

# Ethernet notes

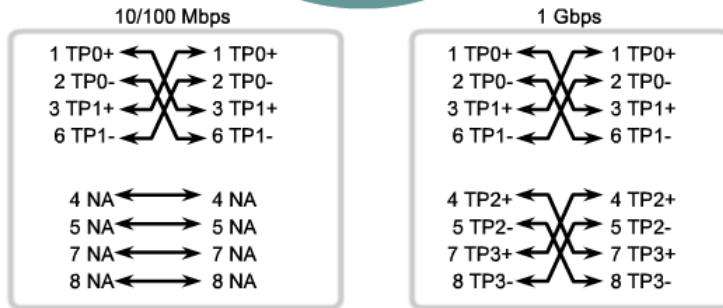
## Types of Ethernet

Types of Ethernet	Bandwidth	Cable Type	Duplex	Maximum Distance
10Base-5	10 Mbps	Thicknet Coaxial	Half	500 m
10Base-2	10 Mbps	Thinnet Coaxial	Half	185 m
10Base-T	10 Mbps	Cat3/Cat5 UTP	Half	100 m
100Base-T	100 Mbps	Cat5 UTP	Half	100 m
100Base-TX	200 Mbps	Cat5 UTP	Full	100 m
100Base-FX	100 Mb/s	Multimode Fiber	Half	400 m
100Base-FX	200 Mbps	Multimode Fiber	Full	2 km
1000Base-T	1 Gbps	Cat 5e UTP	Full	100 m
1000Base-TX	1 Gbps	Cat 6 UTP	Full	100 m
1000Base-SX	1 Gbps	Multimode Fiber	Full	550 m
1000Base-LX	1 Gbps	Single-Mode Fiber	Full	5 km
10GBase-CX4	10 Gbps	Twinaxial	Full	15 m
10GBase-T	10 Gbps	Cat6a/Cat7 UTP	Full	100 m
10GBase-LX4	10 Gbps	Multimode Fiber	Full	300 m
10GBase-LX4	10 Gbps	Single-mode Fiber	Full	10 km

## 10Base-T Ethernet RJ-45 Pinouts

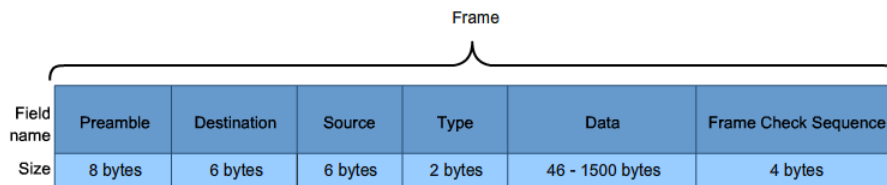


Pin Number	Signal
1	TD+ (Transmit Data, positive-going differential signal)
2	TD- (Transmit Data, negative-going differential signal)
3	RD+ (Receive Data, positive-going differential signal)
4	Unused
5	Unused
6	RD- (Receive Data, negative-going differential signal)
7	Unused
8	Unused



### Ethernet Protocol

A Common Data Link Layer Protocol for LANs



### Physical Media - Characteristics

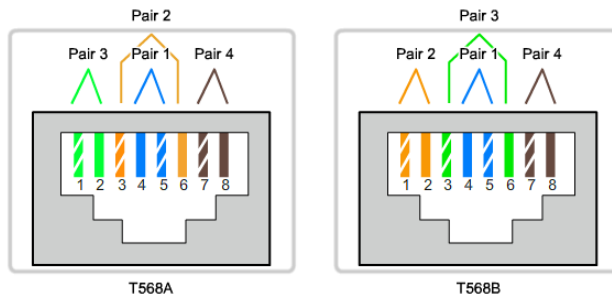
#### Ethernet Media

	10BASE-T	100BASE-TX	100BASE-FX	1000BASE-CX	1000BASE-T
Media	EIA/TIA Category 3, 4, 5 UTP - four pair	EIA/TIA Category 5 UTP - two pair	50/62.5 m multi mode fiber	STP	EIA/TIA Category 5 (or greater) UTP, four pair
Maximum Segment Length	100m (328 feet)	100m (328 feet)	2 km (6562 ft)	25 m (82 feet)	100 m (328 feet)
Topology	Star	Star	Star	Star	Star
Connector	ISO 8877 (RJ-45)	ISO 8877 (RJ-45)		ISO 8877 (RJ-45)	

