
Network Design Basics *for Cabling Professionals*



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Physical layer functions

The Physical layer is responsible for establishing, maintaining, and releasing physical connections between network devices. In the case of LAN communications, the combination of the Physical layer and MAC layer defines the LAN technology. For example, Ethernet is a set of Physical and MAC layer specifications. It is possible to use multiple media types for Physical layer operations—twisted-pair, coaxial, optical fiber, and wireless media can all be used to transport Ethernet frames.

The processes available at the Physical layer include:

- Encoding, used to transform the frame to be transmitted into a format compatible with the medium.
- Signal generation.
- Timing and synchronization between the devices at each end of a connection.

The output of the Physical layer is a signal representing a stream of bits.

Network Signaling**General**

The term network signaling refers to the process used to transfer a sequence of bits over a communications medium. Normally, digital signaling is used since the bits represent messages generated by digital devices. An exception is data transfer over the public switched telephone network (PSTN), which requires analog signaling. In such cases, modems are used to transform digital pulses into analog tones at the sending device and the reverse at the receiving device.

NOTES: An analog signal can be described as a wave that varies continuously over its duration. The amplitude, frequency, and the phase of the wave can vary in different combinations to represent a bit stream.

A digital signal can be described as a sequence of discrete pulses separated by intervals. The pulses and intervals can be grouped in various combinations to represent control and message information.

Baseband and broadband signaling

The terms baseband and broadband are also associated with signaling. Historically, baseband was used to describe a form of digital signaling where the medium provided a single communications channel. In comparison, broadband referred to a form of analog signaling where the medium was divided into multiple communications channels, as in the case of cable television signals.

Currently, the term broadband is more commonly used to refer to high-speed digital signaling, where the communications channel is capable of transporting the data streams simultaneously generated by many devices. For example, a telecommunications circuit capable of operating at megabit per second (Mb/s) rates is often described as a broadband connection.

The following terms are also used to describe different types of signaling:

- Simplex
- Half-duplex
- Full-duplex
- Dual-duplex
- Asynchronous
- Synchronous
- Isochronous

These terms are described below.

Simplex signaling

When simplex signaling is used, the message flow is in one direction only. The receiver cannot send a message back to the sender.

Half-duplex signaling

When half-duplex signaling is used, messages can flow in both directions, but not at the same time. The single communications channel linking the sender and the receiver can transport messages in one direction at a time.

Full-duplex signaling

When full-duplex signaling is used, messages can flow in both directions at the same time—two communications channels link the sender and the receiver.

Dual-duplex signaling

When dual-duplex signaling is used, messages can flow in both directions at the same time over a single communications channel. The single channel linking the sender and the receiver can simultaneously transport messages in both directions.