
Glossary of Industrial Ethernet Terms

The interest in Industrial Ethernet has brought about a completely new dictionary of terms. Here are some of the most important terms introduced to date.

4B/5B—A block encoding scheme used to send Fast Ethernet data. In this signal encoding scheme, 4 bits of data are turned into 5-bit code symbols for transmission over the media system.

10BASE-T—10 Mbps Ethernet system based on Manchester signal encoding transmitted over Category 3 or better twisted-pair cable.

10BASE-FL—Popular 10 Mbps link fiber optic solution which replaces the older FOIRL implementation utilizing 850 nm fiber optic technology.

100BASE-FX—100 Mbps Fast Ethernet system based on 4B/5B signal encoding transmitted over fiber optic cable utilizing 1300 nm fiber optic technology.

100BASE-SX—850 nm fiber optic technology that supports auto-negotiation. 100BASE-SX devices can communicate with 10BASE-FL devices at 10 Mbps and other 100BASE-SX devices at 100 Mbps.

100BASE-TX—100 Mbps Fast Ethernet system based on 4B/5B signal encoding transmitted over two copper pairs.

100BASE-X—Term used when referring to any Fast Ethernet media system based on 4B/5B block encoding. Includes 100BASE-TX and 100BASE-FX media systems.

802.3—IEEE Working Group for CSMA/CD LANs.

AUI—Attachment Unit Interface. The 15-pin signal interface defined in the original Ethernet standard that carries signals between a station and an outboard transceiver.

Auto-negotiation—A protocol defined in the Ethernet standard that allows devices at either end of a link segment to advertise and negotiate modes of operation such as the speed of the link, half- or full-duplex operation, and full-duplex flow control.

Auto-MDIX—A protocol which allows two Ethernet devices to negotiate their use of the Ethernet TX and RX cable pairs. This allows two Ethernet devices with MDI-X or MDI connectors to connect without using a cross-over cable. This feature is also known as Auto-crossover.

Bandwidth—The maximum capacity of a network channel. Usually expressed in bits per second (bps). Ethernet channels have bandwidths of 10, 100, and 1000 Mbps.

Baud—A unit of signaling speed representing the number of discrete signal events per second and, depending upon the encoding, can differ from the bit rate.

Bit—A binary digit. The smallest unit of data, either a zero or a one.

Bit Rate—The amount of bits that can be sent per second. Usually described in units of kbps or Mbps and frequently referred to as the data rate.

Block Encoding—Block encoding is a system whereby a group of data bits are encoded into a larger set of code bits. Block encoding is used in Fast Ethernet.

Bridge—A device that connects two or more networks at the data link layer (layer 2 of the OSI model).

Broadcast—A transmission initiated by one station and sent to all stations on the network.

Bus—A shared connection for multiple devices over a cable or backplane.

Category 5—Twisted-pair cable with electrical characteristics suitable for all twisted-pair Ethernet media systems, including 10BASE-T and 100BASE-TX. Category 5 and Category 5e cable are preferred cable types for structural cabling systems.

Category 5e—An enhanced version of Category 5 cable, developed to improve certain cable characteristics important to Gigabit Ethernet operation. It is recommended that all new structured cabling systems be based on Category 5e cable; however, this cable may not be the best for use in industrial installations because of noise susceptibility.

Collision—The result of having two or more simultaneous transmissions on a common signal channel such as half-duplex Ethernet or shared Ethernet.

Collision Domain—The set of all stations connected to a network where faithful detection of a collision can occur. A collision domain terminates at a switch port.

CRC—Cyclic Redundancy Check. An error-checking technique used to ensure the fidelity of received data.



Crossover Cable—A twisted-pair patch cable wired in such a way as to route the transmit signals from one piece of equipment to the receive port or another piece of equipment, and vice versa. This allows communication between two peer devices. The opposite of a crossover cable is the straight-through cable.

CSMA/CD—Carrier Sense Multiple Access/Collision Detect. The medium access control (MAC) protocol used in Ethernet.

