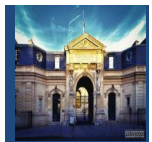
CNAM DE PARIS

RSX 101

Commutation dans les LAN's

CNAM Melun



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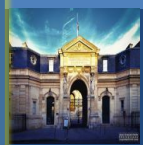
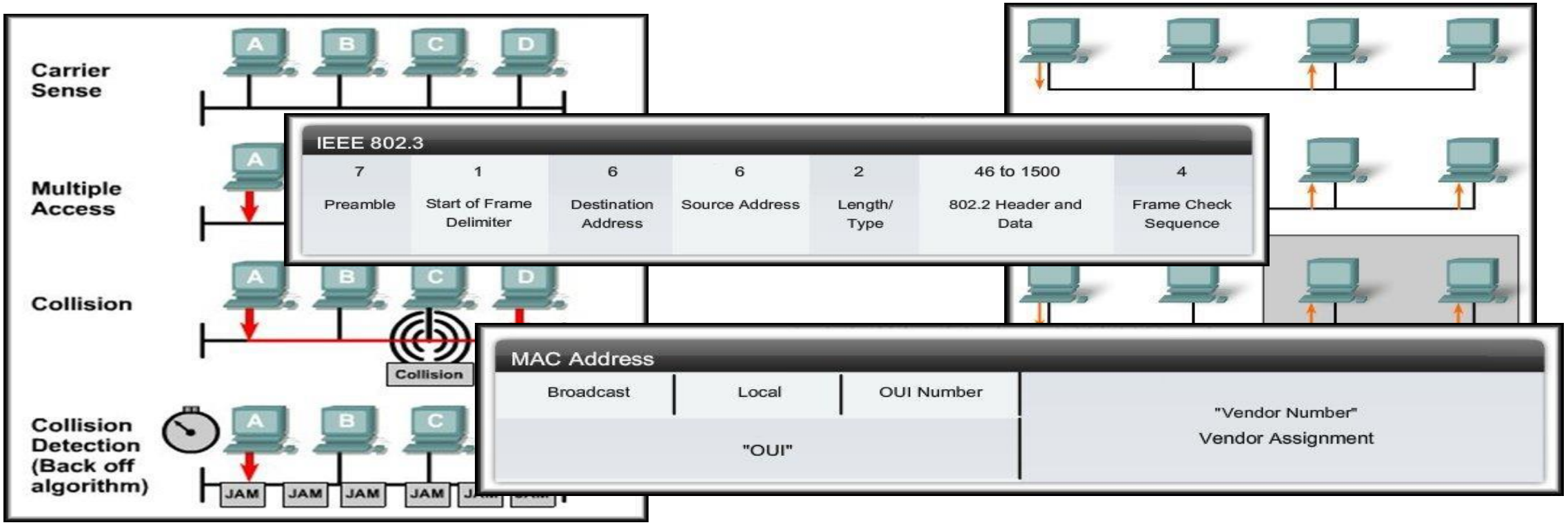
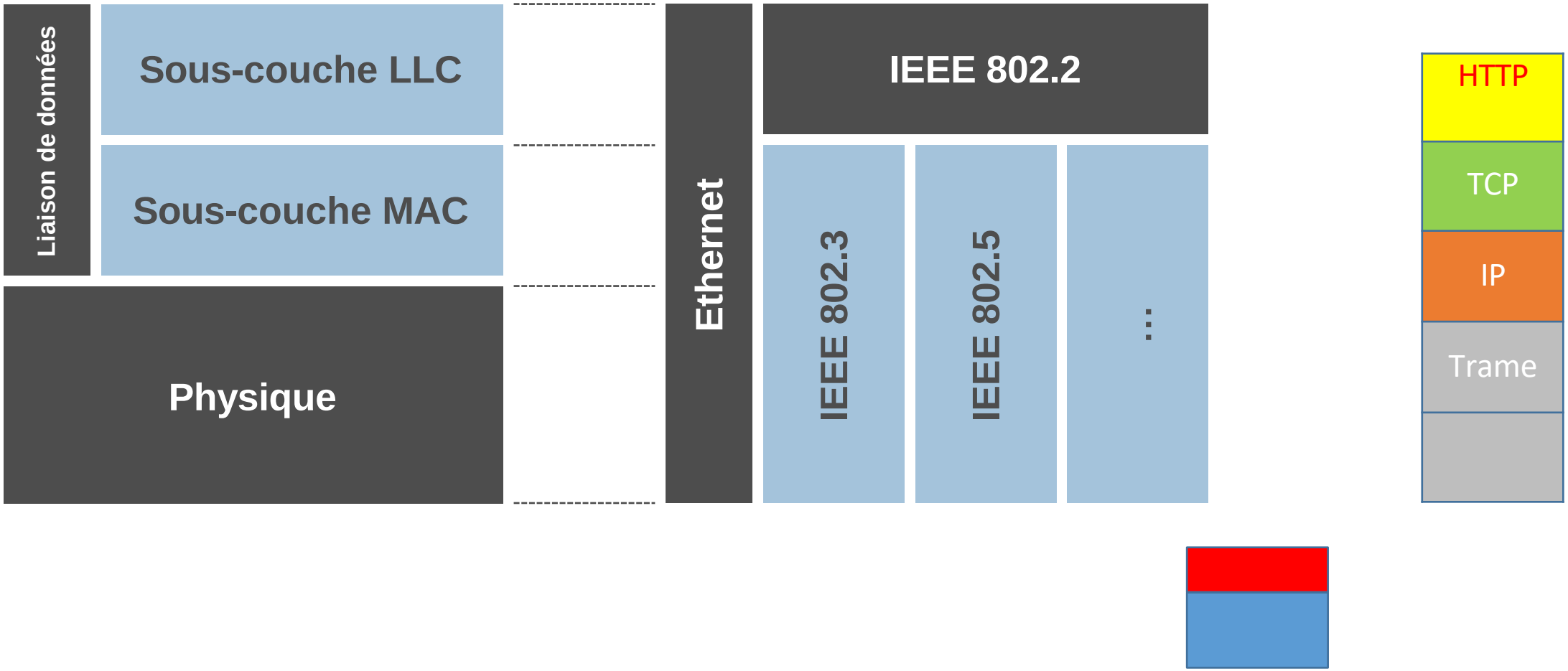


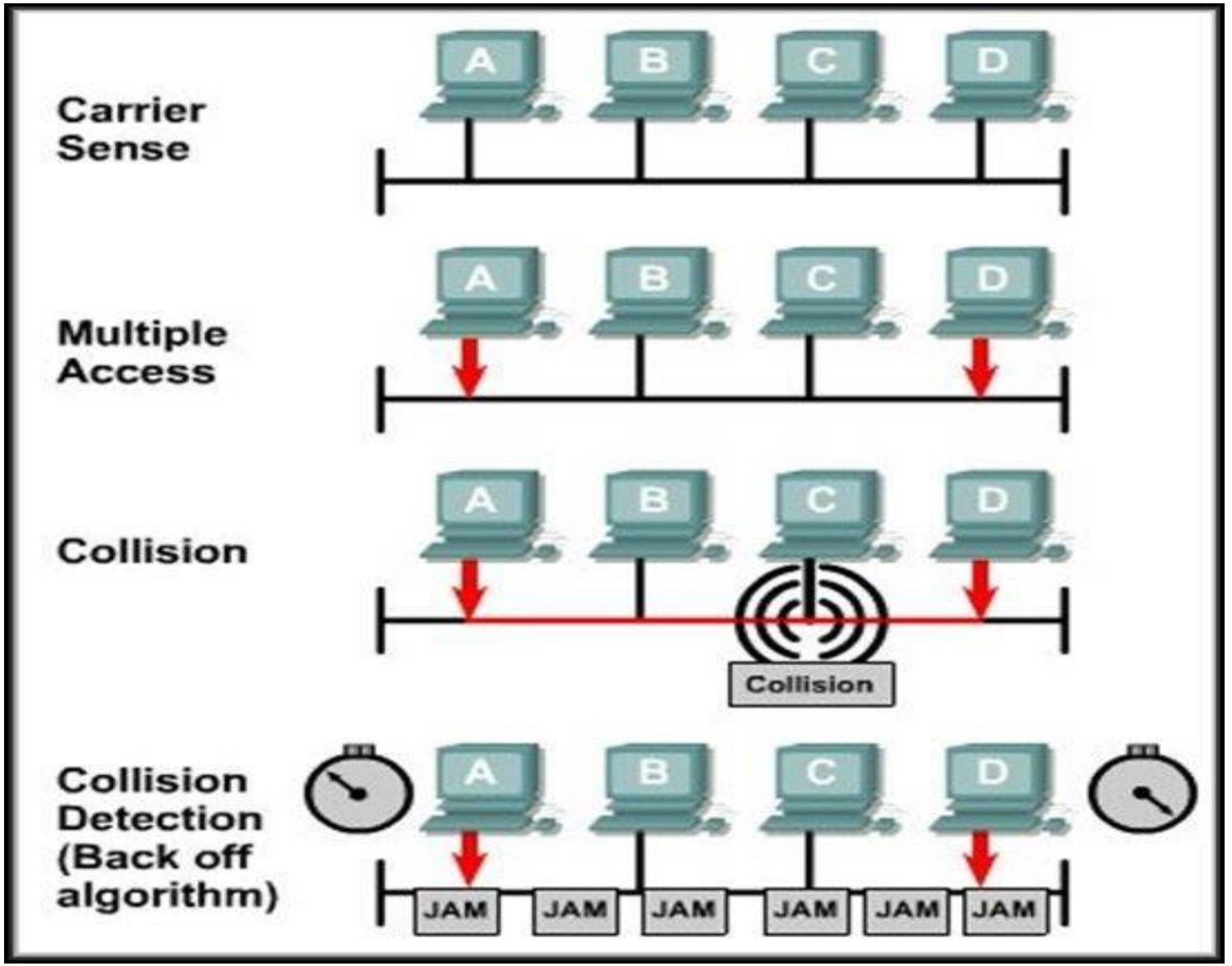
Les éléments clés des LAN's Ethernet 802.3



Ethernet et le modèle TCP/IP



CSMA/CD (principe)