1000BASE-SX	1000BASE-LX	1000BASE-ZX	10GBASE-ZR
50/62.5 micron multimode fiber	50/62.5 micron multimode fiber or 9 micron single mode fiber	9m single mode fiber	9m single mode fiber
Up to 550 m (1,804 ft) depending on fiber used	550 m (MMF) 10 km (SMF)	Approx. 70 km	Up to 80 km
Star	Star	Star	Star

### Straight-through, Crossover, and Rollover Cable Types

Cable Type	Standard	Application
Ethernet Straight-through	Both ends T568A or both ends T568B	Connecting a network host to a network device such as a switch or hub.
Ethernet Crossover	One end T568A, other end T568B	Connecting two network hosts. Connecting two network intermediary devices (switch to switch, or router to router).
Rollover	Cisco proprietary	Connect a workstation serial port to a router console port, using an adapter.



### Fiber Media Connectors

ST Connector



Straight Tip (ST) connector is widely used with multimode fiber

SC Connector



Subscriber Connector (SC) is widely used with single-mode fiber

Single-Mode (LC)



Single-Mode Lucent Connector (LC)

Multimode (LC)



Multimode LC Connector

Duplex Multimode (LC)



Duplex Multimode LC Connector

## Ethernet

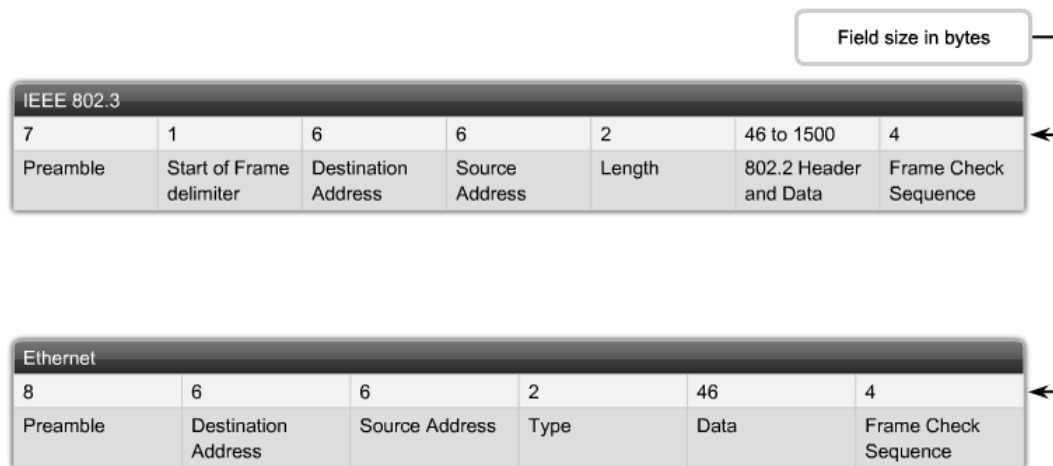
10BASE5, or Thicknet, used a thick coaxial that allowed for cabling distances of up to 500 meters before the signal required a repeater. 10BASE2, or Thinnet, used a thin coaxial cable that was smaller in diameter and more flexible than Thicknet and allowed for cabling distances of 185 meters.

In 10BASE-T networks, typically the central point of the network segment was a hub. This created a shared media. Because the media is shared, only one station could successfully transmit at a time. This type of connection is described as a *half-duplex communication*.

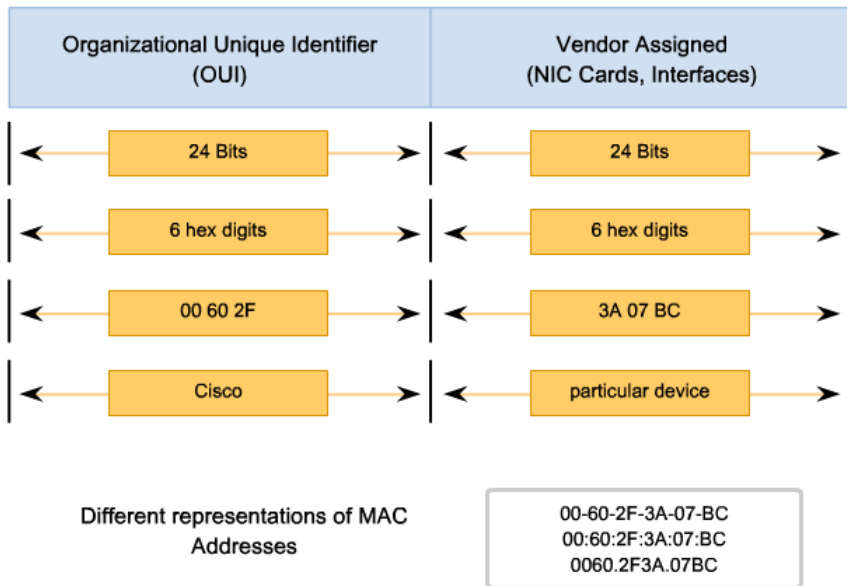
100BASE-TX Ethernet. Switches can control the flow of data by isolating each port and sending a frame only to its proper destination, *full-duplex communications*

