Network Interface Layer
{Ethernet}

★ Content

1. Cabling Standards
2. Collision domains
3. Frame header
4. Operation of Switch
5. Configure a Cisco 2960 switch

Module 1 (Physical Layer Technologies)

★ Wire

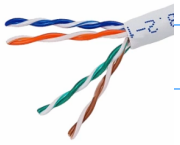
→ Twisted pair cabling {Most Common}

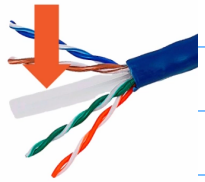
→ Wires are twisted to prevent cross talk.

Cat 5	100Mb Ethernet
Cat 5e	Gigabit Ethernet
Cat 6	Gigabit Ethernet

{Looks exactly same}

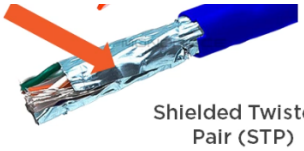
{With twisted plastic piece in between}





→ UTP (Unshilded Twisted Pair)

→ STP (Shielded Twisted Pair) → (Expensive)



Shielded Twisted Pair (STP)

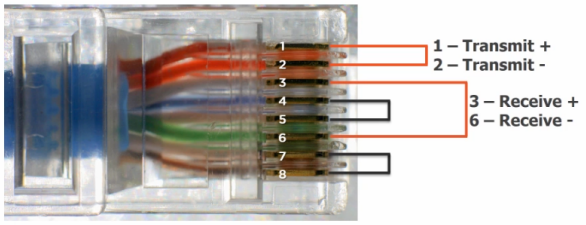
→ This is used to Shield wire inside from extend electro magnetic field.

→ Coaxial Cabling →

→ Serial Cabling →

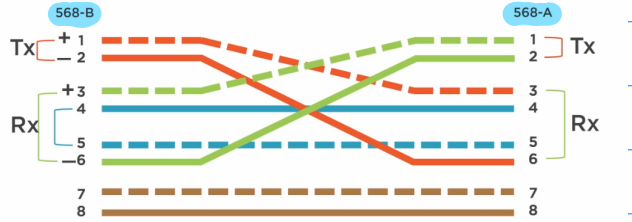
→ Proprietary cabling

★ RJ-45 Connector

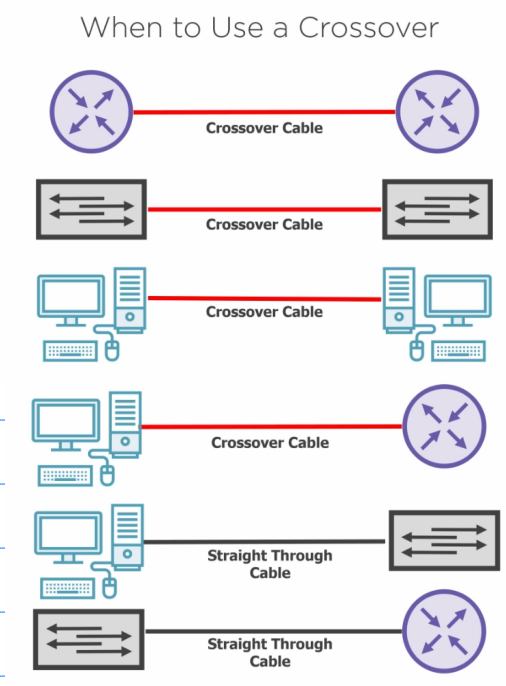


Pin#	Color of Wire	Wire
1	White/Orange	
2	Orange	
3	White/Green	
4	Blue	
5	White/Blue	
6	Green	
7	White/Brown	
8	Brown	

⇒ Cross over cable



⇒ We dont see a lot of use of Cross over cable, mainly because our network interface card automatically figure this stuff out from us.



we dont need these because

★ Wireless Ethernet (802.11)

Channel → Range of frequency we use to transmit information.

⇒ In 802.11 we use two different spectrums:

- 2.4 GHz
- 5 GHz

★ 2.4 GHz Spectrum

⇒ We divide this Spectrum in 14 Channels.

⇒ In order for communication to work over wireless, we actually can only use 3 channel.

★ 5 GHz Spectrum

5.170 GHz — 5.835 GHz

Channel	36	40	44	48	52	56	60	64	100	104	108	112	116	120	124	128	132	136	140	149	153	157	161
(MHz)	5180	5200	5220	5240	5260	5280	5300	5320	5500	5520	5540	5560	5580	5600	5620	5640	5660	5680	5700	5745	5764	5785	5805

Can not use because it overlaps with military application and Doppler radar application

or

If we want to use, we need to do DFS (Dynamic Frequency Selection)

Module 2 {Data Link layer technologies}

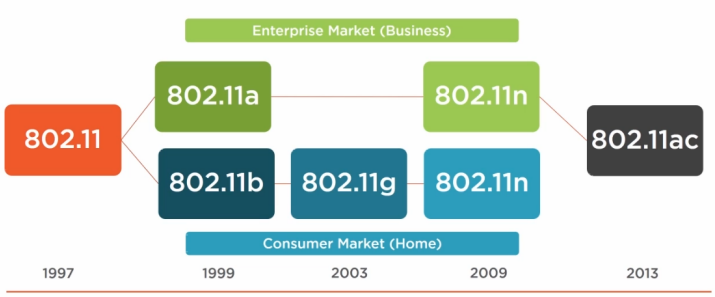
★ Ethernet (IEEE 802.3)

⇒ One of the oldest protocol still working on the internet.