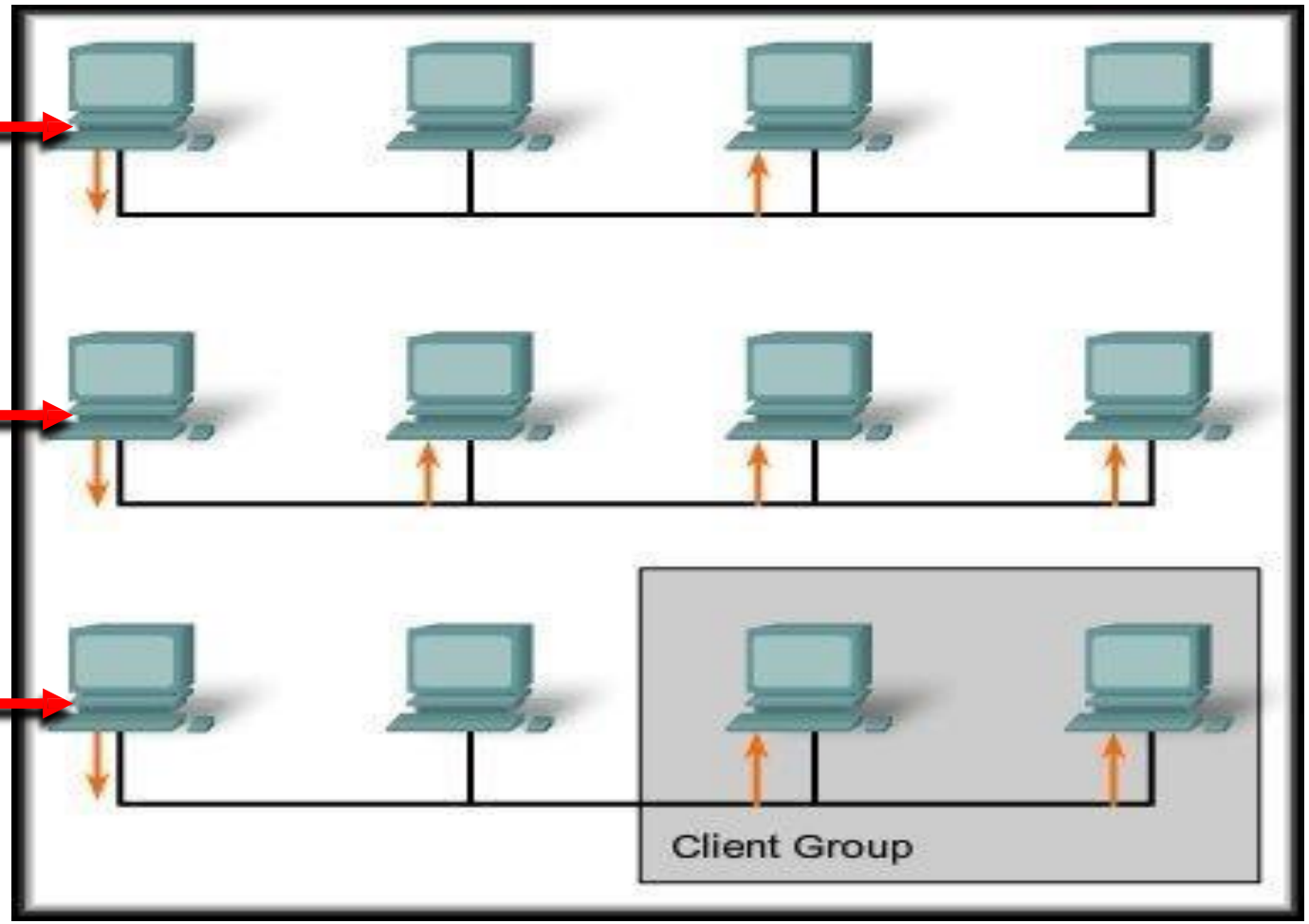


Scenarios de Communications dans les réseaux Ethernet

Unicast:
one-to-one

Broadcast:
one-to-all

Multicast:
one-to-many



Scenarios de Communications dans les réseaux Ethernet (cont.)

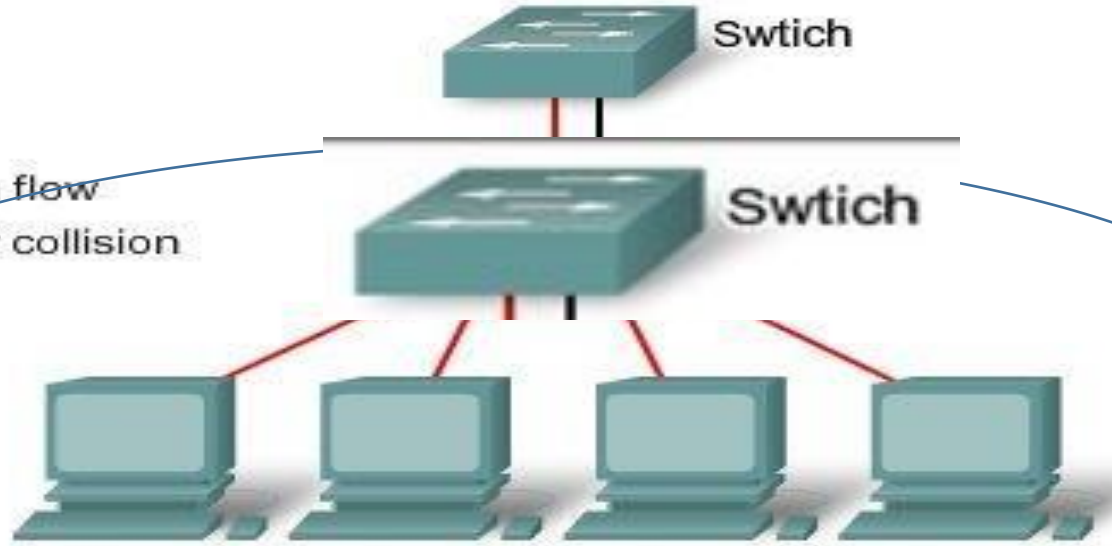
- Ethernet Frame: Minimum 64 bytes, Maximum 1518 bytes

- Preamble : Synchronize to medium
- Destination Address: MAC Address of destination device
- Source Address: MAC address of source device.
- Length/Type: Length of frame or protocol type code
- Data: Encapsulated data from OSI Layers 7 to 3.
- FCS: Frame Check Sequence.

Scenarios de Communications dans les réseaux Ethernet (cont.)

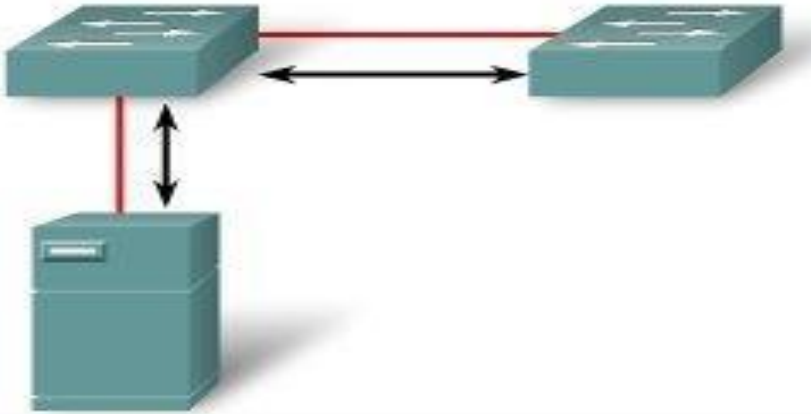
Half Duplex (CSMA/CD)

- Unidirectional data flow
- Higher potential for collision
- Hub connectivity



Full Duplex

- Point-to-point only
- Attached to dedicated switched port
- Requires full-duplex support on both ends
- Collision-free
- Collision detect circuit disabled

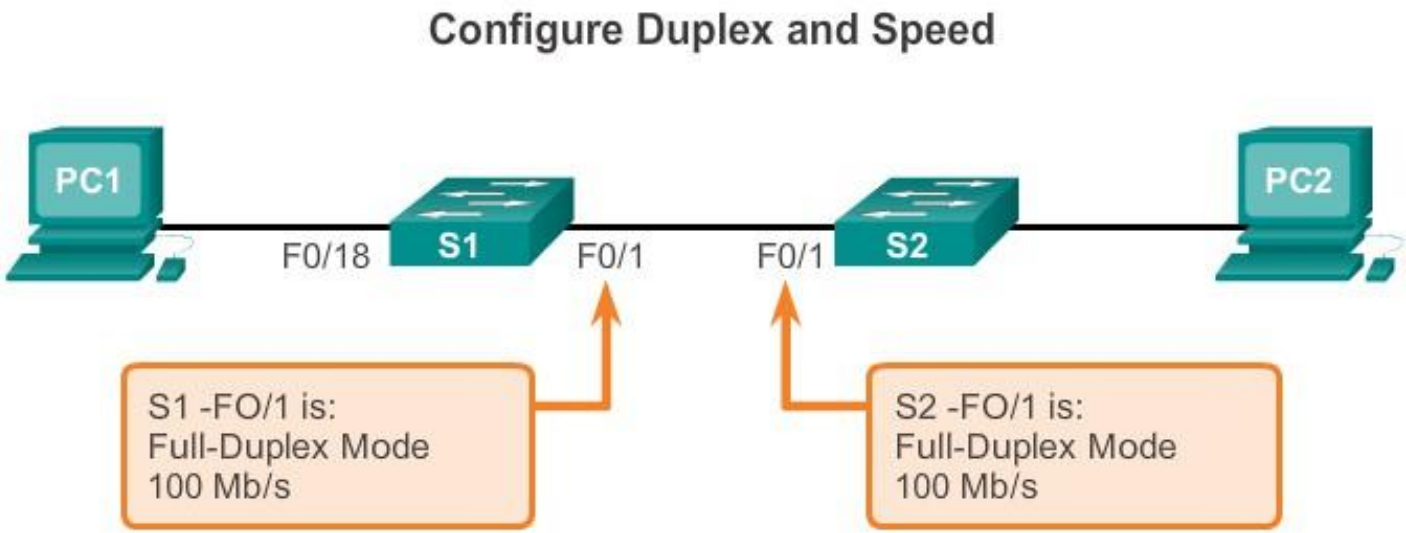


Scenarios de Communications dans les réseaux Ethernet (cont.)

- **Switch Port Settings:**
  - **AUTO:**
    - Auto-negotiation of duplex mode. The two ports communicate to determine the best mode.
      - Default for Fast Ethernet.
  - **FULL:**
    - Full-duplex mode.
      - Default for 100BASE-FX ports
        - (Fast Ethernet – une paire de fibres optiques).
  - **HALF:**
    - Half-duplex mode.

Scenarios de Communications dans les réseaux Ethernet (cont.)

- Exemple de configuration des ports (Duplex et speed)



Cisco Switch IOS Commands	
Enter global configuration mode.	S1# **configure terminal**
Enter interface configuration mode.	S1(config)# **interface fastethernet 0/1**
Configure the interface duplex.	S1(config-if)# **duplex full**
Configure the interface speed.	S1(config-if)# **speed 100**
Return to the privileged EXEC mode.	S1(config-if)# **end**
Save the running config to the startup config.	S1# **copy running-config startup-config**

Table des adresse MAC du commutateur

- **Switches use MAC addresses to direct network traffic to the appropriate port (principle).**
  - A switch builds a MAC address table by learning the MAC addresses of each device connected to each of its ports.
  - Once the MAC address has been added to the table, the switch uses the table entry to forward traffic to that node.
  - If a destination address is not in the table, the switch forwards the frame out all ports except the receiving port.
  - When the destination responds, the MAC address is added to the table.
  - If the port is connected to another switch or a hub, multiple MAC addresses will be recorded in the table.

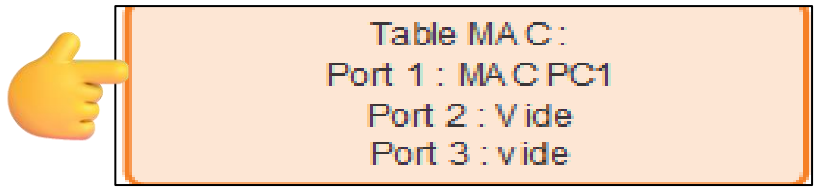


Table des adresse MAC du commutateur (cont.)

