

# Glossary of Terms

## Fiber Optic and FTTx Technologies



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# Glossary of Terms

## **µm**

A micron; a millionth of a meter. Common unit of measurement for fiber optic diameters.

## **4K HDTV**

Enhanced HDTV with a resolution of 3,840 pixels and 2,160 lines, four times the resolution of standard HDTV. Generally requires 13-51 Mbps for compressed streaming video. Lower bandwidth may result in fewer frames per second or reduced video quality.

## **8K HDTV**

Currently the highest level of HDTV standards used by the broadcast and Pro-A/V industries. 8K HDTV has a resolution of 7,680 pixels and 4,320 lines. Generally requires 60-100 Mbps for compressed streaming video. Lower bandwidth may result in fewer frames per second or reduced video quality.

## **Absorption**

Caused by impurities introduced during the manufacturing process, absorption creates loss in a fiber by turning light energy into heat. The amount of absorption is determined by the wavelength and depends upon the composition of the glass or plastic. Absorption and scattering are the two causes of intrinsic attenuation in an optical fiber.

## **Acceptance test**

A test to confirm that an optical cable or link meets established performance specifications.

## **Active device**

An active device is a device that requires electrical power. One type is those that convert signals between electrical and optical formats such as lasers, LEDs, and photodiodes. Active devices also can manipulate light, such as optical amplifiers and modulators.

## **Active Ethernet**

A technique, defined in IEEE 802.3ah, that uses Ethernet as the main transmission method over fiber optics. Active Ethernet is a point-to-point system can use either one fiber (bidirectionally at 1490 nm downstream and 1310 nm upstream) or two fibers (one Tx and one Rx) at 1310 nm. Most active Ethernet systems use SFP modules.

## **Active optical cable (AOC)**

A fiber optic cable that has been pre-terminated with an external electrical endface, thereby removing the termination process. The electrical endfaces can be

manufactured with most module formats. The most common module formats are the SFP and HDMI interfaces, but DVI, VGA, SFP+, and QSFP+ interfaces also can be provided.

## **Adapter**

A mechanical device that is used to mate two connectors. Adapters also provide the transition point for the transmitter or receiver of an optical loss test set (OLTS) to connect to the fiber optic cable assembly.

## **Add/drop multiplexer (ADM)**

A mid-span electronic element that provides opto-electric/electro-optic conversion to add, drop, or multiplex photonic signals. (See *OADM* for optical version.)

## **Aerial**

A type of installation in which the cable is connected to poles or towers by means of clamps or other attachment hardware.

## **Aerial cables**

Cables that are designed to handle environmental concerns such as wind and ice loading, pollution, UV radiation, thermal cycling, stress, and aging in aerial placements. There are several variations of aerial cables including OPGW and ADSS.

## **Air blown fiber (ABF)**

An installation technique developed by British Telecom where micro ducts or "pipe cables" are installed, and then optical fibers or fiber bundles are blown into the cable with spans reaching 10,000 feet.

## **All-dielectric self-supporting (ADSS)**

A self-supporting loose tube cable structure without any metallic elements. Specified by the IEEE P-1222 standard, ADSS cable is designed for a variety of short and long span lengths between poles and to withstand typical weather loads on those spans.

## **Allowable path loss (APL)**

The difference, in dBm, between a transmitter's outputs (minimum or maximum) and the receiver's sensitivities (maximum or overload). Subtracting the minimum APL from the maximum APL equals the differential optical path loss in dB.

## **American National Standards Institute (ANSI)**

The official American standards body through which standards are published and various other standards committees are accredited.



**Amplitude modulation (AM)**

An analog transmission method, used by the CATV industry, in which information carried by an electronic signal causes the height of the sine wave (amplitude) to vary. Principle forms include QDM, QAM, SSB, and VSB.

**Analog**

A data format using continuous physical variables such as voltage amplitude (AM) or frequency (FM) variations that are analogous to the original signal.

**Angled physical contact connector (APC)**

References the ferrule endface of a connector angled at 8° to minimize Fresnel reflections at connection points. APC polishes normally have a component reflectance value of 60-70 dB. They are most often used in high-speed networks and for analog video transmission.

**Aramid yarn**

A woven strength member incorporated into fiber optic cable assemblies for protection and mechanical bonding.

**Architecture**

In networks, it is how the components are connected to and operate with one another. The term "network architecture" focuses on how fiber optic system elements communicate including functional organization (services) and configuration (topology and communications). Network architectures are usually designed as to their protocols. B-PON, G-PON, EPON, GEAPON, SONET, ATM, Ethernet, etc., are examples of network architectures.

**Armored cable**

Cable with metallic sheathing or rods placed under or between cable jackets to prevent rodents from damaging the internal cable elements.

**As built**

Drawings that provide accurate depictions of cable running lines, pedestal locations, electronic sites, manholes, marker posts, etc., to aid with the management of cable assets and allow the facilities to be located, protected, maintained, and modified.

**Asynchronous**

A transmission method that sends one character at a time without waiting for a response that the previous character sent was received.

**Asynchronous transfer mode (ATM)**

A high-speed call-based transmission scheme that provides bandwidth on demand for multimedia (voice, video, or data).

**Asynchronous transfer mode PON (APON)**

See *broadband PON*.

**Asynchronous transmission**

A transmission method with no clocking signal in which each character of information is individually synchronized through start and stop elements that notify the receiver of incoming data without regard for timing of the previous character. Also see synchronous transmission.

**Attenuation**

The loss of optical power, whether caused intrinsically (e.g., absorption, scattering, microbends), or extrinsically by components (e.g., connectors, splices, splitters). Expressed as dB or dB/km (with fiber).

**Attenuator**

A component that incorporates a specific amount of loss into an operational optical network. Attenuators also provide a safety margin in planned networks to allow for electronics degradation over time, or physical changes to the optical component portion of the network. Attenuators come in two styles, fixed and variable. Variable optical attenuators are used for testing systems for dynamic range and quality of signal testing.

**Avalanche photodiode (APD)**

A photodiode that takes advantage of avalanche multiplication of photocurrent to convert one photon to multiple electrons.

**Backbone**

The cabling used to connect entrance facilities, cross-connects, telecommunications closets, and equipment rooms. The backbone may consist of either interbuilding and/or intrabuilding cabling.

**Backreflection**

This term is often interchanged with optical return loss (ORL) for spans, reflectance for components, and Fresnel reflectance. It is the amount of light that is reflected back toward the transmitter, most often from the mated connector points. APC connectors help to minimize the reflectance.

**Backscattering**

See *Rayleigh scattering*.

**Band**

A range of optical spectrum allocated based on optical amplifiers. Six bands are specified: O (original), E (enhanced), S (short), C (conventional), L (long), and U (ultra). These cover the optical spectrum from 1260 nm to 1675 nm. Further, the ITU-T G.983 through G.987 have identified operational wavelength bands with the names of: 1300 nm, intermediate, basic, and enhancement bands.



**Bandwidth**

A measure of the maximum frequency by which light intensity can be modulated before the signal experiences 3 dB of excess attenuation. The difference between the highest and the lowest frequencies of a transmission channel or path; identifies the amount of data that can be sent through a given channel. The greater the bandwidth, the greater the information carrying capacity. Multimode fiber bandwidth is expressed in Megahertz per kilometer (MHz-km).

**Basic band**

The wavelength region originally called out for B-PON, G-PON, and EPON at 1480 to 1500 nm.

**Bend-insensitive (single-mode) fiber (BIF)**

Single-mode fibers that have been modified to demonstrate reduced bend radius characteristics without attenuation changes. Specified in the ITU-T G.657 standard.

**Bend loss**

Increased attenuation due to macrobends (curvature of fiber) or microbends (small distortions in the fiber) coupling light energy from the fiber core to the cladding.

**Bend radius**

The minimum radius that fiber or cable can bend and still maintain its optical and physical qualities.

**Bidirectional (BiDi)**

Operating in both directions.

**Bidirectional transceiver**

A device that sends information in one direction and receives information from the opposite direction.

**Bit**

An electrical or optical pulse whose presence or absence indicates data. The capacity of the optical waveguide to transmit information without error is expressed in bits per second per unit length.

**Bit error rate (BER)**

A measurement of transmission accuracy. It is a ratio of bits received in error versus bits sent. Fiber optic communication systems normally have a BER value of  $10^{-9}$  or  $10^{-12}$ .

**Bit error rate tester (BERT)**

Test equipment that measures the bit error rate of digital transmission systems.

**Bit rate**

A unit of measure for digital transmission speeds expressed in bit per second (b/s).

**Breakout kit**

A kit that provides a breakout cable structure for non-breakout structures (with one fiber per tube).

**Broadband**

A bundle of services over a wide range of wavelengths or frequencies, exchanged over various types of media, between the service provider and the customer.

**Broadband PON (B-PON)**

The first FTTx standard issued as ITU-T G.983, the B-PON standard was designed for the bidirectional transmission of ATM cells over G.652 single-mode fiber at a distance of 20 kilometers using wavelength independent splitters with split rates of up to 1:32. Originally defined by the FSAN S652 document.

**Brownfield**

Network upgrade of an existing legacy network

**Buffer tube**

Buffer tubes accommodate 250-micron coated fibers in a loose tube cable configuration. They can be filled with gel, powder, threads, or tapes to resist moisture intrusion.

**Buried**

Cable placed by trenching, direct burial, plowing, boring, or installation into underground ducts.

**Butt closure**

Closure with cable ports located at one end of the closure.

**Byte**

One segment of digital information; usually 8, 16, or 32 bits equal to a single character. Defined with a capital "B" as opposed to "bits", which uses a lowercase "b".

**Cabinet**

A container that may enclose connection devices, terminations, and equipment.

**Cable assembly**

A fixed length of cable with connectors installed on both ends. Sometimes called a patchcord, patch cable, or jumper.

**Cable jacket**

The protective outer covering of wire or optical cable. Common materials include polyethylene (PE), polyurethane (PU), polyvinyl chloride (PVC) and Teflon (plenum).

**Carrier-to-noise ratio (CNR)**

A quantification of analog system noise. The ratio, expressed in decibels, of the level of the carrier to that of the noise in the receiver bandwidth before any nonlinear process such as amplitude limiting and detection takes place.



**C band**

The C band is the “Conventional” DWDM transmission band, occupying the 1530 to 1565 nm wavelength range, as specified in ITU-T G.692. Most erbium-doped fiber amplifiers (EDFAs) operate in the C-band. See *conventional band*.

**Cell**

A common term used in network protocol language to contain and transport fixed length packets (as in ATM/SONET SMDS systems) or variable length packets (as in Ethernet) of secured identification information (header) and user-processed data (payload).

**Centralized topology**

A PON topology where the optical splitter is located in one location in the outside plant, normally at a fiber distribution hub.

**Center wavelength (CW)**

The nominal value operating wavelength in a laser; thereby, the wavelength defined by a peak mode measurement where the effective optical power resides. Also, the average of the two wavelengths measured at half amplitude points of the power spectrum in lasers and LEDs.

**Central office (CO)**

The building in which telephone companies, etc., locate their switching equipment and terminate their circuits. Sometimes called an “exchange.”

**Central tube cable**

Fiber optic cable type where the fibers are housed in the center of the cable and strength members are located around the centrally located fibers.

**Chromatic dispersion (CD)**

The variation in the velocity of light (group velocity) as a function of wavelength. It causes pulses of a modulated laser source to broaden when traveling within the fiber, up to a point where pulses overlap and bit error rate increases. CD is a limiting factor in high-speed transmission and must be properly compensated, which implies proper testing. A combination of material and waveguide dispersion.

**Churn**

Data scrambling and low-level protection during downstream transmission from the OLT to the ONT. Primarily used for data confidentiality OR subscriber attrition such as switching from one provider or service to another.

**Cladding**

The low refractive index material, usually glass, that surrounds and protects the core and provides the optical refractive barrier.

**Clock**

In data communications, a device that generates precisely spaced timing pulses used for synchronizing transmissions and recording elapsed times.

**Closure**

See *splice closure*.

**Cloud computing**

A representative model for individual access to a shared grouping of computer resources, including other networks, servers, applications, storage and services. These can be easily accessed and managed with little or no service provider intervention. Usually shown as a cloud on network drawings.

**Coarse wavelength division multiplexing (CWDM)**

Applies to greater separation of wavelengths than DWDM. In single-mode applications, CWDM defines a 20 nm separation from 1471 nm to 1611 nm. With multimode fibers, the wavelengths are 778, 800, 825, and 850 nm.

**Coating**

A plastic or acrylate coating, normally up to 245-250 microns, that is placed over the cladding during the manufacturing process. After this process, the fiber can be colored or upper coated to 900 microns for use in tight buffered cables.

**Coexistence**

When WDM is used to overlay older legacy PON systems to newer standards including ITU-T G.987 (10G-PON), ITU-T G.989 (WDM-PON), IEEE 802.3av (10GEPON), and SCTE 174 (RFoG). Legacy systems use different defined wavelength assignments.

**Collapsible ribbon**

A group of fibers semi-attached at various intervals so as to be able to easily be flattened together to create a fiber ribbon without the use of bonding matrix. Various vendors have different versions – each providing high density applications where fiber bundles can be ‘round’ and once released from the cable can easily be flattened into ribbons and mass fusion spliced.

**Color code**

A color system for circuit identification by use of solid colors, contrasting stripes, tracers, braids, surface markings, etc., as determined by the TIA 598 standard.

**Community antenna (or access) television (CATV)**

Often called cable television, CATV uses fiber and coaxial media to provide voice, video, or data services.



**Composite cable**

An NEC term to describe a cable containing mixed media such as fiber with either coax, twisted pair, or power conductors under a common sheath. In wireless applications and regions outside of the US, this configuration may also be referred to as a hybrid cable.

**Compression**

A technique to minimize bandwidth requirements by reducing the data stream needed to convey the information.

**Concatenated**

Connected together in a line.split.

**Connector**

A device installed on the end of an optical fiber to allow it to be connected to another fiber or to a transceiver, test equipment or other device. Connectors are 'mated' via an adapter to properly align and allow the light to pass from one connector to the other. They are available in many different form factors. In the communications space, SC and LC single fiber connectors and MPO multi-fiber connectors are the most common. Specific details are listed in each connector definition in this document. Other connector styles include ST, FC, MU and several vendor specific styles.

