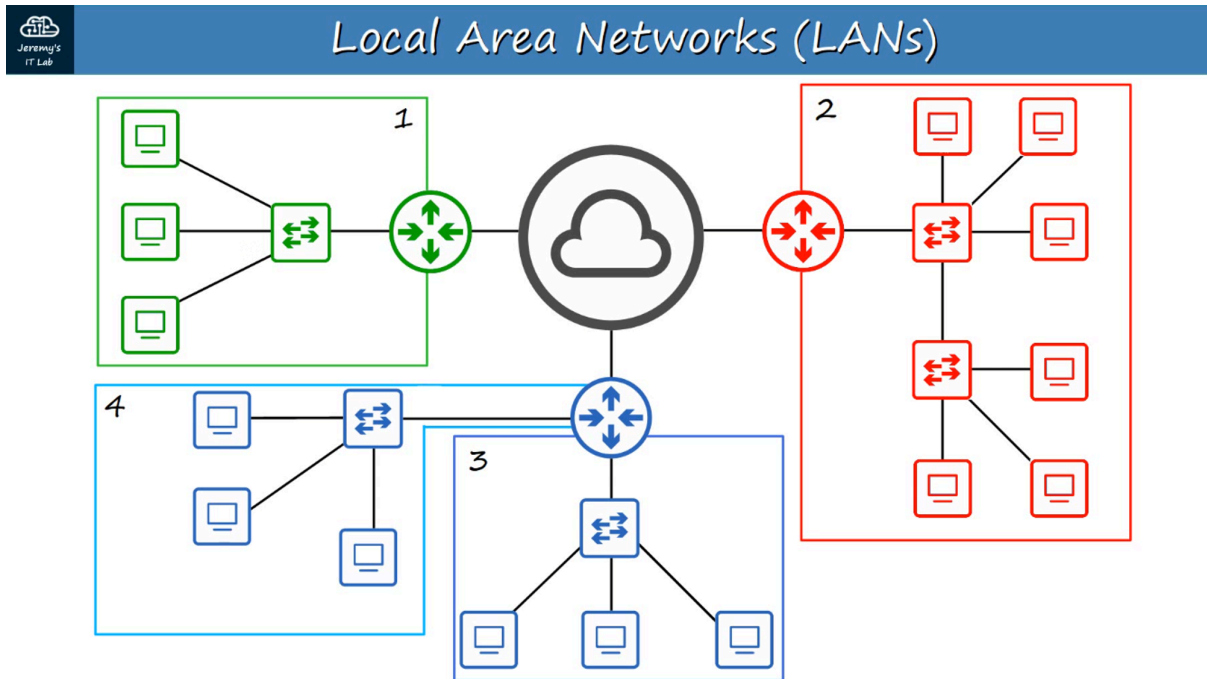


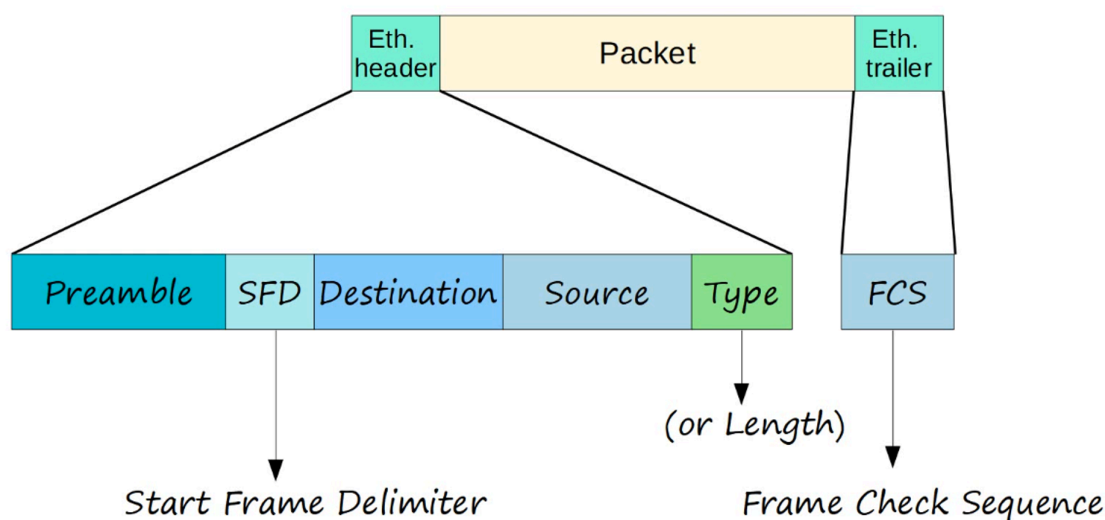
5. ETHERNET LAN SWITCHING: PART 1

What is a LAN?

