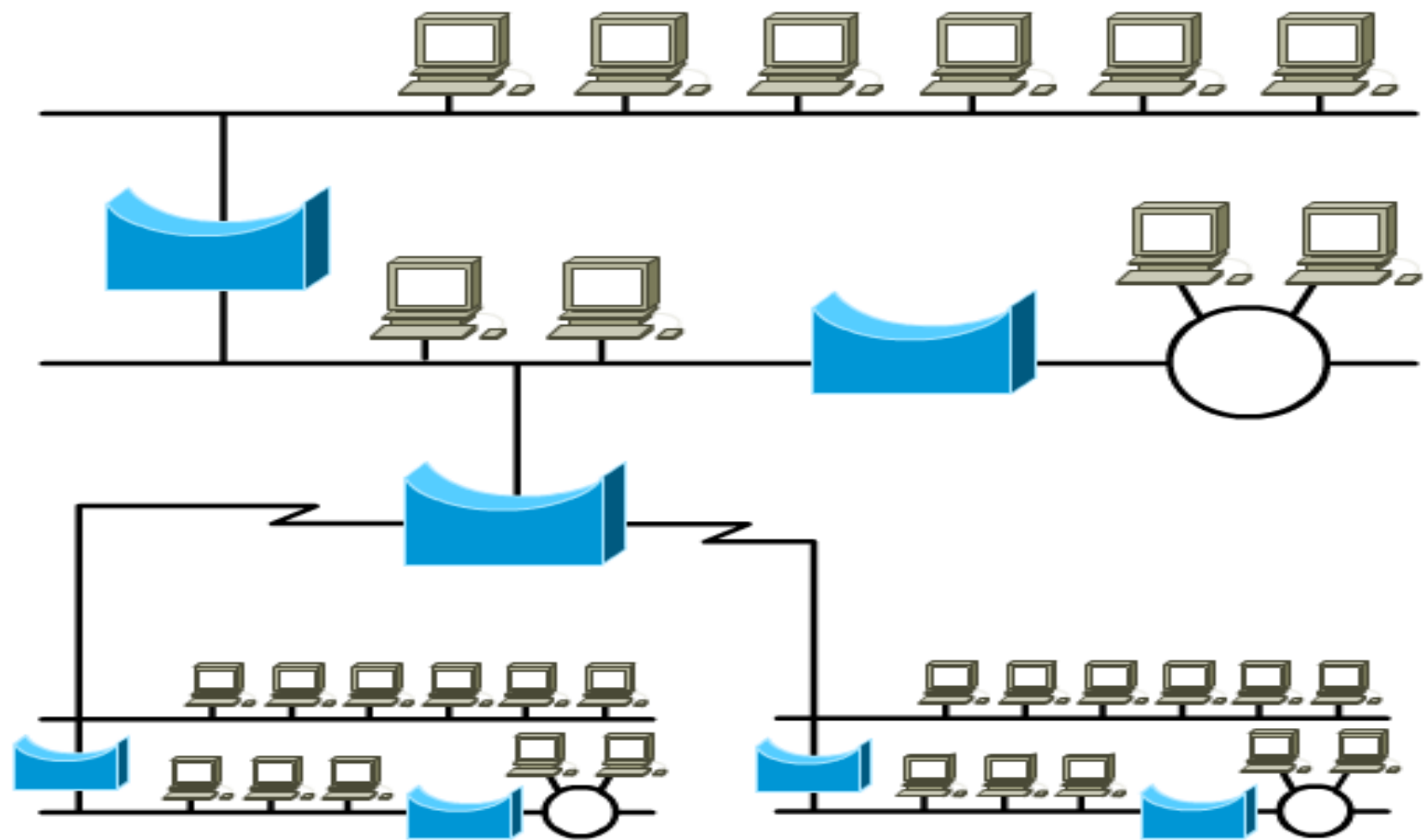
Problem: Too much traffic

Equipos de Red - Capa 1
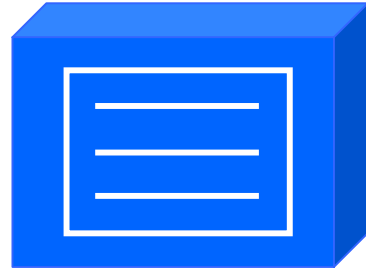
Repeater

Transceiver
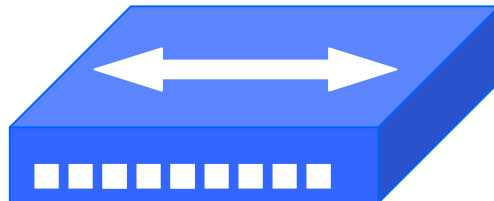
Hub

Repetidor

- Regenera y retemporiza la señal.

- Utilizado cuando el cableado de una red se extiende más allá de su capacidad.

- Se debe tener en cuenta la Norma 5-4-3.This rule states that