Table 5-2 Coaxial cable specifications

Type	Impedance	Core	Uses
RG-59	75 ohms	20 or 22 AWG core, usually made of braided copper	Still used for relatively short connections, for example, when distributing video signals from a central receiver to multiple monitors within a building. RG-59 is less expensive than the more common RG-6, but suffers from greater attenuation.
RG-6	75 ohms	18 AWG conducting core, usually made of solid copper	Used to deliver broadband cable Internet service and cable TV, particularly over long distances. Cable Internet service entering your home is RG-6.

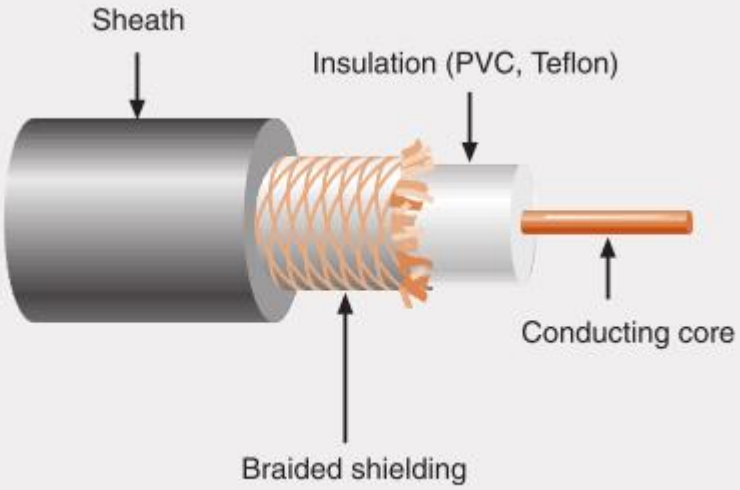


Figure 5-5 Coaxial cable

Table 5-3 Twisted-pair cabling standards

Standard		Maximum supported throughput	Bandwidth/ signal rate	Description
Cat 3 (Category 3)		10 Mbps	Up to 16 MHz	Used for 10-Mbps Ethernet or 4-Mbps Token Ring networks. Rarely found on any modern network.
Cat 5 (Category 5)		100 Mbps	100 MHz	Required minimum standard for Fast Ethernet.
Gigabit Ethernet	Cat 5e (Enhanced Category 5)	1000 Mbps (1 Gbps)	350 MHz	A higher-grade version of Cat 5 wiring that contains high-quality copper, offers a higher twist ratio, and uses advanced methods for reducing crosstalk.
	Cat 6 (Category 6)	10 Gbps	250 MHz	Includes a plastic core to prevent crosstalk between twisted pairs in the cable. Can also have foil insulation that covers the bundle of wire pairs, and a fire-resistant plastic sheath.
	Cat 6a (Augmented Category 6)	10 Gbps	500 MHz	Reduces attenuation and crosstalk and allows for potentially exceeding traditional network segment length limits. Can reliably transmit data at multigigabit per second rates. Backward compatible with Cat 5, Cat 5e, and Cat 6 cabling, which means that it can replace lower-level cabling without requiring connector or equipment changes.
	Cat 7 (Category 7) Not included in TIA/EIA standards	10 Gbps	600 MHz	Supports higher frequencies because each wire pair is wrapped in its own shielding, then packaged in additional shielding beneath the sheath. Requires more sophisticated connectors, either GG45, which is backward compatible with RJ-45, or TERA, which is not. It's larger and less flexible than earlier versions, and is also less common.
	Cat 7a (Augmented Category 7) Not included in TIA/EIA standards	40–100 Gbps	1000 MHz	ISO standards for Cat 7a cabling are still being drafted and simulations conducted.

