

# LIST OF COMMON ABBREVIATIONS

3G .....	Third generation	GSM .....	Global System for Mobile communication
4G .....	Fourth generation	HFC.....	Hybrid Fiber Coaxial
ADSL.....	Asymmetric Digital Subscriber Line	HFM.....	Hybrid Fiber Microwave
AMPS.....	Advanced Mobile Phone Service	HSDPA .....	High Speed Downlink Packet Access
ARPU .....	Average Revenue per User	HSUPA .....	High Speed Uplink Packet Access
AWG.....	American Wire Gauge	HSPA.....	High Speed Packet Access
BHOL.....	Busy Hour Offered Load	HU .....	Housing Units
BPON.....	Broadband Passive Optical Network	Hz .....	Hertz
CAP .....	Competitive Access Provider	iDEN .....	Integrated Digital Enhanced Network
Capex .....	Capital Expenditures	ISP .....	Internet Service Provider
CDMA.....	Code-Division Multiple Access	kft .....	Kilo-feet (1,000 feet)
CLEC .....	Competitive Local Exchange Carrier	ILEC .....	Incumbent Local Exchange Carrier
CO.....	Central Office	IXC.....	Interexchange Carrier
CPE .....	Customer Premises Equipment	kbps .....	Kilobits per second
DOCSIS.....	Data Over Cable Service Interface Specification	kHz.....	Kilohertz (1 thousand Hertz)
DSL .....	Digital Subscriber Line	LATA.....	Local Access and Transport Area
DSLAM.....	Digital Subscriber Line Access Multiplexer	LTE.....	Long-Term Evolution
EBITDA.....	Earnings Before Interest, Taxes, Depreciation and Amortization	Mbps .....	Megabits per second (1 million bits per second)
EPON.....	Ethernet Passive Optical Network	MHz .....	Megahertz (1 million Hertz)
EV-DO .....	Evolution-Data Optimized	MIMO.....	Multiple Input, Multiple Output
FTTN.....	Fiber to the Node or Fiber to the Neighborhood	MSC .....	Mobile Switching Center
FTTP.....	Fiber-to-the-Premise	MSO .....	Multiple System Operator
FW.....	Fixed Wireless	NBP .....	National Broadband Plan
Gbps .....	Gigabits per second	NIU .....	Network Interface Unit
GHz .....	Gigahertz (1 billion Hertz)	NPV.....	Net Present Value
GPON.....	Gigabit Passive Optical Network	OECD.....	Organization for Economic Co-operation and Development
		Opex.....	Operating Expenses

OTT .....	Over-the-top	RT .....	Regional Tandem
POP .....	Point of Presence	SG&A .....	Selling, General and Administrative expenses
PON.....	Passive Optical Network	SINR .....	Signal to Interference plus Noise Ratio
POTS.....	Plain Old Telephone Service	TDMA.....	Time Division Multiple Access
PSTN.....	Public Switched Telephone Network	UMTS .....	Universal Mobile Telecommunications System
PV .....	Present Value	VDSL.....	Very high bit rate Digital Subscriber Line
QAM.....	Quadrature Amplitude Modulation	VOIP .....	Voice Over Internet Protocol
QOS .....	Quality of Service	WCDMA.....	Wideband Code Division Multiple Access
RBOC.....	Regional Bell Operation Company	WISP.....	Wireless ISP
RFoG.....	Radio Frequency Over Glass		

## GLOSSARY

**4G**—Abbreviation for fourth-generation wireless, the stage of broadband mobile communications that will supersede the third generation (3G). Specifies a mobile broadband standard offering both mobility and very high bandwidth. Usually refers to LTE and WiMax technology. For the purposes of analysis in this paper, areas where carriers have announced plans to deliver 4G service are treated as 4G areas; all other areas are treated as non-4G areas.