you can connect five network segments end-to-end using four repeaters but only three segments can have hosts (computers) on them.

- Dispositivos de Capa 1, que actúan sólo a nivel de bits.
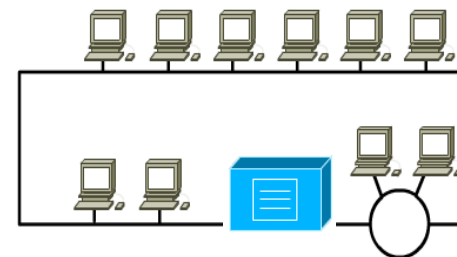
▶Transceiver

Cat 5 UTP   Fiber
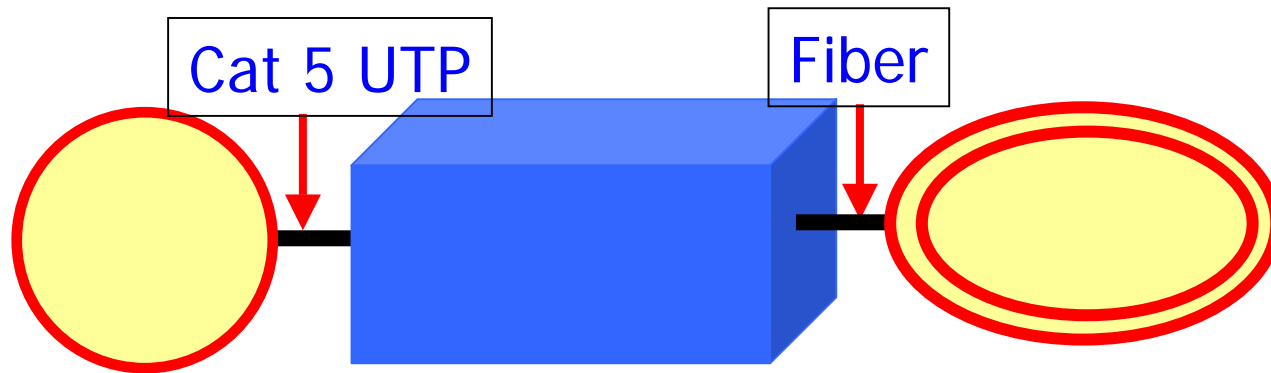
- <u>Trans</u>mitter y R<u>ec</u>eiver de señales electrónicas—repetidor especializado.