10BaseT 100BaseT 1000BaseT → Twisted pair

1000 Mb/sec

★ Wireless Ethernet (IEEE 802.11)



802.11a
- → Use 5GHz spectrum only.
- → Upto 54 MBPS bandwidth.

802.11b
- → Use 2.4GHz Spectrum only.
- → Upto 11MBPS bandwidth.

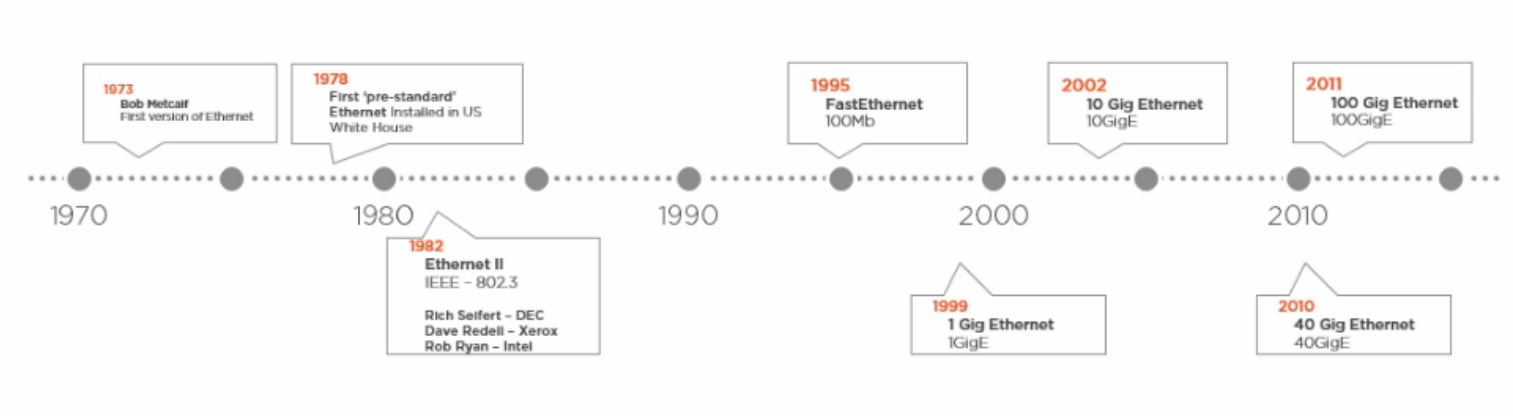
802.11g
- → Use 2.4GHz Spectrum only.
- → Upto 54 MBPS bandwidth.

802.11n
- → Uses 2.4 GHz and 5GHz spectrum both.
- → Upto 300 MBPS bandwidth
- → USES MIMO {Multiple input Multiple output}

802.11ac
- → Uses 5 GHz Spectrum only.
- → Upto 1.3Gbps bandwidth.
- → MIMO and beamforming

Module 3 {Ethernet}

★ A brief history of Ethernet



★ CSMA/CD (Carrier Sense Multiple Access with Collision Detection)

⇒ Collisions are inevitable on Ethernet network and we have a mechanism to deal with them.

Collision domain

↳ A group of network devices that will simultaneously detect a voltage spike.

★ Duplex and Speed

↳ Half Duplex {One device communicates at a time}

↳ {Like WalkieTalkie}

↳ Full Duplex {Two device communicating at the same time}

↳ {Like Telephone}

⇒ In modern communication, a collision domain happens only on a half duplex communication to a switch.

Name	Speed
Ethernet	10Mbps
FastEthernet	100Mbps
GigabitEthernet	1Gbps
10GigabitEthernet	10Gbps
40GigabitEthernet	40Gbps

★ Ethernet II frame

Destination MAC Address	Source MAC Address	Type	Data (Packet)	FCS
48 bits	48 bits	16 bits	MAX 1500 Bytes	32 bits

Manufacturer ID	Serial Number
00:10:D9 : D7:52:7A	
0000 0000 0001 0000 1101 1001 1101 0111 0101 0010 0111 1010	

→ Type of packet we are carrying.