**Continuous wave (CW)**

Energy is emitted from a module continuously, rather than in short pulses. CW applications require the laser to be on at all times. Constant output from an optical source that is active but not modulated by a signal.

**Conventional band**

Defined in ITU-T G.692 as between 1530 and 1565 nm, the C band is used in FTTx applications for RF overlay and RfOG downstream transmission. It is the dominant wavelength in DWDM and long haul transmission systems using EDFA optical amplifiers. See *C-band*.

**Cordage**

Tight buffered breakout cables used to build patch cords (jumpers). Internally, the fibers are normally one or two 900 micron coated fibers. The term "zipcord" describes a two-fiber cordage to allow two separate plugs to have their own strain relief.

**Core**

The light guiding part of the fiber with a refractive index higher than that of the cladding.

**Coupler**

See *splitter*.

**Coupling loss**

The optical attenuation of a connection or passive device, expressed as a value in dB.

**Coupling ratio**

A measure of how a device distributes light from its inputs to its outputs. Expressed as either a percentage or in dB.

**Customer premises equipment (CPE)**

The telecommunications terminal equipment located on the customer's premises, including telephones, private branch exchanges, and data terminals.

**Cutoff wavelength**

The wavelength at which a particular waveguide mode ceases to be a bound mode. When transmitting lower than a single-mode fiber's cutoff wavelength, the fiber transmits multimode. For G.652 single-mode fibers the cutoff wavelength is 1260 nm. For G.655 fibers, it can range from 1260 nm to 1450 nm.

**Dark fiber**

An unused fiber installed for future use.

**Data communications**

The transmission of data from one point to another.

**Data encryption**

A mathematical technique that encodes data so that it is more secure during transmission or storage. The data must be decrypted for use.

**dB**

A decibel, a logarithmic unit describing the ratio of two powers. Used to measure attenuation, reflectance, and amplification of optical signals. The ratio of two power levels, P1 and P2, expressed by  $-10 \log_{10}(P1/P2)$ .

**dB/km**

A logarithmic unit that describes the ratio of loss of power per kilometer distance, always referenced to a specific wavelength, e.g., 0.35 dB/km at 1310 nm. Used by fiber and cable manufacturers to define the fiber's attenuation.

**dBm**

Decibels relative to one milliwatt. A positive number indicates the power is above one milliwatt; a negative number indicates the power is below. This unit has become common in fiber optic communication systems because the power of light sources used with optical fibers is on the order of one milliwatt.

**Dense wavelength division multiplexing (DWDM)**

Specified by ITU-T G.694, DWDM is the transmission of multiple optical wavelengths over a single-mode fiber with spacings of 200 GHz (1.6 nm), 100 GHz (0.8 nm),



or 50 GHz (0.4 nm). First implemented in the 1990s, it is mostly used for oceanic, long haul, and metropolitan area networks.

### Detector

A device such a photodiode or photodetector that converts optical energy into electrical energy. They can be made from various semiconductor materials, depending on the wavelengths to detect. The positive-intrinsic-negative (PIN) and the avalanche photodiode (APD) types are used in fiber optics. PIN types can be used for analog or digital systems, while APDs with their internal amplification can only be used in digital systems.

### Dielectric

An insulating (nonconducting) medium.

### Differential group delay (DGD)

A delay caused by different arrival times of optical signals, which results in modal dispersion. In multimode fibers, DGD is the delay difference of the various modes. In single-mode fibers, DGD can be caused by chromatic, waveguide, and polarization mode dispersion.

### Differential optical path loss (DOPL)

The difference between the maximum and minimum APL calculations. In the ITU-T G.983 and G.984, the DOPL equals 15 dB for Classes A (5-20 dB), B (10-25 dB), and C (15-30 dB) and automatically includes the optical loss for the 1:32 splitter in the PON network.

### Diffraction grating

An array of fine, parallel, equally spaced reflecting or transmitting lines that mutually enhance the effects of diffraction to concentrate the diffracted light in a few directions determined by the spacing of the lines and by the wavelength of the light.

### Digital

A data format that uses discrete varying signals to contain information. Used in fiber optics as this format is easier to process and multiplex, and it is less sensitive to noise than analog transmission.

### Digital signal (DS)

A hierarchy of digital signal speeds used to classify capacities of digital lines and trunks. The fundamental speed level is DS 0 (64 kb/s).

### Digital subscriber line (DSL)

A generic name for a family of digital lines provided by local telephone companies to their subscribers.

### Digital video

Video signals represented by discrete numerical values rather than by continuously varying signal levels as in analog video. Because of this, it is simpler to maintain the fidelity of the video information as it travels through a transmission medium.

### Diplexer

A component used to provide two functions, such as multiplexing or filtering optical signals. For example, a diplexer used at an FTTx optical network terminal filters the downstream 1490 nm wavelength and multiplexes the upstream 1310 nm wavelength to or from a single fiber.

### Directional coupler

A fiber optic coupler that preferentially transmits light in one direction.

### Directionality

A quantification of how much light is passing in any direction, measured in dB. If a 0 dBm signal passes through a coupler with 50 dB directionality, only -50 dB (0.01  $\mu$ m) will pass in the wrong direction.

### Dispersion

The spreading of a pulse of light as it travels over the length of a fiber and is the cause of bandwidth limitations in fiber. For single-mode systems, chromatic dispersion is a combination of material (and waveguide dispersion. Another type of dispersion is polarization mode dispersion (PMD). In multimode systems, modal dispersion is caused by differential optical path lengths known as differential mode delay.

### Dispersion-shifted fiber (DSF)

Specified by ITU-T G.653, this fiber provides low attenuation and dispersion at 1550 nm. It could not be used with DWDM as it caused four wave mixing and has been obsoleted and replaced by G.655 nonzero dispersion-shifted (NZDS) fiber.

### Distributed feedback (DFB) laser

A laser that uses an internal grating to reduce the line width of the laser, and may be used for analog applications, e.g., AM/FM/DWDM.

### Distributed topology

A PON topology where two or more optical splitters are located in the outside plant. The tapered bus using tap splitters is technically a distributed topology.

### Distribution cable

A tight buffered non breakout style cable mostly used for indoor installations. Jackets can be plenum, riser, or low smoke zero halogen to meet building codes. Internally, the fibers have a 900 micron coating. In the outside plant, the term "distribution cable" is used by service providers to describe the cable between the feeder (backbone) and drop cables.



**Distribution network**

The fiber cables network deployed from the splitter to the curb in a PON.

**Distribution panel**

A combination of a patch panel and splice panel.

**DOCSIS**

The Data-Over-Cable-Service Interface Specification that permits a cable modem termination system to be designed as either a layer 3 router or layer 2 switch. Used by the CATV industry.

**Drop cable**

The fiber cable that connects the subscriber to the curb box and into the network.

**Duct**

A small pathway, generally 4" or smaller in diameter. Smaller inner ducts or fabric mesh inner duct are installed to allow cables to be pulled through. It may be buried, installed aerially, or within a building. Common types include smooth wall, ribbed, and corrugated.

**Duplex**

Two; twin. Refers to the type of fiber optic cable, e.g., duplex zipcord, or connector, e.g., duplex SC, LC,.

**Duplex transmission**

Transmission in both directions, either one at a time (half duplex) or both directions simultaneous (full duplex)

**Dynamic bandwidth allocation (DBA)**

A technique where transmission bandwidth in a shared architecture such as a passive optical network (PON) can be allocated on demand.

**Dynamic range**

For an optical instrument, defined as the difference between the smallest signal that can be detected at a specified wavelength and the strongest signal that can be detected accurately. Expressed in dB.

**E band**

Defined by ITU-T G.692 as "extended" for wavelengths between 1360 and 1460 nm, this band includes the high OH peak in single-mode fibers. G.652D fiber is designed for transmission within this band. In FTTx systems, the term can be confused with the enhancement band, which the ITU-T G.983 and G.984 PON FTTx standards define as the wavelengths between 1550 and 1560 nm for RF overlay transmission of video signals. See *extended band*.

**Electromagnetic interference (EMI)**

The frequency spectrum of electromagnetic radiation that extends from subsonic frequency to X rays. Not to be used in place of RFI.

**End separation loss**

The optical power loss caused by distance between the end of a fiber and a source, detector, or another fiber.

**Endface**

The surface area of the fiber optic ferrule where the optical fiber is centered and polished.

**Enhancement band**

A wavelength band (1550-1560 nm) selected for RF overlay capabilities for PON systems. These may include video services and DWDM.

**Enterprise local exchange carrier (ELEC)**

Management of a large number of communication lines associated with a campus-type environment, such as a university, business or theme-type parks with a centralized exchange. The ability to provide multiple services over the entire campus makes it operate like a small town or community, and thus its own exchange carrier.

**Entrance facility**

The entrance to a building for communications and power. It provides the transition between the outside plant and the premises. The entrance facility can connect to telecom, utility, or communication rooms or closets.

**Equipment room (ER)**

An environmentally controlled space that houses telecommunications equipment and intermediate cross-connects (IC) and/or main cross-connects (MC).

**Erbium-doped fiber amplifier (EDFA)**

An optical amplifier that uses active erbium-doped fiber and a pump source (laser) to boost or amplify the optical signal. Used in DWDM, CATV HFC, RF overlay and RFoG systems. Amplifies mostly in the C-band (1530 to 1565 nm).

**Ethernet**

A data communications protocol for premises and local access networks (IEEE 802.3). Ethernet features variable length packets that allow data to be sent with less overhead.

**Ethernet PON (EPON)**

Based on IEEE 802.3ah protocol for Ethernet, EPON is a network data transport using a variable length packet structure up to 1,518 bytes at data rates up to 1,000 Mb/s over single-mode fiber. The EPON format uses up to 1:32 optical splitters and can use either one fiber bidirectionally (BX) or two fibers (LX) in low medium or high-power configurations.



**Exclusive access**

A situation in which a single retail service provider (who may or may not be the network operator) has exclusive use of the FTTH network.

**Extended band**

The E-band, called out in the ITU-T Series G, Sup. 39 as the spectral wavelength region for single-mode fiber between 1360 nm and 1460 nm. See *E band*.

**Extended reach**

See *reach extender*.

**Extrinsic loss**

Loss caused by imperfect alignment of fibers in a connector or splice such as lateral offset, angular misalignment, end separation, and end finish.

**Fabric mesh inner duct**

A type of flexible inner duct used to increase capacity of ducts. It conforms to the shape of the cables placed inside, greatly reducing the space required in the conduit.

**Fabry-Perot (FP) laser**

A multi-longitudinal mode laser diode with a semiconductor on each end to form a resonant chamber to create the lasing effect. Used in digital applications. Limited to 10 Gb/s speeds and used only for digital transmission.

**Fast Ethernet**

IEEE 802.3 standard operating at 100 Mb/s.

**Federal Communications Commission (FCC)**

A United States regulative body created in 1934 to standardize and control both transmitted communications.

**Feeder cable**

The main fiber optic cable coming from the central office to a splice closure near a point of demarcation, such as a fiber distribution hub. Links to distribution part of the network.

**Feeder network**

The fiber cables network deployed from the OLT in the central office to the first splitter in the field in a PON architecture.

**Ferrule**

Most often made of ceramic but can also be steel or plastic. The fiber is bonded internally to the ferrule, which provides the alignment with the mating sleeve and opposite ferrule. Ferrule endfaces can be flat, radiused, or angled depending on the type of fiber and endface polish.

**Fiber**

A single optical transmission element characterized by a core, a cladding, and a coating. Two common structures, single-mode (with a step-index profile) or multimode (with a graded-index profile) are used for fiber optic communication systems. Different variations are made depending on the attenuation, bandwidth, dispersion, wavelengths, and mechanical requirements.

**Fiber access terminal (FAT)**

A small cabinet or pedestal with a limited amount of distribution fiber either to make a transition to drop fibers or a single splitter is placed and then drop fiber is run to the customer's interface. As an example, a low-rise MDU installation could use a FAT as its interface to the network.

**Fiber amplifier**

Most common are the erbium doped fiber amplifiers (EDFAs), semiconductor optical amplifiers (SOAs), and Raman amplifiers, which are used to increase signal gain without electrical conversion.

**Fiber Bragg grating (FBG)**

A piece of photo-refractive fiber that is exposed to high-intensity UV interference patterns, causing it to reflect a specific wavelength while being transparent to all other wavelengths. Used as a filter in WDM systems.

**Fiber break locator**

A low-cost OTDR that is used to locate breaks in optical fiber cables.

**Fiber coating**

A UV cured material immediately surrounding the glass cladding that serves to protect the integrity of the fiber from surface damage and stresses. Normally 200 or 250  $\mu\text{m}$  for outside plant cables and upjacketed to 900  $\mu\text{m}$  for indoor cables.

**Fiber demarcation box (FDB)**

A fiber demarcation box provides a service provider with a customer disconnection point, either via a splice or connector interface. Slack cable storage and battery backup are stored here as well.

**Fiber distribution hub (FDH)**

A type of outside plant cabinet that houses optical splitters in passive optical systems between feeder, distribution, and drop segments. Pole, pad, or wall mounted, they provide an easy fiber management location for connecting subscribers to the service providers.

**Fiber distribution unit (FDU)**

Enclosures that house and organize groups of fibers.



**Fiber in the loop (FITL)**

An outside plant architecture deployed by telephone companies to provide broadband services to subscribers. In this architecture, SONET/SDH fiber runs from the telephone company central office to an optical networking unit. From this unit, subscribers are served in a star topology with a drop of coax, twisted pair, or composite coax/twisted pair.

**Fiber nonlinearities**

Types of nonlinearities include stimulated Brillouin scattering (SBS), four-wave mixing (FWM), modulation instability, self-phase modulation, soliton formation, cross-phase modulation (XPM) and stimulated Raman scattering.

**Fiber optic cable**

A communications cable that consists of one or more optical fibers, each capable of transmitting data via modulated light waves. Loose buffered types for outside plant applications can be armored or dielectric stranded or central tube designs. Applications include aerial figure 8, ducted, direct buried, all dielectric self-supporting (ADSS), and optical power ground wire (OPGW). Indoor designs are tight buffered breakout or distribution types with cable jackets designed to meet building codes for use in plenum, riser, and low smoke zero halogen environments.

