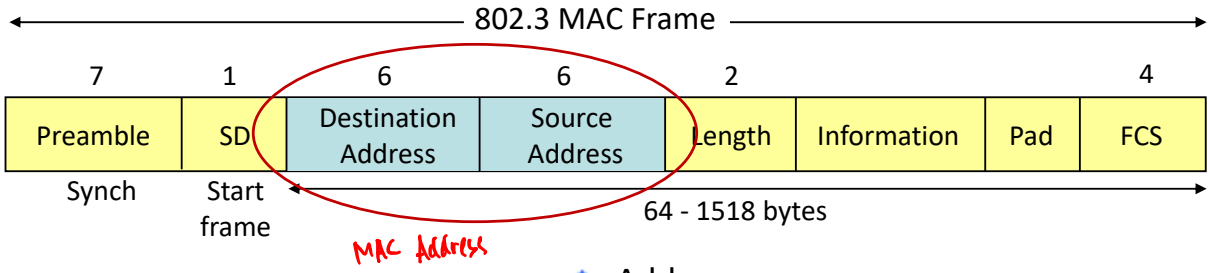
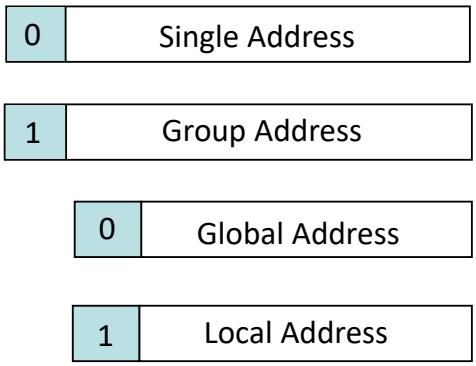
IEEE 802.3 MAC Frame





- Addresses (LSBit)
  - Single or Group (1st bit transmitted)
  - Global or Local (2nd bit transmitted) (2nd LSBit)
- Global Addresses (1st 3 bytes: OUI Organizationally Unique Identifier)
  - 2^{46} global addresses
  - 2^{22} vendors, 2^{24} addresses per vendor
  - E.g., Cisco 00-00-0C

http://standards-oui.ieee.org/

MAC Address:

Apple OUI

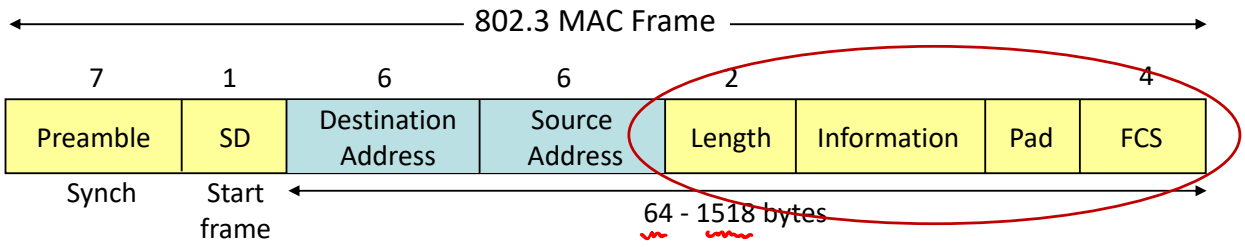
78 D1 62 - - -

0 1 1 1 1 0 0 0

↑ ↑

Global Single

IEEE 802.3 MAC Frame



- Length: # of bytes in the information field
  - Max frame 1518 bytes, excluding preamble & SD
  - Max information 1500 bytes: 05DC

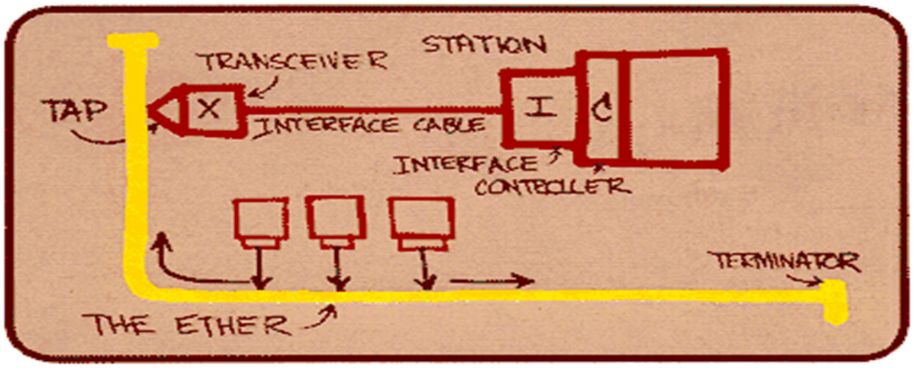
Eg. info : 4 bytes
6+6+2+4+?+4 ≥ 64 bytes
⇒ Pad : 40 bytes

