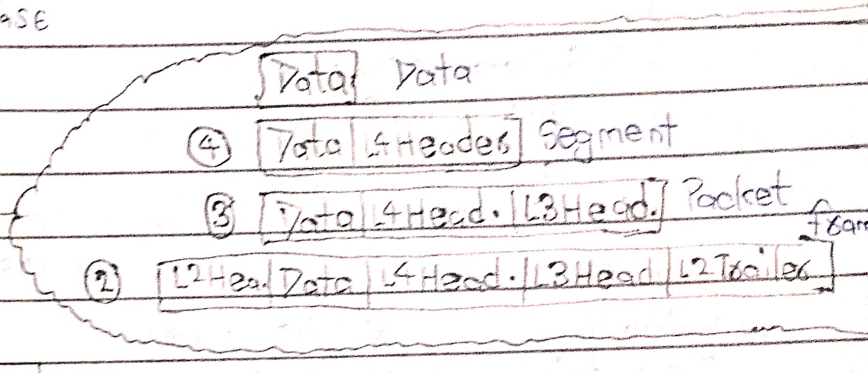
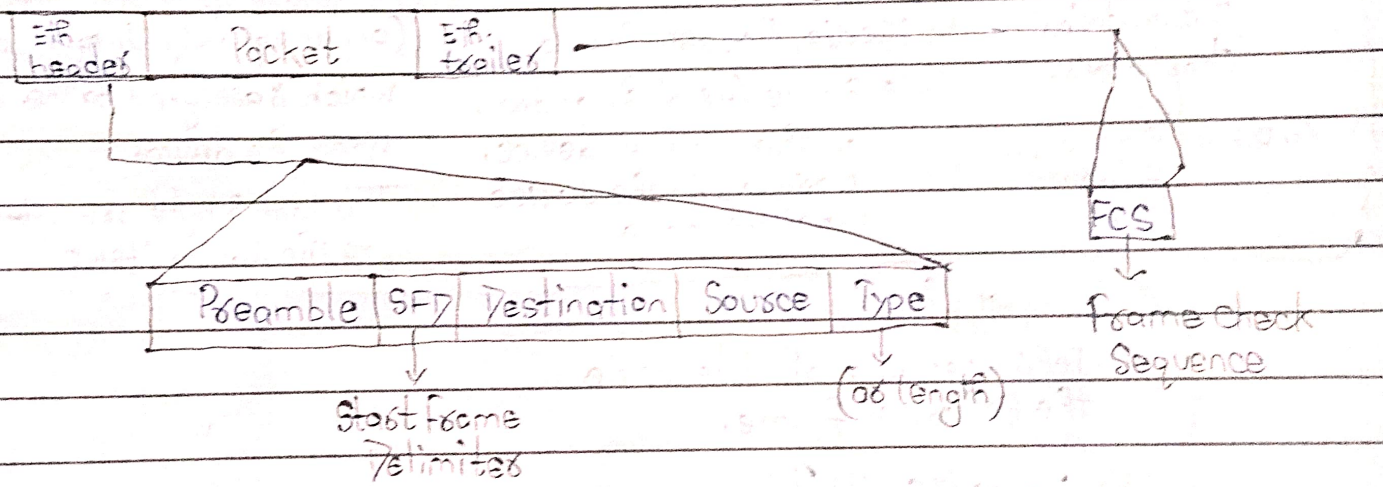
Ethernet LAN Switching

* Local Area Network
  - ↳ Two switch are connected to each other two increase existing LAN(s)

* OSI Model - PDUs
* Ethernet frame





* Preamble & SFD

- Preamble
  - ↳ Length: 7 bytes [56 bits]
  - ↳ Alternating 1's & 0's
  - ↳ 10101010 * 7
  - ↳ It gets the receive ready
  - ↳ Helps the network device sync their clock so they can understand the data properly

- SFD [Start frame Delimiter]
  - ↳ Length: 1 byte (8 bits)
  - ↳ 10101011
  - ↳ It marks the exact start of the real data (frame)
  - ↳ Comes right after the Preamble.