- Conecta diferentes tecnologías de medios

- También llamadas como MAU (Media Attachment Unit)

▶Hub

The Cloud
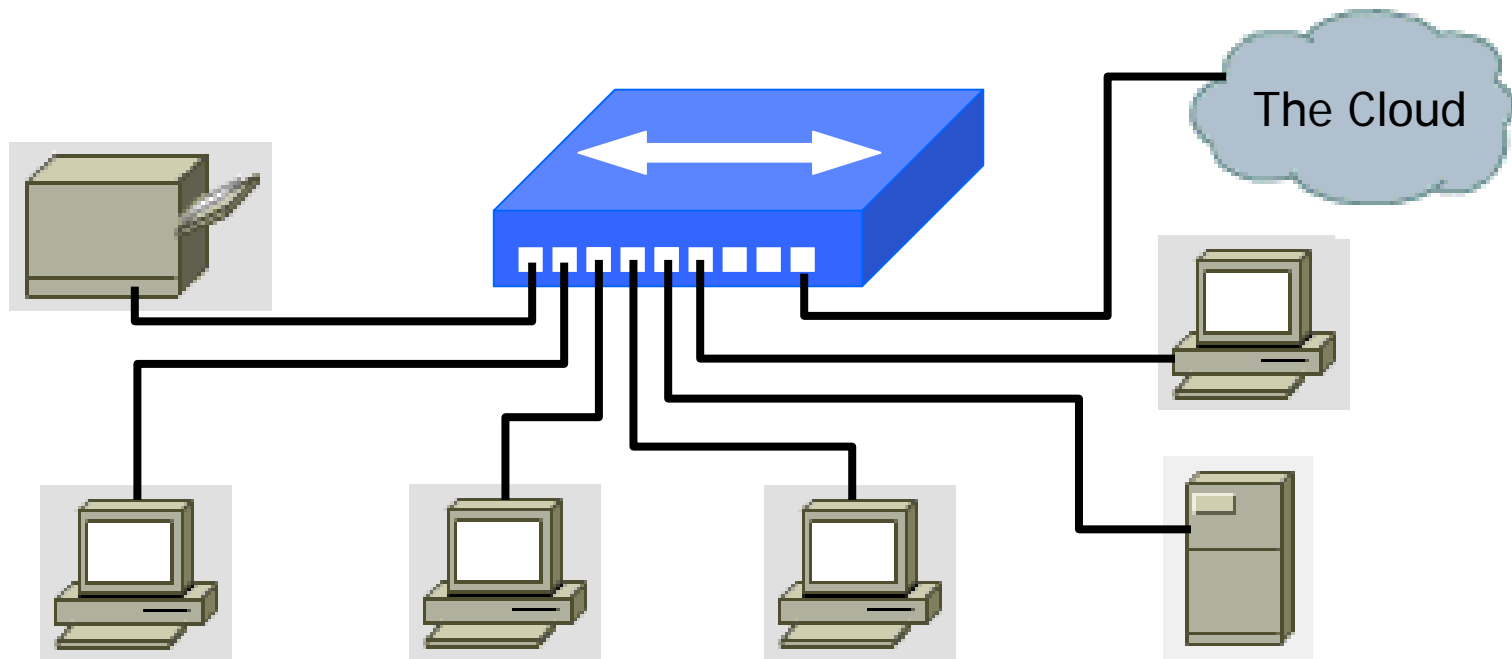
- **Simplemente es un repetidor Multipuerto.**

- **Utilizado para conectar varios equipos en un solo punto (topología estrella).**