- Pad: ensures minimum frame size of 64 bytes
- FCS: CCITT-32 CRC, covers addresses, length, information, and pad fields
  - NIC discards frames with improper lengths or failed CRC

Ethernet LAN Evolution

- 1970 ALOHAnet radio network deployed in Hawaiian islands
- 1973 Metcalf and Boggs invented Ethernet: *random access in wired net*
- 1985 IEEE 802.3 LAN Standard (10 Mbps)
- 1995 Fast Ethernet (100 Mbps)
- 1998 Gigabit Ethernet
- 2002 10 Gigabit Ethernet
- 2007 100 Gigabit Ethernet
- Ethernet is the dominant LAN standard

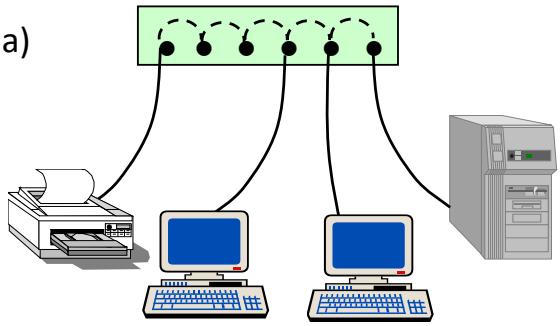
PARC



Metcalf's Famous Sketch

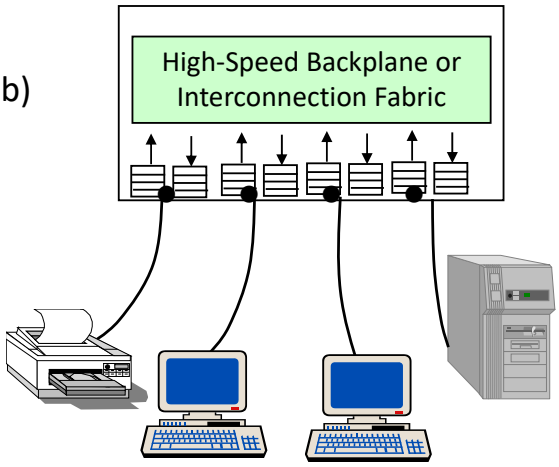
Ethernet Hubs & Switches

(a)



- Twisted pair, cheap
- Easy to work with
- Star-topology CSMA/CD
- Same collision domain
- Same broadcast domain

(b)



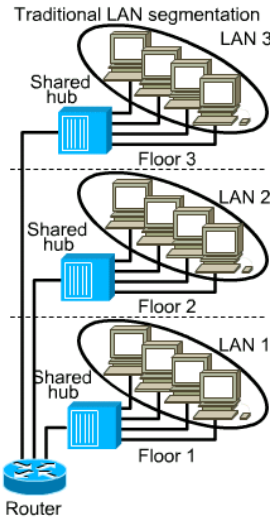
- Separate collision domains
- Same broadcast domain

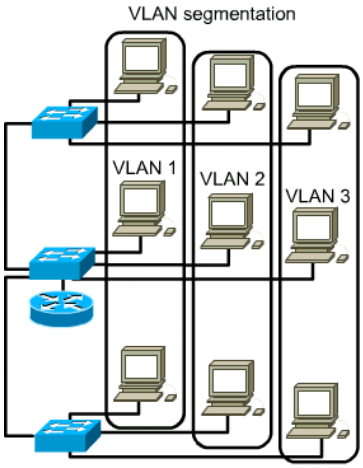
Repeaters, Bridges, Routers, Gateways

- Several ways of interconnecting networks:
  - Repeater at the physical layer
  - Switch (or bridge) at the MAC or data link layer
  - Router at the network layer
  - Gateway at a higher layer