Data Link Layer—Layer 2 of the OSI reference model. This layer passes data between the network layer and the physical layer. The data link layer is responsible for transmitting and receiving frames. It usually includes both the media access control (MAC) protocol and logical link control (LLC) layers.

DCE—Data Communications Equipment. Any equipment that relays data between Data Terminal Equipment (DTE). DCEs are not considered end devices or stations.

Differentiated Services (Diff-Serv)—Diff-Serv is a Quality of Service (QoS) method described in RFCs 2474 and 2475. This is a layer-three method utilizing the eight-bit type-of-service field in an IP packet.

DTE—Data Terminal Equipment. Any piece of equipment at which a communication path begins or ends. A station (computer or host) on the network is capable of initiating or receiving data.

Encoding—A means of combining clock and data information into a self-synchronizing stream of signals.

Error Detection—A method that detects errors in received data by cyclic redundancy checks (CRC) or a checksum.

Ethernet—A popular LAN technology first standardized by DEC, Intel, and Xerox (or DIX) and subsequently standardized by the IEEE through the 802.3 committee.

Fast Ethernet—A version of Ethernet that operates at 100 Mbps. Although 100 Mbps is no longer the fastest data rate, this term is still used.

Fast Link Pulse—A link pulse that encodes information used in the Auto-negotiation protocol. Fast link pulses consist of bursts of the normal link pulses used in 10BASE-T.

Fiber Optic Cable—A cable with a glass or plastic filament which transmits digital signals in the form of light pulses at wavelengths of 850 nm (10BASE-FL and 100BASE-SX) or 1300 nm (100BASE-FX).

Flow Control—The process of controlling data transmission at the sender to avoid overflowing buffers and loss of data at the receiver.

FOIRL—Fiber Optic Inter-Repeater Link. An early version of fiber optic link segment replaced by 10BASE-FL.

Forwarding—The process of moving frames from one port to another in a switching hub.

Frame—The fundamental unit of transmission at the data link layer of the OSI model.

Full-duplex Operation—A communications method that allows for the simultaneous transmission and reception of data.

Gigabit Ethernet—A version of Ethernet that operates at 1000 Mbps.

Half-duplex Operation—A communications method in which transmissions and receptions can occur in either direction but not at the same time.

Hub—A DCE with three or more ports at the center of a star topology network. Hubs can usually be cascaded with a hub-to-hub connection. Frequently this name is used to mean repeating hub.

IEEE—Institute of Electrical & Electronics Engineers. A professional organization and standards body.

IGMP Snooping—The ability of a switch to observe Internet Group Multicast Protocol (IGMP) traffic in order to learn IP Multicast group membership for the purpose of restricting multicast transmissions to only those ports which have requested them.

Internet—Worldwide collection of networks based on the use of TCP/IP network protocols.

Jabber—The act of continuously sending data. A jabbering station is one whose circuitry or logic has failed, and which has locked up a network channel with its incessant transmissions.

LAN—Local Area Network.

Late Collision—A failure of the network in which the collision indication arrives too late in the frame transmission to be automatically dealt with by the medium access control (MAC) protocol. The defective frame may not be detected by all stations requiring that the application layer detect and retransmit the lost frame, resulting in greatly reduced throughput.

Link Integrity Test—This test verifies that an Ethernet link is connected correctly and that signals are being received correctly. This is a helpful aid but does not guarantee the link is completely functional.

Link Layer—Short for Data Link Layer. This is layer 2 on the OSI model.

Link Pulse—A test pulse sent between transceivers on a 10BASE-T link segment during periods of no traffic, to test the signal integrity of the link.



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Link Segment—A point-to-point segment that connects only two devices and is "capable" of supporting full-duplex operation.

MAC—Medium Access Control. A protocol operating at the data link layer used to manage a station's access to the communication channel.

MAC Address—A unique address assigned to a station interface, identifying that station on the network. With Ethernet, this is the unique 48-bit station address. Same as the physical address.

