Collision and Broadcast Domains

Network Programming (UCS413)

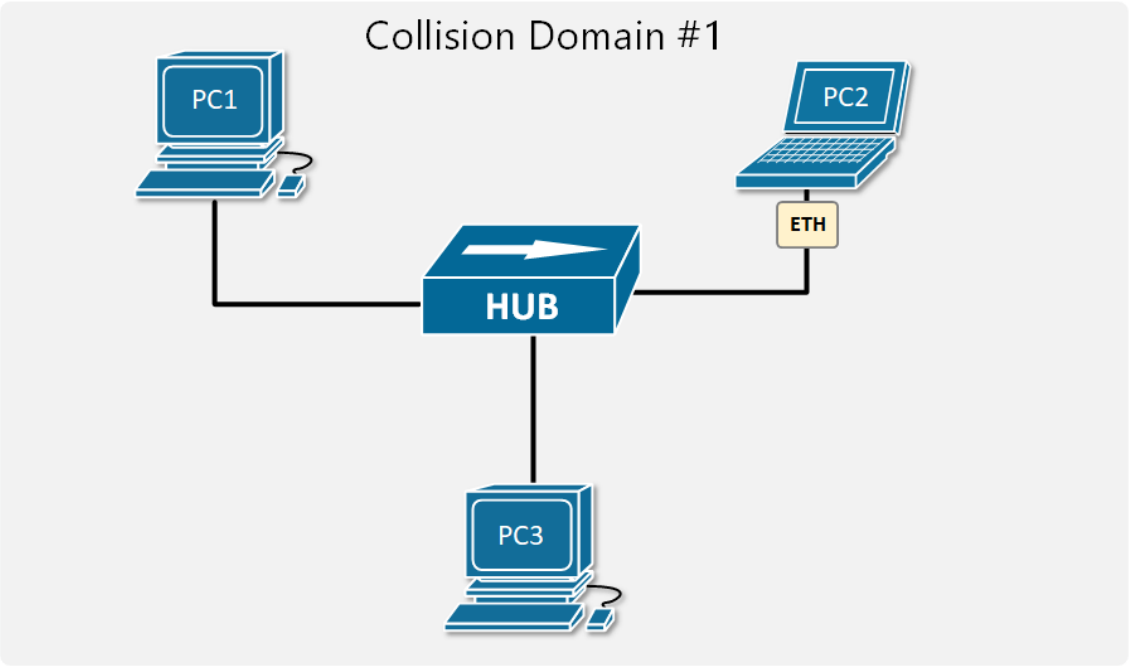
Collision Domains

Ethernet Hub

- Hub is a network device that is used for connecting multiple nodes and making them act as connected to a single network segment.
- It **works purely at the physical layer (L1)** of the OSI model.
- It has multiple ports, in which the incoming electrical signals on one port are repeated at the output of every other port.
- Network is **Half-duplex** (one side communication only)
- There is **no forwarding logic** at all.
- This creates a single shared medium

Collision Domains

- **A network collision occurs when more than one device attempts to send a frame on the segment at the same time.**



Two devices trying to transmit data simultaneously via Hub

Collision Domains

- **If collisions happen all the time, how are devices connected to a Hub even able to communicate?**

- There is a media access control method called **CSMA/CD that devices use when trying to communicate over a shared medium**.
- CSMA/CD stands for Carrier Sense Multiple Access with Collision Detection.

- To understand what is behind Carrier Sense Multiple Access with Collision Avoidance let's look at each component individually:
- **Carrier sense** (CS): The idea that nodes may only send data over the network if the shared medium is free.

- **Multiple access** (MA): Several nodes share a network segment so they need an access method to resolve collisions.

- **Collision detection** (CD): If a collision does occur, it will be detected and the transmission will be tried again after a random amount of time.

Collision Domains

Collision affects the performance of Network Communication.

