# Characteristics of Ethernet Standards

## Scope

* Define 10 Mbps Ethernet, Fast Ethernet, and Gigabit Ethernet.
* Identify the different types of Ethernet in terms of speed, length, topology, and cable type.

## Focused Explanation

Ethernet has more variants than any other type of LAN today.

### 10 Mbps Ethernet

The original Ethernet system operated at 10 Mbps based on the 10Base5 and 10Base2 specification. A series of coaxial cables were used to connect each device in place of switches, hubs, or wiring panels. The series of cables created an electrical bus that was shared among all devices on the Ethernet.

In a single bus, only one electrical signal flows at any given time as per the original Ethernet specification, which supports half duplex behavior where one sender is on the network. This led to increased latency periods. Even the introduction of CSMA/CD did not reduce the latency period. To overcome this problem, LAN switches were introduced. LAN switches had only one device cabled to them, and this allowed full-duplex operation. This overcame problems created by collisions and CSMA/CD. Because no collisions are possible, full-duplex reduces Ethernet congestion.

The advantages of full-duplex operation in comparison to half-duplex 10BaseT operation includes no latency period before sending the frames, no collisions, and doubling of the available bandwidth of 10 Mbps capacity in each direction.

The specifications for the four main 10 Mbps Ethernet standards are shown in **Table 1.2** at the end of this section.

### Fast Ethernet

Many familiar features of 10 Mbps Ethernet such as CSMA/CD, a variety of cabling options, and deployment of shared hubs and switches are retained in Fast Ethernet variants. Fast Ethernet gained market acceptance around the same time that LAN switching became popular. Most Fast Ethernet cards are connected to a switch or cabled to another device.

The two key features of Fast Ethernet, as compared to 10-Mbps Ethernet, are higher bandwidth and autonegotiation. Autonegotiation allows an Ethernet card or switch to operate at 10 or 100 Mbps. It also negotiates half-duplex or full-duplex operation. If the other device is not able to autonegotiate, it settles for half-duplex operation at 10 Mbps.

**Note:** Slow devices should be user-configured to a desired setting rather than allowed to depend on autonegotiation. Ports that are used for end-user devices enable autonegotiation because these devices are moved frequently relative to servers or other network devices, such as routers.

### Gigabit Ethernet

Gigabit Ethernet is built on top of the Ethernet protocol, and it increases speed tenfold to 1000 Mbps, or 1 gigabit per second (Gbps). This specification promises to be a prominent player in high-speed LAN backbones and server connections. Several changes have been made to the physical interface to enhance speeds from 100 Mbps Fast Ethernet up to 1 Gbps. This has been done by merging IEEE 802.3 Ethernet and ANSI X3T11 Fiber Channel.

**Table 1-2** displays the comparison between the different Ethernet standards.

| **Standard** | **MAC Sublayer**  **Specification** | **Speed** | **Maximum**  **Cable Length (segment)** | **Cable Type** | **Topology** |
| --- | --- | --- | --- | --- | --- |
| 10Base2 | 802.3 | 10 Mbps | 185 m | 50-ohm thin coaxial cable | Bus |
| 10Base5 | 802.3 | 10 Mbps | 500 m | 50-ohm thick coaxial cable | Bus |
| 10Base-FL | 802.3 | 10 Mbps | 2000 m | Fiber | Star (often only point-to-point) |
| 10Base-T | 802.3 | 10 Mbps | 100 m | Category 3, 4, or 5 UTP | Star, using either simple repeater hubs or Ethernet switches |

**Table 1-2: Comparison between the Different Ethernet Standards**

# Media Connectors, Media Types, and their Uses

## Scope

* Identify different types of media connectors, such as RJ-11/RJ-45, MT-RJ, ST/SC, IEEE 1394, Fiber, LC F-Type, and USB, and describe their uses.
* Identify the different types of media, such as Category 3, 5, 5e, and 6 media types, coaxial cables, twisted pair cables, and optic cables, and describe their uses.

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## Focused Explanation

### Media Connectors

**RJ-11 (Registered Jack-11):** RJ-11 is a four or six wire connection. It is a standard telephone cable or a computer modem connector in the USA.

**RJ-45 (Registered Jack-45):** RJ-45 is similar to the RJ-11 telephone cable connector, but is larger and accommodates 8 wires. It is commonly used for 10BaseT and 100BaseTX Ethernet connections. RJ-45 is used on all types of twisted pair cable, including Category 3, 4, and 5 UTP.

The varied uses of RJ-45 are as follows:

* Use of four wires of an RJ-45 plug in an Ethernet (10BaseT) and Token Ring network.
* Use of all eight wires of an RJ-45 plug in 100BaseVG.
* Use of the same four wires of the RJ-45 connector as 10BaseT in 100BaseTX. However, the wire belongs to Category 5 instead of Category 3.



Mechanical Transfer Registered Jack:Mechanical Transfer Registered Jack (MT-RJ) is a small duplex connector featuring two pre-polished fiber stubs. Used to connect fiber cables to hardware, this connector resembles the RJ-45 connector. Termination is carried out by inserting the two cleaved fibers into the connector, where they are aligned and butted up through a v-groove. Interstices are filled with index matching gel to improve attenuation and return loss performance. An internal clamping device holds the fibers in position.