- Exemple Step 1:
  - Le commutateur reçoit une trame « broadcast » du PC 1 sur le port 1

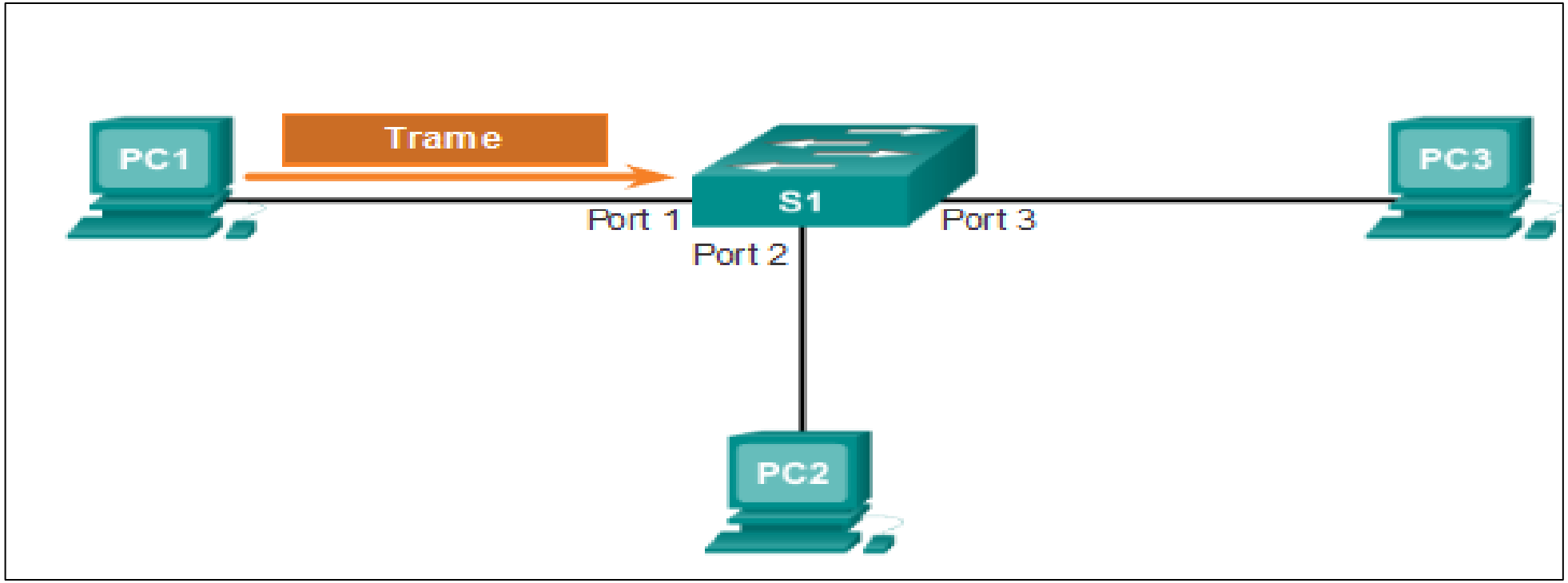
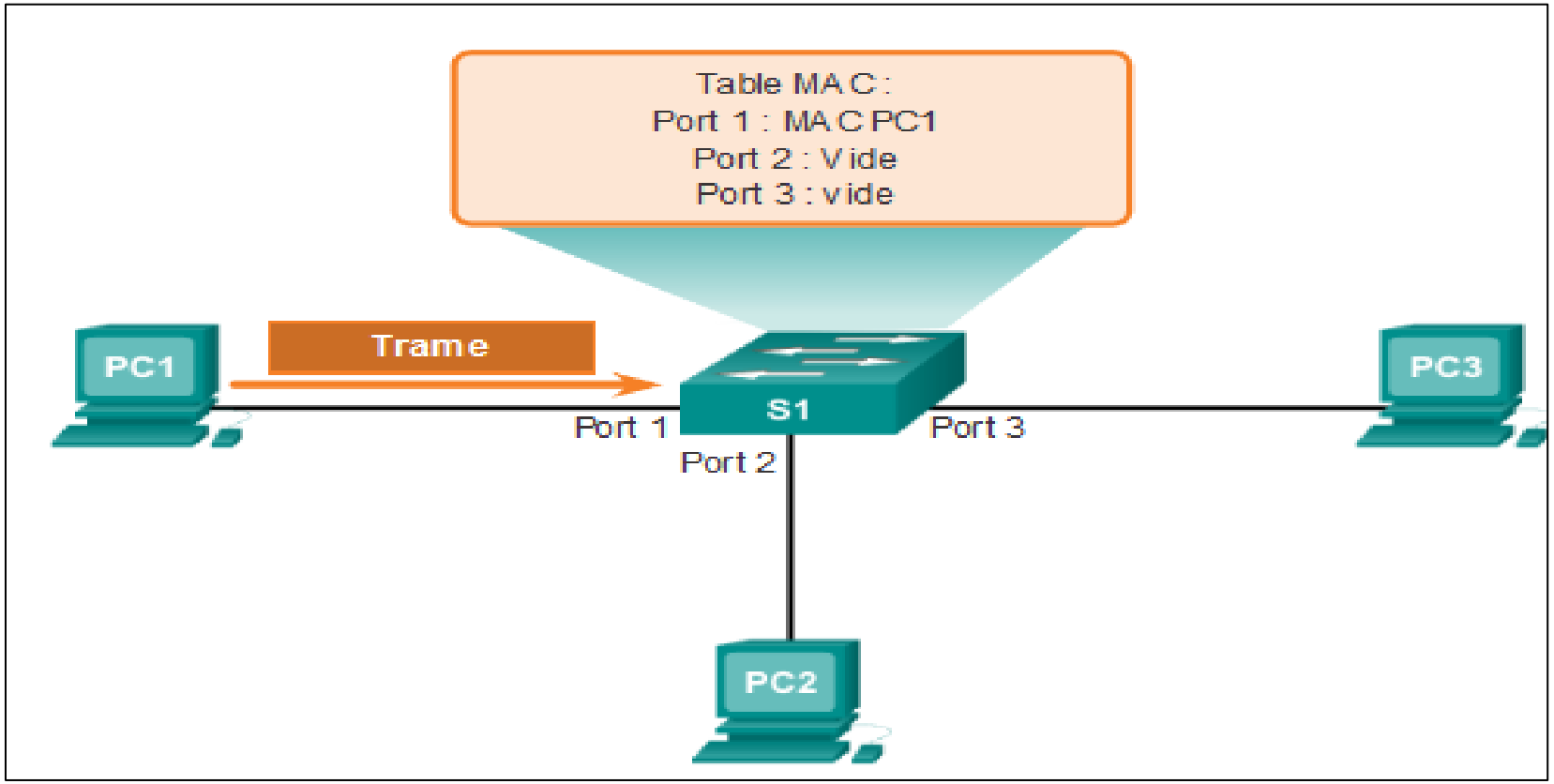


Table des adresse MAC du commutateur (cont.)

- Exemple Step 2:
  - Le commutateur examine l'adresse MAC source et la recherche dans la table d'adresses MAC.



- Si cette adresse ne figure pas dans la table d'adresses MAC, il associe l'adresse MAC source du PC 1 au port d'entrée (port 1) dans la table d'adresses MAC
- Si la table d'adresses MAC comporte déjà une entrée pour cette adresse source, il réinitialise le compteur d'obsolescence. En général, une entrée d'adresse MAC est conservée pendant cinq minutes (aging timer).

Table des adresse MAC du commutateur (cont.)

- Exemple Step 3:
  - Après avoir enregistré les informations d'adresse source, le commutateur examine l'adresse MAC de destination
  - Si l'adresse de destination ne figure pas dans la table MAC ou s'il s'agit d'une adresse MAC de diffusion, c'est-à-dire ne comportant que des F, le commutateur transfère la trame à tous les ports, à l'exception du port d'entrée

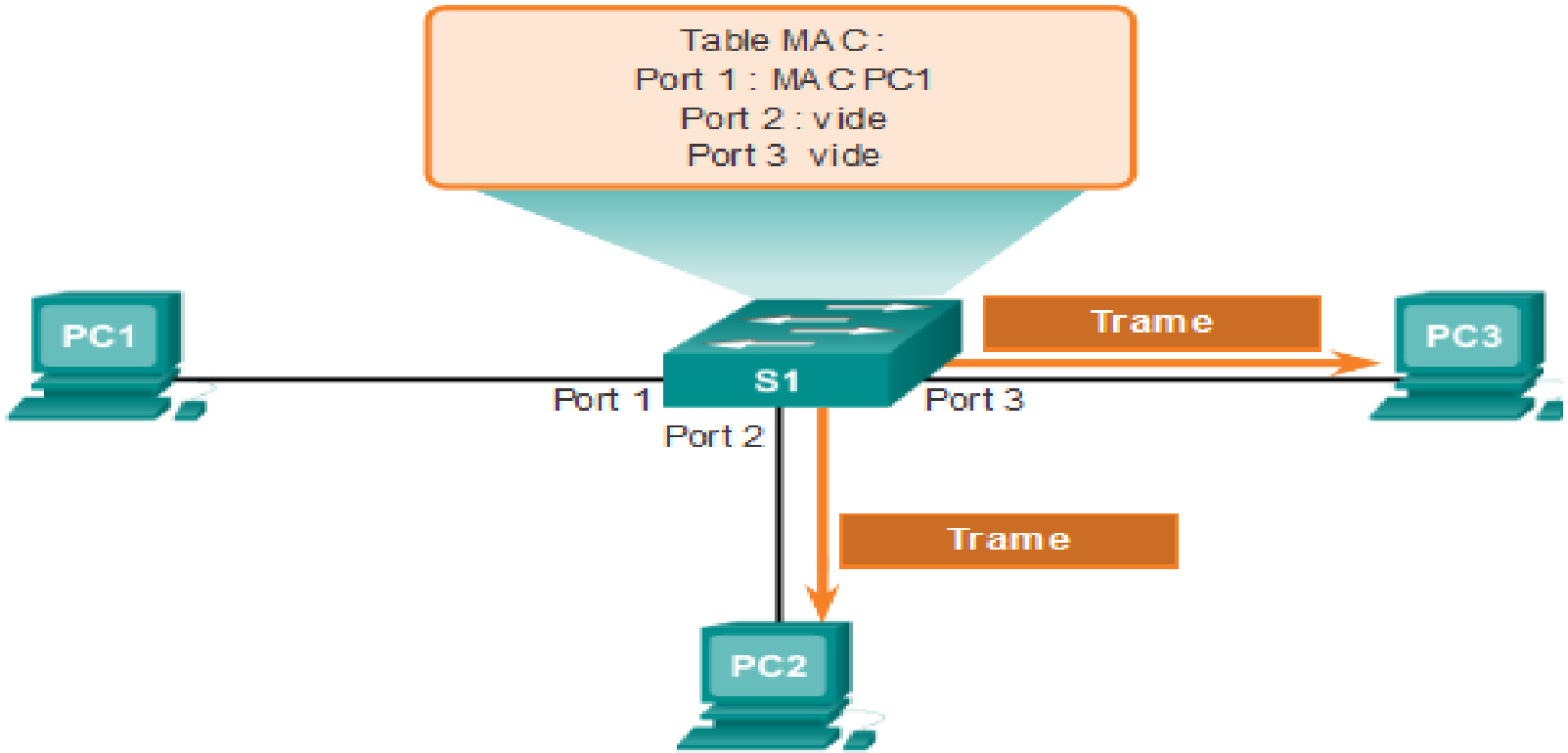


Table des adresse MAC du commutateur (cont.)

