5. ETHERNET LAN SWITCHING : PART 1

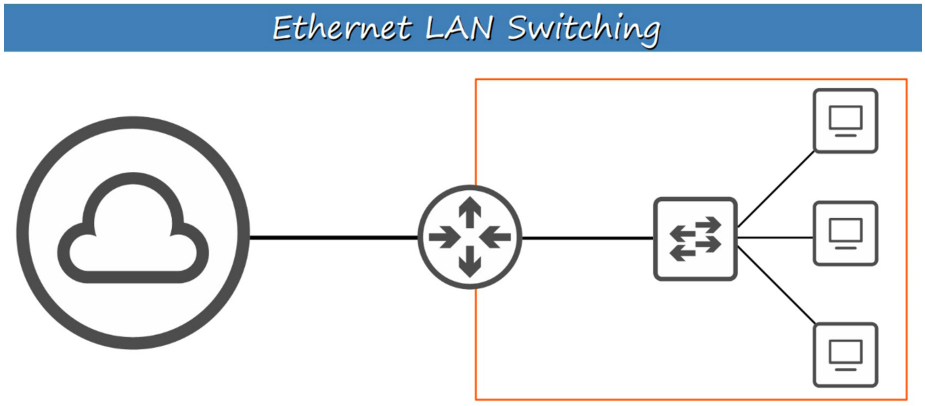

Figure 1: image

7	Application	• Provides node-to-node connectivity and data transfer (for example, PC to switch, switch to router, router to router).
6	Presentation	
5	Session	• Defines how data is formatted for transmission over a physical medium (for example, copper UTP cables)
4	Transport	
3	Network	• Detects and (possibly) corrects Physical Layer errors.
2	Data Link	• Uses Layer 2 addressing, separate from Layer 3 addressing.
1	Physical	• Switches operate at Layer 2.

Figure 2: image

LAN's

- A LAN is a network contained in a relatively small area.
- Routers are used to connect separate LAN's

An ETHERNET FRAME looks like:

Ethernet Trailer — PACKET — Ethernet Header

The Ethernet Header contains 5 Fields:

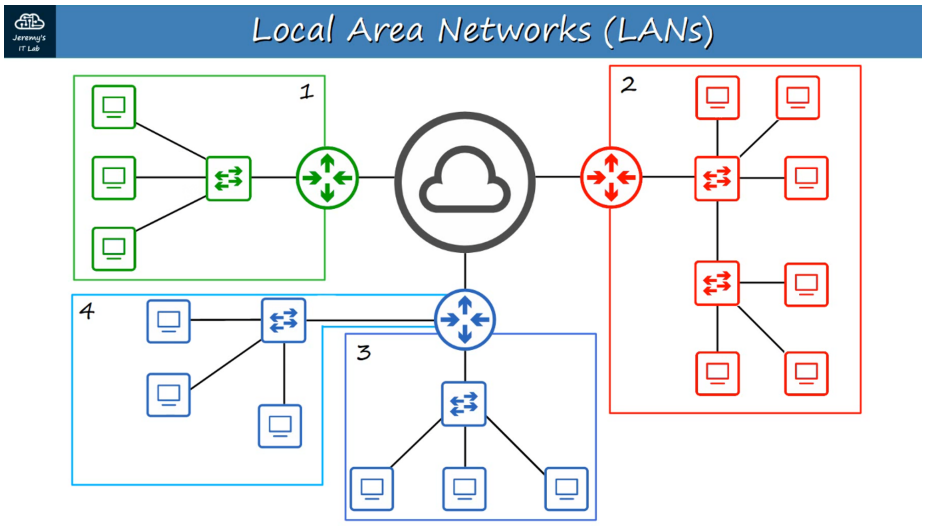

Figure 3: image

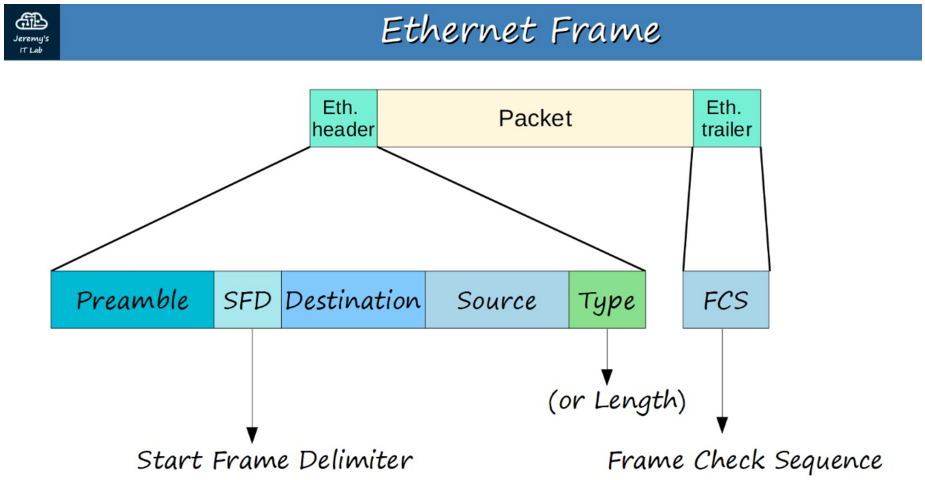

Figure 4: image

Preamble – SFD – Destination – Source – Type 7 bytes – 1 byte – 6 bytes – 6 bytes – 2 bytes

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PREAMBLE:

- Length: 7 bytes (56 bits)
- Alternating 1's and 0's
- 10101010 * 7x
- Allows devices to synchronize their receiver clocks

SFD : 'Start Frame Delimiter'

- Length: 1 byte(8 bits)
- 10101011
- Marks end of the PREAMBLE and beginning of rest of frame.

