

HIGH SPEED INTERNET ACCESS -- "BROADBAND"

Background

High-speed Internet access (sometimes loosely referred to as "broadband Internet access" or simply "broadband") allows users to access the Internet and Internet-related services at significantly higher speeds than traditional modems. High-speed Internet access makes the data processing capabilities necessary to use the Internet available via several devices or high-speed transmission technologies, including:

- Digital Subscriber Line (DSL)
- Cable Modem (CM)
- Wireless Access
- Satellite Access
- Fiber To the Home (FTTH)
- Power Line Broadband

There are many advantages of high-speed Internet access:

- The connection is always on, which means you can access the Internet without the need to dial up your Internet service provider over a telephone line.
- Information can be downloaded into your computer at significantly higher speeds than traditional modems.
- Users can go online without tying up their telephone lines.
- Businesses can use broadband networks for videoconferencing, and to let employees telecommute.
- Users can tap into an expanded number of entertainment resources.

Statistics collected by the Federal Communications Commission (FCC) indicate that there were nearly 17.4 million high-speed residential and small business subscribers as of December 2002. Of these, approximately 5.5 million used asymmetric versions of DSL technology, approximately 11.3 million used CM, and approximately 0.5 million used another high-speed technology. The number of residential and small business subscribers using DSL and CM technology increased by 58% between December 2001 and December 2002.

How Does Broadband Work?

High speed Internet access makes the data processing capabilities necessary to use the Internet available via one of several high-speed transmission technologies. These data processing capabilities are "digital" in nature, meaning that they compress vast amounts of voice, video, and data information that are broken down into what are called "bits." These bits become words, pictures, etc. on our computer screens. The transmission technologies that make high speed Internet access possible move these bits much more quickly than do traditional telephone or wireless connections.



Digital Subscriber Line (DSL)

Digital Subscriber Line (DSL) is a wireline transmission technology that brings data and information faster over copper telephone lines already installed in homes and businesses. Traditional phone service connects your home or business to a telephone company office via copper wires. A DSL modem accesses the local telephone company's central office where a DSL Access Multiplexer (DSLAM) has been installed. The DSLAM then transmits the signal from the copper telephone line onto a network backbone, and eventually to the Internet. With high-speed Internet access that uses DSL transmission technology, there is no need to "dial in" to a telephone number as with a traditional modem. This service allows consumers and businesses to have an "always-on" dedicated connection to the Internet.

The following are types of DSL transmission technologies that may be used to provide high-speed Internet access:

- **Symmetrical Digital Subscriber Line (SDSL)** – used typically for business applications such as video conferencing. The traffic from the user to the network is upstream traffic, and from the network to the user is downstream traffic. When the data rate in both directions is equal, it is called a symmetric service.
- **Asymmetrical Digital Subscriber Line (ADSL)** – used primarily by residential users who receive a lot of data but do not send much, such as Internet surfers. ADSL provides faster speed in a downstream direction (from the telephone central office to the customer's premise) than upstream (from customer's premise to the telephone central office). When the upstream data rate is lower than the downstream rate, it is called an asymmetric service.
- **ISDN Digital Subscriber Line (IDSL)** – provides symmetrical connection with Integrated Services Digital Network (ISDN), and is designed to extend DSL to locations with a long distance to a telephone central office.
- **High-data-rate Digital Subscriber Line (HDSL)** – provides fixed symmetrical high speed access at T1 rate (1.5 Mbps), and is designed for business purposes.
- **Very high-data-rate Digital Subscriber Line (VDSL)** – provides both symmetrical and asymmetrical access with very high bit rate over the copper line. Deployment is very limited at this time.

DSL Compared to ISDN

ISDN is an affordable way to have rapid access to the Internet. It is a digital technology that is widely available and is an option for businesses located in areas not yet served by DSL.

DSL and ISDN are different transmission technologies, yet both offer many of the same higher speed benefits to consumers. DSL offers potentially higher transmission speeds as well as a choice of connection speeds. ISDN is presently more widely available than DSL. DSL is an



always-on service while ISDN requires dialing into a service provider's network. If DSL transmission technology is not available in your area, ISDN may serve as an acceptable substitute for use in providing high-speed Internet access.

Cable Modem (CM)

Cable Modem (CM) is a device that enables cable operators to provide high-speed Internet access using the co-axial cables used for cable TV.

Today, most CMs are external devices that connect to the computer. They will typically have two connections, one to the cable wall outlet and the other to a computer. CMs are attached to the same cable TV company lines that deliver pictures and sound to your TV set.

High-speed Internet access using CM offers both always-on capability and speed. With this service, users never have to dial up using telephone lines and their cable viewing is not hampered while on line. Speeds for this service vary depending on the type of cable modem, cable network, and traffic load, but are generally faster than those offered by traditional dial-up Internet access.

Differences Between DSL and CM Service

High-speed Internet access that uses CM offers shared bandwidth or speed among neighbors on the same cable system. Speed is asymmetric and will vary depending on the number of people on the network. With high-speed Internet access that uses DSL service, you have a dedicated connection to your home. In most cases, however, the performance of DSL-based service depends on the distance between end user and phone company central office.