- Exemple Step 4:
  - Le périphérique de destination (PC 3) répond à la trame avec une trame de monodiffusion destinée au PC 1

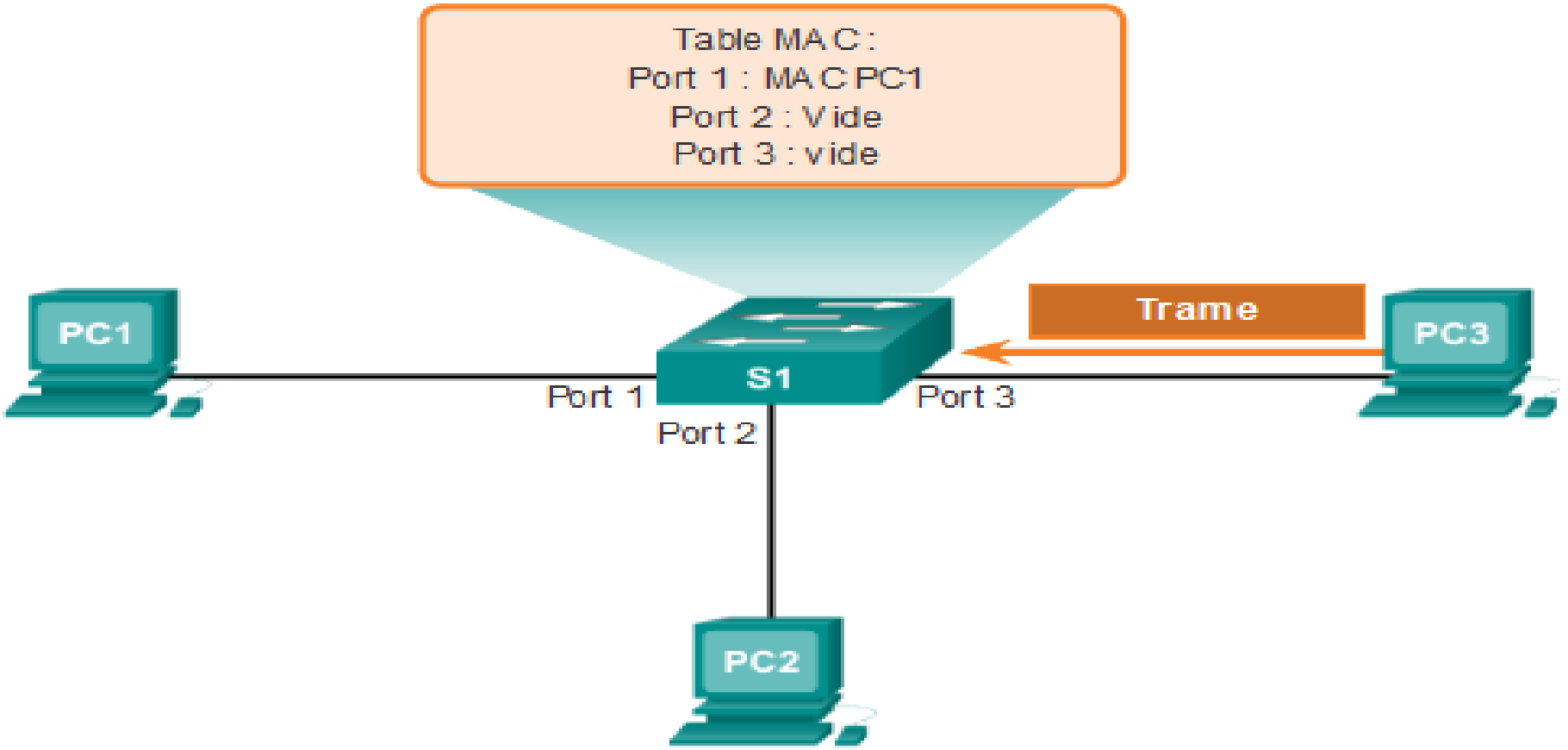


Table des adresse MAC du commutateur (cont.)

- Exemple Step 5:
  - Le commutateur enregistre, dans la table d'adresses, l'adresse MAC source du PC 3 et le numéro de port d'entrée.
  - L'adresse de destination de la trame et le port de sortie qui lui est associé se trouvent dans la table d'adresses MAC

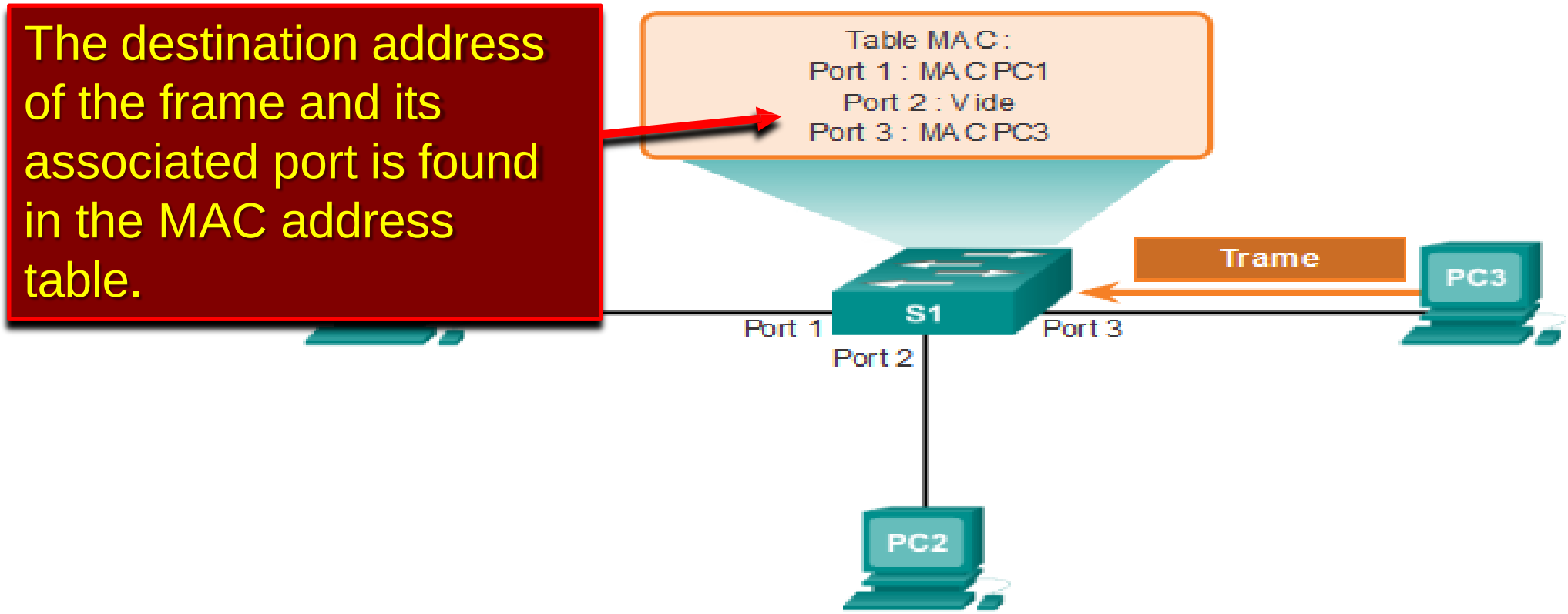


Table des adresse MAC du commutateur (cont.)

- Exemple Step 6:
  - Le commutateur peut désormais transférer les trames entre ces périphériques source et de destination, sans inondation, car il dispose d'entrées dans la table d'adresses qui identifient les ports associés

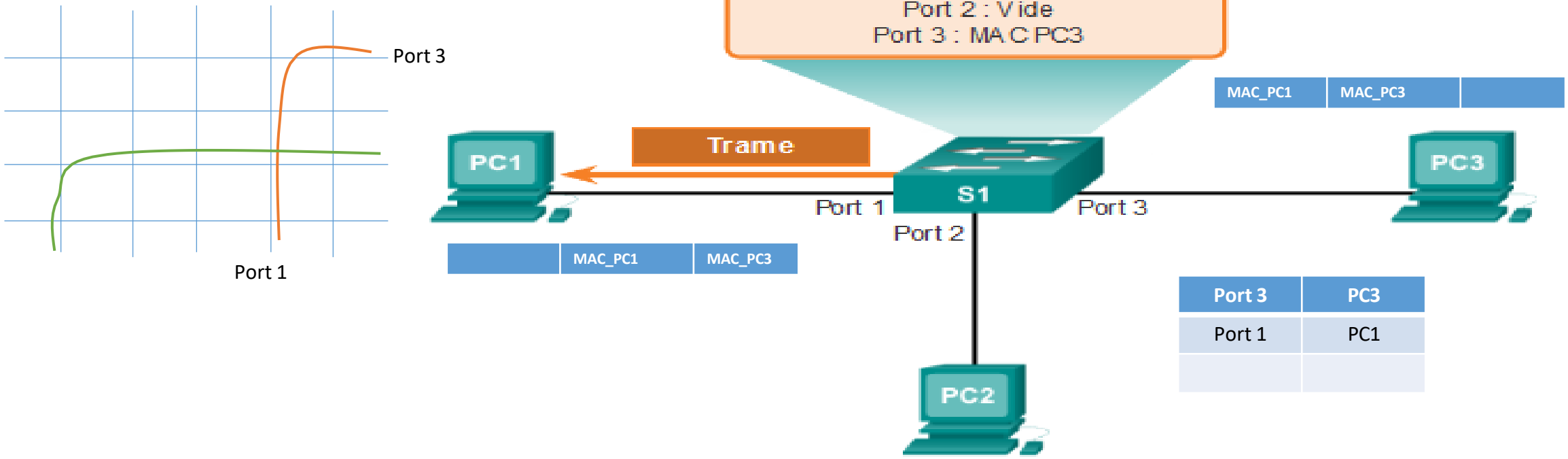
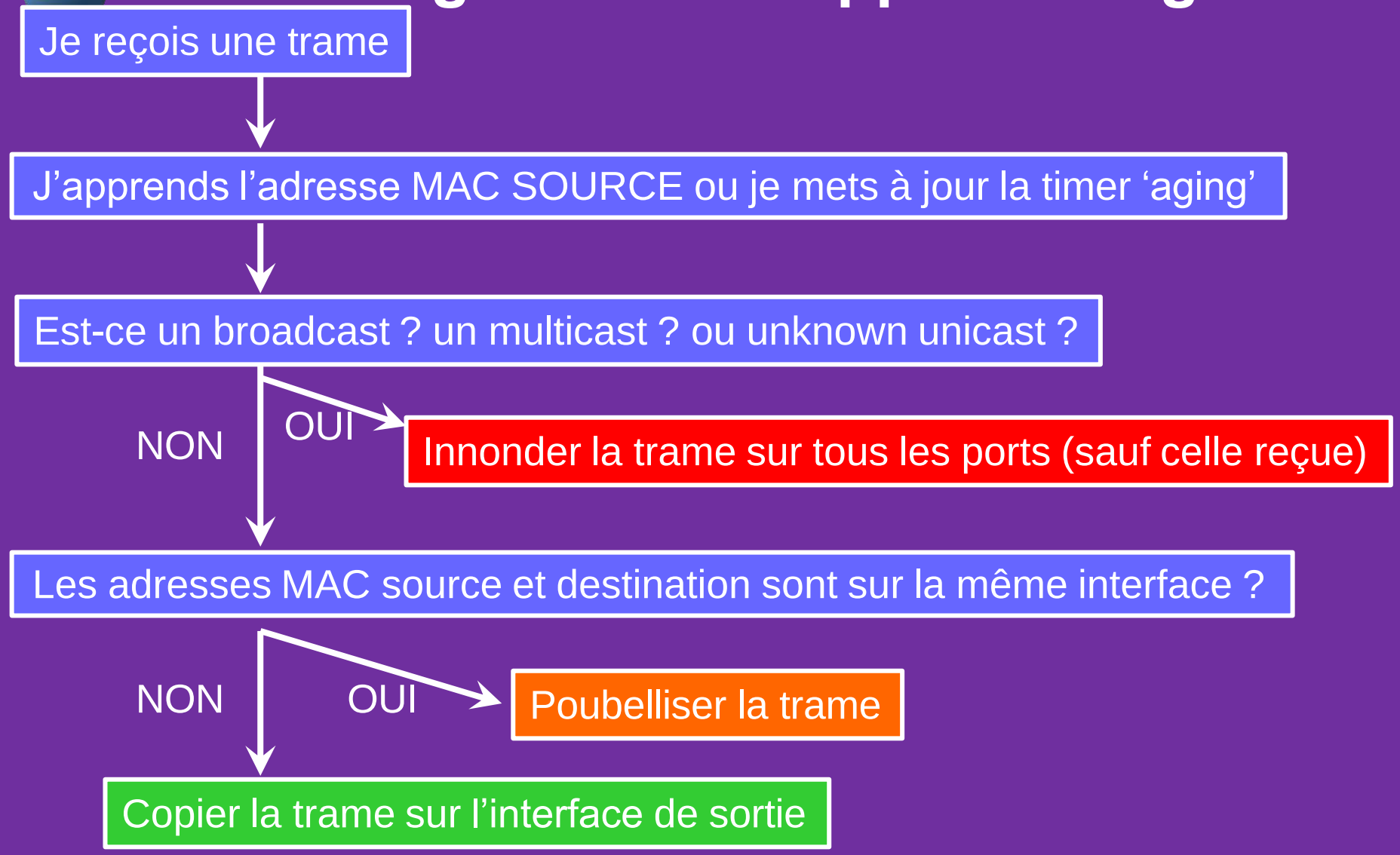


