

## Ethernet Facts

Ethernet is the most popular networking architecture for LANs. It offers high performance at a low cost and is easy to install and manage. The following table describes various details about Ethernet.

Characteristic	Description
Topology	<p>Ethernet uses one or more of the following networking topologies:</p> <ul style="list-style-type: none"><li>• Physical bus, logical bus</li><li>• Physical star, logical bus</li><li>• Physical star, logical star</li></ul>
Networking Devices	<p>Devices used on Ethernet networks include:</p> <ul style="list-style-type: none"><li>• NICs with transceivers</li><li>• Hubs</li><li>• Switches</li><li>• Routers</li></ul>
Transmission Media	<p>Ethernet supports the following cable types:</p> <ul style="list-style-type: none"><li>• Unshielded twisted-pair cables (UTP) with RJ-45 connectors. This is the most common transmission medium used for Ethernet.</li><li>• Fiber optic, most commonly used in high-speed applications such as servers or streaming media.</li><li>• Coaxial for older Ethernet implementations (often called <i>thinnet</i> or <i>thicknet</i> networks).</li></ul>
Media Access Method	<p>Ethernet uses a contention-based media access method called Carrier Sense, Multiple Access/Collision Detection (CSMA/CD). Devices use the following process to send data.</p> <ol style="list-style-type: none"><li>1. Because all devices have equal access (<i>multiple access</i>) to the transmission media, a device with data to send first listens to the transmission medium to determine if it is free (<i>carrier sense</i>).</li><li>2. If it is not free, the device waits a random time and listens again to the transmission medium. When it is free, the device transmits its message.</li><li>3. If two devices transmit at the same time, a <i>collision</i> occurs. The sending devices detect the collision (<i>collision detection</i>) and send a jam signal to notify all other hosts that a collision has occurred.</li><li>4. Both devices wait a random length of time before attempting to resend the original message (called <i>backoff</i>).</li></ol> <p><b>Note:</b> When switches are used on an Ethernet network, collisions disappear. Most devices can detect this and will turn off collision detection and use full-duplex communication.</p>

Physical Addresses	Ethernet devices are identified using the MAC address which is burned into the network interface card.
Frames	<p>A frame is a unit of data that is ready to be sent on the network medium. Ethernet frames contain the following components:</p> <ul style="list-style-type: none"> <li>• The <i>preamble</i> is a set of alternating ones and zeroes terminated by two ones (i.e., 11) that marks it as a frame.</li> <li>• The <i>destination address</i> identifies the receiving host's MAC address.</li> <li>• The <i>source address</i> identifies the sending host's MAC address.</li> <li>• The <i>data</i>, or the information that needs to be transmitted from one host to the other.</li> <li>• Optional bits to <i>pad</i> the frame. Ethernet frames are sized between 64 and 1518 bytes. If the frame is smaller than 64 bytes, the sending NIC places "junk" data in the pad to make it the required 64 bytes.</li> <li>• The <i>CRC (cyclic redundancy check)</i> is the result of a mathematical calculation performed on the frame. The CRC helps verify that the frame contents have arrived uncorrupted.</li> </ul>

## Ethernet Specifications

Ethernet standards are defined by the work of the IEEE 802.3 committee. The following table compares the characteristics of various Ethernet implementations.

Category	Standard	Bandwidth	Cable Type	Maximum Segment Length
Ethernet	10BaseT	10 Mbps (half duplex) 20 Mbps (full duplex)	Twisted pair (Cat3, 4, or 5)	100 meters
	10BaseFL	10 Mbps (multimode cable)	Fiber optic	1,000 to 2,000 meters
Fast Ethernet	100BaseTX	100 Mbps (half duplex) 200 Mbps (full duplex)	Twisted pair (Cat5 or higher) Uses 2 pairs of wires	100 meters
	100BaseFX	100 Mbps (multimode cable)	Fiber optic	412 meters
Gigabit Ethernet	1000BaseT	1,000 Mbps (half duplex) 2,000 Mbps (full duplex)	Twisted pair (Cat5 or higher)	100 meters
	1000BaseCX (short copper)		Special copper (150 ohm)	25 meters, used within wiring closets
	1000BaseSX (short)	Fiber optic		220 to 550 meters depending on cable quality
	1000BaseLX (long)			550 meters

				(multimode) 10 kilometers (single-mode)
10 Gigabit Ethernet	10GBaseT	10 Gbps (full duplex only)	Twisted pair (Cat5e, 6, or 7)	100 meters
	10GBaseSR/10GBaseSW		Multimode fiber optic	300 meters
	10GBaseLR/10GBaseLW		Single mode fiber optic	10 kilometers
	10GBaseER/10GBaseEW		Single mode fiber optic	40 kilometers

You should also know the following facts about Ethernet:

- The maximum cable length for UTP Ethernet "T" implementations is 100 meters for all standards.
- Ethernet standards support a maximum of 1024 hosts on a single subnet.
- 10GBase standards ending in W (i.e. 10GBaseSW) are used for SONET implementations.
- You may also see 10Base2 and 10Base5 Ethernet implementations, both of which are older implementations using coaxial cable. You will not be required to know these for the Network+ exam.

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