

TYPES OF BROADBAND

DSL - Digital Subscriber Line: Broadband over copper wires. Limited in capacity and bandwidth, usually capable of delivering “25/3” for up to 5 miles from distribution point.

Cable broadband: Broadband delivered over a cable (television) network using coaxial cable or hybrid cable/fiber. Faster than DSL. Not as reliable as fiber. Speeds often degrade with more simultaneous users.

Hybrid fiber/cable: Combination of fiber transmission and coaxial cable distribution facilities used by cable providers to deliver broadband to consumers.

Fiber: Technology that converts electrical signals carrying data to light and sends the light through transparent glass fibers.

Wireless

- ▶ **Fixed wireless:** Service delivered using radio spectrum from a fixed location (e.g., tower, antenna) directly to another fixed location. Spectrum may be licensed or unlicensed. Speeds vary depending on spectrum frequency. Higher frequency delivers higher speeds, but shorter range, more interference.
- ▶ **WISPs:** Wireless Internet Services Providers. ISPs using fixed wireless, usually unlicensed to serve areas often unserved by wireline providers. Usually requires line-of-sight where end user equipment can “see the tower.” Subject to slower speeds and interference, interruption.

Mobile

- ▶ **LTE. Long Term Evolution:** Most common 4G (fourth generation) digital technology for mobile service. Enables smart phone use and reasonable bandwidth capacity (usually between 4-12 mbps down and 2 mbps up) for some broadband applications.
- ▶ **5G:** Faster than 4G. Uses 3 different spectrum bands. The highest bands are capable of very fast speeds, but very limited range and ability to penetrate buildings, trees, etc. Middle band spectrum 5G combines both reasonable speed and penetration—much like LTE. Lower band 5G excels in propagation, but limited speed.

Satellite

- ▶ **Low earth orbiting (LEO):** Lower orbits mean satellites pass over a “visible” location every 5 minutes or so. Lower latency, faster speeds (possibly up to 100 mbps downstream). Currently unproven in a commercial setting. Useful in limited situations but limited in capacity and speed. Expensive.
- ▶ **Geosynchronous:** Higher orbit enables satellite to remain stationary over a single spot in space. It “sees” much larger area. Slower speed, very high latency. Expensive.

LOCAL EXCHANGE CARRIERS

A local exchange carrier (**LEC**) is the telephone company which operates within a local area and provides telecommunication services within that area. It was the breakup of the monopoly of AT&T and Bell Systems in 1984 that led to the creation of the **ILEC** and **CLEC**. The Telecommunications Act of 1996 allowed ILECs (who previously could only sell services within their designated area) offer services outside of their region. From this Act also arose the CLECs - to promote competition among both long-distance and local telecommunications service providers.

- ▶ **ILEC** (incumbent local exchange carrier): A U.S.-based telephone company that was providing local service when the Telecommunications Act of 1996 was enacted. The ILEC owns most of the facilities in a local area and provides local telecommunications services to that area.
- ▶ **CLEC** (competitive local exchange carrier): A telecommunications provider that competes with other, already established carriers (generally the ILECs).

- ▶ **Affordable Connectivity Program (ACP).** Provides a discount of up to \$30 per month toward internet service for eligible households and up to \$75 per month for households on qualifying Tribal lands.
- ▶ **ARPA.** American Rescue Plan Act. (March, 2022.) Montana Legislature allocated \$275 million from ARPA funds for broadband infrastructure grants under the ConnectMT Act.
- ▶ **Asymmetrical Service.** Different upload/upstream and download/downstream transmission speeds. 100/20 means 100 mbps download speed and 20 mbps upstream. Upload speeds are increasingly important as more real-time, two-way applications become commonplace.