⊛ Destination & Source

- Destination
  - ↳ The MAC address of the device that should receive the data.
  - ↳ Tells the network who the target it is
  - ↳ Switches use this to deliver the frame to the correct computer or device
- Source
  - ↳ The MAC address that is sending the data.
  - ↳ Tells the receiver who sent the data
  - ↳ Can be used to reply or track where the message came from

⊛ MAC Address → is globally unique

- ↳ Written in 12 hexadecimal characters.
- ↳ A.K.A "Burned-In Address" (BIA)
- ↳ Media Access Control.
- ↳ = 6 byte (48 bits) address of the physical device, assigned to the device when its made
- ↳ The first 3 bytes are OUI (Organizationally Unique Identifier) which is assigned to the company making the device
- ↳ The last 3 byte are unique to the device itself

⊛ TYPE/Length

- ↳ Tells what kind of data inside the Ethernet frame.
- ↳ 2 byte (16-bit) field
- ↳ A value of 1500 or less in the field indicates the length of the encapsulated packet (in bytes)
- ↳ A value of 1536 or greater in this field indicates the TYPES of the encapsulated Packet (Usually IPv4 or IPv6) & the length is determined via other methods

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

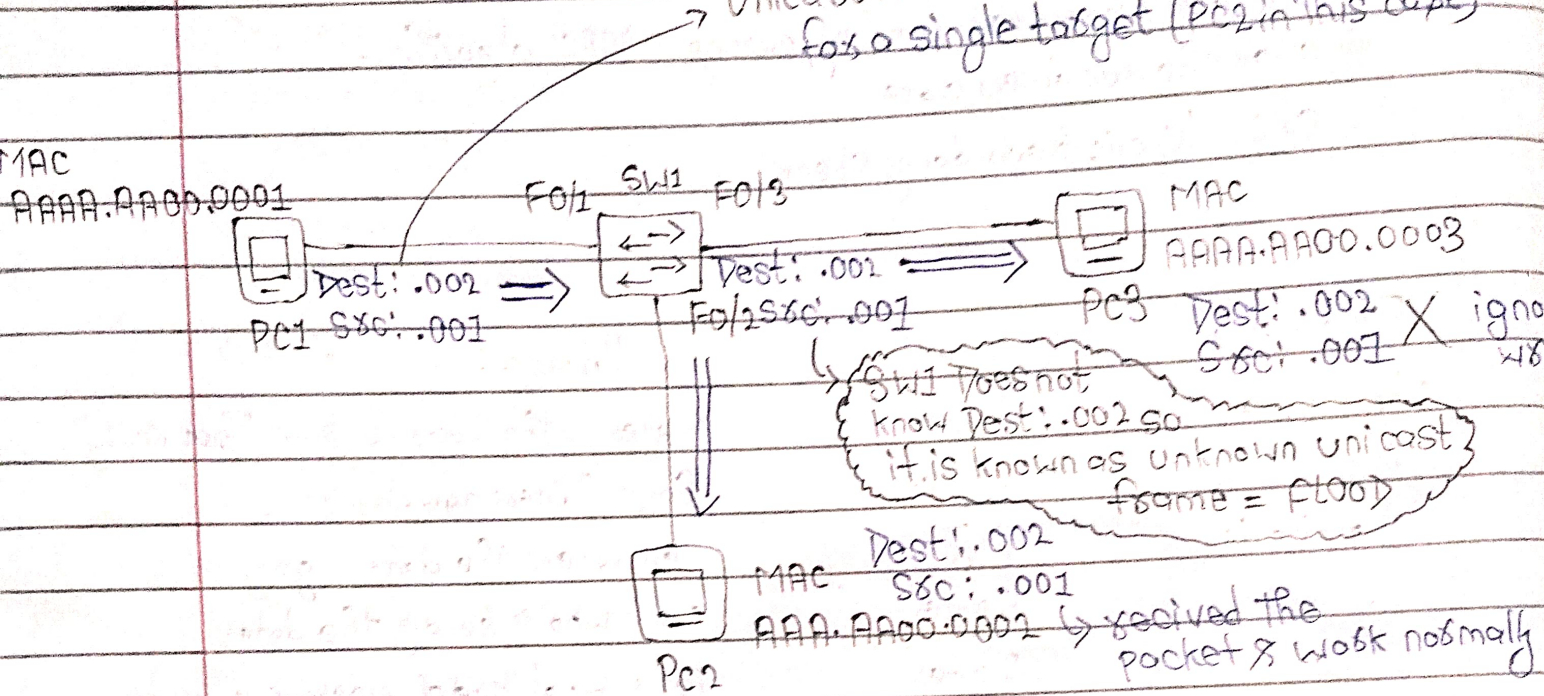
Preamble	SFD	Destination	Source	TYPE	(Packet)	FCS