VLAN (Virtual LAN)

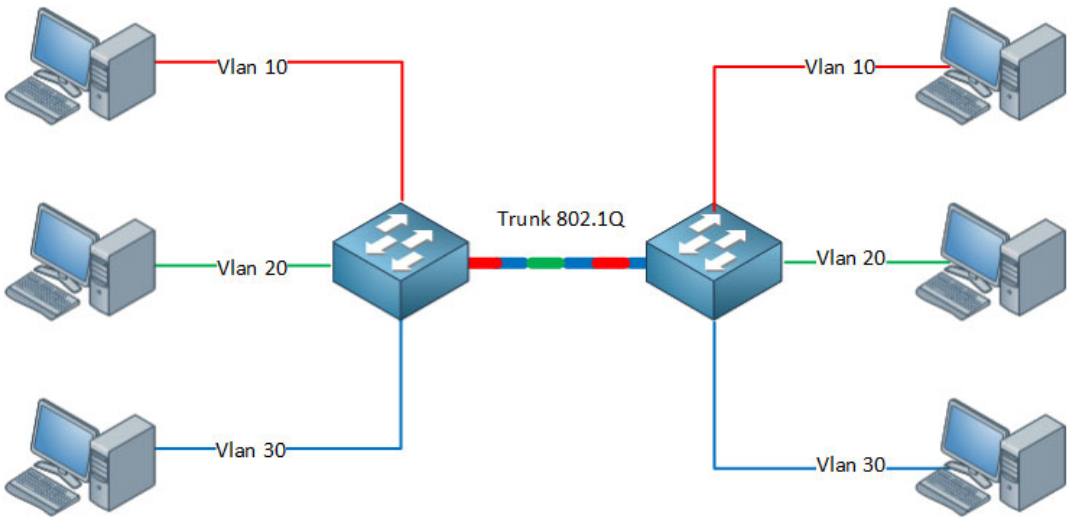
- VLAN Benefits
- VLAN types
  - Port-based
  - MAC address-based
  - IP address-based
  - Policy-based



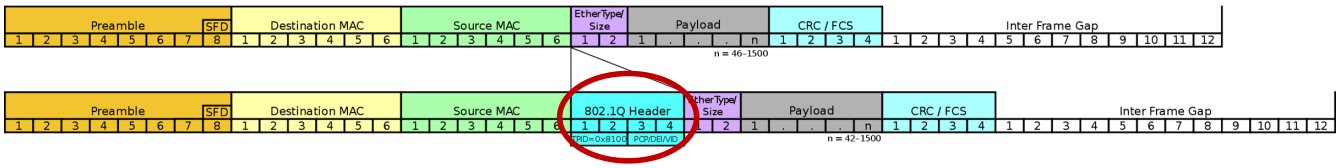


IEEE 802.1q

- Dot1q
- VLAN tagging
- VLAN trunking



IEEE 802.1q



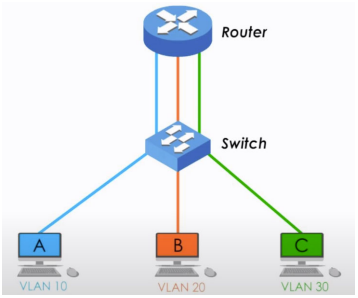
802.1Q tag format

16 bits	3 bits	1 bit	12 bits
TPID	TCI		
	PCP	DEI	VID

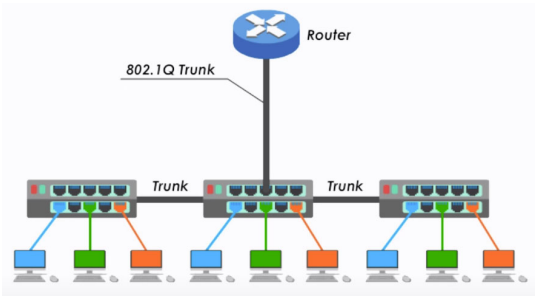
- 802.1q tag:
  - TPID (16 bits) – Tag Protocol Identifier 0x0810
  - PCP (3 bits) – Priority Code Point
  - DEI (1 bit) – Drop Eligible Indicator
  - VLAN ID (12 bits)

Inter VLAN Routing

- Traditional



- Router-on-a-Stick



- Level-3 Switch