- A **LAN** (Local Area Network) is a network contained in a relatively small area.
- **Routers** are used to connect separate LANs.



Structure of an Ethernet Frame



Ethernet Frame:

- **Ethernet Header | Packet | Ethernet Trailer**

Ethernet Header Fields (26 bytes total):

1. Preamble:

- **Length:** 7 bytes (56 bits).
- Alternating 1s and 0s: **10101010** (repeated 7 times).
- Allows devices to **synchronize receiver clocks**.

2. SFD (*Start Frame Delimiter*):

- **Length:** 1 byte (8 bits).
- Value: **10101011**.
- Marks the **end of the preamble** and **start of the frame**.

3. Destination and Source Address:

- **Layer 2 Address** (MAC Address).
- **6 bytes (48 bits)** each for source and destination.
- Represents the **physical address** of devices.

4. Type/Length Field:

- **Length:** 2 bytes (16 bits).
- Determines either:
 - **Length** of the encapsulated packet (if ≤ 1500).
 - **Type** of the encapsulated packet (if ≥ 1536).
- Examples:

- IPv4 = 0x0800 (2048 in decimal).
- IPv6 = 0x86DD (34525 in decimal).

Ethernet Trailer Field

1. **FCS** (*Frame Check Sequence*):
 - **Length**: 4 bytes (32 bits).
 - Used for **error detection** via CRC (*Cyclic Redundancy Check*).
 - Detects corrupted data in the frame.
-

MAC Address

- **Length**: 6 bytes (48 bits).
- Also known as the **Burned-In Address (BIA)**.
- **Globally unique** for every device.
- Structure:
 - First **3 bytes**: OUI (*Organizationally Unique Identifier*).
 - Last **3 bytes**: Unique to the device.
- Represented in **hexadecimal**: e.g., E8:BA:70:11:28:74.

Hexadecimal

DEC.	HEX.	DEC.	HEX.	DEC.	HEX.	DEC.	HEX.
0	0	8	8	16	10	24	18
1	1	9	9	17	11	25	19
2	2	10	A	18	12	26	1A
3	3	11	B	19	13	27	1B
4	4	12	C	20	14	28	1C
5	5	13	D	21	15	29	1D
6	6	14	E	22	16	30	1E
7	7	15	F	23	17	31	1F

Interface Names

- Common format: F0/1, F0/2, F0/3...
 - F: Indicates *Fast Ethernet* (100 Mbps interfaces).
-

MAC Address Table

Dynamic MAC Address Table:

- A switch learns MAC addresses dynamically using the **Source MAC Address** from incoming frames.
 - Stored MAC addresses allow efficient **frame forwarding** to the correct destination.
-

Frame Forwarding Logic

1. Unknown Unicast Frame:

- When the **Destination MAC Address** is not found in the MAC Address Table.
- The frame is **flooded**: sent out on all interfaces except the one it was received on. Only devices that sent out frames will have their MAC Address learnt in the table.

2. Known Unicast Frame:

- If the Destination MAC Address is recognized, the frame is **forwarded** to the appropriate interface.
-

MAC Address Table Timeout

- Dynamic MAC addresses are **removed from the MAC Address Table** after **5 minutes of inactivity**.

MAC Addresses

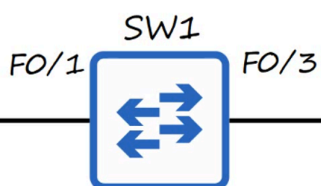
MAC:

AAAA.AA00.0001

Dest: .0001
Src: .0002

PC1

MAC Address Table	
MAC	Interface
.0001	F0/1
.0002	F0/2



MAC:

AAAA.AA00.0003



PC3

F0/2



PC2

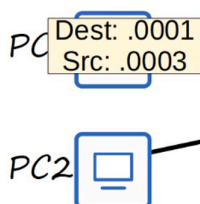
MAC:

AAAA.AA00.0002

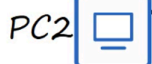
Known Unicast frame
= FORWARD

MAC Addresses

MAC: AAAA.AA00.0001



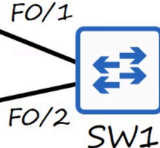
Dest: .0001
Src: .0003



MAC: AAAA.AA00.0002

SW1 MAC Address Table

MAC	Interface
.0001	F0/1
.0003	F0/3



F0/1
F0/2
SW1

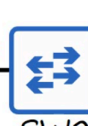
F0/3

F0/3

MAC: AAAA.AA00.0003



PC3



SW2

F0/1
F0/2



PC4

MAC: AAAA.AA00.0004

SW2 MAC Address Table

MAC	Interface
.0001	F0/3
.0003	F0/1