Table des adresse MAC du commutateur (cont.)

Bilan : l'algorithme d'apprentissage



Design Considerations – Ethernet/802.3

Bandwidth and Throughput:

- A major disadvantage of Ethernet is collisions.
  - When two hosts transmit frames simultaneously, the collision results in the transmitted frames being corrupted or destroyed.
  - The sending hosts stop sending based on the Ethernet 802.3 rules of CSMA/CD.

- *It is important to understand that when stating the bandwidth of the Ethernet network is 10 Mb/s, full bandwidth for transmission is available only after any collisions have been resolved.*

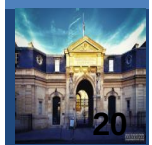
Design Considerations – Ethernet/802.3

Bandwidth and Throughput:

- A major disadvantage of Ethernet is collisions.

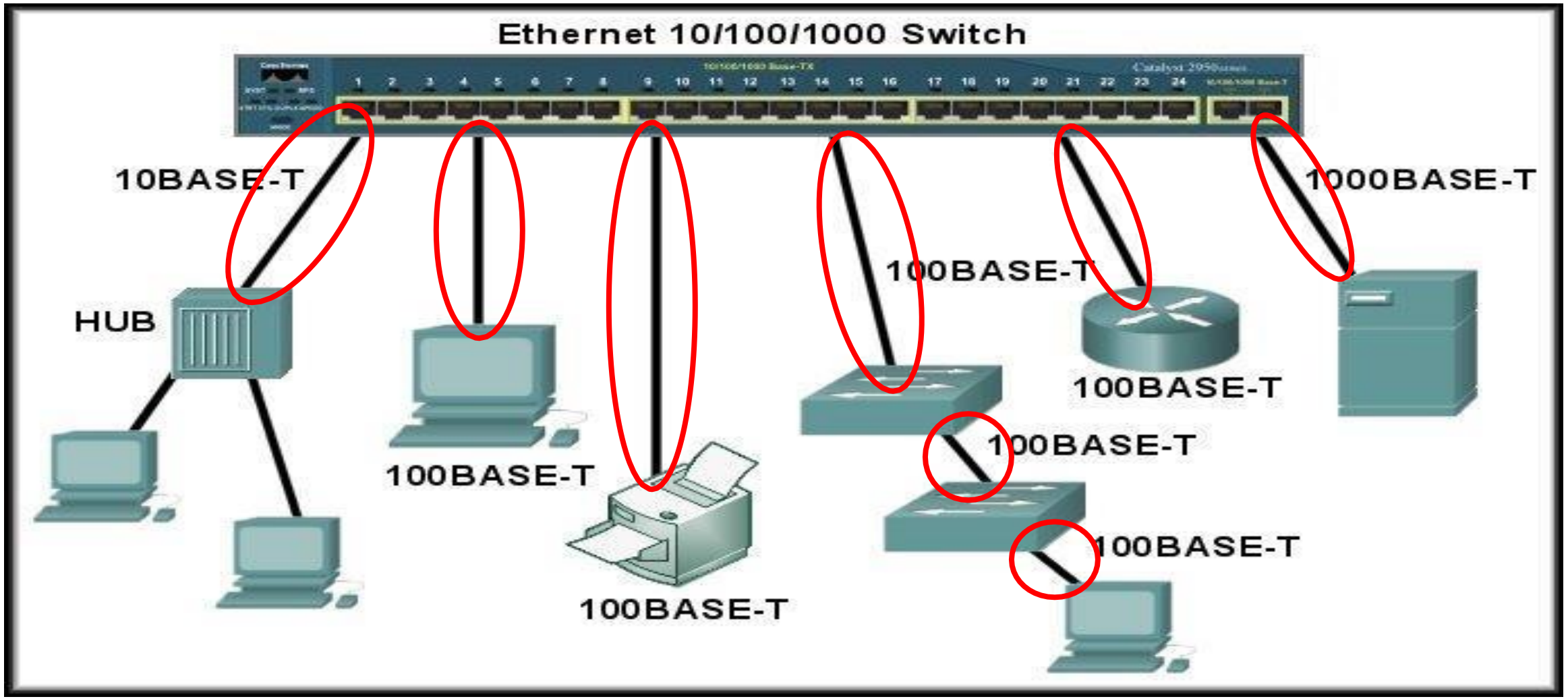
- A hub offers no mechanisms to either eliminate or reduce collisions and the available bandwidth that any one node has to transmit is correspondingly reduced.

- As a result, the number of nodes sharing the Ethernet network will have effect on the throughput.



Design Considerations – Ethernet/802.3

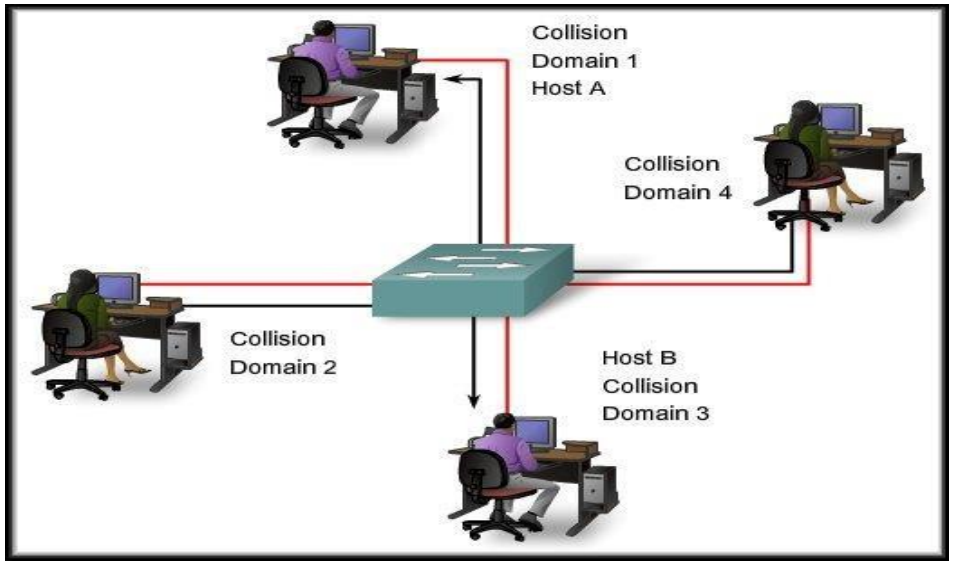
- Collision Domains:



Design Considerations – Ethernet/802.3

Microsegment:

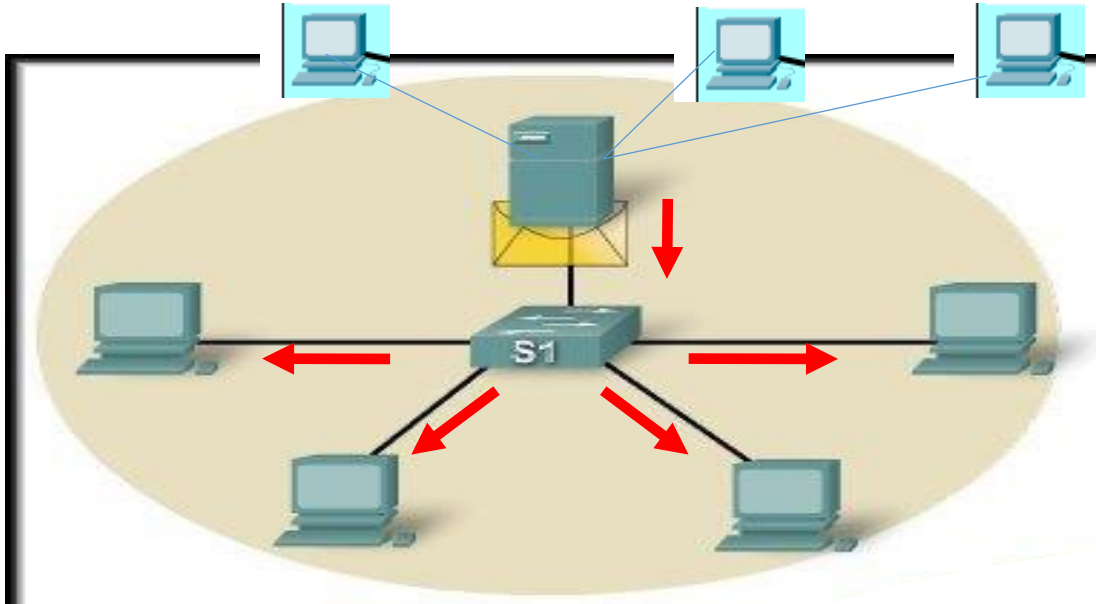
- When two connected hosts want to communicate with each other, the switch uses the switching table to establish a connection between the ports.