Equipos de Red - Capa 2

Bridge

Switch

Bridge
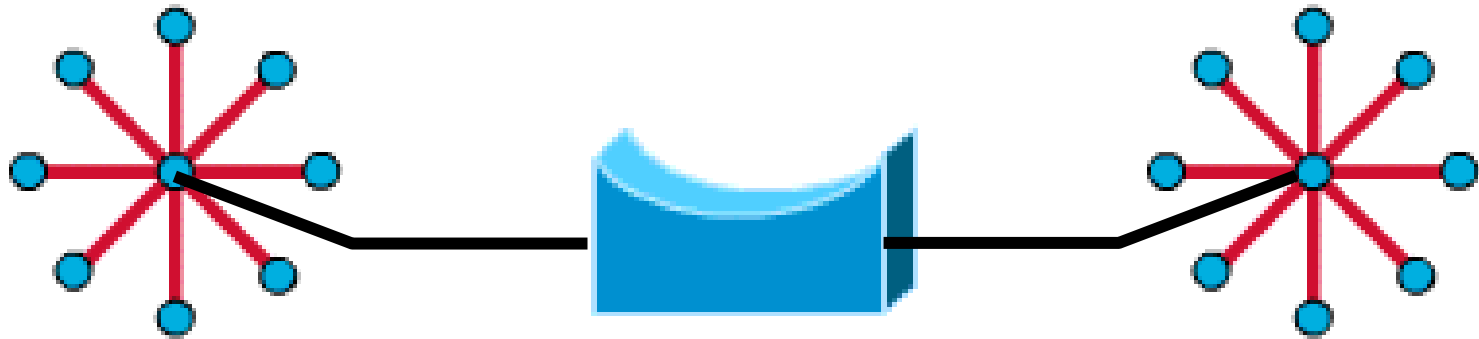
- **Conecta dos segmentos de red.**

- **Filtra el tráfico local basado en las direcciones MAC (físicas) de los equipos.**

- **Crea una lista de direcciones MAC para toma de desiciones**

▶Switch

The Cloud
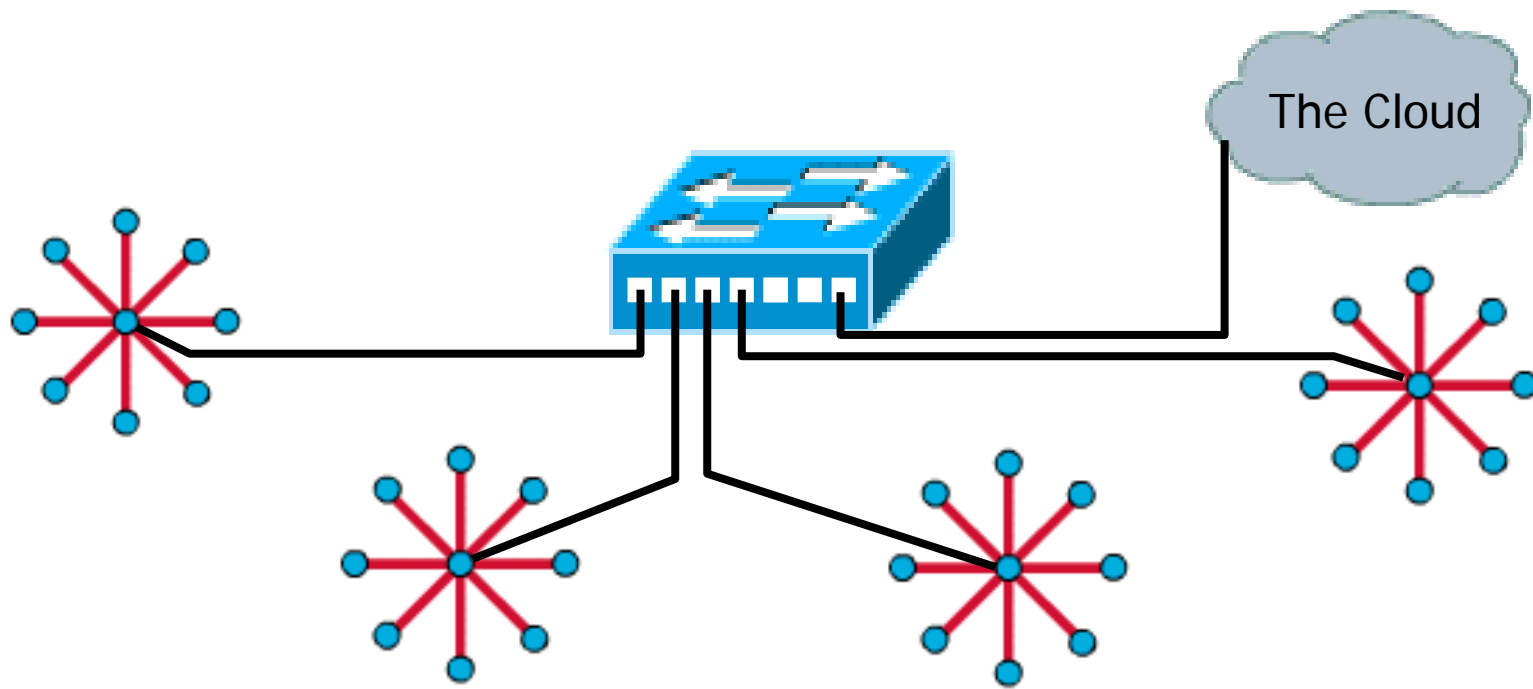
- **Conecta multiples segmentos de redes.**
- **Puede considerarse un bridge multi-puerto**
- **Suministra a cada puerto el ancho de banda total**