Manchester Encoding—Signal encoding method used in all 10 Mbps Ethernet media systems. Each bit of information is converted into a "bit symbol" which is divided into two halves. One half is high and the other is low. Manchester encoding results in a 20 Mbaud stream although data is only being sent at 10 Mbps.

MAU—Medium Attachment Unit. The MAU provides the physical and electrical interface between an Ethernet device and the media system to which it is connected. Also referred to as a transceiver.

MDI—Medium Dependent Interface. The name for the connector used to make a physical and electrical connection between a transceiver and a media segment. For example, the RJ-45-style connector is the MDI for 10BASE-T and 100BASE-TX.

MDI-X—An MDI port on a hub or media converter that implements an internal crossover function. This means that a "straight-through" cable can be used to connect a station to this port, since the signal crossover is performed inside the port.

MIB—Management Information Base. A management information base (MIB) describes a set of managed objects. An SNMP management console application can manipulate the objects on a specific computer if the SNMP service has an extension agent DLL that supports the MIB. Each managed object in a MIB has a unique identifier. The identifier includes the object's type (such as counter, string, gauge, or address), the object's access level (such as read, or read/write), size restrictions, and range information.

MII—Medium Independent Interface. Similar to the original AUI function, but designed to support both 10 and 100 Mbps, an MII provides a 40-pin connection to outboard transceivers (also called PHY devices). Used to attach 802.3 interfaces (MACs) to a variety of physical media systems.

Media Converter—A device that converts signals from one media type to that of another.

Multicast—A transmission initiated by one station to many stations on the network.

NIC—Network Interface Card. Also called an adapter, network interface module, or interface card. The set of electronics that provides a connection between a computer and a network.

Node—A node is where data enters and exits a network.

OPC—Originally, OLE for Process Control. A process control communications standard for accessing process data from multi-vendor systems.

OSI—Open Systems Interconnection. A seven-layer reference model for networks, developed by the International Organization for Standardization (ISO). The OSI reference model is a formal method for describing the interlocking sets of networking hardware and software used to deliver network services. It is a good model, but strict compliance to the model is seldom accomplished.

OUI—Organizationally Unique Identifier. A 24-bit value assigned to an organization by the IEEE. Ethernet vendors use the 24-bit OUI they receive from the IEEE in the process of creating unique 48-bit Ethernet addresses. Contemporary Controls has been assigned a vendor OUI.

Packet—A unit of data exchanged at the network layer. This is a much abused definition and the terms "frame" and "packet" are frequently interchanged.

Patch Cable—A twisted-pair or fiber optic jumper cable used to make a connection between a network interface (on a station or network port on a hub) and a media segment, or to directly connect stations and hub ports together.

PAUSE—A unique frame sent by full-duplex capable stations to indicate to the sender to slow down transmissions.

PHY—Physical Layer Device. The name used for a transceiver in Fast Ethernet and Gigabit Ethernet systems.

Physical Layer—The bottom layer in the OSI seven-layer reference model. This layer is responsible for physical signaling—including connectors, timing, voltages, and related issues. Data sent over the physical layer are termed symbols.

Plenum Cable—A cable that is rated as having adequate fire resistance and satisfactorily low smoke-producing characteristics for use in plenums (air-handling spaces). Air-handling spaces are often located below machine room floors, or above suspended ceilings and require the use of plenum-rated cable.

Point-to-Point Technology—A network system composed of point-to-point links. Each point-to-point link connects two and only two, devices—one at each end. Devices could be DTEs or DCEs, but no more than two can be connected on one link.



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Port—A connection point for a cable. Repeater hubs and switching hubs typically provide multiple ports for connecting Ethernet devices.

Port Mirroring—Port mirroring allows a switch port to monitor packets from any or all of its ports so that traffic can be analyzed.

Promiscuous Mode—A mode of operation where a device is configured to receive all frames on a network regardless of the destination addresses. Typically used by network analyzer tools.

Propagation Delay—The signal transit time through a cable, network segment, or device. Important in making collision domain calculations.