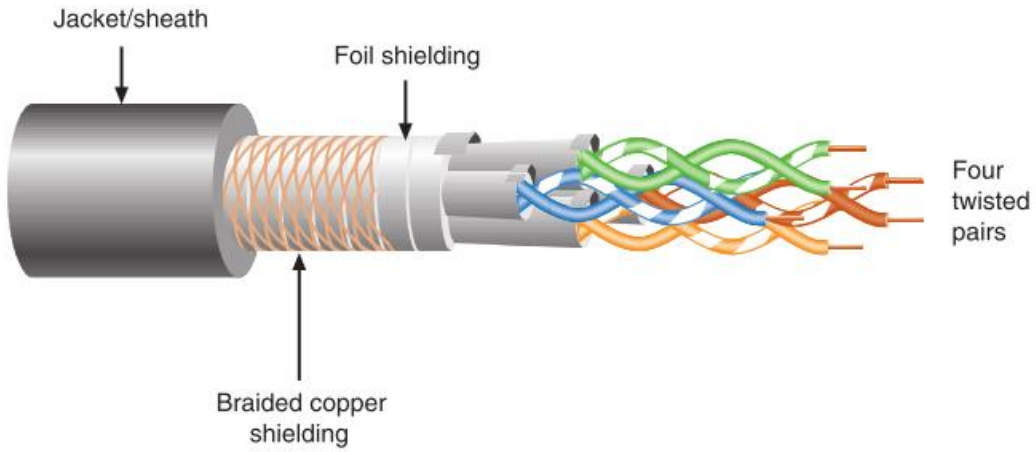


Figure 5-10 STP cable

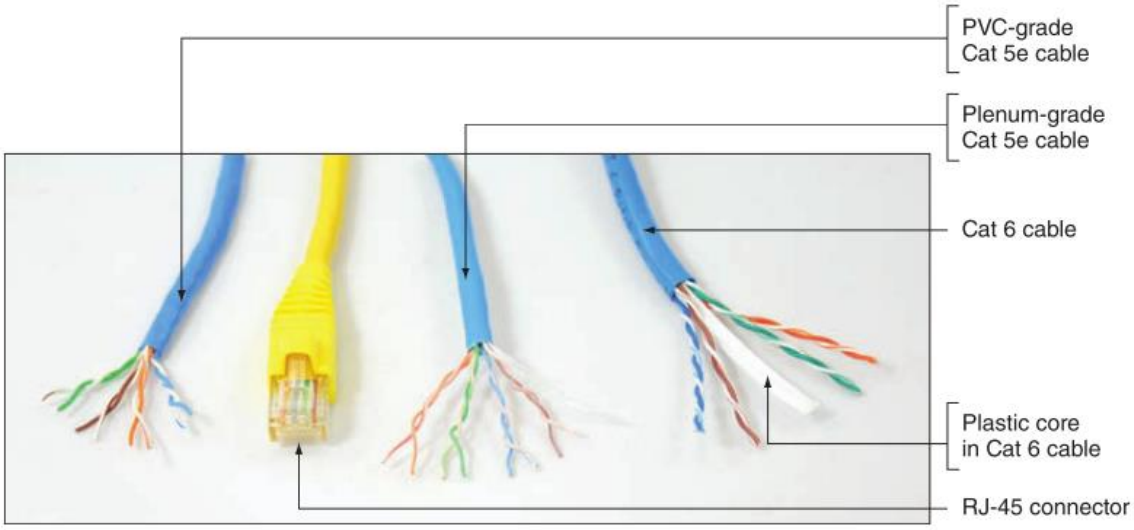


Figure 5-11 Various UTP cables and RJ-45 connector

Table 5-4 Ethernet standards used with twisted-pair cabling

Standard	Maximum transmission speed (Mbps)	Maximum distance per segment (m)	Physical media	Pairs of wires used for transmission
100Base-T Fast Ethernet	100	100	Cat 5 or better	2 pair
1000Base-T Gigabit Ethernet	1000	100	Cat 5 or better (Cat 5e is preferred)	4 pair
10GBase-T 10-Gigabit Ethernet	10,000	100	Cat 6a or Cat 7 (Cat 7 is preferred)	4 pair