Equipos de Red - Capa 3

Router

▶LAN Segmentation

- ## Benefits of Segmenting the Network

  - ◆By segmenting a LAN fewer devices are sharing the same bandwidth, improving performance of a shared media LAN

  - ◆Each segment is considered its own collision domain

  - ◆How many broadcast domains in graphic?

Collision Domains

Collision Domain 4

Bridge — LAN switch — Router

10 Mbps

Collision Domain 1   Collision Domain 2   Collision Domain 3
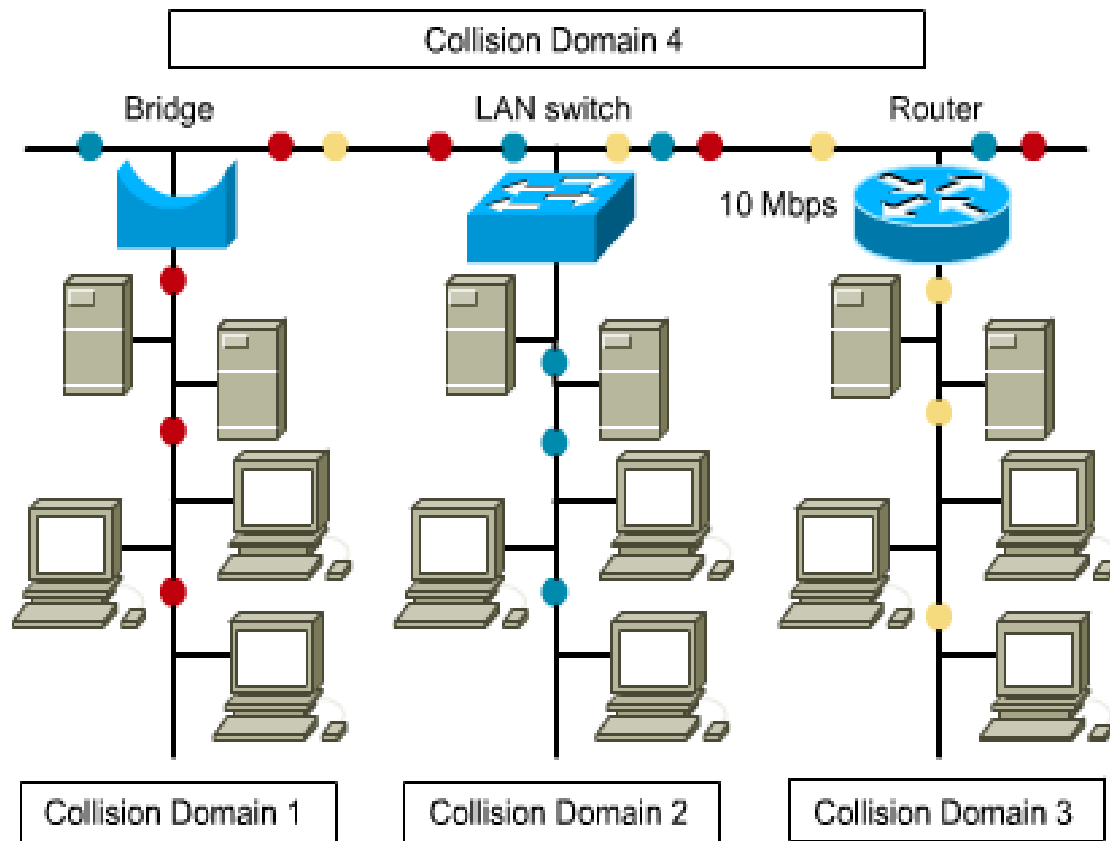
Segmenting with Bridges