Protocol—A set of agreed-upon rules and message formats for exchanging information among devices on a network.

Quality of Service (QoS)—Some switches support QoS (per 802.1p and 802.1Q standards) whereby tagged messages, or messages received on a certain port, can be assigned one of eight levels of priority. QoS can be important where time-critical applications can be impaired by data delays.

RapidRing™—Contemporary Controls' proprietary redundant ring technology which provides an alternate path in the event of a single break in the ring.

Rapid Spanning Tree—Newer version of Spanning Tree Protocol that is backward compatible while providing a faster recovery time.

Rate Limiting—The ability of a switch to limit the throughput of particular ports on the switch. Used to prevent certain ports from consuming all the bandwidth.

Repeater—A physical layer DCE used to interconnect segments within the same network. An Ethernet repeater can only link Ethernet segments that are all operating in half-duplex mode and at the same speed. Some repeaters offer media conversion as well.

Repeating Hub—A repeater with more than two ports. This name is frequently shortened to simply "hub."

RJ-45—An 8-pin modular connector used on twisted-pair links.

SC—Subscriber Connector. This is a type of fiber optic connector used in 100BASE-FX fiber optic media systems. The connector is designed to be pushed into place, automatically seating itself.

Segment—A cable made up of one or more cable sections and connections joined together to produce the equivalent of a continuous cable.

Slot Time—A unit of time used in the medium access control (MAC) protocol for Ethernet.

SNMP—Simple Network Management Protocol. The *de facto* standard for switch management. A familiarity with MIB objects is necessary to manage a switch with an SNMP management program. SNMP is not necessarily limited to TCP/IP networks.

Spanning Tree Protocol—A link management protocol providing path redundancy and preventing network loops by defining a tree to span all switches in a network. It forces redundant data paths into a standby (blocked) state. If a path malfunctions, the topology is reconfigured and the link reestablished by activating the standby path.

ST—Straight Tip. This is a type of fiber optic connector used mostly in 10BASE-FL and FOIRL links, but also in 100BASE-TX links. The male end of this connector has an inner sleeve with a slot cut into it, and an outer ring with a bayonet latch. The inner sleeve is aligned with a mating key in the socket and the outer ring is turned to complete the bayonet latch.

Star Topology—A network topology in which each station on the network is connected directly to a hub.

Straight-through—Refers to a cable where cable connections at both ends of the cable are pinned the same way. Used to interconnect non-peer devices such as a hub to a station.

Station—A unique, addressable DTE on a network. Sometimes referred to as a node.

Switching Hub—A switching hub is another name for a multiport bridge; a DCE that interconnects network segments at the data link layer. Switching hubs are typically located in the center of a star topology, and provide multiple ports for connections to network stations. Frequently this name is shortened to switch.

TIA-568A, B—Two standards used to define RJ-45 pin connectors and wire color-coding schemes.

Topology—The physical layout of a network.

Transceiver—A combination of the words transmitter and receiver. A transceiver is the set of electronics that sends and receives signals on a media system. Transceivers may be internal or external. Sometimes called a MAU.

Trunking—Two or more ports grouped together as one logical path to increase bandwidth between a switch and a network node when a single path cannot handle the traffic. Loops are avoided because specific paths are designated. Often a single link is designated for flooding broadcasts and packets of unknown destination. Trunks can provide redundancy to critical devices.



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Twisted-Pair Cable—A multiple-conductor cable whose component wires are paired together, twisted, and enclosed in a single jacket. A typical Category 5 twisted-pair segment is composed of a cable with four twisted pairs contained in a single jacket. Each pair consists of two insulated copper wires that are twisted together.

VLAN—Virtual Local Area Network. A LAN that maps stations on a basis other than location such as by department, user type or application. Managing traffic, workstations, and bandwidth can be easier with a VLAN and improve network efficiency.

Web Server—A computer or device that serves up Web pages. By installing server software and connecting a computer or device to the network, it can become a Web server. Every Web server has an IP address and possibly a domain name.



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