**Access Network**—Combination of Last and Second Mile portions of a broadband network. See Last Mile and Second Mile.

**Actual Speed**—Refers to the data throughput delivered between the network interface unit (NIU) located at the end-user’s premises and the service provider Internet gateway that is the shortest administrative distance from that NIU. In the future, the technical definition of “actual speed” should be crafted by the FCC, with input from consumer groups, industry and other technical experts, as is proposed in Chapter 4 of the National Broadband Plan. The technical definition should include precisely defined metrics to promote clarity and shared understanding among stakeholders. For example, “actual download speeds of at least 4 Mbps” may require certain achievable download speeds over a given time period. Acceptable quality of service should be defined by the FCC.

**Advanced Mobile Phone Service (AMPS)**—A standard system for analog signal cellular telephone service in the United States and elsewhere. It is based on the initial electromagnetic radiation spectrum allocation for cellular service by the FCC in 1970 and first introduced by AT&T in 1983.

**American Wire Gauge (AWG)**—A U.S. measurement standard of the diameter of non-ferrous wire, which includes copper and aluminum—the smaller the number, the thicker the wire. In general, the thicker the wire, the greater the current-carrying capacity and the longer the distance it can span.

**Analog reclamation**—In a cable system, refers to repurposing spectrum previously used to carry analog channels for other uses, either digital channels or high-speed data.

**Asymmetric Digital Subscriber Line (ADSL)**—A technology that transmits a data signal over twisted-pair copper, often over facilities deployed originally to provide voice telephony. Downstream rates are higher than upstream rates—i.e., are asymmetric. ADSL technology enables data transmission over existing copper wiring at data rates several hundred times faster than analog modems using an ANSI standard.

**Average Revenue Per User (ARPU)**—A metric used by investors and financial analysts to measure the financial performance of telecommunications service providers. ARPU is the average amount of revenue a company collects from each user per month.

**Availability Gap**—See Broadband Availability Gap and Investment Gap.

**Base Case**—The basic set of assumptions that leads to the \$23.5 billion Investment Gap. The base case in the model compares the most economical technologies: 12,000-foot-loop DSL and Fixed Wireless. For the 12k-foot-loop DSL, the main assumption is that there is one competing provider in areas that are assumed to receive 4G service, and zero competing technologies in non-4G areas. For Fixed Wireless, costs are allocated to mobile infrastructure in 4G areas; in non-4G areas, all costs are allocated to fixed service, but the carrier is assumed to earn incremental revenue from mobile operations.

**Broadband**—For the purposes of determining the Investment Gap, 4 Mbps actual download and 1 Mbps actual upload; see also the National Broadband Availability Target.

**Broadband Availability Gap**—The amount of funding necessary to upgrade or extend existing infrastructure up to the level necessary to support the National Broadband Availability Target. Because this is a financial metric, and to avoid confusion with measures of whether local networks are capable of supporting a given level of broadband service, the Broadband Availability Gap is referred to as the *Investment Gap* throughout this paper.

**Broadband Passive Optical Network (BPON)**—A type of PON standardized by the ITU-T, offering downstream capacities of up to 622 Mbps and upstream capacities of up to 155 Mbps, shared among a limited number of end users.

<sup>1</sup> The authors provide this glossary as a reader aid. These definitions do not necessarily represent the views of the FCC or the United States Government on past, present or future technology, policy or law and thus have no interpretive or precedential value.

*Brownfield*—A network in which a carrier already has infrastructure in the area that can be used to deliver service going forward.

*Burst Rate*—The maximum rate or “speed” which a network is capable of delivering within a short timeframe, typically seconds or minutes. This is usually expressed as a rate in Mbps.

*Busy Hour Offered Load (BHOL)*—BHOL (per subscriber) is the network capacity required by each user, averaged across all subscribers on the network, during the peak utilization hours of the network. Network capacity required is the data received/transmitted by a subscriber during an hour; this can be expressed as a data rate (like kbps) when the volume of data received/transmitted is divided by the time duration.

*Capacity*—Ability of telecommunications infrastructure to carry information. The measurement unit depends on the facility. A data line’s capacity might be measured in bits per second, while the capacity of a piece of equipment might be measured in numbers of ports.

*Capital Expenditures (Capex)*—Business expense to acquire or upgrade physical assets such as buildings, machinery and in this case telecommunications equipment; also called capital spending or capital expense.