- **Slow Communication:** Collision enforces random time wait for hosts and retransmission of signals which slow downs communication

- **Scaling problem:** if more number of hosts are connected to network then more collision will occur, so scaling network will increase collision in network

Collision Domains

- **Switches**
- LAN switches completely resolve the problem with collisions.
- They operate at **layer 2 of the OSI model**, meaning that **they look at the ethernet header and trailer**.
- Their main advantage is that all their ports can operate in **full-duplex**, meaning they can simultaneously transmit and receive frames on any given port at any given time.
- Because of this, the media access algorithm for collision detection (CSMA/CD) is no longer required and is disabled by default.
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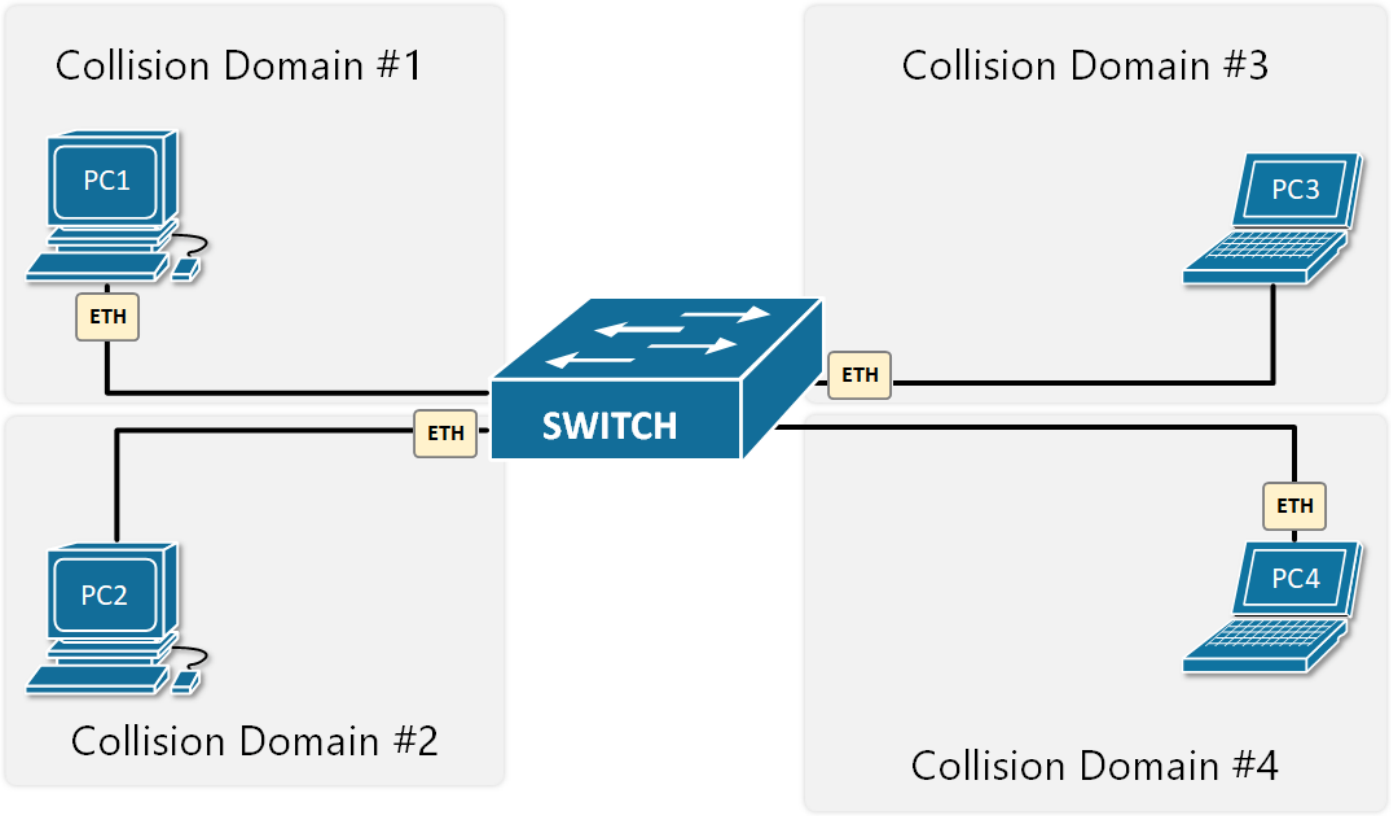
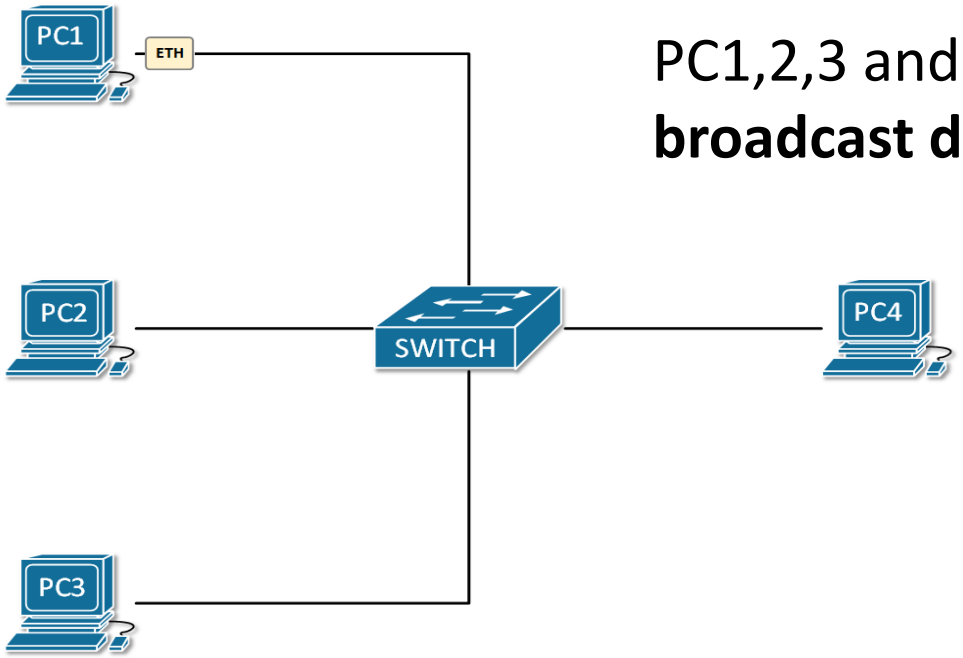
Collision Domains