Ethernet 10Base-T	asynchronous , Manchester-encoding
Fast Ethernet 100Base-TX, FX, CX	synchronous, 4B/5B encoding
Gigabit Ethernet 1000Base-TX	synchronous, four pairs, 4D-PAM5
Gigabit Ethernet 1000Base-SX, LX	synchronous, fiber, 8B/10B
10 Gigabit Ethernet 10GBase-ZR	

Comparison of 802.3 and Ethernet Frame Structures and Field Size



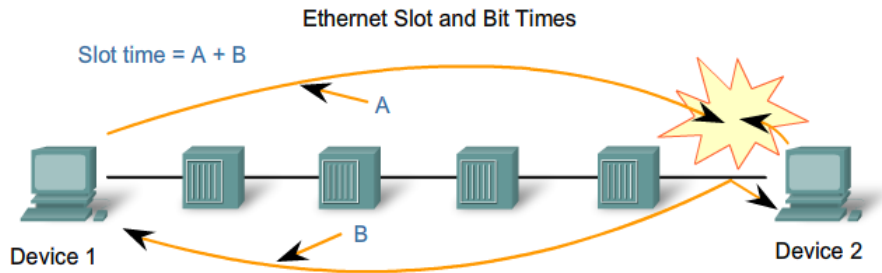
## The Ethernet MAC Address Structure



Broadcast MAC address is FF-FF-FF-FF-FF-FF

The multicast MAC address is a special value that begins with 01-00-5E in hexadecimal. The value ends by converting the lower 23 bits of the IP multicast group address into the remaining 6 hexadecimal characters of the Ethernet address. The remaining bit in the MAC address is always a "0".

And at 1000 Mbps, it only takes 1 nS to transmit a bit. As a rough estimate, 20.3 centimeters (8 inches) per nanosecond is often used for calculating the propagation delay on a UTP cable.

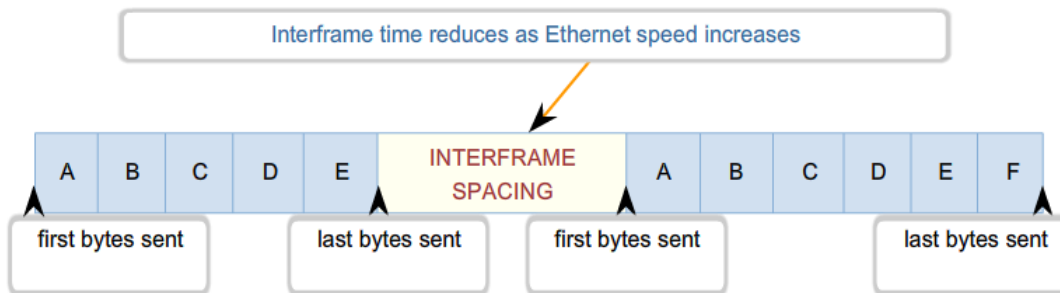


Speed	Slot Time	Time Interval
10 Mbps	512 bit time	51.2 $\mu$ s
100 Mbps	512 bit time	5.12 $\mu$ s
1 Gbps	4096 bit time	4.096 $\mu$ s
10 Gbps	not applicable	not applicable

Ethernet Speed	Bit time
10 Mbps	100 ns
100 Mbps	10 ns
1000 Mbps = 1 Gbps	1 ns
10,000 Mbps = 10 Gbps	.1 ns

### Ethernet Interframe Spacing

Speed	Interframe Spacing	Time Required
10 Mbps	96 bit time	9.6 $\mu$ s
100 Mbps	96 bit time	0.96 $\mu$ s
1 Gbps	96 bit time	0.096 $\mu$ s
10 Gbps	96 bit time	0.0096 $\mu$ s



### Jam Signal

32-bit "jam" signal is simply a repeating 1, 0, 1, 0 pattern, the same as the Preamble.