- The circuit is maintained until the session is terminated.
- The microsegment behaves as if the network has only two hosts, providing maximum available bandwidth to both hosts.
- *Switches reduce collisions and improve bandwidth use on network segments because they provide dedicated bandwidth to each network segment.*

Design Considerations – Ethernet/802.3

- Broadcast Domains:

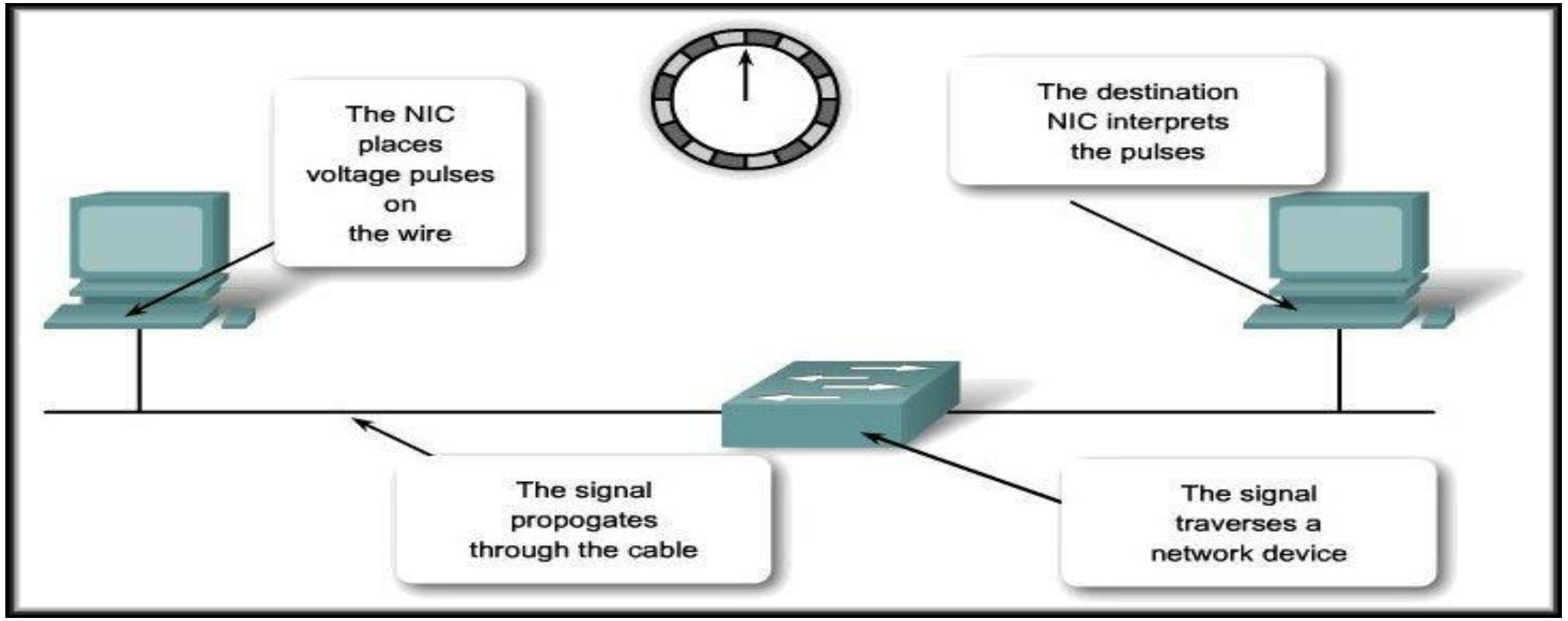


Interconnecting switches extends the broadcast domain.

Design Considerations – Ethernet/802.3

Network Latency:

- Latency is the time a frame or a packet takes to travel from the source to the final destination.

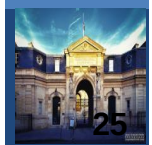


Design Considerations – Ethernet/802.3

Network Congestion:

- The primary reason for segmenting a LAN into smaller parts is to isolate traffic and to achieve better use of bandwidth per user.
- Without segmentation, a LAN quickly becomes clogged with traffic and collisions.
- Most common causes:
  - ✓ Increasingly powerful computer and network technologies.
  - ✓ Increasing volume of network traffic.
  - ✓ High-bandwidth applications.

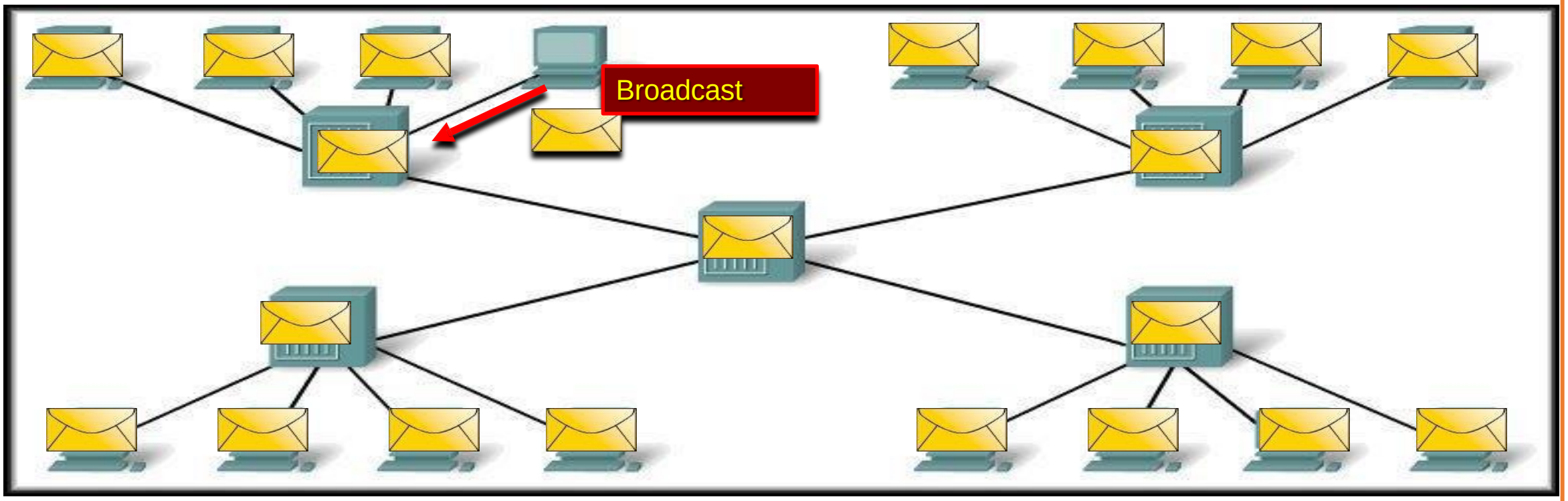
Clogged : saturé



Design Considerations – Ethernet/802.3

LAN Segmentation:

- LANs are segmented into a number of smaller collision and broadcast domains using routers and switches



Design Considerations – Ethernet/802.3

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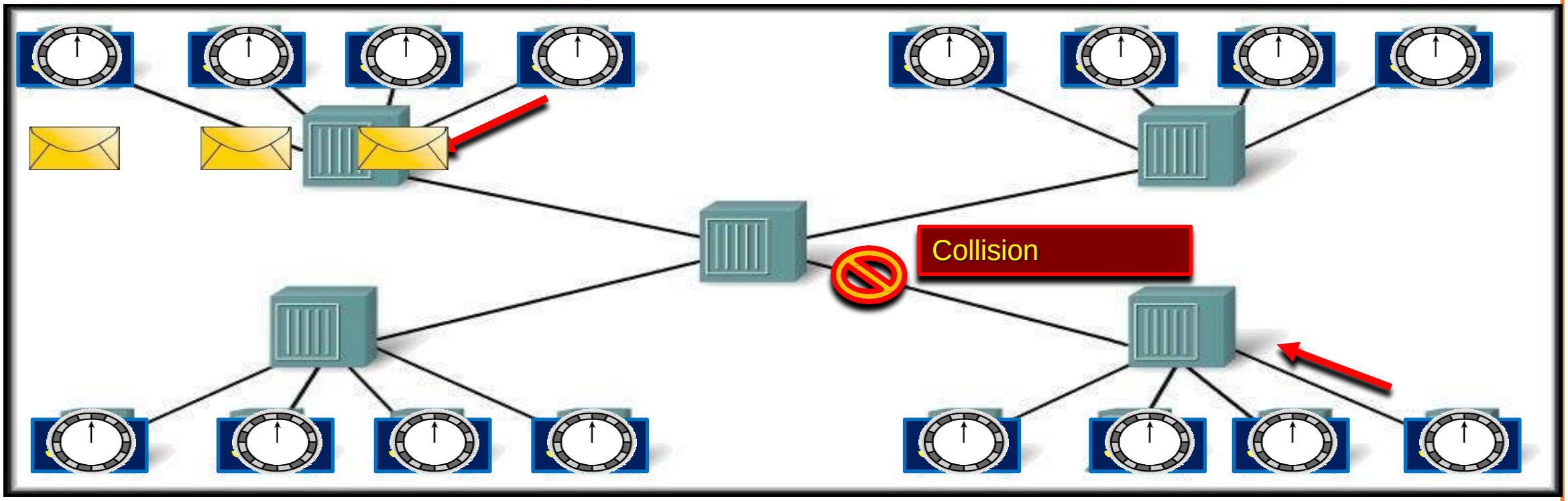

Design Considerations – Ethernet/802.3

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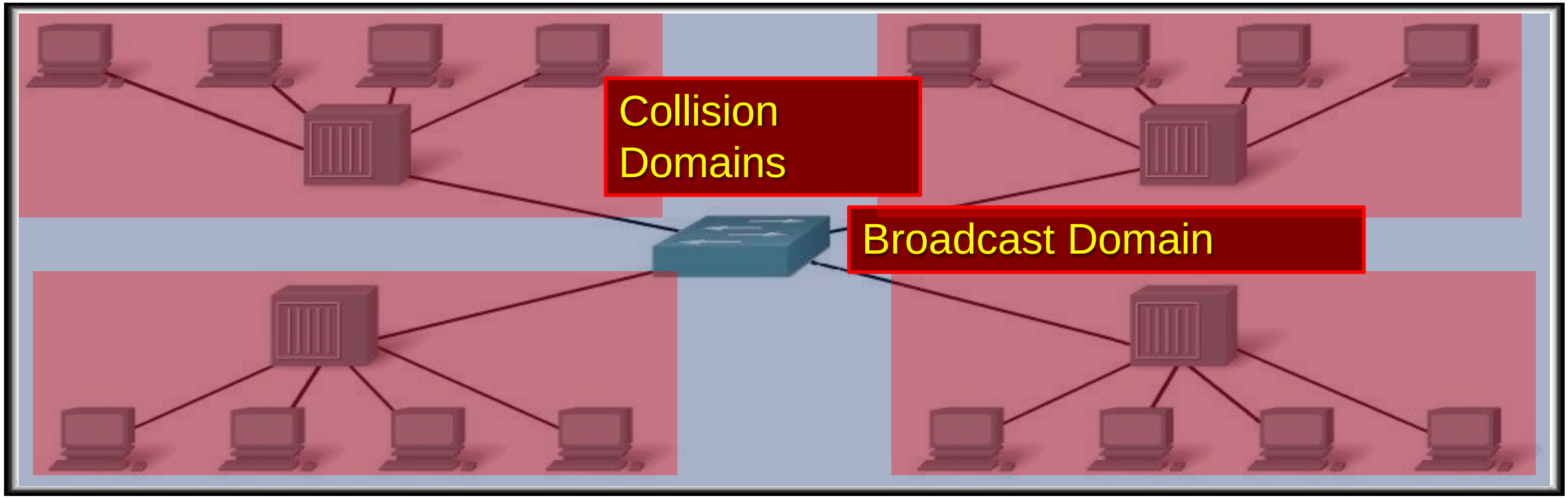