*Census Block*—The smallest level of geography designated by the U.S. Census Bureau, which may approximate actual city street blocks in urban areas. In rural districts, census blocks may span larger geographical areas to cover a more dispersed population.

*Central Office (CO)*—A telephone company facility in a locality to which subscriber home and business lines are connected on what is called a local loop. The central office has switching equipment that can switch calls locally or to long-distance carrier phone offices. In other countries, the term *public exchange* is often used.

*Churn*—The number of subscribers who leave a service provider over a given period of time, usually expressed as a percentage of total customers.

*Code-Division Multiple Access (CDMA)*—Any of several protocols used in so-called second-generation (2G) and third-generation (3G) wireless communications. As the term implies, CDMA is a form of multiplexing, which allows numerous signals to occupy a single transmission channel, optimizing the use of available bandwidth. The technology is used in ultra-high-frequency (UHF) cellular telephone systems in the 800-MHz and 1.9-GHz bands.

*Competitive Access Provider (CAP)*—Facilities-based competitive local exchange carriers (CLECs).

*Competitive Local Exchange Carrier (CLEC)*—The term and concept coined by the Telecommunications Act of 1996 for any new local phone company that was formed to compete with the ILEC (Incumbent Local Exchange Carrier).

*Coverage*—In wireless communications, refers to the geographic area in which one can obtain service.

*Customer Premises Equipment (CPE)*—Equipment which resides on the customer’s premise. Examples include set top boxes, cable modems, wireless routers, optical network terminals, integrated access devices, etc.

*Data Over Cable Service Interface Specification (DOCSIS)*—A cable modem standard from the CableLabs research consortium ([www.cablelabs.com](http://www.cablelabs.com)), which provides equipment certification for interoperability. DOCSIS supports IP traffic (Internet traffic) over digital cable TV channels, and most cable modems are DOCSIS compliant. Some cable companies are currently deploying third-generation (DOCSIS 3.0) equipment. Originally formed by four major cable operators and managed by Multimedia Cable Network System, the project was later turned over to CableLabs.

*Digital signal 1 (DS-1)*—Also known as T1; a T-carrier signaling scheme devised by Bell Labs. DS-1 is a widely used standard in telecommunications in North America and Japan to transmit voice and data between devices. DS-1 is the logical bit pattern used over a physical T1 line; however, the terms DS-1 and T1 are often used interchangeably. Carries approximately 1.544 Mbps.

*Digital Subscriber Line (DSL)*—A generic name for a group of enhanced speed digital services generally provided by telephone service providers. DSL services run on twisted-pair copper wires, which can carry both voice and data signals.

*Digital Subscriber Line Access Multiplexer (DSLAM)*—Technology that concentrates or aggregates traffic in DSL networks. Located in the central office or in a remote terminal.

*Discount Rate*—The annual percentage rate used to determine the current value of future cash flows.

*Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA)*—An approximate measure of a company’s operating cash flow based on data from the company’s income statement. Calculated by looking at earnings, which are calculated by subtracting opex and SG&A from net revenues, before the deduction of interest expenses, taxes, depreciation and amortization. This earnings measure is of particular interest in cases where companies have large amounts of fixed assets which are subject to large depreciation.

*Ethernet Passive Optical Network (EPON)*—A type of PON standardized by the IEEE, offering downstream capacities of up to 1.25 Gbps and upstream capacities of up to 1.25 Gbps, shared among a limited number of end users.

*Evolution-Data Optimized (EV-DO)*—A 3G wireless radio broadband data standard that enables faster speeds than are available in existing CDMA networks or other 2G services, such as GPRS or EDGE.

*Fast Ethernet (Fast-E)*—A network transmission standard that provides a data rate of 100 Mbps.

*Fiber*—Shorthand for “fiber-optic cable.” Fiber-optic cable is the medium associated with the transmission of information as light impulses along a strand of glass.

