4.1.2 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:

<table>
<tr><th>Characteristic</th><th>Description</th></tr>
<tr><td>Topology</td><td>Ethernet uses the following networking topologies as specified:
Physical bus, logical bus
Physical star, logical bus
Physical star, logical star</td></tr>
<tr><td>Networking Devices</td><td>Devices used on Ethernet networks include:
NICs
Hubs (obsolete)
Switches
Routers</td></tr>
<tr><td>Transmission Media</td><td>Ethernet supports the following cable types:
Unshielded twisted pair (UTP) cables with RJ45 connectors. This is the most common transmission medium used for Ethernet.
Fiber optic cables, which are most commonly used for high-speed applications such as server connections or media streaming.
Coaxial cables for older Ethernet implementations (often called thinnet or thicknet networks).</td></tr>
<tr><td>Media Access Method</td><td>Ethernet uses a contention-based media access method defined by the IEEE 802.3 standards called Carrier Sense, Multiple Access/Collision Detection (CSMA/CD). Devices use the following process to send data:
Because all devices have equal access (multiple access) to the transmission media, a device listens to the transmission medium to determine whether it is free before sending data (carrier sense).
If it is not free, the device waits a random amount of time and listens to the transmission medium again. If it is free, the device transmits its message.
If two devices transmit at the same time, a collision occurs. The sending devices detect the collision (collision detection) and send a jam signal to notify all other hosts that a collision has occurred.
Both devices wait a random length of time before attempting to resend the original message (backoff).
Devices with collision detection turned on operate in half-duplex mode; devices with collision detection turned off operate in full-duplex mode.<table><tr><th>Mode</th><th>Description</th><th>Bandwidth</th></tr><tr><td>Half-Duplex</td><td>Collision detection is turned on.
The device can send or receive in only one direction at a time.
Devices connected to a hub must use half-duplex communication.</td><td>Up to the rated bandwidth (100 Mbps for 100BaseT and so on.)</td></tr><tr><td>Full-Duplex</td><td>Collision detection is turned off.
The device can send and receive at the same time.
Mode requires full-duplex capable NICs.
Mode requires switches with dedicated switch ports (a single device per port).</td><td>Double the rated bandwidth (200 Mbps for 100BaseT and so on.)</td></tr></table></td></tr>
<tr><td>Physical Addresses</td><td>Ethernet devices are identified by MAC address, which is burned into the network interface card.</td></tr>
<tr><td>Frames</td><td>A frame is a unit of data that is ready to be sent on the network medium. Ethernet frames contain the following components:
The preamble is a set of alternating ones and zeros terminated by two ones (11) that mark it as a frame.
The destination address identifies the receiving host's MAC address.
The source address identifies the sending host's MAC address.</td></tr>
</table>

	▪ The *data* is the information that needs to be transmitted from one host to the other. ▪ Optional bits *pad* the frame. Ethernet frames are between 64 and 1518 bytes in size. If the frame is smaller than 64 bytes, the sending NIC places junk data in the pad to make it the required minimum of 64 bytes. ▪ The *cyclic redundancy check* (CRC) is the result of a mathematical calculation performed on the frame. The CRC helps verify that the frame contents have arrived uncorrupted.