↳ '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'

Field Name	Size	Purpose :
• Preamble	7 bytes	Wakes up the receive, says "Get ready"
• SFD	1 bytes	Says "Start now!"
• Destination	6 bytes	Tell where the data is going
• Source	6 bytes	Tell who is sending the data
• Type	2 bytes	Tells what kind of message is inside
• FCS	4 bytes	checks for errors in the frame, like a final check

↳ = 26 bytes (header + trailer)

MAC Addresses

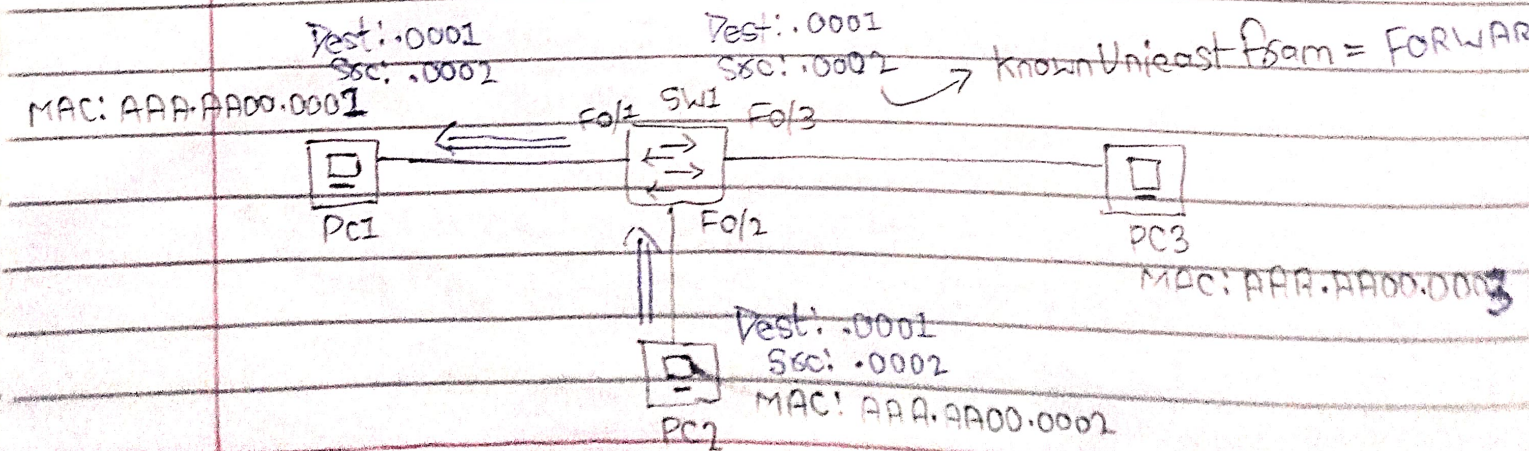


MAC Address Table ⟶ It is known as Dynamically learned MAC address / Dynamic MAC Address