- Another big advantage of switches is that they forward frames based on MAC addresses so any given frame doesn't need to be sent to all ports as hubs do.



Broadcast Domains

- In Ethernet LANs, **a broadcast is one-to-all** communication, which means that if a node sends a broadcast frame, **everybody receives a copy of it**.
- At the Ethernet layer, broadcast frames have a destination MAC address of FF-FF-FF-FF-FF-FF. When a switch receives a frame with this MAC, it sends a copy of the frame out all its interfaces, except the one it received the broadcast on.

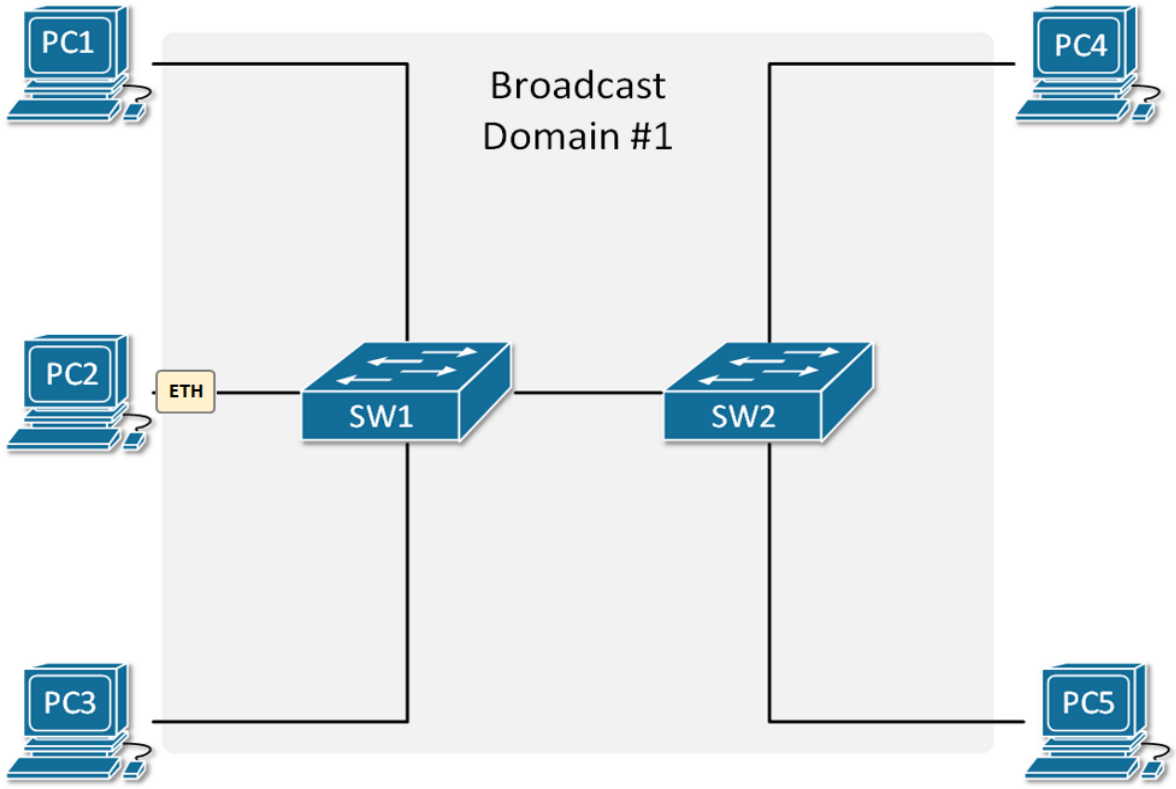


PC1,2,3 and 4 are in **one broadcast domain**.

Broadcast Domains

Multi-switch broadcast domain

- The same network logic applies when the LAN is made of more than one switch. When a node sends a broadcast frame, it is **"flooded" to everybody in the broadcast domain**.