**Fiber optic test procedure (FOTP)**

Standardized methods for testing various fiber optic components, as specified in the TIA-455 standard.

**Fiber optics**

Term used to describe links used for voice, video, data, medical, sensing, and illumination applications. All use optical fibers to transmit or receive optical signals or power.

**Fiber to the antenna (FTTA)**

See *fiber to the cell*.

**Fiber to the building/business (FTTB)**

A topological reference to a network that supports multiple subscribers in a single structure, i.e., a business or a building. Multiple dwelling unit (MDU) defines residential use and multiple tenant unit (MTU) defines business units. In order to classify as FTTB, the fiber must at least: (a) enter the building; (b) terminate on an external wall of the building; (c) terminate no more than 2m from an external wall of the building; (d) enter at least one building within a cluster of buildings on the same property; (e) terminate on an external wall of one building within a cluster of buildings on the same property; or (f) terminate no more than 2m from an external wall of one building within a cluster of buildings on the same property.

**Fiber to the cell (FTTCell)**

Fiber to the cell tower. Used to provide greater bandwidth and to transition to IP requirements using Ethernet.

**Fiber to the curb/customer (FTTC)**

Distribution of communication services by providing fiber optic links to a central point in each neighborhood and continuing to homes by either twisted pair or coax.

**Fiber to the desk (FTTD)**

Transmission system using fiber optics from transmitter to desktop.

**Fiber to the home (FTTH)**

An access network architecture in which the final connection to the subscriber's premises is optical fiber. The fiber optic communications path is terminated on or inside the premises for the purpose of carrying communication services (voice, video, data) to a single subscriber. In order to be classified as FTTH, the access fiber must cross the subscriber's premises boundary and terminate: (a) inside the premises; (b) on an external wall of the subscriber's premises; or (c) no more than 2m from an external wall of the subscriber's premises. FTTH excludes architectures where the optical fiber terminates before reaching the premises and where the access path continues to the subscriber over a physical medium other than optical fiber, i.e., coax.

**Fiber to the node (FTTN)**

An access network in which fiber is used for part, but not all, of the link from the OLT to the end user. An optical-to-electrical conversion takes place at a node, which typically serves a neighborhood. The terminal network segment is usually twisted copper pair (FTTC) or coaxial cable (HFC). Most current CATV and telephony networks have FTTN architectures.

**Fiber to the premises (FTTP)**

Coined around the preliminary debates associated with the RBOCs and the CLECs before the FCC triennial review of the Telecommunications Act of 1996. A less generic term for fiber to the user (FTTx).

**Fiber to the user (FTTx)**

A more generic term than FTTP covering all types rather than one specifically.

**Five nines**

Any system operating 99.999% of the time.

**Forward error correction (FEC)**

A method to improve the performance of large-capacity optical transmission systems. System designs employing FEC can accept relatively large BER (better than  $10^{-12}$ ) in the optical transmission line before encoding.



**Frequency**

The number of cycles per unit of time, denoted by Hertz (Hz); 1 Hertz = 1 cycle per second.

**Frequency division multiplexing (FDM)**

Two or more signals combined at different frequencies so they can be transmitted as one signal.

**Frequency modulation (FM)**

A modulation scheme in which the message signal modulates a carrier signal so that the frequency (as opposed to the amplitude or phase) of the carrier is varied.

**Fresnel reflection**

Reflection of a portion of the incident light at a planar interface between connectors, mechanical splices, or two homogeneous media having different refractive indices.

**Full duplex**

Information can be sent in both directions simultaneously, as with a telephone.

**Full Service Access Network (FSAN)**

Develops PON specifications, which it forwards to the ITU to develop into standards. The FSAN S652 document is considered to be the grandfather document for the ITU G.983 B-PON standard. FSAN is working on next generation PON standards, including G.987 10G-PON and WDM-PON.

**Full width half maximum (FWHM)**

Used to measure the spectral width of light sources. Measure the spectral width at 3 dB (half power from peak) and at the full width of the source's power peak.

**Fused biconical taper (FBT)**

A splitter manufacturing process by which two fibers are positioned side-by-side, twisted together and pulled while being heated in a hydrogen flame, until their cores are close enough laterally to allow light transmission between them.

**Fusion splicer**

A mechanical device that optically joins optical fibers by discharging voltage between two electrodes. Variations include the single fiber and ribbon fixed V-groove types, the profile alignment splicer (PAS) and the local injection detection (LID), both of which are categorized as core alignment splicers.

**G.652**

Recommendation ITU-T G.652 describes the geometrical, mechanical, and transmission attributes of a single-mode optical fiber and cable that has zero-dispersion wavelength around 1310 nm. This fiber was originally optimized for use in the 1310 nm

wavelength region but can also be used in the 1550 nm region. This is the most commonly used fiber in typical FTTH networks.

**G.657**

ITU-T Recommendation that describes the geometrical, mechanical, and transmission attributes of fibers with strongly improved bending performance when compared to G.652 single mode fiber and cables. These fibers are increasingly used in FTTH networks, especially in the headend, cabinet, and in the last segments to and in the home and MDU.

**Generic Requirements (GR) document**

A broad range of Technical Specifications developed and published by Telcordia Technologies, typically with substantial input from leading industry manufacturers and service providers.

**Giga (G)**

A prefix meaning one billion.

**Gigabit Ethernet**

The IEEE 802.3z standard for high-speed Ethernet, capable of transmitting one billion bits per second. It provides increased network bandwidth and interoperability and can be used in backbone environments to interconnect multiple lower-speed Ethernet systems.

**Gigabit PON (G-PON)**

Standardized in ITU-T G.984, G-PON handles data rates up to 2.5 Gb/s and split ratios up to 1:64. The standard features the G-PON encapsulation method (GEM), which allows for the transmission of Ethernet packets and ATM cells.

**Gigahertz (GHz)**

A unit of frequency equal to one billion Hertz.

**G-PON encapsulation method (GEM)**

A method of data encapsulation over the G-PON network, similar to ATM, that uses variable length frames to transport up to an encapsulated payload of 1500 bytes. Capable of sending ATM cells or Ethernet packets over the network.

**Greenfield**

Network deployment in an area under development. Since everything is being built for the first time, network construction can be done with few obstructions and installation can be accomplished parallel to other utilities.

**Ground**

An electrical connection to the earth, generally through a ground rod.



**Handhole**

An access opening provided in equipment or in a below-the-surface enclosure into which personnel reach, but do not enter, to work with or place cable. Also known as maintenance access handhole.

**Head end**

Central distribution point for a CATV system where a link is created between the HFC system and any external data networks. Video signals are received, and frequency is converted to the appropriate channels, combined with locally originated signals, and then rebroadcast.

**High-definition television (HDTV)**

Digital television with significantly more resolution than that of a good NTSC or PAL television signal. The specific resolution can vary, however it is typically about twice the resolution of standard television signals and has a 16:9 aspect ratio.

**High-density connector**

Typically, connectors with multiple fibers in a small form factor housing, i.e., MPO, MTP®.

**Home run**

A PON architecture where the optical splitter is housed at the service provider's facility. Home runs are the easiest for handling changes but require a fiber rich cabling system as one fiber is dedicated for each subscriber.

**Homes connected**

The number of premises that are connected to an FTTH network.

**Homes passed**

The potential number of premises to which an operator has capability to connect in a service area, but the premises may or may not be connected to the network.

**Horizontal cabling**

Cabling that extends between and includes the horizontal cross-connect and the telecommunications outlet.

**Horizontal cross-connect (HC)**

Known internationally as a floor distributor (FD), a cross-connect of horizontal cabling to other cabling, e.g., horizontal, backbone or equipment. Could be a patch panel or LAN (small) panel.

**Hybrid cable**

An NEC term for a cable with multiple types of optical fibers (e.g., multimode and single-mode) under a common sheath and is differentiated from the other NEC term, composite cable, which typically includes

mixed media. In wireless applications and regions outside the US, both of these cable types are referred to as hybrid cables.

**Hybrid fiber coax (HFC)**

A hybrid system, used by the CATV industry, that employs a fiber optic backbone and coax cables for final distribution from the node to the customer.

**Incumbent local exchange carrier (ILEC)**

The dominant phone carrier within a geographic area that provides local exchange service to that area.

**Index matching fluid**

A gel or liquid material whose index of refraction is almost equal to that of the fiber core. It is used to reduce Fresnel reflections in mechanical splices or cleave and crimp connectors.

**Index of refraction (IOR)**

The ratio of the speed of light in a vacuum to the speed of light in a material. When light strikes the surface of a transparent material, some light is reflected while some is bent (refracted) as it enters. The IOR is used to calibrate OTDRs for measuring fiber length.

**Indium gallium arsenide (InGaAs)**

The components of crystalline semiconductors used in fiber optic photodetectors.

**Indoor living unit (ILU)**

The customer premises within a multi-dwelling unit.

**Infrared**

Light wavelengths extending from 770 nm on.

**Inline splice closure**

Closure that has cable ports at opposite ends.

**Innerduct**

Usually a nonmetallic pathway that may be placed within a duct to facilitate initial and subsequent placement of multiple cables in a single duct.

**Insertion loss**

Total optical power loss caused by the insertion of an optical component such as a connector, splice or splitter.

**Inside plant**

The portion of the network that resides solely indoors and generally consists of indoor riser or plenum rated cables and associated patch panels, interconnects and transmission equipment.

**Inspection scope**

A microscope or digital scope that inspects fiber connector ferrule and termin endfaces for polish quality, damage, or contamination. Many scopes include auto pass/fail detection against IEC 61300-3-35 endface quality standards.



**Institute of Electrical & Electronics Engineers (IEEE)**

A standards organization representing the United States on the ISO in the areas of electrical or electronic standards. Writes standards on communications including Ethernet and OPGW and ADSS cables.

**Insulated Cable Engineers Association (ICEA)**

Professional organization dedicated to developing cable standards for the electric power, control, and telecommunications industries.

**Interbuilding backbone**

A network that provides communications between buildings, (e.g., college campus, office park, or military installation).

**Interconnection**

A scheme that provides for the direct connection of a cable to the other cable without a patchcord or jumper.

**Interexchange carrier (IXC)**

Any common carrier that provides long-distance services, i.e., Sprint or AT&T.

**Intermediate band**

A wavelength region allocated in the ITU-T G.983.1 for future use between 1360 nm and 1480 nm. Included guard bands for allocation by ITU.

**Intermediate cross-connect (IC)**

A cross-connect between first and second level backbone cabling. It can be between main (MC) and horizontal (HC). Normally would consist of a patch panel.

**Intermediate distribution frame (IDF)**

Currently known as intermediate cross-connect (IC), or internationally as the building distributor (BD). A connection between first and secondary cabling topologies within a building. Usually two separate patch panels connected with a patch cord connecting the two backbones. Typically located within a dedicated telecommunications space such as a telecom Room (TR).

**International Electrotechnical Commission (IEC)**

An international standards body responsible for a wide range of recommendations and standards for telecommunications.

**International Standards Organization (ISO)**

An international body funded by the United Nations, that provides consistent worldwide standards. U.S. membership is provided by ANSI.

**International Telecommunications Union (ITU)**

The international body for communications standards. The telecommunications group within ITU is designated as ITU-T.

**Internet protocol (IP)**

A set of rules for how data is transmitted from place to place on the Internet. IP is a connectionless protocol in which data is broken down into small bundles known as packets. Each packet is transmitted separately, possibly along a different route than other packets from the same message.

**Internet protocol address**

A protocol on which the Internet is based, this software-describing standard tracks addresses for different nodes, routes outgoing messages, and recognizes incoming messages.

**Internet protocol television (IPTV)**

A compressed digitized video provided through packet or cell transmission (FTTH) to subscribers.

**Internet service provider (ISP)**

An organization whose business is connecting users to the Internet. By serving as the interface between end users and the Internet, the ISP's equipment is analogous to a CATV head end or telephony CO.

**Intrabuilding backbone**

A network that provides communications within a building; often referred to as the riser backbone in vertical buildings.

**Intrinsic losses**

Losses arising from differences in fiber tolerances.

**Integrated services digital network (ISDN)**

A legacy digital network available to business or home users for transmission of voice, video, or data up to 1.5 Mb/s.

**Isolator**

A passive fiber optic component that either allows only unidirectional passing of light or that passes only some wavelengths of light. Used in conjunction with lasers or optical amplifiers to reduce or remove backreflections.

**Jacketing**

The outer jacket of a cable, which can be made from a variety of materials including but not limited to HDPE, MDPE, PVC, *et. al.*

**Jitter**

The variation in time of a received signal compared to the instance of its transmission or compared to a fixed time frame at the receiver. Examples of jitter sources include signal-pattern-dependent laser turn-on delay jitter, noise-induced jitter on a gating turn-on point, gating hysteresis jitter, and gating jitter that accumulates in a link between two nodes.

**Jumper**

See *patchcord*.



**Kellems grips**

Wire, aramid or synthetic mesh that is placed around the cable to be installed, intended to provide positive pulling power. Also known as pulling or mesh grips.

**Kevlar™**

Strands of protective aramid fiber used to provide strain relief in cable assemblies. Also used in cables as their dominant means of strain relief. Kevlar™ is a trademarked name by DuPont.

**Keyed**

Connectors in which the plug and adaptor are fixed in alignment to prevent rotation and physical fiber endface damage.

**Kilo (k)**

Numerical prefix denoting one thousand.

**Kilometer (km)**

Standard length of measurement for fiber optics; 1,000 meters, 3,281 feet, or 0.621 miles.

**Kpsi**

Tensile strength measured in thousands of pounds per square inch.

**Laser**

Light amplification by stimulated emission of radiation; a coherent source of light with a narrow spectral width.

**Laser chirp**

Noise created by reflected or crosstalk optical energy entering the lasing chamber.

**Laser diode**

A semiconductor diode that emits light in a narrow spectrum; used because of its speed and efficiency.

**Lashing**

Attaching a cable to a supporting strand or cable using a steel or dielectric filament around both cable and messenger.