- **Bridge Operation**

  - **Bridges "learn" a network's segmentation by building address tables that contain:**

    - **Bridge interface that will reach that device**

    - **Each device's MAC address**

Interface	MAC address
E0	0260.8c01.1111
E0	0260.8c01.2222
E1	0260.8c01.3333
E1	0260.8c01.4444

0260.8c01.1111

0260.8c01.2222

E0   E1

0260.8c01.3333

0260.8c01.4444
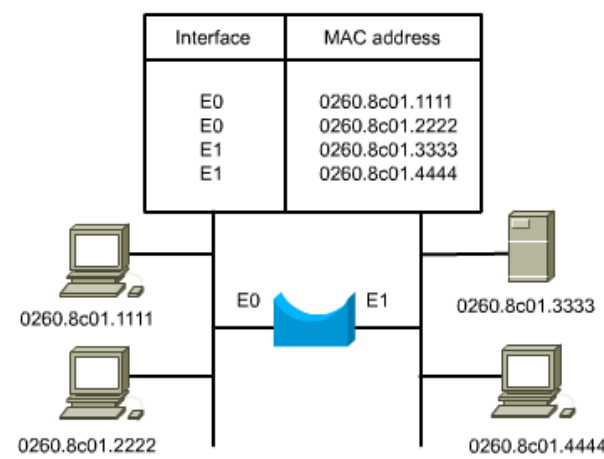
Segmenting with Bridges

- **Generic Frame Format**

    - **Frame can be any length depending on technology**

    - **Ethernet frame can be up to 1522 bytes long**

    - **Address section is 12 bytes (6 bytes for**

    –

Start Frame	Address	Type/ Length	Data	FCS	Stop Frame

Segmenting with Bridges

- **Bridge Performance**
  - **adds 10% to 30% latency due to decision-making process**
  - **considered a <u>store-and-forward</u> device because it must calculate the CRC at the end of the frame to check it for errors before forwarding**
  - **if the bridge does not have an entry for the destination MAC, it...**
    - **adds the source MAC to its bridging table**
    - **forwards the frame out all interfaces except the one it was received on**
    - **when a reply returns, it adds the destination MAC to the table**

▶Segmenting with Routers

- **Router Operation**
  - **Routers...**
    - **use layer 3 addressing (IP, IPX) and routing protocols (RIP, IGRP) to determine the path and**
    - **switch the packet out the correct interface to the destination**
  - **because a router must open the packet to read Layer 3 addressing, it adds latency**
  - **In addition, protocols like TCP which require acknowledgments of every packet can increase latency, reducing throughput from 20% to 40%**

▶Segmenting with Routers

- **Router Benefits**
  - **Like switches, routers segment collision domains.**
  - **However, since a router will not forward broadcasts, it also segments broadcast domains.**
  - **Each router interface represents its own broadcast domain.**