Network Congestion: when multiple hosts simultaneously broadcast frames , The **complete network will be flooded with broadcast frames** to create network congestion

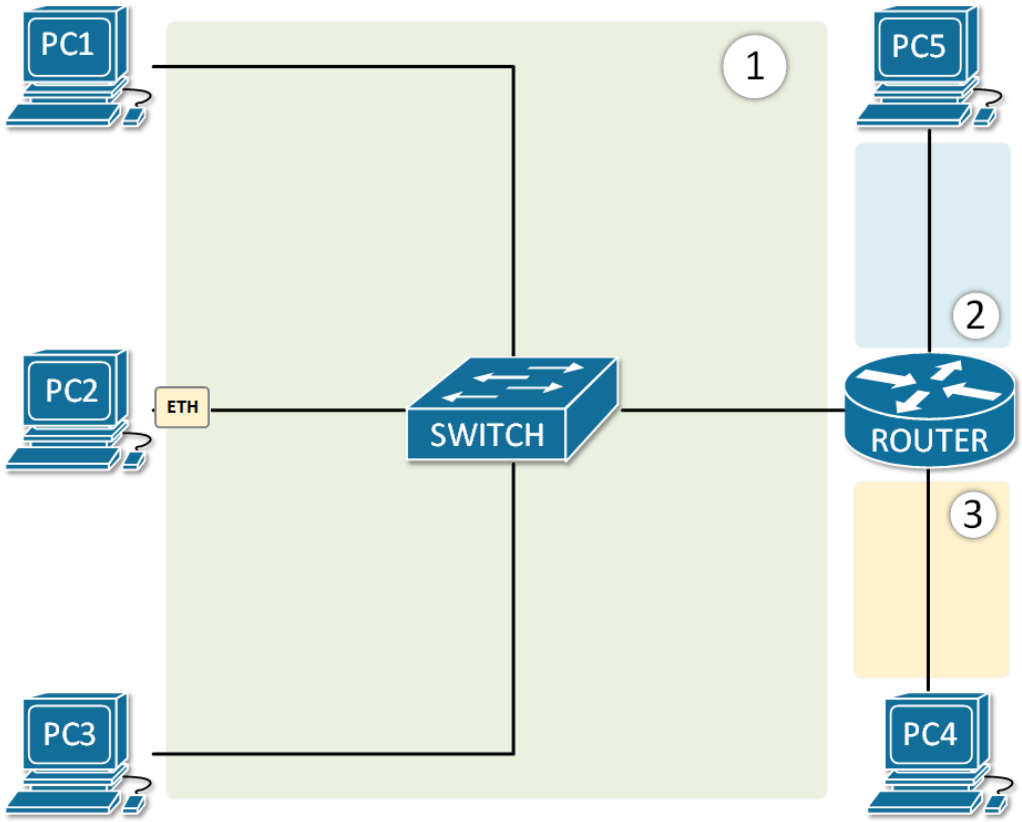
Broadcast Domains

Routers

- Routers solves the problem associated with switches i.e. Routers do not send broadcast frames outside network segment
- If we want to break down a broadcast domain into smaller domains, we use a router.
- **Routers don't flood broadcast frames** but instead decapsulate the ethernet frames and act upon the **layer 3** information within the IP packets

Broadcast Domains

- Since Routers can read **layer 3** (network layer of OSI model) therefore it can read IP from header.
- So instead of broadcasting it sends the frame to corresponding IP only.



Because of Router there are **Three** broadcast domains here