**Last mile**

The last mile is the local access network that extends from the CO to the end-user subscriber. Also called the local loop network, it was traditionally copper-based but has increasingly become mostly fiber-based.

**Latency**

Delay of a signal in time, which can be caused by transmission, processing, rotation, and propagation delays.

**L band**

The "long" DWDM transmission band, occupying the 1565 nm to 1625 nm wavelength range. See *long band*.

**LC connector**

This small form, latched connector provides high density and is common in FTTH networks, data centers and other fiber intensive applications. The LC is available in many form factors including several simplex, duplex, and hardened versions.

**Light**

The region of the electromagnetic spectrum perceived by human vision is designated by the visible spectrum and nominally covering the wavelength range of 400 770 nm. In optical telecommunications, the wavelength range is typically 850-1650 nm.

**Light-emitting diode (LED)**

A semiconductor device that emits incoherent light formed by the P N junction. Burrus (well) and edge-emitting diodes are used with systems operating up to 622 Mb/s over multimode fibers.

**Light source**

The fiber optic transmitter in an optical loss test set (OLTS) that uses one or more LEDs or lasers at specified wavelength. Lasers used in communication systems must be stabilized and operating in continuous wave or modulated at 2 kHz.

**Link**

An optical cable with connectors attached to a transmitter and receiver.

**Local access and transport area (LATA)**

The geographic area that is the domain of the local exchange carrier. Bell operating companies are generally precluded from carrying traffic across LATA boundaries; this traffic must be handed off to an interexchange carrier.

**Local area network (LAN)**

An interconnected system of separate layer 2 and 3 network devices and IP enabled peripherals, connected by wireless, fiber, or twisted pair cabling, usually following Ethernet protocols, in a contained relatively small geographical location such as an office building or campus.

**Local exchange carrier (LEC)**

The phone carrier providing local transmission services. Defined as either independent or regional Bell operating company (RBOC).

**Local loop**

The connection between a customer's telephone or data equipment and a local exchange company or other telephone service provider.



**Long band**

The L-band, the spectral band allocated by the ITU-T Series G Sup. 39 as the wavelengths between 1565 nm and 1625 nm. See *L band*.

**Loose tube cable**

A type of cable where the internal 250 micron fibers are loose within buffer tubes. Types include stranded, central tube, OPGW, ADSS, and microduct cable. Also known as loose buffer cable.

**Loose tube gel filled (LTGF)**

A loose tube cable structure with buffer tubes filled with gel to restrict moisture intrusion. Mostly replaced with "dry" techniques, it is still used in areas of extreme low temperatures.

**Loss**

See *attenuation*.

**Loss budget**

The tolerable difference between the light impulse where it originates and the light impulse where it arrives at the receiving end. If too much light power has been lost along the way through deficiencies in the cable or connectors, the signal cannot be read and interpreted.

**Loss windows**

Fiber optic transmission typically occurs at 850, 1300, 1310, 1550, and/or 1625 nm. These "windows" were selected because absorption and scattering losses were lower within them. These wavelengths require light sources and photodetectors that operate efficiently over multimode and single-mode fibers.

**Low-smoke zero halogen (LSZH) cable**

The standard cable used in Europe in place of plenum or riser cable types. Internationally, LSZH cables are used in place of plenum and riser cable jackets. In North America, LSZH cables are used on ships and in tunnels. Also known as zero halogen cable.

**Macrobanding**

In an optical fiber, all macroscopic deviations of the axis from a straight line; distinguished from microbanding.

**Main cross-connect (MC)**

A cross-connect for first and second level cabling, e.g., from equipment facility connecting to all other locations (ICs and HCs). Usually would consist of a distribution or patch panel.

**Main distribution frame (MDF)**

Currently known as main cross-connect (MC), or internationally as the campus distributor (CD). A connection between service cables entering the building, equipment cables, and the first level

backbone cabling topologies within a building or campus. Usually two separate patch panels connected with a patch cord connecting the incoming cabling to the equipment cabling or connecting the equipment cabling to the building or campus backbone. Typically located within a dedicated telecommunications space such as an entrance facility (EF) or telecommunications room (TR).

**Margin**

The amount of additional loss that can be tolerated in a link.

**Material dispersion**

Dispersion caused by differential delay of various wavelengths of light in a waveguide material.

**Material safety data sheet (MSDS)**

Technical bulletin required by OSHA detailing information about the physical or health hazards of a chemical or mixture.

**Mean time between failure (MTBF)**

Developed by the military to estimate maintenance or replacement times for various pieces of high-end equipment, MTBF is based upon statistical evidence derived from in-use testing under extreme conditions (simulated or actual environment). Testing is performed by the manufacturer of the equipment or an independent test facility.

**Mechanical splice**

A fiber splice accomplished by fixtures or materials, rather than by thermal fusion. Index matching material may be applied between the two fiber ends.

**Mega (M)**

A prefix meaning one million.

**Megabit (Mb)**

One million bits.

**Messenger wire**

Galvanized wire ranging from 1/4" to 9/16" which is placed between poles and which standard cable types are lashed.

**Metropolitan area network (MAN)**

An interconnected data transmission system connecting users and LANs in a localized geographical area such as a city.

**Microbanding**

An effect where small stresses or flaws create attenuation. Mostly an extrinsic effect caused by tie wraps and point deformations onto the fiber that allow light to escape. Intrinsic sources are flaws or defects in the core/cladding boundary created during the manufacturing process.



**Microduct**

Small HDPE ducts up to 16 mm in diameter that can be installed in empty or partially filled ducts to provide space for microduct fiber optic cables.

**Microduct cable**

Microduct cables are designed for high-density fiber counts in a small optical cable, normally between 5-16 mm. Designed for blowing into microducts.

**Micron ( $\mu\text{m}$ )**

A millionth ( $10^{-6}$ ) of a meter. A common unit of measurement for fiber optic diameters.

**Mid-entry**

Opening a cable in the middle of a span to access the fibers. Also known as an express entry.

**Mode**

A light path.

**Mode field diameter (MFD)**

The portion of a single-mode fiber that actually transmits the light energy. Generally 20% larger than the physical core. The size of the mode field varies with wavelength.

**Modulated laser**

A laser module that allows users to control output power by varying a control voltage, which turns the laser on and off.

**Modulation**

The coding of information onto a carrier frequency. May use amplitude, frequency, phase, or time, plus many forms of on/off digital coding.

**Modulator**

A waveguide device used externally to the laser to electro-optically change the refractive index of the waveguide in response to an applied electric field. The phase changes induced can result in amplitude modulation of light at the output port.

**Moving Pictures Experts Group (MPEG)**

Various standards, established by the, that define the amount of compression, and thereby the quality, of the resultant video information file.

**Multifiber push-on connector (MPO)**

A high-density array connector that can terminate multiple fibers in a single ferrule. The ferrules, made from a composite material, align fibers in rows of 12 or 16 fibers. These connectors are keyed and aligned via pins mounted at the edges of the ferrule. A mated pair consists of one pinned and one unpinned connector.

**Multilongitudinal mode (MLM) laser**

A laser, usually Fabry-Perot, that has a measured spectral width specified by the maximum root mean square of the spectral distribution (side modes), limited to no more than 20 dB down from the peak mode.

**Multimode fiber (MMF)**

An optical waveguide that allows more than one mode to be guided. 50/125, 62.5/125 and 100/140 are the most common. Graded-index types are used in fiber optic communication systems. Multimode fibers are also specified by the IEC 11801 standard and classified by modal bandwidth as OM1, OM2, OM3, OM4 or OM5

**Multiple system operator (MSO)**

A cable television provider.

**Multiplex**

A concept in which independent sources of information are combined and transmitted over a single communication channel. Electronic multiplexing includes TDM and FDM, while optical multiplexing includes wide, coarse, and dense wavelength division multiplexing.

**Multiplexer (Mux)**

A device which combines two or more separate signals for transmission through a single fiber. Optical multiplexer combines signals at different wavelengths. Electronic multiplexer combines TDM or FDM signals electronically before they are converted into optical form.

**Multiple dwelling unit (MDU)**

Apartment or condominium units within a larger building. Also known as a multifamily dwelling unit.

**Multipoint service terminal (MST)**

An environmentally hardened outside plant fixture that contains 4-12 ruggedized connector ports, connectors, and optical fiber cable length to span from splitter location to MST location.

**Multiprotocol label switching (MPLS)**

An overall data-carrying protocol that encompasses circuit-based and packet-switching services such as ATM, SONET, and Ethernet, as well as network digital formats such as VoIP and IPTV.

**Multitenant data center (MTDC)**

A facility that provides Internet infrastructure services, such as electrical power, fire suppression, security, cooling, and network access, usually over optical fiber. Some firms lease datacenter space to other providers or individual enterprises. Colocation data centers sell space on the basis of racks, cabinets, or cages.



**Multi-user telecommunications outlet assembly (MUTOA)**

Used in work areas of premises networks to allow multiple terminations.

**Nanometer (nm)**

One billionth of a meter, or  $10^{-9}$  meters. Most common unit of measurement for light.

**Nanosecond (ns)**

One billionth of a second, expressed as  $10^{-9}$  seconds.

**National Electrical Code (NEC)**

A North American code that addresses proper electrical/fiber optic systems and equipment installation to protect people and property from hazards stemming from the use of those systems in buildings and structures. Updated every three years. In Canada, refer to the Canadian Electrical Code (CEC).

**National Electrical Safety Code (NESC)**

This outside plant code contains basic safety provisions that cover supply, communication lines, equipment, and work practices of personnel employed by utilities.

**National Television Standards Committee (NTSC)**

Committee that defines specifications and methods for displaying video information on a standard television.

**Network equipment building system (NEBS)**

A multi-level requirement for central office equipment in the North American Public Switched Telephone Network. Originally developed by Bell Labs (now Telcordia) in the 1970s and released as a public document in 1985.

**Network operations center (NOC)**

The group responsible for the day-to-day care and feeding of a network. Also called a network control center (NCC).

**Network topology**

The cable plant that connects the operator's premises and the subscriber's premises, i.e., point-to-point, point-to-multipoint, or ring topology.

**Next generation PON (NG-PON)**

Defined by FSAN as NG1 and released by the ITU as the G.987 10 Gigabit PON standard and G.9807.1 XGS-PON (symmetrical transmission).

**Next generation PON2 (NG-PON2)**

A 40-Gigabit passive optical network that uses time and wavelength division multiplexing (TWDM). Released as ITU T G.989.

**Node**

Transmission equipment placed in the outside plant to connect multiple users to a common link that extends back to a head end, CO, or similar location.

**Noise**

In a cable or circuit, any extraneous signal that tends to interfere with the signal normally present in or passing through the system.

**Nonzero dispersion-shifted fiber (NZDS)**

Single-mode fiber designed for DWDM and optical amplifier applications. Specified in ITU T G.655.

**Numerical aperture (NA)**

A measure of the angular acceptance for a fiber, approximately the sine of the half-angle of the acceptance cone. The NA of an optical fiber defines a characteristic of the fiber in terms of its acceptance of incoming light. "Light gathering ability" and "acceptance cone" are terms describing this characteristic.

**O band**

The "original" transmission band, occupying the 1260 to 1360 nm wavelength range, with a center wavelength of 1310 nm. Used in FTTH standards for upstream transmission. See *original band*.

**Occupational Safety & Health Administration (OSHA)**

The main government agency for enforcement of safety and health law in the United States.

**Optical fiber nonconductive plenum (OFNP)**

A fire performance rating related to cable jackets for indoor applications as specified by the NEC in article 770.179.

**Open access**

When multiple retail service providers may share use of infrastructure or network and compete to offer their services to end users.

**Open access (duct)**

The situation where multiple retail or wholesale service providers may use the infrastructure covering a substantial region by drawing or blowing their fiber cables through shared ducts and compete to offer their services.

**Open access (packet)**

The situation where multiple retail service providers may use the FTTH network on an equitable base by connecting at a packet layer interface and competing to offer their services to end users.

**Open access flexibility point**

The concentration point, possibly located at a building or cabinet, where multiple retail or service providers may connect via their feeder cables and access Layer 1 feeder fiber connectivity to each household.



**OSI Model**

A seven-layered open system interconnection (OSI) framework of standards for network communication. OSI creates an open systems networking environment where different systems can share data regardless of vendor or platform.

**Operational support system (OSS)**

Software that furnishes tools to provide network control, monitoring and business functions.

**Operations, administration, and maintenance (OAM)**

A group of network management functions that provide fault indications, performance information, and network diagnosis.

**Optical access networking (OAN)**

An access network made up of optical transmission links as opposed to copper links composed of twisted-pair or coaxial cabling.

**Optical add/drop multiplexer (OADM)**

A multiplexer typically used in DWDM systems to allow a wavelength to be added or dropped optically. Can be fixed (FOADM), reconfigurable (ROADM), or dynamic (DOADM).

**Optical amplifier**

A device that amplifies light without converting it to electrical signal. Types include the EDFA, Raman, and SOA.

**Optical attenuator**

A passive component that produces controlled signal loss in an optical transmission line to decrease the optical power. Available as fixed or as variable types.

**Optical carrier (OC)**

Usually followed by a numerical designator such as 1, 12, 192, etc. Used in SONET and ATM transmission systems to describe the optical conversion of a synchronous transport signal at a specific rate, i.e., OC 3.

**Optical circulator**

A multiport device that steers optical energy between specific ports. Used in conjunction with a Bragg filter to provide OADM.

**Optical code division multiple access (OCDMA)**

Creates a unique optical code, similar to a bar code, for each channel by selectively filtering out portions of the spectrum. This spectrally encoded light is then modulated with the data to be transmitted.

**Optical distribution network (ODN)**

The fibers, splitters, couplers, etc., in a passive optical network that provide the optical transmission means from the OLT to the users, and vice versa.

**Optical-electrical-optical (OEO)**

Specifies a network switch that receives an optical signal, and demultiplexes, switches, multiplexes and re-transmits the signal optically. Can perform 3R functions.

**Optical fiber**

An optical waveguide comprised of a light-carrying core and cladding, which traps light in the core. Fiber optic communication systems use either single-mode or multimode types.