*Fiber to the Node (FTTN)*—A high-capacity bandwidth approach that uses both fiber and copper wires. Optical fiber is used from the core of the telco or CATV network to an intelligent node in the neighborhood where copper wire is used for the connection to the end-user, with one node serving perhaps many residences or small businesses. The few 100 meters or so of the local loop from the node to the premises generally is either unshielded twisted pair (UTP) in a telco application or coaxial cable (coax) in an HFC application, although some form of wireless technology is also possible. Known as Fiber to the Neighborhood, or Fiber to the Cabinet (FTTCab), as well.

*Fiber-to-the-Premise (FTTP)*—A fiber-deployment architecture in which optical fiber extends all the way to the customer’s premise. Also known as Fiber to the Home (FTTH) or Fiber to the Building (FTTB). Typically using PON for residential deployments.

*Fisher-Pry Model*—A mathematical model used to forecast technology adoption when substitution is driven by superior technology where the new product or service presents some technological advantage over the old one.

*Fixed Wireless (FW)*—Wireless service that uses fixed CPE in addition to (or, possibly, even instead of) mobile portable devices to deliver data services. FW solutions have been deployed as a substitute for wired access technologies. For example, it is being used commercially in the U.S. by Clearwire with WiMAX and Stelera with HSPA, and globally by Telstra with HSPA.

*Gabriel Network Topology*—An approach to modeling efficient (shortest-route) connections between known network nodes, where the links are determined by making a pairwise comparison of points in the context of the points around them. In a classic Gabriel network, the set of points should not include any co-incident points, that is two points that lie exactly at the same location.

*Gigabit Ethernet (Gig-E)*—A network transmission standard that provides a data rate of 1,000 megabits per second.

*Gigabit Passive Optical Network (GPON)*—A type of PON standardized by the ITU-T, offering downstream capacities of up to 2.5 Gbps and upstream capacities of up to 1.25 Gbps, shared among a limited number of end users.

*Global System for Mobile communication (GSM)*—A second-generation digital mobile cellular technology using a combination of frequency division multiple access (FDMA) and time division multiple access (TDMA). GSM operates in several frequency bands: 400MHz, 900MHz and 1800MHz. On the TDMA side, there are eight timeslots or channels carrying calls, which operate on the same frequency. The standard was jointly developed between European administrations under Groupe Speciale Mobile in the 1980s and introduced commercially in 1991. Unlike other cellular systems, GSM provides a high degree of security by using subscriber identity module (SIM) cards and GSM encryption.

*Gompertz Model*—A mathematical model used to forecast technology adoption when substitution is driven by superior technology, but purchase depends on consumer choice.

*Greenfield*—A network in which a carrier has no infrastructure currently (of that technology), and it needs to be built from scratch.

*High Speed Packet Access (HSPA)*—A family of high-speed 3G digital data services provided by cellular carriers worldwide that uses the GSM technology. HSPA service works with HSPA cell phones as well as laptops and portable devices with HSPA modems. The two established standards of HSPA are HSDPA (Downlink) and HSUPA (Uplink).

*Housing Units (HU)*—Includes a house, an apartment, a mobile home, a group of rooms or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters.

*Hybrid Fiber Microwave (HFM)*—A network (usually wireless) whereby the backhaul transport elements of the network are a mixture or combination of fiber-optic facilities and wireless microwave transport.

*Hybrid Fiber Coaxial (HFC)*—Another term for cable systems, which are a combination of fiber (Middle and Second Mile) and coaxial cable (Last Mile).

*Incumbent Local Exchange Carrier (ILEC)*—The dominant local phone carrier within a geographical area. Section 252 of the Telecommunications Act of 1996 defines Incumbent Local Exchange Carrier as a carrier that, as of the date of enactment of the Act, provided local exchange service to a specific area; for example, Verizon, Windstream and Frontier. In contrast, Competitive Access Providers (CAPs) and competitive local exchange carriers (CLECs) are companies that compete against the ILECs in local service areas.

*Integrated Digital Enhanced Network (iDEN)*—A wireless technology from Motorola combining the capabilities of a digital cellular telephone, two-way radio, alphanumeric pager and data/fax modem in a single network. iDEN operates in the 800 MHz, 900MHz and 1.5 GHz bands and is based on time division multiple access (TDMA) and GSM architecture. It uses Motorola's Vector Sum Excited Linear Predictors (VSELP) voice encoder for voice compression and QAM modulation to deliver 64 kbps over a 25 KHz channel.