- ▶ **Backhaul.** Large-volume data transmission from a location—often a wireless tower—back to the network hub or the Internet.
- ▶ **Bandwidth.** Analogous to speed. The capacity of a broadband transmission medium to transmit at various speeds.
- ▶ **BEAD.** Broadband Equity, Access, and Deployment Program. Part of the Infrastructure Investment and Jobs Act (IIJA), the bipartisan infrastructure bill enacted in November 2021. The BEAD Program provides \$42.5 billion for broadband infrastructure investment, including a minimum of \$100 million for each state. The remainder will be determined by a statutory formula and rules promulgated by the National Telecommunications and Information Administration (NTIA).
- ▶ **Broadband.** General term for “high speed” internet. What is considered “high speed” has changed continually. Not long ago, it was measured in kilobits. Remember AOL? Then it was 4 megabits (mbps) download from the Internet to the consumer (download speed) and 1 mbps upload speed to the Internet (4/1). Then it was 10 mbps download and 1 mbps upstream (10/1). The FCC currently defines broadband as 25 mbps downstream and 3 mbps upstream (25/3). “25/3” is long obsolete. The FCC is now considering a national standard of 100/20 and 1 gig/500mbps for the future.
- ▶ **Cloud.** Data storage and retrieval on the internet. For example, programs and applications that are accessible with an Internet connection and stored on remote, connected servers (the cloud).
- ▶ **Competitive Neutrality.** A term used by ISPs—usually those who are unable or unwilling to meet or exceed higher bandwidth speeds—to argue for rules that allow all ISPs, regardless of ability, to compete for broadband infrastructure grants. True neutrality means any ISP service that delivers broadband that meets or exceeds future expectations can compete. Competitors should meet minimum standards, rather than standards meeting competitors’ ability.
- ▶ **ConnectMT Program.** Enacted by the Montana Legislature in 2021. Establishes the process for qualifying, submitting, reviewing, and approving broadband infrastructure grant projects.
- ▶ **Download/Downstream.** The transmission of data from the Internet to the consumer/device, as in downloading content from the Internet.
- ▶ **Gbps–gigabit (“gig”).** 1,000 megabits per second.
- ▶ **IIJA.** Infrastructure Investment and Jobs Act—a.k.a., bipartisan infrastructure bill. (November 2022.) Includes \$42.5 billion for broadband-specific investment under the BEAD program.
- ▶ **ISP.** Internet service provider.
- ▶ **Kbps–kilobit.** 1,000 bits per second. (A **bit** is a single unit of data).
- ▶ **Last mile.** Distribution network facilities from a network hub to the end-user location.
- ▶ **Latency.** Delay in transmission of data from origin to destination. Low latency means less delay.
- ▶ **Mbps–megabit.** 1,000 kilobits per second.
- ▶ **Middle mile.** Transmission facilities between network hubs. For example, the fiber cables connecting network facilities between network hubs in two nearby towns. From the hub, the fiber is distributed to individual locations—the “last mile” connection.
- ▶ **Modem.** A combined device for modulation and demodulation, for example, between the digital data of a computer and the analog signal of a phone line.
- ▶ **NTIA.** The National Telecommunications and Information Administration, an agency under the U.S. Department of Commerce, responsible for administering the BEAD Program.
- ▶ **Open Access.** Nondiscriminatory access to and use of a network on a wholesale basis.
- ▶ **Quality of Service (QoS).** Reliability and consistency of service. Note: QoS can be affected by customer equipment (router, computer, device) as well as by network infrastructure.
- ▶ **Reliability.** The U.S. Treasury, responsible for implementing ARPA, includes such factors as “whether users actually receive internet service at or above the speed thresholds at all hours of the day...or [whether] existing connections make their user experience unreliable.” NTIA rules consider unlicensed fixed wireless and satellite not reliable.
- ▶ **Router.** A device that forwards data packets to the appropriate parts of a computer network.
- ▶ **Spectrum.** Refers to radio waves of various frequencies or wavelengths. Lower frequencies can penetrate obstacles (e.g., buildings, trees) but are not capable of faster speeds. Higher frequencies are faster, but less capable of reaching far from a tower or penetrating obstacles.
- ▶ **Speed.** Broadband data transmission rate. The higher the speed the more data that can be downloaded or uploaded at a faster rate. The average (download) speed (2020) is over 86 mbps.
- ▶ **Symmetrical service.** The same upload/upstream and download/downstream. Symmetrical 100 mbps service means 100 mbps upstream and downstream. Upload speeds are increasingly important as more real-time, two-way applications become commonplace.
- ▶ **Technological Neutrality.** See Competitive Neutrality. Term used by ISPs to argue that infrastructure grant rules should allow any technology to compete for grants, regardless of capacity or quality. This is really technology protectionism. Truly neutral rules must allow any technology that delivers broadband service that meets or exceeds future expectations. Protecting less capable technologies benefits providers, but not consumers.
- ▶ **Universal Service.** Federal statute that states all Americans should have access to telecommunications services at reasonably comparable rates and quality.
- ▶ **Upload/Upstream.** Transmission of data from the consumer device to the Internet, as in uploading files to the cloud.
- ▶ **VOIP.** Voice over Internet Protocol. Digital voice service on an Internet-based application.