**Optical filter**

A passive component used to modify the optical radiation that passes through it, usually by altering the spectral distribution. Employed to reject or absorb optical radiation in particular ranges of wavelength while transmitting it in other ranges. Tunable optical filters can track the signal wavelength variation over its operating wavelength range while untunable models have fixed values.

**Optical isolator (OI)**

A nonreciprocal device intended to suppress backward reflections along an optical fiber transmission line while having minimum insertion loss in the forward direction.

**Optical line terminal (OLT)**

The OLT is a multi-point line card and contains a bidirectional transceiver using wavelength division multiplexing technology. It is located at the service provider facility transmitting downstream to the subscriber's optical network terminal over a PON network. The OLT also receives upstream transmission from the subscriber's ONT.

**Optical loss**

The amount of optical power lost as light is transmitted through fiber, splices, couplers, etc. See *attenuation*.

**Optical loss test set (OLTS)**

A single-mode or multimode test set consisting of a light source and power meter. OLTS is used for measuring a completed fiber optic cable assembly's loss (in dB) at the connector interfaces, within the specified wavelength of the fiber optic.

**Optical network terminal (ONT)**

A media converter or gateway at a home or business that converts signals from light to electrical signals and contains ports to distribute signals within the subscriber premises.

**Optical power**

The amount of radiant energy per unit time, expressed linearly (watts) or logarithmically (dB).



**Optical receiver**

An electronic device that converts optical signals to electrical signals.

**Optical return loss (ORL)**

The sum of the amount of light reflected from all optical fibers and components. The fiber, connectors, or splices in an optical system can cause the reflection. Measured in dB.

**Optical signal-to-noise ratio (OSNR)**

The difference between the signal being transmitted and the noise being created by an optical laser's pulse. The higher the OSNR, the better the quality of service.

**Optical supervisory channel (OSC)**

A channel used for maintenance purposes including but not limited to remote site alarm reporting, communications necessary for fault location, and orderwire. Does not carry payload traffic.

**Optical switch**

A passive component possessing two or more ports that selectively transmits, redirects, or blocks optical power in an optical fiber transmission line, or that re-routes signals from one optical fiber into others. Types include MEMs, matrix, bypass, and optical cross-connect.

**Optical time-division multiplexing (OTDM)**

Use of optical processors to multiplex, process, and demultiplex signals to achieve higher speeds. There are two fundamentally different types of OTDM, interleaved and slotted. OTDM may well be a practical necessity for generating data rates well above 40 Gb/s.

**Optical time-domain reflectometer (OTDR)**

A type of test equipment used to characterize a fiber via the transmission of an optical pulse. The resulting backscatter and reflections are measured as a function of time attenuation. The OTDR provides identification of defects over a length of fiber. Types include mainframe, full feature, mini, fault locators, and specialty OTDRs.

**Optical-to-electrical (OE)**

Shorthand notation for a point or device that converts an optical signal to an electrical signal.

**Optoelectronic**

Pertaining to a device that responds to optical power, emits or modifies optical radiation, or utilizes optical radiation for its internal operation.

**Optomechanical switch**

Bipolar switch, based on moving fibers or mirrors, that moves optical signals between fibers.

**Original band**

The O-band, the spectral band for single-mode, as called out in the ITU-T Series G, Sup. 39, ranging from 1260 nm to 1360 nm. See *O band*.

**OS1**

Obsolete/grandfathered specification.

**OS1a**

Indoor single-mode fiber cable performance specification as designated by IEC 11801-1(2017) Table 92.

**OS2**

Outdoor single-mode fiber cable performance specification, as designated by IEC 11801-1(2017) Table 92.

**Outlet**

See *telecommunications outlet*.

**Output power**

Radiant power, expressed in watts.

**Outside plant (OSP)**

The portion of a communication network that exists mostly outdoors, but also between transmission sites. It includes patch panels, closures, pedestals, the media (e.g., fiber, twisted pair, coax) and the structure (aerial, underground, etc.) where the cable is installed and routed. The patch panels at each end are points of access for testing, as well as a point of separation of responsibilities for the transmission network.

**Overbuild**

A type of FTTX network installation that makes upgrades or additions to existing legacy copper or coax installations.

**Packet**

A data unit of variable length used in communications protocols such as Ethernet and IP. Packets allow some flexibility by allowing more data to be sent without breaking it up into pieces and then re-assembling it at the receiver, in turn reducing overhead.

**Packet switching**

Messages are divided into small chunks that fit easily into memory and reassembled into the original message at the destination, enabling communications channels to be used simultaneously by more than one node.

**Passive**

A component that requires no electrical power to operate, i.e., optical splitters, wavelength division multiplexers, filters, circulators, and optical attenuators.



**Passive optical network (PON)**

A point-to-multipoint system, specified by the ITU, IEEE, and SCTE, that is made up of fiber optic cabling, passive splitters and WDMs that distribute an optical signal from the service provider to homes (FTTH) or buildings (FTTB).

**Patchcord**

A fixed length of cable with like connectors on both ends (or, in the case of a hybrid cable, different connectors). Sometimes called a cable assembly, patch cable or jumper.

**Patch panel**

A wall or rack-mounted cross-connect panel for interconnection of multiple cables or fibers.

**Pathway**

A facility for the placement of telecommunications cable.

**Pay-per-view (PPV)**

The sale of content to subscribers on a per-program basis as opposed to a subscription basis.

**Penetration rate**

Homes connected divided by the number of premises in a served area.

**Photodetector**

An electro-optic device that transforms light energy into electrical energy.

**Photodiode**

A semiconductor that converts light into an electrical signal, used in fiber optic receivers.

**Photon**

The packet or element of light exhibiting features of both particle and wave.

**Physical contact (PC)**

Refers to the endface polish of a ferrule. Designed to lower reflections by changing the spherical or angular geometry at the end of a ferrule and its internal fiber. Variations include PC, super PC (SPC), ultra PC (UPC), and angled PC (APC).

**Pigtail**

A short length of fiber cord or cable that has one end terminated with a connector.

**PIN diode**

Positive intrinsic negative diode, a type of photodiode used to convert optical signals in a receiver.

**Plain old telephone service (POTS)**

Basic telephone service, dial tone without special features.

**Planar lightwave circuit (PLC)**

A wafer-based optical splitter enabling consistent optical power outputs used in point to multipoint network (PON) topologies.

**Planar waveguide**

A waveguide formed on the surface of an optically flat material where the area of propagation has a high refractive index and guides light in the same manner as optical fiber. When utilized in couplers or splitters, the waveguide is divided from a single input into multiple outputs.

**Plenum**

Defined in the NEC as the air handling space between walls, under structural floors, and above suspended drop ceilings, which can be used to route intrabuilding cabling. See *OFNP*.

**Plug**

Connector. The male side of a connection. Usually consists of three main parts: the body, ferrule and strain relief boot.

**Point of presence (POP)**

The physical location where a long-distance carrier terminates lines before connecting to the local exchange company, another carrier, or directly to a customer.

**Point-to-multipoint (P2MP)**

A star topology with optical splitters for PON systems in which an OLT is optically linked to multiple ONTs through entirely passive means. It provides branching optical fiber paths from a communication node to more than one premises such that a portion of the optical paths are shared by traffic to and from multiple premises.

**Point-to-point (P2P, PtP, Pt-Pt)**

A topology in which all fiber links are from one transmitter to one receiver. Branching can be done at an intermediate point via an active device located anywhere on the network, including the CO or a curb-side enclosure. It provides an uninterrupted optical fiber path from the communication switching equipment point to a single location at the premises. For FTTx systems, it is typically used in active Ethernet.

**Polarization**

The orientation of the electric and magnetic field vectors of a propagating electromagnetic wave. An electromagnetic wave theory describes in detail the propagation of optical signals (light).

**Polarization mode dispersion (PMD)**

Typical single-mode fibers support two perpendicular polarizations of the original transmitted signal, which may travel at different speeds and arrive at different



times. The average difference in arrival times of the two polarization modes, normalized with length, is referred to as PMD.

#### **Polarized dispersion loss (PDL)**

The difference in dB between the maximum and minimum values of loss (attenuation) due to variation of the polarization states of light propagating through a device. The ITU defines PDL as polarization dependent loss, the maximum variation of insertion loss due to a variation of the state of polarization (SOP) over all SOPs.

#### **Power**

The rate at which energy is absorbed, received, transmitted, transferred, etc., per unit time. Optical power is measured in dBm or watts.

#### **Power budget**

The difference (in dB) between the transmitted optical power (in dBm) and receiver sensitivity (in dBm).

#### **Power meter**

Test equipment that measures the optical power (dBm) and attenuation (dB) in a fiber optic connector, fiber optic cable, or fiber optic system.

#### **Premises**

Defined as the subscriber's home or place of business. In a multiple dwelling unit, each apartment is counted as one.

#### **Private branch exchange (PBX)**

Customer premises version of central office switch. Switches calls between phones on premises and provides a second dial tone for calls over the public network.

#### **Protocol**

A set of communications conventions that enable orderly and accurate transfer of data between stations.

#### **Public switched telephone network (PSTN)**

The traditional voice network infrastructure, including both local and long distance service, that has been in use in various parts of the world for the last century.

#### **Pulling tension**

The force that can be applied to a cable without affecting the specified characteristics for the cable, or the longitudinal force exerted on a cable during installation. Also known as pulling stress.

#### **Pulse broadening**

An increase in pulse duration resulting in optical dispersion.

#### **Pulse code modulation (PCM)**

A coding scheme for converting analog signals into a digital bit stream.

#### **Pulse spreading**

The dispersion of incoming optical signals along the length of an optical fiber.

#### **Pulse width**

A measurement of the full width half maximum (FWHM) value of a light source's peak power and spectral width at the 3 dB point. Lasers in OTDRs can change pulse width to create greater dynamic range.

#### **Quadplexer**

Commonly known as a passive WDM, this transceiver package performs four multiplexing or demultiplexing functions. Used in 10 Gigabit OLTs when coexisting with legacy PON systems.

#### **Quality of service (QoS)**

A measure of the service quality, including but not limited to packet loss, latency, and jitter on a network, as measured by bit error rate and availability.

#### **Raceway**

A metal or plastic channel designed to hold and protect cables. Types include ladder, splice, and mesh trays. Fiber raceway systems are designed specifically for fiber optic cables.

#### **Radio frequency interference (RFI)**

The disruption of signals which can be caused by high voltage and lightning.

#### **Radio frequency over glass (RFoG)**

An SCTE 174 standard released in 2010, RFoG addresses PON network transmission for the CATV industry.

#### **Rayleigh scattering**

The scattering of light into a direction generally reverse to the original one. The principle on which OTDRs operate; the scattering of light caused by index of refraction variations in the submicroscopic structure of the glass. One of the two major causes of attenuation in optical fibers.

#### **Reach extender (RE)**

The extended distance of the ODN beyond the 20 km maximum limit agreed upon by the originating standards bodies. Used by active Ethernet and XG PON for network distances from 40 to 80 km. Also known as reach extension and extended reach. Reach extension can occur by using optical amplifiers (1R) or 3R signal regeneration.

#### **Receive (Rx)**

Refers to the detection of light from an optical source.



**Receiver (RCVR)**

An electronic unit that converts an optical signal to an electrical signal using an APD or PIN photodiode.

**Receiver sensitivity**

This tells how much optical power the photodetector must receive to achieve a specified base band performance, such as a specified bit error rate or signal-to-noise ratio. Expressed in dBm.

**Receptacle**

A connector adapter with an internal LED, laser or detector that connects to optical plug assemblies.

**Reconfigurable OADM (ROADM)**

Unlike OADMs, ROADMs can be managed via a network connection without need for a truck roll. They function as optical switches, allowing for remote service changes, and provide an express wavelength path and power monitoring.

**Reflectance**

The percentage of light reflected from a component, such as a connector, splice, splitter, or WDM.

**Reflection**

The abrupt change in direction of a light beam at an interface between two dissimilar media that returns the light beam back into the medium where it originated, i.e., a mirror.

**Refraction**

The bending of a beam of light in transmission between two dissimilar materials or in a graded index fiber where the refractive index is a continuous function of position.

**Refractive index**

The ratio of light velocity in a vacuum to its velocity in the transmitting medium.

**Regional Bell operating company (RBOC)**

A company formed from the forced breakup of AT&T and the Bell system.

**Relative intensity noise (RIN)**

Light is reflected back into a laser and amplified through the same physical mechanism that causes laser action. Caused by reflections from discontinuities in endfaces, connectors, or splices.

**Remote terminal (RT)**

A POTS-related switching terminal that is remotely located in a pedestal or electronics cabinet.

**Repeatability**

The number of times a connector can be mated within an interface before the amount of insertion loss measured exceeds the Telcordia GR-20 standard.

Detailed optical connector performance specifications may be found in Telcordia GR-326 (single fiber) and GR-1435 (multi-fiber).

**Repeater/regenerator**

A 3R repeater is a device inserted at intervals along a circuit that detects a weak signal, amplifies it, cleans it up, and retransmits it in optical form. A 3R regenerator is a receiver and transmitter combination used to reconstruct signals for digital transmission. Optical amplifiers are 2R regenerators.

**RF overlay**

RF and RF overlay are terms commonly used in the FTTx architecture to refer to the analog video signal added, usually via a WDM to the optical network within a certain wavelength band or region.

**Ribbon cable and fiber**

A series of single fibers bonded or partially bonded together to facilitate mass fusion splicing.

**Ribbon splice**

A fusion or mechanical splice that aligns and fuses or mechanically bonds two ribbon fibers together. Ribbon splices require special stripping and cleaving tools.

**Rights of way (ROW)**

Legal right of passage over land owned by another.

**Ring topology**

A communications topology in which each station is logically arrayed in a ring and passes information to the next station in order. It provides a sequence of optical fiber paths in a closed loop that connects a series of communication nodes.

**Rise time**

The time required for the leading edge of a pulse to rise from 10% to 90% of its amplitude; the time required for a component to produce such a result.

**Riser cable**

Cable installed in vertical runs and penetrating more than one floor or cables installed in vertical runs in a shaft. Rated by the NEC/CEC for resisting flame spread and smoke generation.

