Ethernet—The 802.3 family of physical and data link (osi layer 2) standards for hard-wired nets. The same L2 protocols defined in 802.3 are used for all physical cable types and transmission speeds.

IEEE #	Name	Description	Speed	Cable & Max Length
802.3 i	10BASE-T	Ethernet	10 Mbps	Copper, 100 m
802.3 u	100BASE-T	Fast Ethernet	100 Mbps	Copper, 100 m
802.3 z	1000BASE-LX	Gigabit Ethernet	1 Gbps	Fiber, 5000 m
802.3 ab	1000BASE-T	Gigabit Ethernet	1 Gbps	Copper, 100 m
802.3 an	10GBASE-T	10 Gig Ethernet	10 Gbps	Copper, 100 m

Frame—An L2 (osi Layer 2) data structure including header, data, and trailer

SOHO (Small Office / Home Office)—i.e. a small network

AP (Access Point)—Wireless network radio for the 802.11 family of standards

LAYER 1 (PHYSICAL) STANDARDS

UTP (Unshielded Twisted Pair) Pinouts for routers and hosts

RJ-45 Pins	10BASE-T & 100BASE-T	Gigabit
1,2	Send (routers, hosts, wireless APs) or Receive (switches & hubs)	Send, Receive
3,6	Receive (routers, hosts, wireless APs) or Send (switches & hubs)	Send, Receive
4,5	N/C	Send, Receive
7,8	N/C	Send, Receive

Straight-through Cable—Pin 1 goes to pin 1, etc. Good for connecting dissimilar devices, like a computer to a switch.

Crossover Cable—Connects the pins 1&2 to 3&6 for wiring like devices directly to each other, e.g. two routers.

Crosstalk—Interference between pairs of wires in the same cable due to EMI (ElectroMagnetic Interference)

RJ-45—Common name for the connector on utp Ethernet cables.

NIC (Network Interface Card)

SFP+ (Small Form-factor Pluggable)—a family of transceivers that can be plugged into generic ports on Cisco devices to offer flexible media choices.

MAC (Media Access Control) Address—48-bit address used by Ethernet.

OUI (Organizationally Unique Identifier)—24-bit number assigned by IEEE to Ethernet equipment manufacturers. Used as the first half of a MAC address, helping to ensure that all unicast MAC addresses are unique.

Group (non-unicast) MAC Addresses:

- Broadcast—FFFF.FFFF.FFFF goes to all devices on the LAN
- Multicast—goes to a subset of devices that have volunteered to receive.

Ethernet Frame

FIELD	BYTES	PURPOSE
Preamble	7	Alternating 1s and 0s to set bit-pace
Start of Frame (SOF) Delimiter	1	Announces that the next byte begins the destination address
Destination Address	6	MAC address
Source Address	6	
Length	2	Length of the Data field
Data	46-1500	802.2 header and data. Can be padded to meet minimum size
FCS	4	Frame Check Sequence for error detection

Frame Size—The preamble and start of frame delimiter aren't counted. The maximum frame size is 1518 bytes (18 bytes of Ethernet header + 1500 bytes of data payload). The minimum is 64 bytes (18 + 46). You'll see the 1500 byte payload maximum referred to as the MTU (Maximum Transmission Unit) from the Layer 3 (IP) perspective.

Ethertype Field—tells what kind of Layer 3 content is in the payload. Formerly this was in what is now the length field. Now it is usually in an 802.2 header that is part of the data field.

FCS (Frame Check Sequence) Error *Detection*—On receipt, if the computed FCS doesn't match the one in the frame trailer, the frame is discarded. Upper layer protocols like TCP can resend the (now missing) frame to achieve error *recovery*.

Duplex—With switches, separate pairs can be used for send and receive, allowing full-duplex. Hubs send and receive on the same pair, forcing half-duplex operation where only one end of the link can talk at once. Hubs are considered Layer-one devices; they electrically amplify and distribute a received signal out all other ports without understanding or regenerating it. If you know a hub is attached to a port on your switch or router, you should force half-duplex operation on that port.

CSMA/CD (Carrier-Sense Multiple Access / Collision Detection)—Used in half duplex. A Sender:

- Listens until the line is silent
- Begin sending the frame while listening for a collision
- On Collision, all sending nodes:
  - Send a jamming signal announcing the collision
  - Back off for a random period of time and begin at the top when time's up