Design Considerations – Ethernet/802.3

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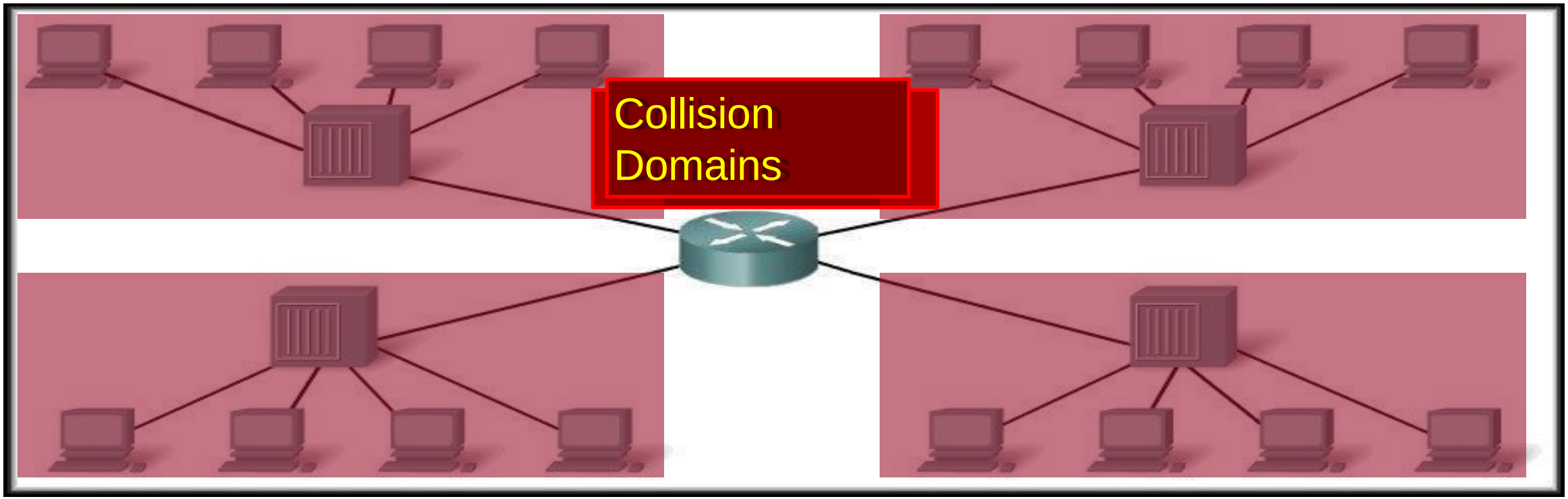
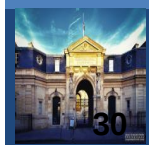


LAN Design Considerations

There are two primary considerations when designing a LAN:

- Controlling network latency
- Removing bottlenecks



LAN Design Considerations

Oversubscribed : surnombre

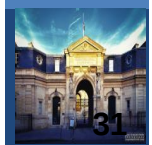
Controlling Network Latency:

- Consider the latency caused by each device on the network.

Switches at Layer 2 can introduce latency on a network when oversubscribed on a busy network.

The use of higher layer devices can also increase latency on a network.

- When a Layer 3 device, such as a router, needs to examine the Layer 3 addressing information contained within the frame, it must read further into the frame than a Layer 2 device, which creates a longer processing time.



LAN Design Considerations

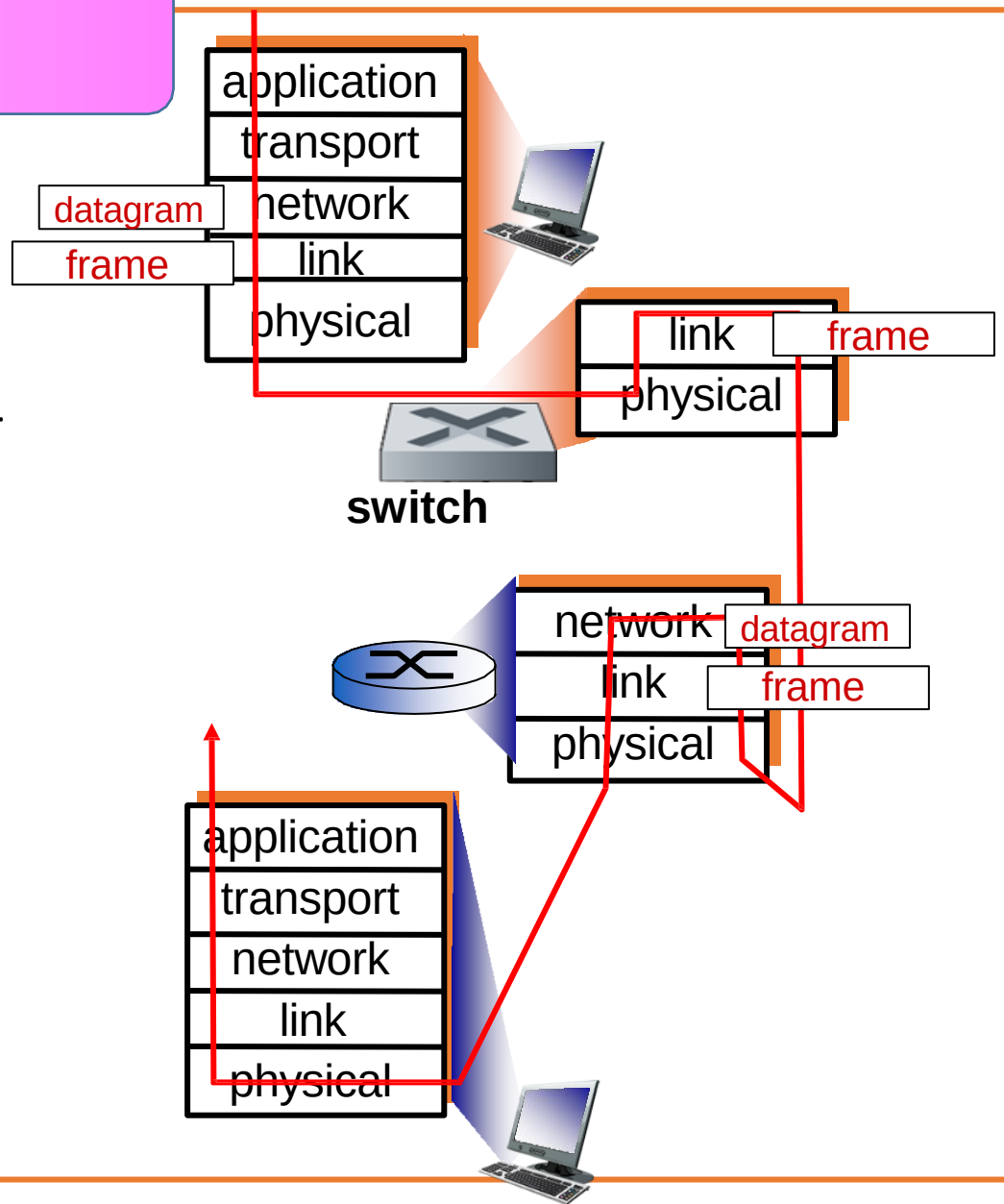
Switches vs. routers

both are store-and-forward:

- ***routers:*** network-layer devices (examine network-layer headers)
- ***switches:*** link-layer devices (examine link-layer headers)

both have forwarding tables:

- ***routers:*** compute tables using **routing algorithms, IP addresses**
- ***switches:*** learn forwarding table using **flooding, learning, MAC addresses**



LAN Design Considerations

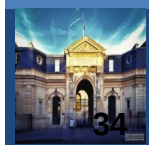
Forwarding Frames Using a Switch

- Store-and-forward
- Cut-through
- Fast-forward
- Fragment-free
- Symmetric
- Asymmetric
- Memory Buffering

Switch Forwarding Methods

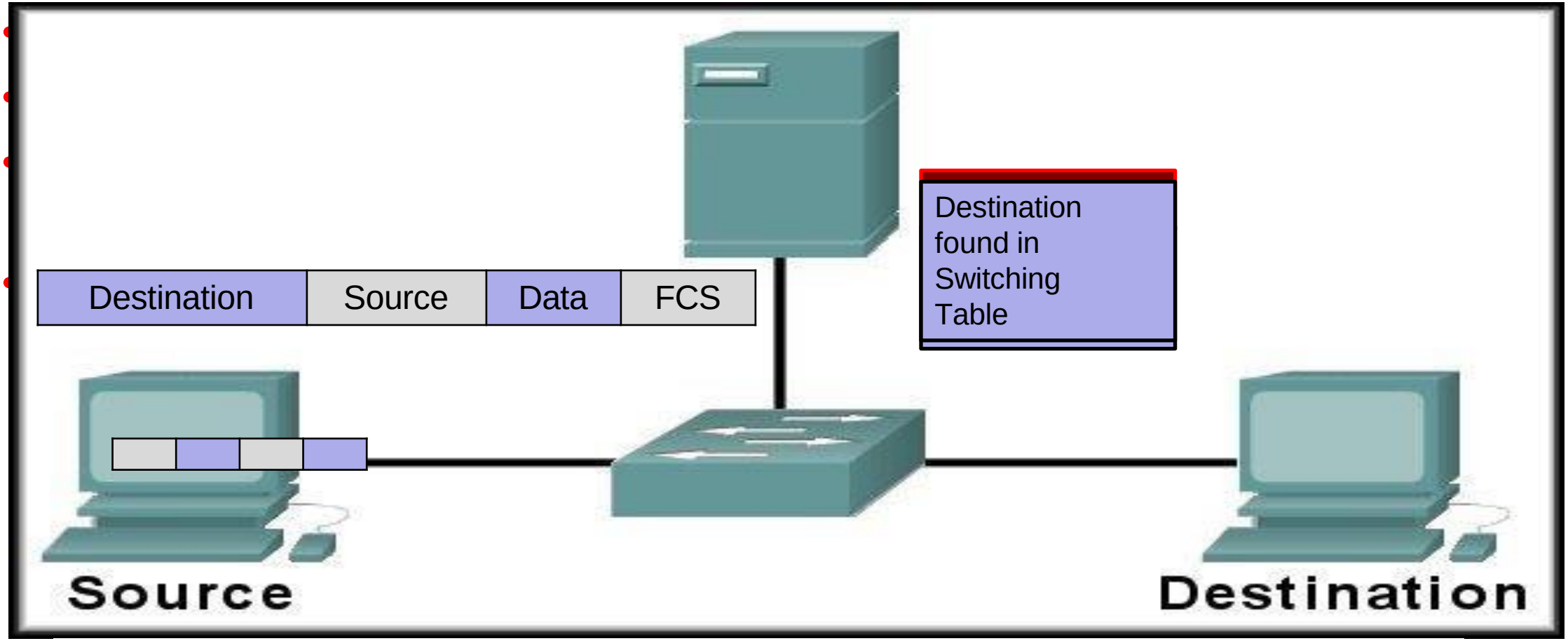
Méthodes utilisées par les commutateurs pour retransmettre les trames

- Store-and-forward.
- Cut-through:
  - Fast-forward switching.
  - Fragment-free switching.



Switch Forwarding Methods

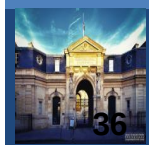
- Store-and forward:



Un commutateur store-and-forward reçoit la trame en entier et calcule le CRC. Si le CRC est valide, le commutateur recherche l'adresse de destination qui détermine l'interface de sortie. La trame est ensuite acheminée par le port approprié.