→ Example

IPv4 - 0x0800
IPv6 - 0x86DD
ARP - 0x0806

→ Frame Check Sequence

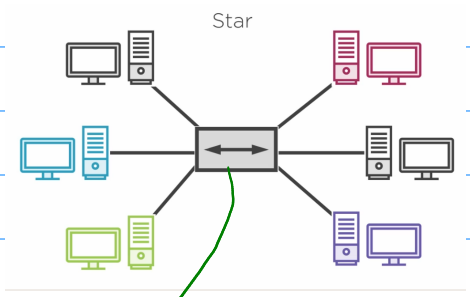
→ It holds value of a calculation called cyclical redundancy check.

Module 4 {Ethernet Switching}

★ Network topology

→ Bus topology
→ Ring topology
→ Star topology

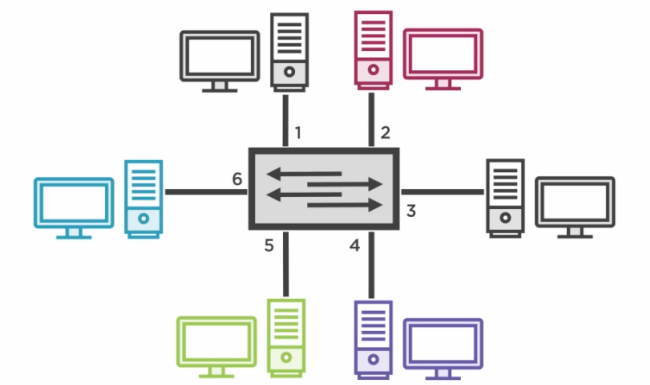
{Not used Commonly}

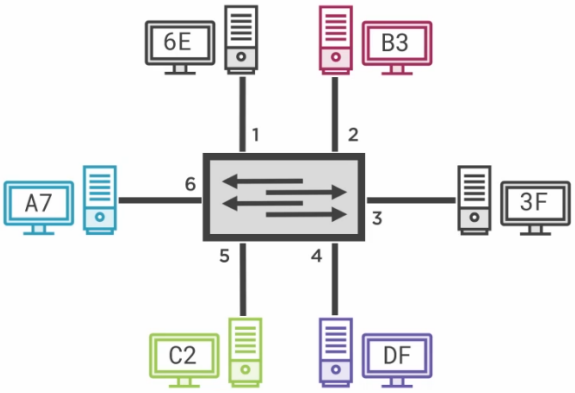


HUB

→ Repeats the message sent to all the other ports.

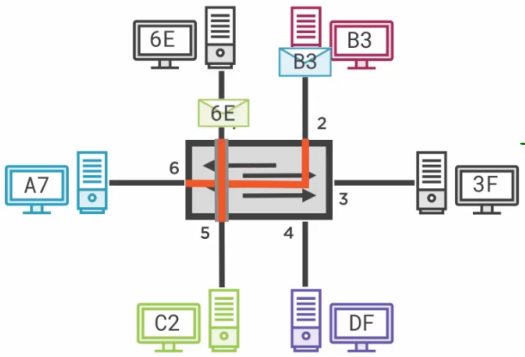
★ Layer 2 Switch





Port	MAC
1	6E
2	B3
3	3F
4	DF
5	C2
6	A7

← Mac address table
↳ switch maintains it.



→ Can have multiple communication at the same time.

★ Mac address aging

⇒ If a device does not sent any message over switch for more than 300 Sec, then the MCE address of the device will time out from Mac address table.

⇒ When a message is received to switch with destination MAC address not in the mac address table, then it will flood the message to all the ports, except the one from which it receives.

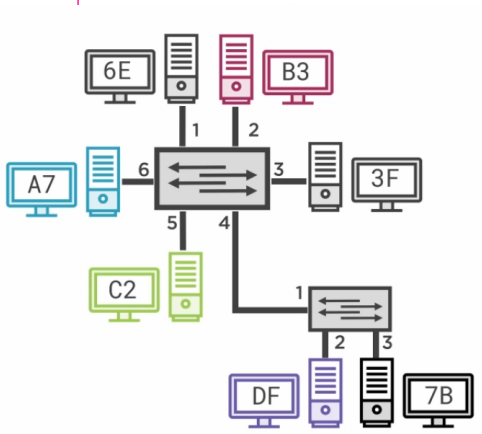
★ Broadcast

Destination MAC Address	Source MAC Address	Type	Data (Packet)	FCS
FFFF FFFF FFFF	48 bits	16 bits	MAX 1500 Bytes	32 bits

↑ Layer 2 Broadcast Address

⇒ When the destination mac address of the frame is all Fs, the frame is sent out all active interface, except the receiving interface.

★ Cascading Switch



Top Switch	
Port	MAC
1	6E
2	B3
3	3F
4	DF 7B
5	C2
6	A7

Bottom Switch	
Port	MAC
1	C2 A7 6E B3 3F
2	DF
3	7B

Mac table changed