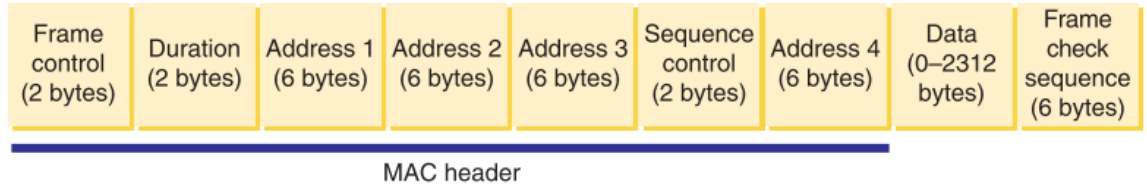
Table 5-6 Ethernet standards using fiber-optic cable

Standard		Maximum transmission speed (Mbps)	Maximum distance per segment (m)	Physical media
Gigabit Ethernet	**1000Base-LX**	1000	550 for MMF, 5000 for SMF	MMF or SMF
	1000Base-SX	1000	Up to 550, depending on modal bandwidth and fiber core diameter	MMF
10-Gigabit Ethernet	10GBase-SR and 10GBase-SW	10,000	Up to 300, depending on modal bandwidth and fiber core diameter	MMF
	10GBase-LR and 10GBase-LW	10,000	10,000	SMF
	10GBase-ER and 10GBase-EW	10,000	40,000	SMF

Table 6-4 Technical details for 802.11 wireless standards

Standard		Frequency band	Max. theoretical throughput	Geographic range
802.11b		2.4 GHz	11 Mbps	100 m
802.11a		5 GHz	54 Mbps	50 m
802.11g		2.4 GHz	54 Mbps	100 m
802.11n		2.4 GHz or 5 GHz	600 Mbps	Indoor: 70 m Outdoor: 250 m
802.11ac	Wave 1 (3 data streams)	5 GHz	1.3 Gbps	Indoor: 70 m Outdoor: 250 m
	Wave 2 (4 data streams)		3.47 Gbps	
	Wave 3 (8 data streams)		6.93 Gbps	

802.11 data frame:



802.3 (Ethernet) frame:

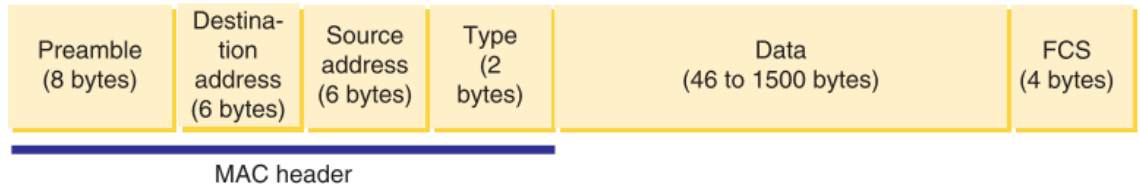


Figure 6-18 Basic 802.11 data frame compared with an 802.3 Ethernet frame

Table 6-5 Fields in an 802.11 data frame

	Field name	Length	Description
Header	Frame control	2 bytes	Holds information about the protocol in use, the type of frame being transmitted, whether the frame is part of a larger, fragmented packet, whether the frame is one that was reissued after an unverified delivery attempt, what type of security the frame uses, and so on.
	Duration	2 bytes	Indicates how long the field's transmission will take so other nodes know when the channel will be available again.
	Address 1	6 bytes	Source address.
	Address 2	6 bytes	Transmitter address.
	Address 3	6 bytes	Receiver address.
	Sequence control	2 bytes	Indicates how a large packet is fragmented.
	Address 4	6 bytes	Destination address.
Data		0–2312 bytes	Includes the data originally sent by the source host, plus headers from higher layers. The Data field is not part of the frame header or trailer—it is encapsulated by the frame.
Trailer	Frame check sequence	6 bytes	Uses a cyclical code to check for errors in the transmission.