*Interexchange Carrier (IXC)*—A telecommunications service provider authorized by the FCC to provide interstate, long distance communications services and authorized by the state to provide long distance intrastate communications services. An Interexchange Carrier provides, directly or indirectly, interLATA or intraLATA telephone toll services. May be an individual, partnership, association, joint-stock company, trust, governmental entity or corporation engaged for hire in interstate or foreign communication by wire or radio, and between two or more exchanges. Also known as an Interexchange Common Carrier.

*Internet Service Provider (ISP)*—A company that provides a connection to the public Internet, often owning and operating the Last-Mile connection to end-user locations.

*Investment Gap*—The amount of funding necessary to upgrade or extend existing infrastructure up to the level necessary to support the National Broadband Availability Target, which is referred to in the National Broadband Plan as the Broadband Availability Gap.

*Last Mile*—Refers generally to the transport and transmission of data communications from the demarcation point between the end user's internal network and the carrier's network at the customer premise to the first point of aggregation in the carrier's network (such as a remote terminal, wireless tower location, or HFC node).

*Levelized*—A method, often used in regulatory proceedings, to calculate the annuitized equivalent—i.e., the effective annual value of cash flows—of the costs and revenues associated with building and operating a network. A “levelized” calculation provides a steady cash-flow stream, rather than trying to model or guess the timing of largely unpredictable yet sizable real-world payouts like those for upgrading and repairing equipment. The (net) present value of a levelized cash flow is equal to the (net) present value of actual cash flows.

*Link Budget*—A calculation involving the gain and loss factors associated with the antennas, transmitters, transmission lines and propagation environment used to determine the maximum distance at which a transmitter and receiver can successfully operate.

*Local Access and Transport Area (LATA)*—One of 196 local geographical areas in the U.S. created by the Modified Final Judgment in which a divested Regional Bell operating company (RBOC) was permitted to offer exchange telecommunications and exchange access services.

*Long-Term Evolution (LTE)*—A high performance air interface for cellular mobile communication systems. LTE technology increases the capacity and speed of wireless networks relative to current 3G deployments.

*Microwave*—Microwave transmission refers to the technique of transmitting information over microwave frequencies, using various integrated wireless technologies. Microwaves are short-wavelength, high-frequency signals that occupy the electromagnetic spectrum 1 GHz to roughly 300 GHz, (typically within ITU Radio Band Signal EHF) though definitions vary. This is above the radio frequency range and below the infrared range.

*Middle Mile*—Refers generally to the transport and transmission of data communications from the central office, cable headend or wireless switching station to an Internet point of presence.

*Mobile Switching Center (MSC)*—The mobile switching center (MSC) connects the landline public switched telephone network (PSTN) system to the wireless communication system. The mobile switching center is typically split into a mobile switching center server and a media gateway, and incorporates the bearer independent call control (BICC). The MSC routes the communications to another subscribing wireless unit via a BSC/base station path or via the PSTN/Internet/other network to terminating destination.

*Multiple Input Multiple Output (MIMO)*—An antenna technology for wireless communications in which multiple antennas are used at both the source (transmitter) and the destination (receiver). The antennas at each end of the communications circuit are combined to minimize errors and optimize data speed. MIMO is one of several forms of smart antenna technology, the others being MISO (multiple input, single output) and SIMO (single input, multiple output).

*Multiple System Operator (MSO)*—Typically refers to a firm that owns more than one cable system, but may refer also to an operator of only one system.

*National Broadband Availability Target*—The level of service set in the National Broadband Plan that should be available to every household and business location in the U.S. The initial target is an actual download speed of at least 4 Mbps and an upload speed of at least 1 Mbps, with a proposed review and update every four years.

*Net Present Value (NPV)*—A technique used to assess the current worth of future cash flows by discounting those future cash flows at today's cost of capital. The Net Present Value (NPV) of a project is the total discounted value of all revenues and costs; NPVs greater than zero generate value for a company.

*Node*—An active or passive element in a cable system where Second-Mile fiber connects with coaxial cable.