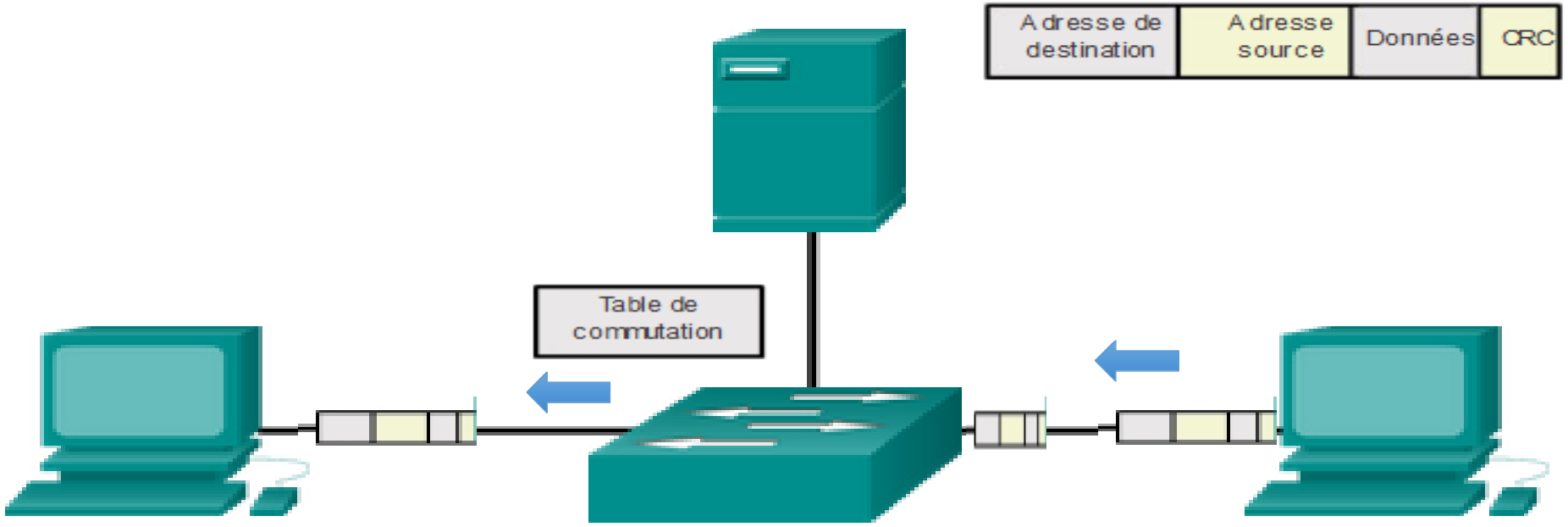
Switch Forwarding Methods

- Store-and forward:
  - Reçoit une trame complète
  - Contrôle absence d'erreur (CRC)
  - Vérifie la taille de la trame
  - Si CRC et taille ok, le commutateur vérifie la table pour trouver une adresse MAC s de destination pour retransmettre la trame
  - Si CRC ou taille est KO alors la trame est ignorée
  - C'est la méthode qui est utilisée de base dans les commutateurs Cisco



Switch Forwarding Methods

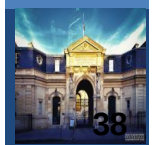
- Cut-through:



Un commutateur cut-through achemine la trame avant qu'elle ne soit entièrement reçue. Au minimum, l'adresse de destination de la trame doit être lue avant que celle-ci ne soit retransmise.

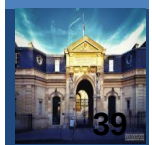
Switch Forwarding Methods

- Cut-through:
  - la méthode cut-through lance le processus de transfert dès que l'adresse MAC de destination d'une trame entrante et le port de sortie sont déterminés.
  - Plus rapide que store-and-forward.
  - Pas de vérification d’erreur.
    - *Une trame corrompue est alors retransmise avec comme conséquence qu’elle va consommer de la bande passante*



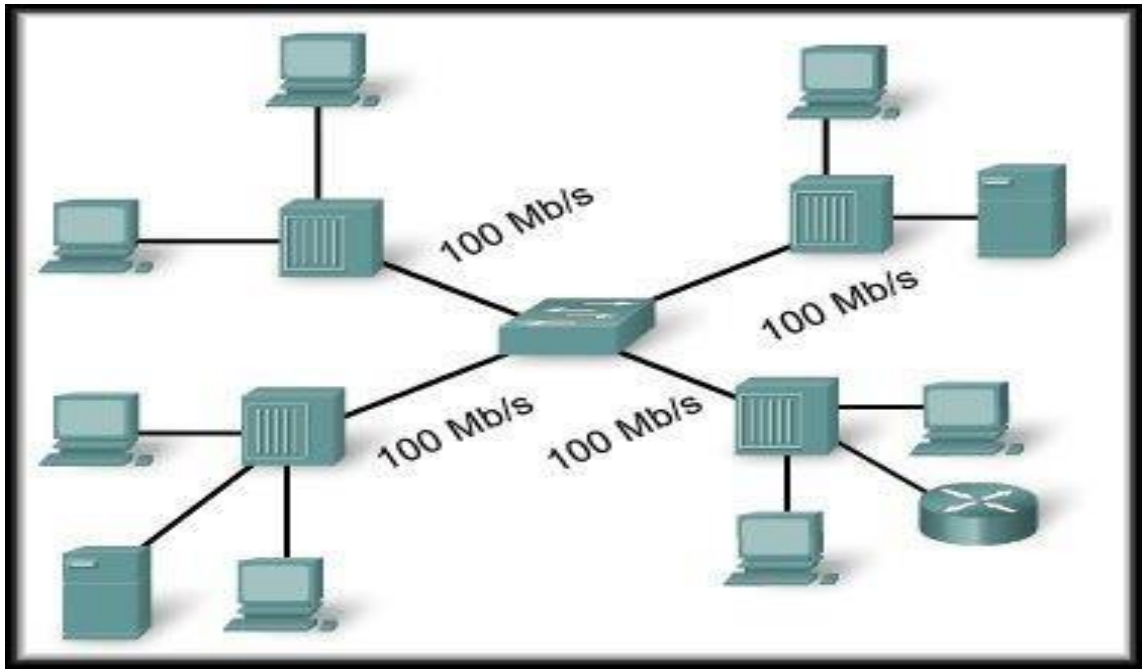
Switch Forwarding Methods

- La commutation cut-through comporte deux caractéristiques principales :
  - la transmission rapide des trames (Cut-through – Fast-forward)
  - et le traitement des trames incorrectes (Cut-through – Fragment-free)
- Cut-through – Fast-forward:
  - Méthode type de cut-through.
  - Retransmet la trame immédiatement après avoir trouvé l'adresse MAC de destination dans la table d'adresses MAC
- Cut-through – Fragment-free:
  - Une forme modifiée de Cut-through où le commutateur attend la fin de la réception de la fenêtre de collision (64 octets) avant de transférer la trame..
  - **En effet, c'est dans les 64 premiers octets ou la plus part des erreurs et collisions se produisent**



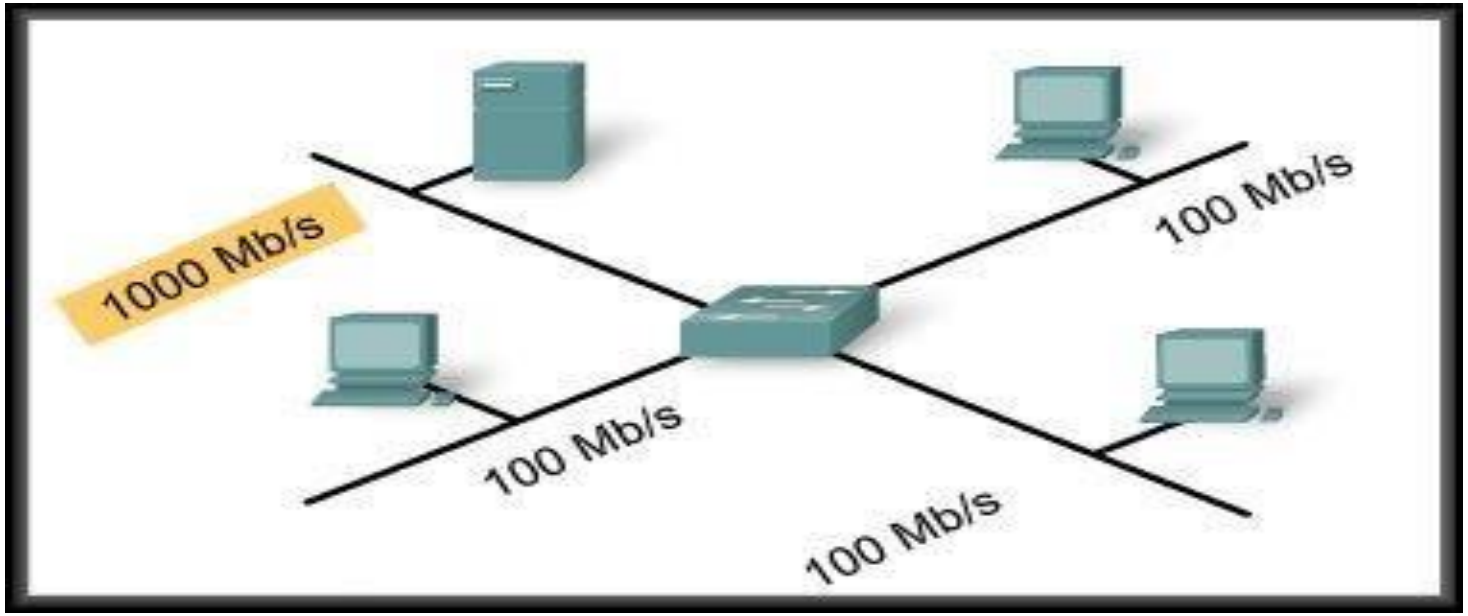
Symmetric and Asymmetric Switching

- Symmetric:
  - All ports are of the same bandwidth.
  - Optimized for a reasonably distributed traffic load.
  - For example, a peer-to-peer network.



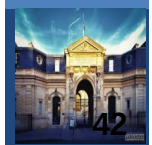
Symmetric and Asymmetric Switching

- Asymmetric:
  - Provides switched connections between ports of unlike bandwidth.
  - For example, more bandwidth can be assigned to a server to prevent bottlenecks.



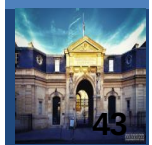
Memory Buffering

- A switch analyzes some or all of a packet before it forwards it to the destination host based on the forwarding method.
- It stores the packet for the brief time in a memory buffer.
- Memory built into the hardware
  - Two types:
    - Port based.
    - Shared.



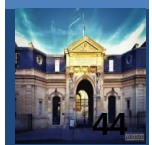
Memory Buffering

- Port Based:
  - Frames are stored in queues that are linked to specific incoming and outgoing ports.
  - A frame is transmitted to the outgoing port only when all the frames ahead of it in the queue have been successfully transmitted.
  - Consequence : It is possible for a single frame to delay the transmission of all the frames in memory because of a busy destination port.



Memory Buffering

- Shared:
  - Deposits all frames into a common memory buffer that all the ports on the switch share.
  - The amount of buffer memory required by a port is dynamically allocated.
  - The frames in the buffer are linked dynamically to the destination port.
  - Allows the packet to be received on one port and then transmitted on another port, **without moving it to a different queue**.



Fin du chapitre

Pause-réflexion sur le chapitre

Avez-vous des questions ?