

SWITCHING IN NETWORKING

Framework Used: The Why, What, and How.

Why Learn Switching?

1. **Efficient Communication:** Switches control how data is forwarded in a network, ensuring efficient communication between devices.
2. **Scalability:** Switching is the backbone of enterprise networks, allowing them to grow and handle more devices.
3. **Security and Control:** Advanced switching features, i.e., VLANs and port security, enable secure and segmented networks.

What is Switching?

1. **Definition:** Switching is the process of forwarding data packets (frames) between devices in a network based on L2 (datalink) or L3 (network) information.
2. **Types of switching:**
 - **Layer 2 Switching :** Based on MAC addresses

- **Layer 3 Switching:** Incorporates routing capabilities using IP addresses.

3. Switching Modes:

- **Cut Through:** Forwards frames as soon as the destination MAC is read (low latency but no error checking)
- **Store-and-Forward:** Buffers and verifies the frame before forwarding (High latency but error-free)
- **Fragment-Free:** Checks the first 64 bytes for errors, then forwards by compromising between speed and reliability.

How Does Switching Work?

1. Switch MAC Address Table

- Switches learn which MAC addresses are connected to which ports by examining the source MAC address of incoming frames.
- Frames are forwarded to the destination MAC based on this table.
- Unknown destinations trigger flooding (broadcasting to all ports).

2. Frame Switching Process

- Receives a frame
- Looks up the destination MAC in the MAC address table

- *Forwards it to the corresponding port.*
- *If the destination MAC is not found (an unknown destination), the switch floods the frame, sending it out to all ports except the one on which it was received.*

TO NOTE:

- **Unicast Frame:** *If the Mac table has the destination MAC, the switch sends the frame to the specific port.*
- **Broadcast Frame:** *Since the destination MAC is FF:FF:FF:FF:FF:FF, the frame is transmitted to every port.*
- **Unknown Frame:** *If the destination MAC is not in the table, the frame is flooded to all ports, except the incoming port.*

Practical Lab: Observing the MAC Address Table

Objective:

- *Learn how switches dynamically (automatically) learn and update their MAC address table.*
- *Connect two PCs (PC1 and PC2) to a switch on ports Fa0/1 and Fa0/2.*
- *Set up IP addresses for both PCs.*

- Ping from *PC1* to *PC2*.

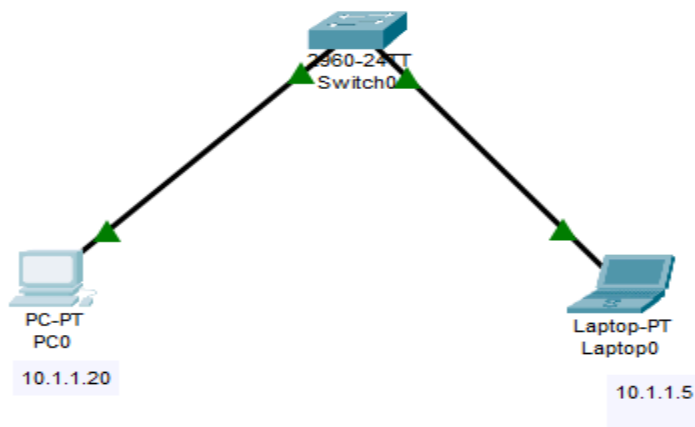
Topology:

- 1 Switch
- 2 PCs (*PC A* and *PC B*)

Steps:

1. Connect PCs to the Switch:

- *PC A*: Port *Fa0/1*
- *PC B*: Port *Fa0/2*

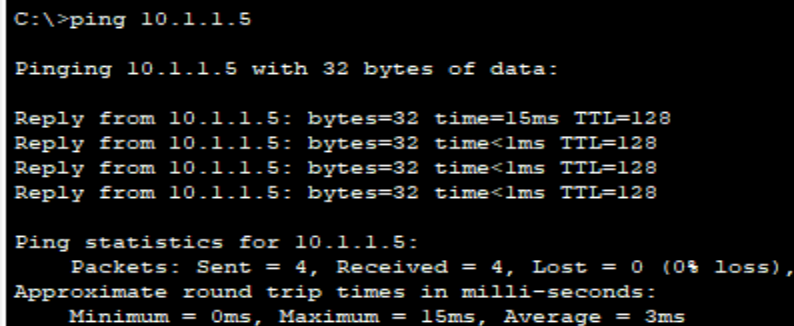


2. Check the Initial MAC Address Table:

```
Switch#show mac address-table
      Mac Address Table
-----
Vlan    Mac Address      Type    Ports
----    -

```

3. Generate Traffic:



```
C:\>ping 10.1.1.5

Pinging 10.1.1.5 with 32 bytes of data:

Reply from 10.1.1.5: bytes=32 time=15ms TTL=128
Reply from 10.1.1.5: bytes=32 time<1ms TTL=128
Reply from 10.1.1.5: bytes=32 time<1ms TTL=128
Reply from 10.1.1.5: bytes=32 time<1ms TTL=128

Ping statistics for 10.1.1.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 15ms, Average = 3ms
```

TO NOTE:

Test for communication from the above topology;

- *The switch learns the PC's MAC when the ping starts.*
- *If the laptop's MAC isn't already in the table, the switch floods the packet.*

- The laptop responds, and its MAC address is added to the MAC table.

4. Verify the MAC Address Table:

```
Switch#show mac address-table
```

Mac Address Table			

Vlan	Mac Address	Type	Ports
----	-----	-----	-----
1	0030.a387.949d	DYNAMIC	Fa0/2
1	0090.2b75.8b57	DYNAMIC	Fa0/1

Note:

- **Vlan:** The VLAN ID associated with the MAC address.
 - **MAC Address:** The unique identifier of the device.
 - **Type:** Indicates how the MAC address was learned (e.g., dynamic means it was automatically learned by the switch.)
 - **Ports:** The port the MAC address is connected to.
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Troubleshooting a possible network issue during switching, especially on the MAC Address Table.

Issue: A computer cannot communicate with the network;

- *If the computer's MAC address isn't listed, it may not be sending traffic to the switch.*

WHY??

- *Cable issue*
- *NIC Problem*

NB → You should also check on the ports and ensure they are up and receiving traffic.