DESTINATION AND SOURCE

- Layer 2 Address
- Indicates the devices sending / receiving the frame
- MAC = 'Media Access Control'
- = 6 byte (48-bit) address of the physical device

TYPE / LENGTH

- 2 bytes (16-bit) field
- A value of 1**500 or less** in this field indicates the LENGTH of the encapsulated packet (in bytes)
- A value of **1536 or greater** in this field indicates the TYPE of the encapsulated packet and length is determined via other methods.
- IPv4 = 0x0800 (hexadecimal) = 2048 in decimal
- IPv6 = 0x86DD (hexadecimal) = 34525 in decimal
- Layer 3 protocol used in the encapsulated Packet, which is almost always Internet Protocol (IP) version 4 or version 6.

The ETHERNET TRAILER contains:

FCS

- 'FRAME CHECK SEQUENCE'
- 4 bytes (32 bits) in length
- Detects corrupted data by running a 'CRC' algorithm over the received data
- CRC = "Cyclic Redundancy Check"

Altogether the ETHERNET FRAME = 26 bytes (header + trailer)

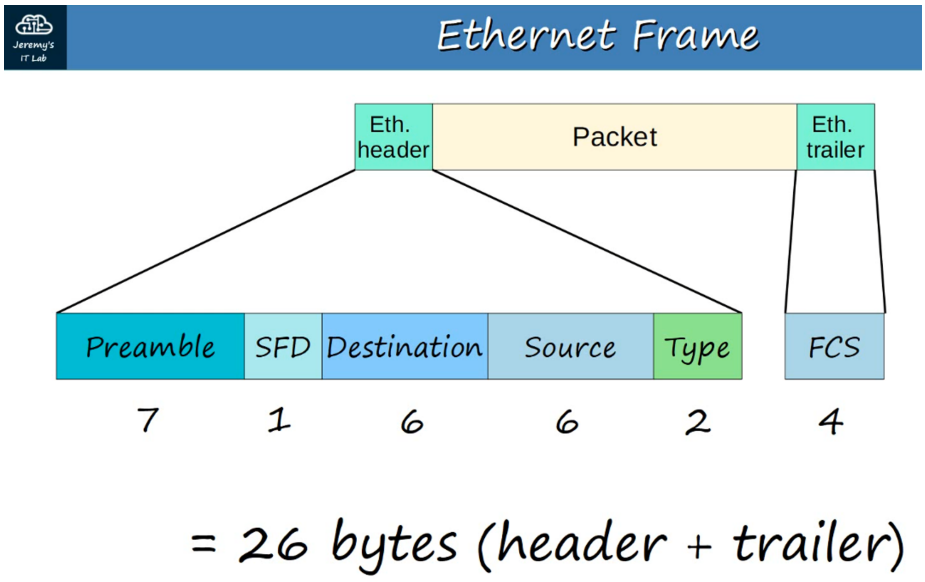

Figure 5: image

MAC ADDRESS (48 bits long)

- 6-bytes (48-bits) physical address assigned to the device when it is made.
- AKA 'Burned-In Address' (BIA)
- Is globally unique
- First 3 bytes are the OUI (Organizationally Unique Identifier) which is assigned to the company making the device
- The last 3 bytes are unique to the device itself
- Written as 12 hexadecimal characters

Example:

E8:BA:70 // 11:28:74 OUI // Unique Device ID

HEXADECIMAL

INTERFACE NAMES

F0/1, F0/2, F0/3… F stands for "Fast Ethernet" or 100 Mbps interfaces.