*Node splitting*—In a cable system, adding infrastructure so that subscribers previously served by a single node are moved to multiple nodes, reducing the number of subscribers per node.

*Operating Expenses (Opex)*—An expense a business incurs over the course of its normal operations. Examples include product overhead, employee salaries and electric bill payments. Importantly, operating expenses on a balance sheet reflect only ordinary expenses rather than unexpected, one-time expenses. One subtracts the operating expense from operating revenue to determine the operating profit.

*Organization for Economic Co-operation and Development (OECD)*—The 30 member countries are: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

*Over-the-top (OTT)*—Carried over an Internet connection. For example, OTT video would include video delivered by YouTube, Hulu and TV Everywhere.

*Passive Optical Network (PON)*—A type of Fiber To The Premise (FTTP) network in which unpowered optical splitters are utilized to enable a single fiber to be shared by multiple end users. There are several varieties of PON currently in use in the U.S., including BPON, EPON and GPON, each of which has its own set of standards and capabilities.

*Plain Old Telephone Service (POTS)*—The basic single line switched access service offered by local exchange carriers to residential and business end users, using loop-start signaling.

*Point of Presence (POP)*—An access point to the Internet. A point of presence is a physical location that houses servers, routers, switches and aggregation equipment.

*Point to point (P2P)*—A type of fiber to the premise network in which each endpoint is connected to its serving office via a dedicated fiber optic strand.

*Present Value (PV)*—The value today of a future payment, or stream of payments, discounted at some appropriate compound discount rate. For example, the present value of \$100 to be received 10 years from now using a discount rate equal to 10% interest compounded annually is about \$38.55.

*Public Switched Telephone Network (PSTN)*—The worldwide collection of interconnected public telephone networks that was designed primarily for voice traffic. The PSTN is a circuit-switched network, in which a dedicated circuit (also referred to as a channel) is established for the duration of a transmission, such as a telephone call. This contrasts with packet switching networks, in which messages are divided into small segments called packets and each packet is sent individually. Packet switching networks were initially designed primarily for data traffic.

*Quadrature Amplitude Modulation (QAM)*—A system of modulation in which data is transferred by modulating the amplitude of two separate carrier waves, mostly sinusoidal, which are out of phase by 90 degrees (sine and cosine). Due to their phase difference, they are called quadrature carriers. Used extensively in cable systems.

*Quality of Service (QoS)*—The ability to provide different priority to different applications, users or data flows, or to guarantee a certain level of performance to a data flow in a broadband network.

*Radio Frequency over Glass (RFoG)*—An evolutionary technology that allows cable companies to offer an all-fiber architecture (not hybrid-fiber coax) without changing modulation schemes. RFoG is an SCTE Interface Practices Subcommittee standard in development for Point to Multipoint (P2MP) operations that has a proposed wavelength plan compatible with data PON solutions including EPON and 10G-EPON.

*Regional Bell Operation Company (RBOC)*—Local exchange carriers formed after the breakup of AT&T in 1984. The seven regional holding companies (RHCs) of roughly equal size were formed as a result of the 1982 Consent Decree AT&T signed with the U.S. Department of Justice, stipulating that it would divest itself of its 22 wholly owned telephone operating companies. The seven RHCs were Ameritech, Bell Atlantic, BellSouth, NYNEX, Pacific Telesis, Southwestern Bell and US West. After a series of acquisitions, mergers and name changes (including one in which a combination of several RHCs reclaimed the original AT&T name), only three of the original seven remain. They are AT&T, Qwest and Verizon. The RBOCs are the incumbent local exchange carriers (ILECs) in their local markets.

*Regional Tandem (RT)*—A tandem switch is an intermediate switch or connection between an originating telephone call or location and the final destination of the call. These are hub facilities that interconnect telephone central office exchanges and are deployed by geographical region within a telco LATA or exchange.

*Remote Terminal*—Telephone communications equipment that is installed within the service area or “neighborhood” that traditionally aggregates and multiplexes telephone local loops and transmits the aggregated signals from the service area back to the telephone central office switch. This has evolved to become the “Node” within a service area in a fiber-to-the-node architecture.