**Rogue ONT**

An ONT that emits power outside of its allocated timeslot. It transmits optical power in upstream timeslots, where no ONT is assigned to transmit. This fails to deliver proper service and also degrades or totally disables the service of other customers on the same fiber network.

**Roll-off**

An OTDR trace of a fiber that gradually rolls off due to nonreflective breaks.



**Router**

Highly intelligent devices that connect networks, typically supporting multiple protocols.

**S band**

The “short” DWDM transmission band, which occupies the 1460-1530 nm wavelength range.

**SC connector**

Subscriber connector, aka “Sam Charlie” Connector, is a push/pull connector style that is common in FTTH networks. The connector is keyed and is available in simplex, duplex or hardened styles.

**Service loop**

(a) Allowing for “slack” in a splice tray, closure, or vault to accommodate future needs. (b) When a device is terminated to the wire in the communications outlet, a fair amount of “slack” should be left on the wire and wound in the box to accommodate future trimming when devices are changed out.

**Serving area (SA)**

An area defined by 32 optical network terminals (ONTs).

**Signal-to-noise ratio (SNR)**

The ratio of the power of the signal versus the power of the background noise, usually measured in decibels. Describes the quality of an electronic transmission system.

**Silicon detector**

A semiconductor that used absorbed photon energy to stimulate carriers from one energy level to a higher one. The change in charge across the junction is monitored as a current in the external photodiode circuit. Silicon photodetectors are commonly used in multimode systems operating at 850 nm.

**Simple network management protocol (SNMP)**

Network management architecture initially designed for the Internet but easily applied or extended to any network type.

**Simplex**

Operation of a communications channel in one direction only with no capability of reversing.

**Simplex cable**

A cord containing only one fiber.

**Single-longitudinal mode (SLM) laser**

A laser, usually distributed feedback (DFB) type, where the spectral width is the width at the 20 dB down points divided by 6.07.

**Single-mode**

A step-index waveguide in which only one mode will propagate above the cutoff wavelength.

**Single-mode fiber (SMF)**

A fiber type that propagates a single mode of light through a defined mode field diameter. The most common types used in FTTH networks are those specified by the ITU as G.652 (standard SMF), G.652.D (low water peak SMF) and G.657 (bend-insensitive SMF).

**Sleeve**

A mating device of either split or solid construction, commonly made of ceramic or phosphor bronze, that is used to align two ferrules within an adapter.

**Small form factor (SFF)**

A connector family utilizing (in general) a 1.25 mm ferrule that offers higher density than legacy 2.5 mm ferrule connector types.

**Source**

Usually an LED or laser used to convert an electrical information-carrying signal into a corresponding optical signal for transmission by an optical fiber.

**Spectral width**

A full width half maximum (FWHM) measurement of a LED or laser light source to determine its optical width.

**Speed of light**

$2.998 \times 10^8$  meters per second measured in a vacuum.

**Splice**

The mechanical or fusion means of joining two fibers together with a minimal loss and reflectance.

**Splice closure**

An inline or butt style cable and fiber management product that environmentally protects and houses optical splices. Splice closures can also hold connectors and optical splitters. Telcordia GR-771 specifies mechanical requirements and environmental specifications and tests.

**Splice panel**

A rack or wall-mounted panel for organizing or splicing cables. The panel holds splice trays, secures the cable, grounds any metallic members, and stores buffer tubes, fibers, and splices.

**Splice protector**

A device placed over a fusion splice to provide mechanical strength and protection to allow easy handling of the splice for organization in a splice tray or other storage. Two types are the heat shrink protector and the butterfly.

**Splice tray**

A protective tray that holds spliced fibers for slack and protection. A tray or other device used for the permanent storage of mechanical or fusion optical splices.



**Splicing**

Permanent joining of identical or similar fiber ends without a connector.

**Splitter**

A fiber device that optically splits signals. The splitters used in a PON are optical splitters that distribute optical signals from the OLT to the ONTs. Splitters used in FTTH installations are specified by the ITU G.671 standard as wavelength independent couplers (WIC), which provide the same attenuation regardless of wavelength or direction.

**ST connector**

A straight tip, keyed bayonet with 2.5 mm ferrules. Available in ST I or ST II styles.

**Star coupler**

An optical splitter in which many fibers have their signals mixed at a single optical element. The mixed signals are then transmitted back through all the fibers. The name comes from the geometrical arrangement; all fibers come together at a single point.

**Star topology**

Also known as a point-to-multipoint (P2MP) topology, the star topology has one hub that connects all users. In FTTH, all PON systems are star topologies. Variations include the distributed star topology, which has two or more splitters cascaded from a single port.

**Storage area network (SAN)**

A network which links host computers to storage servers and systems.

**Strain relief**

The method by which a cable's physical load is attached and addressed at the rear of a connector. In fiber optic cable assemblies, various methods of strain relief techniques are used to isolate loading stresses between cable, connectors, and other components that would impact performance.

**Stranded cable**

In stranded cables, individual color-coded buffer tubes are wrapped or "stranded" around the cable's central strength member.

**Subscriber**

A premise connected to a FTTH network that uses at least one service on this connection under a commercial contract.

**Subscriber line interface circuit (SLIC)**

The line card that provides the interface between local loop and telco switching equipment.

**Super physical contact (SPC)**

The spherical endface polish of a ferrule and fiber that is performed on a polishing machine. Typically 50 dB return loss. Superseded by the UPC polish.

**Switched video on demand (SVOD)**

Television service provided over an established network but not continuously broadcast, therefore requiring less bandwidth than conventional broadcast systems. Signal transmission is initiated when a subscriber selects a channel, which triggers a request back to the service provider.

**Synchronous digital hierarchy (SDH)**

A worldwide, high-speed synchronous protocol standard transmitting at up to 10 Gb/s. Known as SONET in North America.

**Synchronous optical network (SONET)**

ANSI-standard physical interface defined by its optical line rates known as optical carrier (OC) signals, frame format and OAM&P protocol. Adopted by the ITU as SDH.

**Synchronous transfer mode (STM)**

A transport and switching method that depends on information occurring in regular and fixed patterns with respect to a reference such as a frame pattern.

**Synchronous transmission**

A transmission method in which data characters are synchronized by timing signals generated at sending and receiving stations (as opposed to start/stop communications). Both stations operate continuously at the same frequency and are maintained in a desired phase relationship. Several codes may be used as long as they utilize the required line control characters. Also called "bi sync" or "binary synchronous."

**Synchronous transport signaling (STS)**

The transmission speed of a SONET transmission medium, e.g., OC-48.

**T1**

A North American data exchange protocol for constant bit rate systems. It operates at 1.544 Mb/s and can handle up to 24 telephone calls or other data. The corresponding European protocol E1 operates at 2.048 Mb/s and handles up to 30 telephone calls or other data.

**T3**

A faster implementation of T1. Using coaxial cable, T3 allows for data transmission rates of 45 Mb/s and is used for WAN backbones, the Internet backbone and connections from Internet service providers to the Internet backbone.



**Take rate**

Subscribers divided by homes connected. Expressed as a percentage, it can also be based on each type of service, i.e., take rates for data, video, voice, or triple/quadruple services.

**Tap**

A coupler in which part of the light carried by one fiber is split off and inserted into another fiber. Essentially the same as a Tee coupler. An example would be a 10/90% optical splitter.

**TCP/IP**

Transport control protocol/Internet protocol. Originally developed by the U.S. government, this product is the de facto standard for Internet and inter-network communications.

**Telcordia Technologies**

Formerly known as Bell Communications Research (Bellcore). Originally created at the breakup of the Bell System in 1982, it was given a broad mandate to provide consulting services, R&D, and software development to the RBOCs. Telcordia was privatized in 1996 and later acquired by Ericsson in January 2012.

**Telecommunications room (TR)**

A telecommunications space, excluding equipment rooms (ER) and entrance facilities (EF), that typically houses the intermediate cross-connect (IC) for a building or floor distributor.

**Telecommunications Industry Association (TIA)**

An organization that participates in setting standards accredited by ANSI. Superseded the Electronic Industry Association (EIA).

**Telecommunications outlet (TO)**

A single-piece cable termination assembly (typically on the floor or in the wall) that contains one or more modular telecom jacks (e.g., RJ45, coaxial terminators, fiber optic connections).

**Telecommunications space**

A secure enclosed space that houses telecom equipment, cable terminations, and cross-connections. A generic term to include entrance facilities (EF), equipment rooms (ER), and telecommunications rooms (TR – ITR/MTR).

**Telephony PON (TPON)**

A passive optical network, developed by British Telecom, with all or part of its transmission system between telephone switch and subscriber.

**Tensile strength**

The pull stress that is required to break a given specimen.

**Termination**

Endpoint, connection or the action of installing a connector to cordage or cable.

**Termination tools**

Tools used in preparing optical fibers for splicing and/or installation of connectors.

**Terminator**

An optical plug with the fiber dead ended so that there is no reflectance. Terminators measure component reflectance using the OTDR and also reduce Fresnel reflections at open connector ports.

**Threshold**

A defined pass or fail value, i.e., the maximum or minimum value of insertion loss in dB or dBm.

**Tight buffered cable**

A type of cable typically rated for indoor use to meet plenum, riser and LSZH requirements. Designed for easier breakout and distributions styles. Internal fibers are commonly 900-micron coated.

**Time and wavelength division multiplexing (TWDM)**

A hybrid of time division multiplexing (TDM) and wavelength division multiplexing (WDM).

**Time division multiple access (TDMA)**

A data transmission method in which a number of individual transmitters in different locations share a transmission channel, each occupying the channel for a portion of the total time. Used for upstream transmission on Passive Optical Networks (PON).

**Time division multiplexing (TDM)**

A digital technique for combining two or more signals into a single stream of data by sharing time. Used for downstream transmission on Passive Optical Networks (PON).

**Topology**

Physical and logical layout of a network.

**Total internal reflection**

The interface between core and cladding that acts like a mirror to keep the light reflecting and contained within the core.

**Transmitter**

An electronic unit that converts an electrical signal to an optical signal using LEDs or lasers.

**Triple play**

Voice, video, and data communications.

**Triplexer**

Commonly known as a passive WDM, this transceiver package performs three multiplexing or demultiplexing functions.



**Tunable laser**

A laser that can change wavelength. Applications include research, OTDRs, and protection in transmission systems.

**U band**

The “ultra-long” DWDM transmission band, occupying the 1625-1675 nm wavelength range.

**Ultra high definition television (UHDTV)**

The highest bandwidth applications for video are the new UHDTV sets just now entering production in the broadcast and Pro A/V industries. See *4K HDTV* and *8K HDTV*.

**Ultra physical contact (UPC)**

The spherical endface polish of a ferrule and fiber that is performed on a polishing machine to reduce reflections. Typically 55 dB return loss.

**Unbundled network element (UNE)**

Locally owned media and components of an established telephone network.

**Uninterruptible power supply (UPS)**

An auxiliary power unit providing continuous power in case commercial power is lost.

**Unitube cable**

This type of cable has a large central tube in which the fibers are grouped using color-coded binder thread. Unitube cables are physically smaller than stranded-type cables. Also known as central tube or LXE cable.

**User network interface (UNI)**

The user end of an access network, similar to an ONU but not necessarily optical.

**Variable optical attenuator (VOA)**

A fiber system component with adjustable attenuation, often used to test system performance by increasing attenuation until the system degrades.

**Vault**

Storage product for excess cable slack and splice case.

**Vertical-cavity surface-emitting laser (VCSEL)**

A high-speed, low-cost laser operating at the 850 nm wavelength for applications such as Gigabit Ethernet where the modulation rate of current LEDs is insufficient.

**Video**

Exchange of visual material by use of digital or analog (RF) (or other encoding and transport protocols).

**Video on demand**

A video service that allows users to select a program and begin viewing it at any time.

**Video over IP**

The transmission of video programming over an IP network. If the source is digital, it is encapsulated into IP packets. Otherwise, it is digitized and usually compressed. It can then be converted back to analog by equipment at the customer’s premises or viewed on a digital television.

**Visible light**

Electromagnetic wavelengths, ranging from 380-770 nm, that are visible to the human eye.

**Voice**

Exchange of bidirectional, real-time, full-duplex, human conversations via IP, encoding, or transport protocols.

**Voice over IP (VoIP)**

The transmission of telephone calls over an IP network.

**Waveguide**

An older term for optical fiber.

**Waveguide dispersion**

Dispersion caused by the difference in the speed of light of the core and the cladding in single-mode fibers. Waveguide dispersion also changes with wavelength as the size of the mode field diameters increases with wavelength.

**Wavelength**

The color of light in the electromagnetic spectrum used in fiber transmission. The optical spectrum typically used in single-mode fiber typically used 1260 nm to 1650 nm wavelengths for transmission.

**Wavelength division multiplexing (WDM)**

Combining two or more optical signals (different wavelengths) for transmission over a single fiber. WDM devices have specific channel wavelength spacing for CWDM (coarse WDM) and for DWDM (dense WDM) applications.

**Wavelength independent coupler (WIC)**

Defined in ITU G.671 as an optical splitter that provides the same attenuation regardless of wavelength or direction.

**WDM coupler**

A passive device designed to either (a) optimally combine light of multiple predetermined wavelengths into a single core; or (b) optimally sort and segment those wavelengths and couple them separately into output fiber cores.

**WDM-PON**

A passive optical network with utilization of wavelength division multiplexing on a physical layer - assigning different wavelengths for separate ONU units.



Specified by the ITU T G.989 document, two variations of WDM-PON ARE: point-to-point (P2P) and time and wavelength division multiplexing (TWDM).

**Wide area network (WAN)**

An integrated data network linking metropolitan or local networks over common carrier facilities.

**Work area (WA)**

A building space where the occupants may interact with telecommunications terminal equipment (computers, phones, etc.). A media or telecommunications outlet would be used here for fiber terminations or, in the case of multiple users, a MUT-OA outlet.

**XG-PON**

10 Gigabit passive optical networks covered under the ITU-T G.987 for telecommunication based optical networks.

**Yield**

The percentage of terminations that pass specifications and are good the first time. The higher the yield (e.g., 95%), the greater the installed cost benefit.