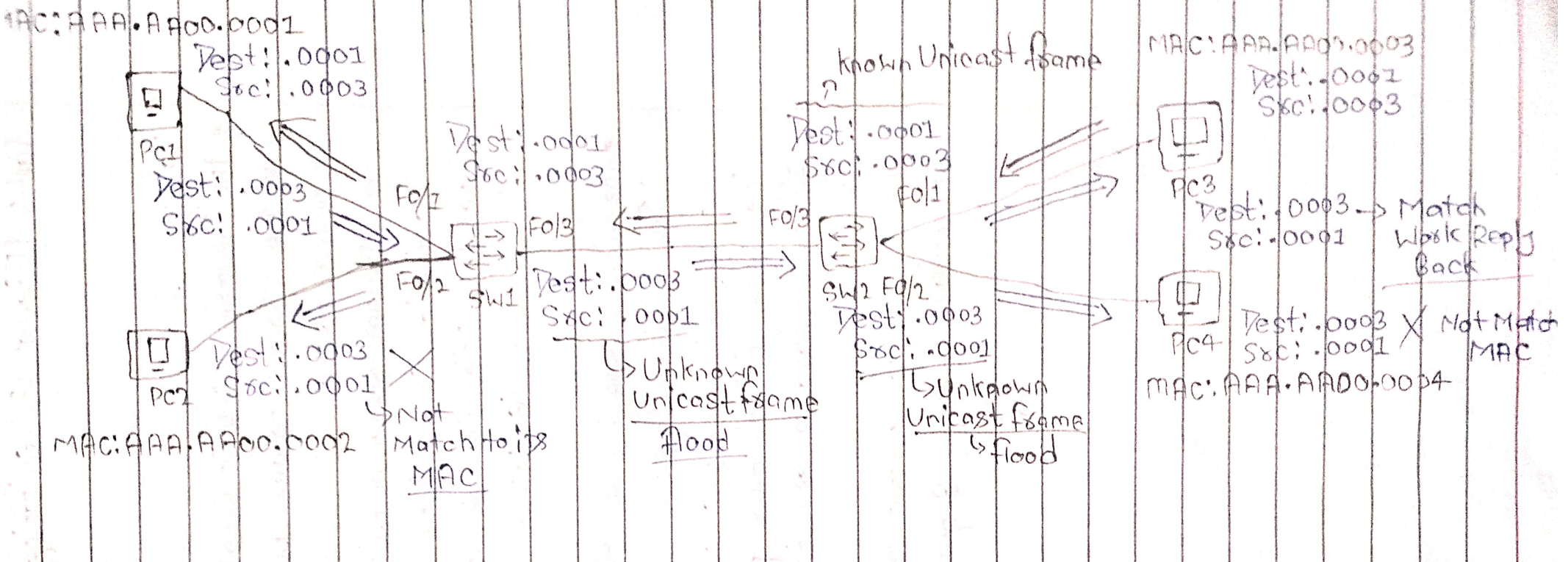
MAC	Interface
.0001	Fo/1
.0002	Fo/2

- In cisco switches Dynamic MAC addresses are removed from the MAC address table after 5 minutes of inactivity.