MAC ADDRESS TABLE

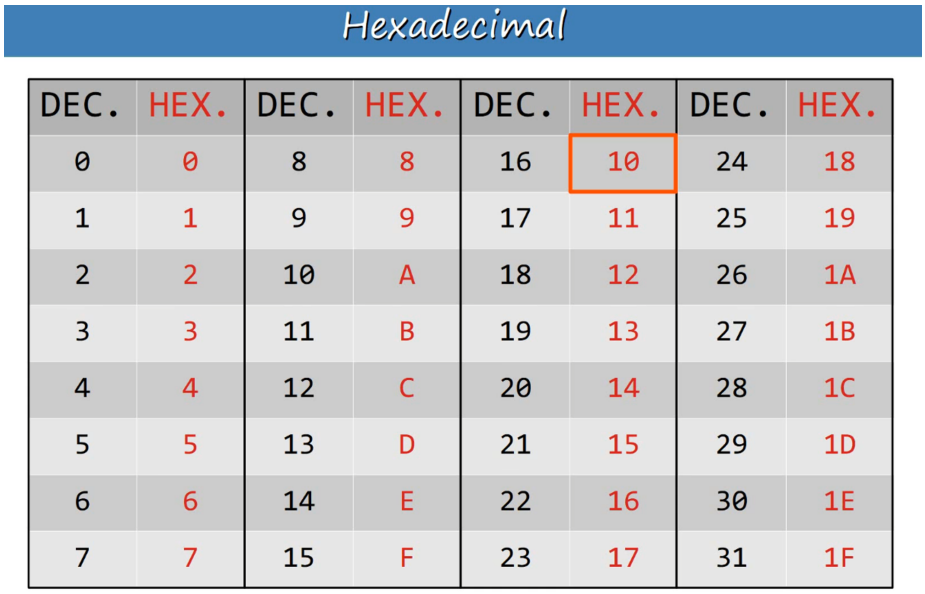

Figure 6: image

Each Switch stores a DYNAMICALLY LEARNED MAC ADDRESS TABLE, using the SOURCE MAC ADDRESS of frames it receives.

When a Switch doesn't know the DESTINATION MAC ADDRESS of a frame (UNKNOWN UNICAST FRAME), it is forced to FLOOD the frame - Forward the frame out of ALL it's interfaces, except the one it received the packet from.

When a KNOWN Unicast Frame is known (MAC Address is recognized by the entry in the MAC ADDRESS TABLE), the frame is FORWARDED like normal.

- Note: Dynamic MAC Addresses are removed from the MAC ADDRESS TABLE every 5 minutes of inactivity.

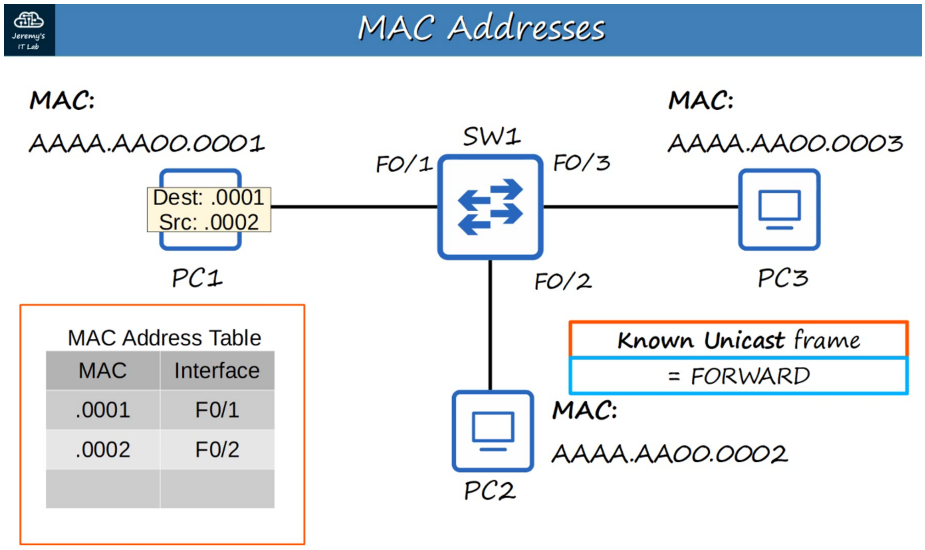

Figure 7: image

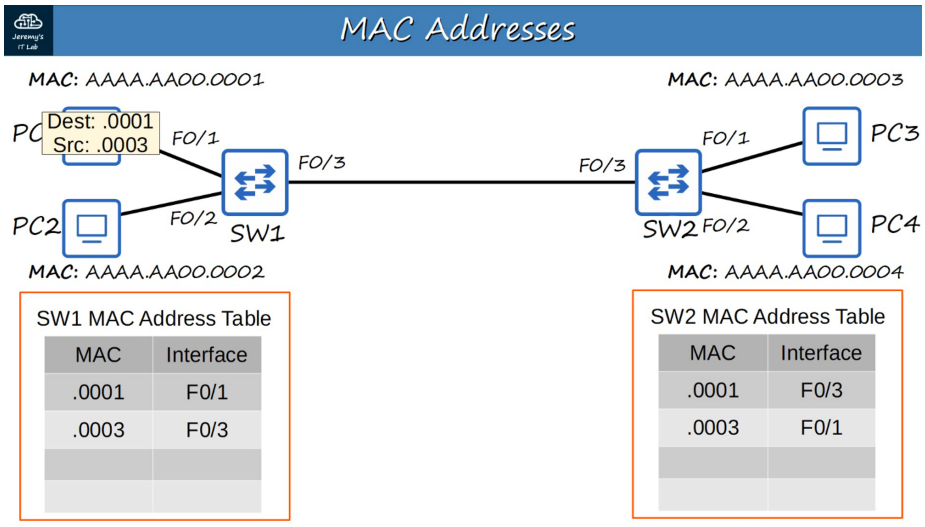

Figure 8: image