**Zipcord**

A separable, two-fiber, breakout-style cable with a diameter (per buffer) of 1.6 mm (mini Zipcord), 2.0 mm, or 3.0 mm generally used for cable assemblies/ patchcords.



# Acronyms

<b>µm</b>	Micron (also micrometer)	<b>BI-MMF</b>	Bend-insensitive multimode fiber
<b>10G-EPON</b>	10 Gigabit Ethernet passive optical network (Symmetrical – IEEE 802.3av)	<b>B-ISDN</b>	Broadband Integrated Services Digital Network
<b>3DTV</b>	Three-dimensional television	<b>BLEC</b>	Building local exchange carrier
<b>4KTV</b>	Four thousand horizontal line resolution TV	<b>BOSA</b>	Bidirectional optical subassembly
<b>5G</b>	Fifth generation of wireless	<b>B-PON</b>	Broadband passive optical network (ITU-T G.983)
<b>8KTV</b>	Eight thousand horizontal line resolution TV	<b>BX</b>	Single fiber designation for Ethernet
<b>ABF</b>	Air blown fiber	<b>CAP</b>	Competitive access provider
<b>ADM</b>	Add/drop multiplexer	<b>CAPEX</b>	Capital expenditures
<b>ADSL</b>	Asymmetric digital subscriber line	<b>CATV</b>	Community antenna (access) television
<b>ADSS</b>	All-dielectric self-supporting	<b>CCTV</b>	Closed circuit television
<b>AE</b>	Active Ethernet	<b>CD</b>	Chromatic dispersion, or campus distributor
<b>AES</b>	Advanced encryption standard	<b>CEC</b>	Canadian Electrical Code
<b>AF</b>	Assured forwarding	<b>CEV</b>	Controlled environmental vault
<b>AGC</b>	Automatic gain control	<b>CLEC</b>	Competitive local exchange carrier
<b>AM</b>	Amplitude modulation	<b>CM</b>	Cable modem
<b>AN</b>	Access network, or access node	<b>CMTS</b>	Cable modem termination system
<b>ANSI</b>	American National Standards Institute	<b>CNR</b>	Carrier-to-noise ratio
<b>AOC</b>	Active optical cable	<b>CO</b>	Central office
<b>AON</b>	All-optical network	<b>CODEC</b>	Coder/decoder
<b>APC</b>	Angled physical contact	<b>CPE</b>	Customer premises equipment
<b>APD</b>	Avalanche photodiode	<b>CRC</b>	Cyclic redundancy check
<b>APL</b>	Allowable path loss	<b>CSA</b>	Canadian Standards Organization
<b>APON</b>	Asynchronous transfer mode (ATM) PON	<b>CSM</b>	Central strength member
<b>APS</b>	Automatic protection switching	<b>CSMA/CD</b>	Carrier sense multiple access / collision detection
<b>APVD</b>	Advanced plasma and vapor deposition	<b>CSO</b>	Composite second order
<b>ARPU</b>	Average revenue per user	<b>CTB</b>	Composite triple beat
<b>ASOF</b>	Application-specific optical fibers	<b>CTR</b>	Common telecommunications room
<b>ATM</b>	Asynchronous transfer mode	<b>CW</b>	Center wavelength, or continuous wave
<b>AWG</b>	Arrayed waveguide grating	<b>CWDM</b>	Coarse wavelength division multiplexing
<b>b/s</b>	Bits per second; also bit/s or bps	<b>DAS</b>	Distributed antennae system
<b>BD</b>	Building distributor	<b>dB</b>	Decibel
<b>BE</b>	Best effort	<b>DBA</b>	Dynamic bandwidth allocation
<b>BER</b>	Bit error rate	<b>DBFA</b>	Dual-band fiber amplifier
<b>BERT</b>	Bit error rate tester	<b>dBm</b>	Decibels relative to one milliwatt
<b>Bidi</b>	Bidirectional	<b>DBS</b>	Digital broadcast satellite
<b>BIF</b>	Bend-insensitive fiber		



<b>DCF</b>	Dispersion-compensating fiber	<b>EMI</b>	Electromagnetic interference
<b>DEL</b>	Density economical location	<b>EML</b>	Element management layer
<b>DEMUX</b>	Demultiplexer	<b>EMP</b>	Electromagnetic pulse
<b>DFB</b>	Distributed feedback (laser)	<b>EMS</b>	Element management system
<b>DGD</b>	Differential group delay	<b>ENMS</b>	Enterprise network management system
<b>DGE</b>	Dynamic gain equalizer	<b>EP2P</b>	Ethernet over P2P in IEEE 802.3ah
<b>DH1</b>	Digital signal hierarchy, level 1	<b>EPON</b>	Ethernet passive optical network (IEEE 802.3ah)
<b>DH3</b>	Digital signal hierarchy, level 3	<b>ER</b>	Equipment room, or extinction ratio
<b>DHCP</b>	Dynamic host configuration protocol	<b>ERK</b>	Emergency restoration kit
<b>DIB</b>	Dual-insulated buffer	<b>ESL</b>	Estimated splice loss
<b>DIP</b>	Dual inline package	<b>ETL</b>	Electrical Testing Labs (Intertek)
<b>DLC</b>	Digital loop carrier	<b>ETSI</b>	European Telecommunications Standards Institute
<b>DMD</b>	Differential mode delay	<b>EVC</b>	Equivalent voice channels, or Ethernet virtual connection (ITU-T)
<b>DML</b>	Directly-modulated laser	<b>FAT</b>	Fiber access terminal
<b>DOCSIS</b>	Data-Over-Cable-Service Interface Specification	<b>FBG</b>	Fiber Bragg grating
<b>DOPL</b>	Differential optical path loss	<b>FBT</b>	Fused biconical taper
<b>DPON</b>	DOCSIS passive optical network	<b>FC</b>	Fiber connector, or frame control
<b>DPSK</b>	Differential phase-shift keying	<b>FCAPS</b>	Fault configuration accounting performance security
<b>DPSS</b>	Diode-pumped solid-state	<b>FCC</b>	Federal Communications Commission
<b>DQPSK</b>	Differential quadrature phase shift keying	<b>FCGA</b>	FTTH/FBA Council's Global Alliance
<b>DS</b>	Downstream, or digital signal	<b>FCIA</b>	Fibre Channel Industry Association
<b>DSF</b>	Dispersion-shifted fiber	<b>FD</b>	Floor distributor
<b>DSG</b>	DOCSIS set-top gateway	<b>FDB</b>	Fiber demarcation box
<b>DSL</b>	Digital subscriber line	<b>DFD</b>	Fiber distribution frame
<b>DSLAM</b>	Digital subscriber loop access multiplexer	<b>FDH</b>	Fiber distribution hub
<b>DSP</b>	Digital signal processing	<b>FDM</b>	Frequency division multiplexing
<b>DTV</b>	Digital television	<b>FDMA</b>	Frequency division multiple access
<b>DWDM</b>	Dense wavelength division multiplexing	<b>FDT</b>	Fiber distribution terminal
<b>DWS</b>	Dynamic wave slicing	<b>FDU</b>	Fiber distribution unit
<b>E/O</b>	Electrical to optical	<b>FEC</b>	Fiber entrance cabinet, or forward error correction
<b>ECSA</b>	Exchange Carriers Standards Association	<b>FET</b>	Field effect transistor
<b>EDA</b>	Equipment distribution area	<b>FFS</b>	For future study
<b>EDFA</b>	Erbium-doped fiber amplifier	<b>FILM</b>	Fiber in the last mile
<b>EDTV</b>	Expanded high definition television	<b>FIT</b>	Factory installed termination
<b>EF</b>	Expedited forwarding, or entrance facility	<b>FITL</b>	Fiber in the loop
<b>EFM</b>	Ethernet in the First Mile	<b>FM</b>	Frequency modulation
<b>ELEC</b>	Enterprise local exchange carrier	<b>FOCIS</b>	Fiber Optic Connector Intermateability Standard (ANSI/TIA 604-xx)
<b>EMC</b>	Emergency management center		
<b>EMD</b>	Equilibrium modal distribution		



<b>FOTP</b>	Fiber optic test procedure	<b>HDLC</b>	High-level data link control
<b>FOTR</b>	Fiber optic transceiver	<b>HDMI</b>	High definition multimedia interface
<b>FOTS</b>	Fiber optic transmission system	<b>HDPE</b>	High-density polyethylene
<b>FP</b>	Fabry-Perot (laser)	<b>HDSL</b>	High bit rate digital subscriber line
<b>FSAN</b>	Full Service Access Network	<b>HDTV</b>	High definition television
<b>FSB</b>	Fiber splitter box	<b>HFC</b>	Hybrid fiber coax
<b>FSWDM</b>	Full spectrum wavelength division multiplexing	<b>HFOC</b>	Hardened fiber-optic connector
<b>FTTA</b>	Fiber to the antenna	<b>HHP</b>	Households passed
<b>FTTB</b>	Fiber to the building, or business	<b>HMFOC</b>	Hardened multifiber optic connector
<b>FTTC</b>	Fiber to the curb, or customer	<b>HRC</b>	Harmonic related carriers
<b>FTTCell</b>	Fiber to the cell tower	<b>HVAC</b>	Heating, ventilation, and air conditioning
<b>FTTD</b>	Fiber to the desk	<b>HVAD</b>	Hybrid vapor axial deposition
<b>FTTH</b>	Fiber to the home	<b>IC</b>	Integrated circuit, or intermediate cross-connect
<b>FTTN</b>	Fiber to the node	<b>ICCF</b>	Interexchange Carrier Compatibility Forum
<b>FTTO</b>	Fiber to the office	<b>ICEA</b>	Insulated Cable Engineers Association
<b>FTTP</b>	Fiber to the premises	<b>ICMP</b>	Internet control message protocol
<b>FTTx</b>	Fiber to the user	<b>IDC</b>	Indoor drop cables
<b>FWHM</b>	Full width half maximum	<b>IDF</b>	Intermediate distribution frame
<b>FWM</b>	Four wave mixing	<b>IEC</b>	International Electrotechnical Commission
<b>GaAsP</b>	Gallium arsenide phosphide	<b>IEEE</b>	Institute of Electrical and Electronic Engineers
<b>GbE</b>	Gigabit Ethernet	<b>IETF</b>	Internet Engineering Task Force
<b>Gb/s</b>	Gigabits per seconds; also Gbps or Gbit/s	<b>IFC</b>	Intra fiber cabling
<b>GBIC</b>	Gigabit interface converter	<b>IFDH</b>	Indoor fiber distribution hub
<b>GEL</b>	Geographical economical location	<b>IL</b>	Insertion loss
<b>GEM</b>	G-PON encapsulation method	<b>ILD</b>	Injection laser diode
<b>GEPON</b>	Gigabit Ethernet passive optical network (IEEE 802.3ah)	<b>ILEC</b>	Incumbent local exchange carrier
<b>GFF</b>	Gain flattening filter	<b>ILU</b>	Indoor living unit
<b>GFP</b>	Generic framing procedure	<b>InGaAsP</b>	Indium gallium arsenide phosphide
<b>GIS</b>	Graphic information services	<b>IP</b>	Internet protocol
<b>GLB</b>	Grade level box	<b>IPA</b>	Isopropyl alcohol
<b>GMII</b>	Gigabit media independent interface	<b>IP-SDV</b>	Internet protocol-switched digital video
<b>G-PON</b>	Gigabit passive optical network (ITU-T G.984)	<b>IPTV</b>	Internet protocol television
<b>GR</b>	Generic requirements (Telcordia/iconectiv)	<b>IPv4</b>	Internet protocol, version 4
<b>GRIN</b>	Gradient index (lens)	<b>IPv6</b>	Internet protocol, version 6
<b>HAN</b>	Home area network	<b>IOR</b>	Index of refraction
<b>HASB</b>	High air-speed blown (fiber)	<b>IRC</b>	Incremental related carriers
<b>HC</b>	Horizontal cross-connect	<b>ISDN</b>	Integrated Services Digital Network
<b>HDA</b>	Horizontal distribution area	<b>ISO</b>	International Standards Organization



## Glossary of Terms

<b>ISP</b>	Internet service provider	<b>MFT</b>	Multifiber terminal
<b>ITU</b>	International Telecommunications Union	<b>MFU</b>	Multiple family unit
<b>ITU-T</b>	International Telecommunications Union –Telecommunications Standards	<b>MIB</b>	Management information base
<b>IVD</b>	Inside vapor deposition	<b>MLM</b>	Multilongitudinal mode (laser)
<b>IXC</b>	Interexchange carrier	<b>MMF</b>	Multimode fiber
<b>kb/s</b>	Kilobits per second; also kbps or kbit/s	<b>MMTA</b>	Multimedia Telecommunications Association
<b>km</b>	Kilometer	<b>MPD</b>	Mode power distribution
<b>LAN</b>	Local area network	<b>MPEG</b>	Moving Pictures Experts Group
<b>LASER</b>	Light amplification by simulated emission of radiation	<b>MPLS</b>	Multiprotocol label switching
<b>LATA</b>	Local access and transport area	<b>MPO</b>	Multifiber push-on connector
<b>LCP</b>	Local convergence point	<b>MRCL</b>	Maximum rated cable load
<b>LD</b>	Laser diode	<b>MSB</b>	Most significant bit
<b>LEC</b>	Local exchange carrier	<b>MSDS</b>	Material Safety Data Sheet
<b>LED</b>	Light-emitting diode	<b>MSO</b>	Multiple system operator
<b>LID</b>	Local injection and detection	<b>MSP</b>	Managed service provider
<b>LSA</b>	Least square approximation	<b>MST</b>	Multiport service terminal
<b>LSB</b>	Least significant bit	<b>MSTP</b>	Multiservice transport platform
<b>LSPM</b>	Light source/power meter	<b>MTBF</b>	Mean time between failure
<b>LSZH</b>	Low smoke zero halogen	<b>MTDC</b>	Multitenant data center
<b>LTGF</b>	Loose tube gel filled	<b>MTP</b>	Multiple termination plug
<b>LWP</b>	Low water peak	<b>MTR</b>	Main telecom room
<b>LX</b>	Dual fiber designation for Ethernet	<b>MT-RJ</b>	Multiple termination RJ connector
<b>MAC</b>	Media access control	<b>MTT</b>	Multitask technician
<b>MAN</b>	Metropolitan area network	<b>MTU</b>	Multiple tenant unit, or multiterminal unit
<b>Mb/s</b>	Megabits per second; also Mbps or Mbit/s	<b>MUTOA</b>	Multi-user telecommunications outlet assembly
<b>MC</b>	Main cross-connect	<b>MUX</b>	Multiplexer
<b>M-CMTS</b>	Modular cable modem termination system	<b>NA</b>	Numerical aperture
<b>MCVD</b>	Modified chemical vapor deposition	<b>NAP</b>	Network access point
<b>MDA</b>	Main distribution area	<b>NCTA</b>	National Cable and Telecommunications Association
<b>MDF</b>	Main distribution frame	<b>NEBS</b>	Network Equipment Building System (Telcordia/iconectiv)
<b>MDI</b>	Medium dependent interface	<b>NEC</b>	National Electrical Code (NFPA-70)
<b>MDPE</b>	Medium-density polyethylene	<b>NEMA</b>	National Electrical Manufacturers Association
<b>MDU</b>	Multiple dwelling unit, or multifamily dwelling unit	<b>NENP</b>	No epoxy/no polish
<b>MEF</b>	Metro Ethernet Forum	<b>NESC</b>	National Electrical Safety Code (IEEE)
<b>MEM</b>	Micro-electro-mechanical	<b>NFPA</b>	National Fire Protection Association
<b>MEMS</b>	Micro-electro-mechanical system	<b>NG</b>	Next generation
<b>MFD</b>	Mode-field diameter	<b>NGA</b>	Next generation access