How PC2 Reply back



⊛ Two Switches



SW1 MAC Address Table

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

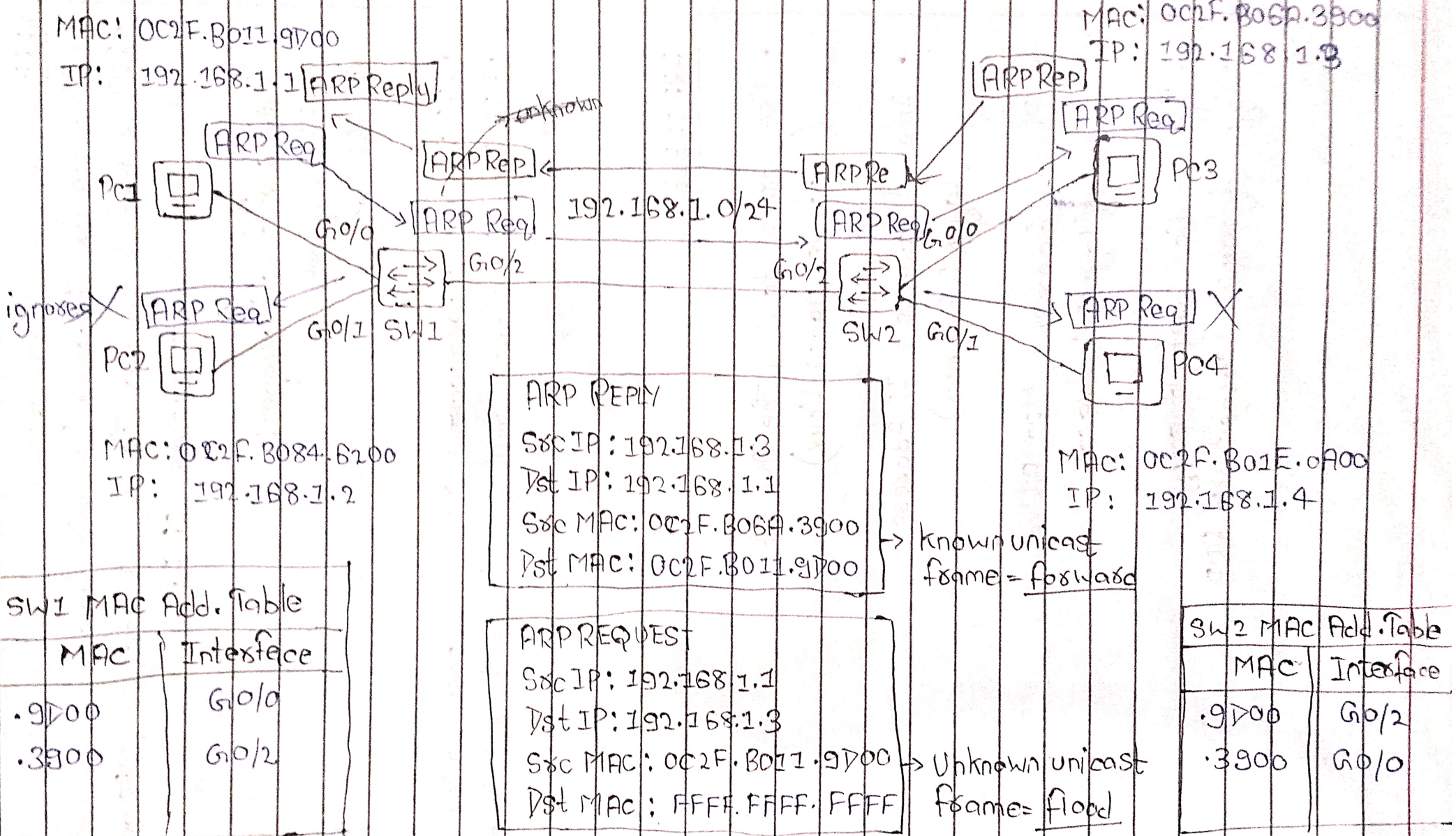
SW2 MAC Address Table

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

Note:-

- The Preamble & SFD is usually not considered past of the Ethernet header but it sended every Ethernet frame.
  So, Ethernet frame contains these three things (Destination, Source, Type, FCS).
  Therefore the size of the Ethernet header + trailer is 18 bytes (6+6+2+4)

- The minimum size for an Ethernet frame (Header + Payload [Packet] + Trailer) is 64 bytes.
  64 bytes - 18 bytes (Header + trailer size) = 46 bytes
  Therefore the minimum payload (packet) size is 46 bytes.
  If the payload is less than 46 bytes, padding bytes are added.
  i.e if 34 bytes packet then 12 bytes of padding is added (34+12) 46 bytes.



ARP REPLY
Src IP: 192.168.1.3
Dst IP: 192.168.1.1
Src MAC: 0C2F.B06A.3900
Dst MAC: 0C2F.B011.9D00
→ known unicast frame = forward

ARP REQUEST
Src IP: 192.168.1.1
Dst IP: 192.168.1.3
Src MAC: 0C2F.B011.9D00
Dst MAC: FFFF.FFFF.FFFF
→ Unknown unicast frame = flood

SW1 MAC Add. Table

MAC	Interface
.9D00	Gi0/0
.3900	Gi0/2

SW2 MAC Add. Table

MAC	Interface
.9D00	Gi0/2
.3900	Gi0/0

#ARP

- ARP stands for 'Address Resolution Protocol'
- ARP is used to discover the layer 2 address (MAC add.) of a known layer 3 address (IP Address)

Consists of two Messages:

(1) ARP Request

(2) ARP Reply

- ARP Request is broadcast = sent to all hosts on the network.
- ARP Reply is unicast = sent only to one host (the host that sent the request)

ARP TABLE

- Use "arp -a" to view the ARP Table (Windows, Macos, Linux)
- Internet Address = IP Address (Layer 3 Address)
- Physical Address = MAC Address (Layer 2 Address)
- Type static = default entry
- Type dynamic = learned via ARP

Ping

- A Network utility that is used to test reachability
- Measures round-trip time

Uses two messages:

(1) ICMP Echo Request

(2) ICMP Echo Reply

- Command to use ping: ping (ip-address)

MAC Address Table

- 'show mac address-table'
  this command is used on Cisco switches to display the MAC address table.

Clearing the MAC Address Table:

Dynamic MAC Address are remove after 5 mint (inactive) from MAC Address table this is known as Aging.

We can also remove manually MAC address from table:

→ clear mac address-table dynamic
→ clear mac address-table dynamic address mac-address
→ clear mac address-table dynamic interface interface-id