*Second Mile*—Refers generally to the transport and transmission of data communications from the first point of aggregation (such as a remote terminal, wireless tower location, or HFC node) to the point of connection with the Middle Mile transport.

*Selling, General and Administrative expenses (SG&A)*—Corporate overhead costs, including expenses such as marketing, advertising, salaries and rent. SG&A is found on a corporate income statement as a deduction from revenues in calculating operating income.

*Signal to Interference plus Noise Ratio (SINR)*—For a wireless communications device, the ratio of the received strength of the desired signal to the received strength of undesired signals (noise and interference).

*Spectrum Allocation*—The amount of spectrum dedicated (or allocated) to a specific use; in wireless, spectrum allocation is typically made in paired bands, with one band for upstream and the other for downstream.

*Spectrum Band*—The frequency of the carrier wave in wireless communications. Radios can transmit on different frequencies in the same area at the same time without interfering; frequency marks the division of different parts of spectrum for different uses. Frequency is measured in Hertz (Hz); the range of frequency typically used for radio communications is between 10,000 (10 kHz) and 30,000,000,000 Hz (30 GHz). Different frequencies have different natural properties: Lower frequencies travel farther and penetrate solids better, while higher frequencies can carry more information (faster data rates, etc.) The best balance of these properties for the purpose of cell phones is in the range of roughly 700-2,500 MHz. A specific range of frequencies allocated for a specific purpose is called a “band.”

*Switched Digital Video (SDV)*—A network scheme for distributing digital video via a cable more efficiently to free up bandwidth for other uses. Only channels being watched by end-users in a given node are transmitted to that node.

*Take rate*—The ratio of the number of premises that elect to take a service divided by the total number of premises in a market area; effectively a penetration rate of homes passed.

*Time Division Multiple Access (TDMA)*—Technology used in digital cellular telephone communication that divides each cellular channel into three time slots in order to increase the amount of data that can be carried. TDMA is used by Digital-American Mobile Phone Service (D-AMPS), Global System for Mobile communications (GSM), and Personal Digital Cellular (PDC). Each of these systems implements TDMA in somewhat different and potentially incompatible ways. An alternative multiplexing scheme to FDMA with TDMA is CDMA (code division multiple access), which takes the entire allocated frequency range for a given service and multiplexes information for all users across the spectrum range at the same time.

*Universal Mobile Telecommunications System (UMTS)*—Third-generation (3G) broadband, packet-based transmission of text, digitized voice, video and multimedia at data rates up to and possibly higher than 2 Mbps, offering a consistent set of services to mobile computer and phone users. Based on the Global System for Mobile (GSM) communication standard.

*Unserved*—Those housing units without access to a broadband network capable of offering service that meets the National Broadband Availability Target.

*Very high bit rate Digital Subscriber Line (VDSL)*—A form of DSL similar to ADSL but providing higher speeds at shorter loop lengths.

*Voice Over Internet Protocol (VOIP)*—A family of transmission technologies for delivery of voice communications over IP networks such as the Internet or other packet-switched networks. Other terms frequently encountered and synonymous with VoIP are *IP telephony*, *Internet telephony*, *voice over broadband (VoBB)*, *broadband telephony* and *broadband phone*.

*Wideband Code Division Multiple Access (WCDMA)*—Another name for UMTS. Also see Universal Mobile Telecommunications System.

*Wireless ISP (WISP)*—An Internet service provider that provides fixed or mobile wireless services to its customers. Using Wi-Fi or proprietary wireless methods, WISPs provide last mile access, often in rural areas and areas in and around smaller cities and towns. The largest provider of wireless broadband in the U.S. is currently Clearwire Corporation, a WISP that uses an early version of WiMAX to deliver the Internet to customers in the U.S., Ireland, Belgium and Denmark (see WiMAX).

*WiMax*—Worldwide Interoperability for Microwave Access (WiMAX) is a telecommunications technology that uses radio spectrum to transmit bandwidth between digital devices. Similar to WiFi, WiMAX brings with it the ability to transmit over far greater distances and to handle much more data.

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