Segment 2

Hub

Segment 1

Hub

Hub

Hub
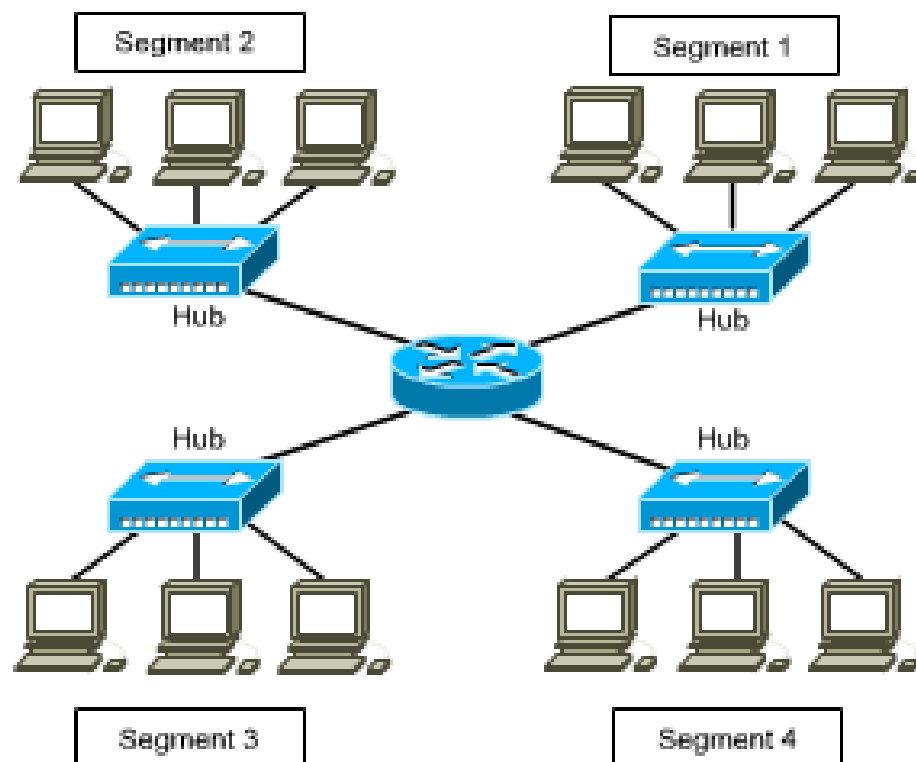
Segment 3

Segment 4

Segmenting with Switches

- **Switching Benefits**
  - **a switch is simply a multi-port bridge, making forwarding decisions based on MAC addresses**
  - **so, like a bridge, segmenting a LAN with a switch creates more collision domains**
  - **replacing hubs with switches therefore decreases congestion and increases available bandwidth.**
  - **a switch can <u>microsegment</u> a LAN creating collision-free domains but still be in the same broadcast domain.**
  - **switch creates a virtual circuits, allowing many users to communicate in parallel.**

Memory Buffering

- **Defined**
  - **Area of memory in a switch where destination and transmission data are stored** until it can be switched out the correct port.
- **Two types**
  - **Port-based memory buffering**
    - packets are stored in a queue on each port
    - possible for one packet to delay transmission of other packets because of a busy destination port
  - **Shared memory buffering**
    - common memory buffering shared by all ports
    - allows packets to be RX on one port and TX out another port without changing it to a different queue.

Two Switching Methods

- **Store-and-Forward**

  – **The switch receives the entire frame, calculating the CRC at the end, before sending it to the destination**

- **Cut-through**

  – <u>**Fast forward switching**</u>**--only checks the destination MAC before immediately forwarding the frame**

  – <u>**Fragment Free**</u>**--reads the first 64 bytes to reduce errors before forwarding the frame**

7 bytes	1 byte	6 bytes	6 bytes	2 bytes	Max 1500 bytes	4 bytes
Preamble	SFD	Dest. Address	Source Address	Length	Data	FCS

Fast Forward
Lowest Latency
No error checking
(Default)

Store-and-Forward
Highest Latency
All errors filtered

Fragment Free
Low Latency
Checks for collisions
(Filters most errors)