<b>NGDLC</b>	Next generation digital loop carrier	<b>OFCS</b>	Optical fiber communication system
<b>NGOA</b>	Next generation optical access	<b>OFDM</b>	Orthogonal frequency division multiplexing
<b>NGI</b>	Next generation Internet	<b>OFDMA</b>	Orthogonal frequency division multiple access
<b>NG-PON</b>	Next generation PON (FSAN workgroup name. Adopted XG-PON1 – ITU-T G.987)	<b>OFNP</b>	Optical fiber nonconductive plenum
<b>NG-PON2</b>	Next generation PON2 (40-Gigabit TWDM-PON– Asymmetrical - ITU-T G.989)	<b>OFNR</b>	Optical fiber nonconductive riser
<b>NIST</b>	National Institute of Standards and Technology	<b>OFSTP</b>	Optical Fiber System Test Procedures (ANSI/TIA 526-xx)
<b>NMS</b>	Network management system	<b>OI</b>	Optical isolator
<b>NOC</b>	Network operations center	<b>OLS</b>	Optical line system
<b>NPC</b>	No-polish connector	<b>OLT</b>	Optical line terminal
<b>NRZ</b>	Nonreturn to zero	<b>OLTS</b>	Optical loss test set
<b>NT</b>	Network terminal	<b>OMA</b>	Optical modulation amplitude
<b>NTSC</b>	National Television Standards Committee	<b>OMCC</b>	Optical network unit management and control channel
<b>NZDS</b>	Nonzero dispersion-shifted fiber	<b>OMCI</b>	Optical network terminal management and control interface
<b>O/E</b>	Optical to electrical	<b>OMU</b>	Optical multiplexer unit
<b>OADM</b>	Optical add/drop multiplexer	<b>ONT</b>	Optical network terminal
<b>OAM</b>	Operations, administration and maintenance	<b>ONU</b>	Optical network unit
<b>OAM&amp;P</b>	Operations, administration, maintenance, and provisioning	<b>OOB</b>	Out of band
<b>OAN</b>	Optical access networking	<b>OOO</b>	Optical-optical-optical
<b>OAS</b>	Optical access switch	<b>OPEX</b>	Operational expenditures
<b>OAU</b>	Optical access units	<b>OPGW</b>	Optical power ground wire
<b>OC</b>	Optical carrier	<b>OPM</b>	Optical power meter
<b>OC-3</b>	Optical carrier, level 3	<b>OPS</b>	Optical protection switch
<b>OC-3e</b>	Optical carrier, level 3 concatenated	<b>ORL</b>	Optical return loss
<b>OCDMA</b>	Optical code division multiple access	<b>OS</b>	Operating system
<b>OD</b>	Outside diameter	<b>OSA</b>	Optical spectrum analyzer, optical subassembly, or Optical Society of America
<b>ODE</b>	Outdoor distribution enclosure	<b>OSC</b>	Optical supervisory channel
<b>ODN</b>	Optical distribution network	<b>OSHA</b>	Occupational Safety and Health Administration
<b>ODS</b>	Optical distribution segment	<b>OSI</b>	Open system interconnection
<b>ODSI</b>	Optical domain service interconnect	<b>OSNR</b>	Optical signal-to-noise ratio
<b>ODU</b>	Optical demultiplexer unit	<b>OSP</b>	Outside plant
<b>OE</b>	Optical-to-electrical	<b>OSS</b>	Operational support system
<b>OEE</b>	Optical entrance enclosure	<b>OTDM</b>	Optical time-division multiplexing
<b>OEIC</b>	Optoelectronic integrated circuit	<b>OTDR</b>	Optical time-domain reflectometer
<b>OEM</b>	Original equipment manufacturer	<b>OTN</b>	Optical transport network
<b>OEO</b>	Optical to electrical to optical	<b>OTU</b>	Optical translator unit
<b>OFCP</b>	Optical fiber conductive plenum		
<b>OFCR</b>	Optical fiber conductive riser		



<b>OVD</b>	Outside vapor deposition	<b>PX</b>	Designation for an Ethernet PON system
<b>OXC</b>	Optical cross-connect	<b>PXC</b>	Photonic cross-connect
<b>P2MP</b>	Point-to-multipoint	<b>QAM</b>	Quadrature amplitude modulation
<b>P2P/PtP</b>	Point-to-point	<b>QDM</b>	Double-band amplitude modulation
<b>PAS</b>	Profile alignment system	<b>QoS</b>	Quality of service
<b>PAU</b>	PON access unit	<b>QPSK</b>	Quadrature phase-shift keying
<b>PBX</b>	Private branch exchange	<b>RADSL</b>	Rate adaptive digital subscriber line
<b>PC</b>	Physical contact	<b>RBHC</b>	Regional Bell Holding Company
<b>PCM</b>	Pulse code modulation	<b>RBOC</b>	Regional Bell Operating Company
<b>PCU</b>	PON control unit	<b>RBS</b>	Rated breaking strength
<b>PCVD</b>	Plasma activated chemical vapor deposition	<b>RCVR</b>	Receiver
<b>PDC</b>	Polarization dependence of the center wavelength	<b>RE</b>	Reach extender
<b>PDL</b>	Polarized dispersion loss	<b>RF</b>	Radio frequency
<b>PDU</b>	Protocol data unit	<b>RFC</b>	Request for comments
<b>PE</b>	Polyethylene	<b>RFI</b>	Radio frequency interference
<b>PHY</b>	Physical layer	<b>RFoG</b>	Radio frequency over glass
<b>PIN</b>	Positive intrinsic negative	<b>RFTS</b>	Remote fiber test system
<b>PIN FET</b>	Positive-intrinsic-negative field-effect transistor	<b>RIN</b>	Relative intensity noise
<b>PLC</b>	Planar lightwave circuit	<b>RM</b>	Receive module
<b>PLOAM</b>	Physical layer operations, administration, and maintenance	<b>RMS</b>	Root mean square
<b>PMD</b>	Polarization mode dispersion, or physical medium dependent layer	<b>ROADM</b>	Reconfigurable optical add/drop multiplexer
<b>PM-QPSK</b>	Polarization multiplexed quadrature phase shift keying	<b>ROSA</b>	Receiver optical subassembly
<b>POF</b>	Plastic optical fiber	<b>ROW</b>	Rights of way
<b>PON</b>	Passive optical network	<b>RPR</b>	Resilient packet ring
<b>POP</b>	Point of presence	<b>RT</b>	Remote terminal
<b>POTP</b>	Passive optical transport platform	<b>RTU</b>	Remote test unit
<b>POTS</b>	Plain old telephone service	<b>RU</b>	Rack unit
<b>PPD</b>	Partial packet discard	<b>Rx</b>	Receive
<b>PPP</b>	Point-to-point protocol	<b>RZ</b>	Return to zero
<b>PPV</b>	Pay-per-view	<b>SA</b>	Serving area
<b>PR</b>	Power budget, symmetric rate	<b>SAN</b>	Storage area network
<b>PRS</b>	Primary reference source	<b>SAP</b>	Service access point
<b>PRX</b>	Power budget, asymmetric rate	<b>SBS</b>	Stimulated Brillouin scattering
<b>ps</b>	Picosecond	<b>SCADA</b>	Supervisory control and data acquisition
<b>PSTN</b>	Public Switched Telephone Network	<b>SCTE</b>	Society of Cable Telecommunications Engineers
<b>PU</b>	Polyurethane	<b>SDH</b>	Synchronous digital hierarchy
<b>PUD</b>	Public utility district	<b>SDS</b>	Switched digital service
		<b>SDSL</b>	Single-pair symmetrical digital subscriber line
		<b>SDTV</b>	Standard definition television



<b>SDV</b>	Switched digital video	<b>TDMA</b>	Time division multiple access
<b>SFF</b>	Small form factor	<b>TE</b>	Telecommunications enclosure
<b>SFP</b>	Small form-factor pluggable	<b>Telco</b>	Telephone company
<b>SIEPON</b>	Service interoperability in Ethernet passive optical networks	<b>TIA</b>	Telecommunications Industry Association
<b>SLA</b>	Service level agreement	<b>TO</b>	Telecommunications outlet
<b>SLIC</b>	Subscriber line interface circuit	<b>TOSA</b>	Transmitter optical subassembly
<b>SLM</b>	Single longitudinal mode (laser)	<b>TPON</b>	Telephony passive optical network
<b>SMDS</b>	Switched multimegabit data service	<b>TR</b>	Telecommunications room
<b>SMF</b>	Single-mode fiber	<b>TSB</b>	Technical service bulletin
<b>SMPTTE</b>	Society of Motion Picture and Television Engineers	<b>TWDM</b>	Time and wavelength division multiplexing
<b>SMS</b>	Service management system	<b>Tx</b>	Transmit
<b>SN</b>	Service node	<b>UBR</b>	Unspecified bit rate
<b>SNI</b>	Service node interface, or standard network interface	<b>UHDTV</b>	Ultra high definition television
<b>SNMP</b>	Simple (or signaling) network management protocol	<b>UL</b>	Underwriters Laboratories
<b>SNR</b>	Signal-to-noise ratio	<b>UNE</b>	Unbundled network element
<b>SOA</b>	Semiconductor optical amplifier	<b>UNI</b>	User network interface
<b>SOHO</b>	Small office/home office	<b>UPC</b>	Ultra physical contact
<b>SONET</b>	Synchronous optical network	<b>UPS</b>	Uninterruptible power supply
<b>SPC</b>	Super physical contact	<b>US</b>	Upstream
<b>SPIE</b>	Society of Photographic Instrumentation Engineers	<b>UTP</b>	Unshielded twisted pair
<b>SRS</b>	Stimulated Raman scattering	<b>UV</b>	Ultraviolet
<b>SSB</b>	Single side band	<b>VAD</b>	Vapor axial deposition
<b>STB</b>	Set-top box	<b>VBR</b>	Variable bit rate
<b>STM</b>	Synchronous transfer mode, or synchronous transport module	<b>VC</b>	Virtual channel, or virtual circuit
<b>STS</b>	Synchronous transport signaling	<b>VCC</b>	Virtual circuit connection
<b>SVC</b>	Switched virtual circuit	<b>VCSEL</b>	Vertical-cavity surface-emitting laser
<b>SVOD</b>	Switched video on demand	<b>VDSL</b>	Very high bit-rate digital subscriber line
<b>T1</b>	T-Carrier level 1, or transmission system 1	<b>VFC</b>	Voice frequency channels
<b>T3</b>	T-Carrier level 3, or transmission system 3	<b>VLAN</b>	Virtual local area network
<b>TAXI</b>	Transparent asynchronous transmitter receiver interface	<b>VOA</b>	Variable optical attenuator
<b>TC</b>	Telecommunications closet, or transmission convergence	<b>VOD</b>	Video on demand
<b>TCL</b>	Transmission convergence layer	<b>VoIP</b>	Voice over Internet protocol
<b>T-CONT</b>	Transmission container	<b>VP</b>	Virtual path
<b>TCP/IP</b>	Transport control protocol/Internet protocol	<b>VPC</b>	Virtual path connection
<b>TDM</b>	Time division multiplexing	<b>VPCI</b>	Virtual path connection identifier
		<b>VPN</b>	Virtual private network
		<b>VPON</b>	Video passive optical network
		<b>VSB</b>	Vestigial sideband
		<b>VT</b>	Virtual tributary
		<b>VTG</b>	Virtual tributary group



- WA** Work area
- WAN** Wide area network
- WA-PON** Wavelength agile passive optical network
- WBF** Wavelength blocking filter
- WDM** Wavelength division multiplexing
- WDM-PON** Wavelength division multiplexing passive optical network
- WHMIS** Workplace Hazardous Material Information System
- WIC** Wavelength independent coupler
- WIMAX** Worldwide interoperability for microwave access
- WSS** Wavelength selectable switch
- WSXC** Wavelength-selective cross-connect
- WWDM** Wide wavelength division multiplexing
- WXC** Wavelength cross-connect
- X/S** Interference/optical power of Basic band
- xDSL** Generic digital subscriber line
- XFP** 10 Gigabit small form factor pluggable
- XGEM** XG-PON encapsulation method
- XGMII** 10 Gigabit media independent interface
- XG-PON** 10 Gigabit asymmetrical passive optical network (ITU-T G.987)
- XG-PON2** 10 Gigabit passive optical network 2 (renamed XGS-PON)
- XGS-PON** 10 Gigabit-capable symmetrical passive optical network (ITU-T G.9807.1)
- XGTC** 10 Gigabit transmission convergence
- XMD** 10 Gigabit miniature device
- XPM** Cross phase modulation
- ZDA** Zone distribution area
- ZWP** Zero water peak