Today, high-speed Internet access provided using either DSL or CM typically is offered with a pricing plan that allows access to the service for as long as needed without incurring additional usage charges. Many phone and cable companies are offering bundled packages of various services (such as telephone, cable, and high-speed Internet access) to lower costs to consumers.

High-speed Internet access using CM is targeted towards residential use while DSL-based service is targeted towards residential and business uses.

Advantages and Disadvantages of Having DSL or CM

High-speed Internet access provided using DSL and cable modems is much faster than dial-up modems, however their speeds differ. The distance between the user's premises and the phone company's central office is a primary factor in deciding if DSL-based Internet access service is available and its speed. In contrast, the speed of CM-based Internet access service does not depend on the distance from cable company to end user. Because DSL transmission technology must access the local phone company's central office, competitive providers using DSL technology must coordinate with local phone companies to provide service. Because both versions of high-speed Internet access (DSL and CM) are always on, you may want to check with the provider about security precautions. DSL and CM equipment are generally based on standard specifications and required certification, however, the best advice is to check with the



service provider prior to purchase of such equipment. Different varieties of DSL transmission technology provide different maximum speeds, from twice as fast as analog modems to higher than 100 times faster.

Getting DSL or CM Service

Contact a provider in your geographical area. The provider may be your local telephone service provider or one of its competitors (for DSL-based Internet access), or your local cable company (for CM-based Internet access). There are different high-speed Internet access services available, and the equipment of one provider may not be inter-operable in another area or with another provider. Check with your service provider for technical compatibility.

Prior to getting high-speed Internet access service, residential users should check with the service provider to find out the minimum data speed that the provider can deliver. Consumers should also check the cost of the service. After receiving the service, contact the provider and make it aware of any adverse experience(s) you encounter. Investigate obtaining service through a different provider if you are not pleased with your current service or provider.

Wireless Internet Access

Wireless access providers connect homes and businesses to the Internet using wireless, or radio connection technology, rather than using technologies such as coaxial cable (CM) or twisted copper paired telephone lines (DSL). Wireless providers can use mobile or fixed wireless technologies.

Generally, with fixed wireless technology, a computer, or network of computers, employs a radio link from the customer's location to the service provider. This radio link is usually established between rooftop antennas in order for the radio link to have direct line of sight between the two antennas. These rooftop antennas are usually dish shaped antennas with a very narrow beam of connectivity to prevent interference. The antenna at the customer's location is connected by a cable that runs between the rooftop antenna and the local transmitting and receiving radio equipment. This terminal radio equipment is then connected to the local computer network.

With mobile wireless Internet access, information is transmitted in basically the same way wireless phone calls are transmitted. When a consumer types information into his or her handheld wireless device, it is converted to radio waves. The radio waves travel through the air until they reach a receiver at a nearby base station. The base station then sends the information through the telephone network and Internet until it reaches its destination. When a consumer receives information through the Internet on the consumer's wireless device, the data travels through the telephone network until reaches a base station close to the consumer's device. Then the base station sends out radio waves that are detected by a receiver in the consumer's device.

Advantages and Disadvantages of Wireless

Fixed wireless access customers can be located between 2 and 35 miles from the wireless provider's network between the two locations. Fixed wireless provides Internet-access at



speeds ranging from one up to 155 megabits per second (Mbps). Of course the fixed wireless radio access is dependent on the radio connection and the quality of the radio connection will determine the ultimate quality of service to the customer.

There are several types of new technologies under development that will make it easier for consumers to access the Internet through fixed wireless services. Some providers have initiated wireless access that does not require line of sight radio connectivity. Since many customers may not have line of sight capabilities, this technology could create additional fixed wireless opportunities for consumers. Other providers are implementing systems that are easy for the customer to install and simply “plug and play.”

There are thousands of commercial locations across the country, such as restaurants, hotels, airports, bookstores, convention centers, and city parks and squares, where customers can use laptop computers, handheld devices, and other portable computing devices with special “wireless modem cards” to connect to the Internet wirelessly. While consumers cannot get wireless Internet access once outside these buildings or “hotspots,” inside the hotspots they can get Internet access on their devices at speeds of up to 11 Mbps. Also, some wireless providers offer customers packages where they can get wireless Internet access at a collection of different hotspots. The technology that enables the wireless access in hotspots is called “WiFi.” This technology was originally developed as a home networking technology to network home computers wirelessly. There are currently efforts in the industry to develop solutions to extend this technology for longer distances where WiFi can be used as the last-mile solution for Internet access.

Finally, wireless carriers are planning to provide some measure of high-speed Internet access on mobile, or cellular, phones using what is called “third generation” technology. This technology would give mobile phone users, with the appropriate digital phone, the ability to access the Internet via their phone at speeds up to 2 Mbps in order to provide multi-media types of services. These mobile devices would be connected via radio to a network of base stations that in turn provide connection around the country. Most of the national cellular phone carriers are on an evolutionary path to provide data services over their networks, and many carriers have already upgraded their networks to provide mobile Internet access at speeds comparable to landline dial-up Internet access.

This capability would give mobile phone users with the appropriate digital phone, the ability to access the Internet via their phone at speeds up to 2 Mbps in order to provide multi-media types of services. Future generations of mobile phone service promise even faster speeds but are envisioned for some time in the future.

Internet Access Via Satellite

Satellites are used to transmit telephone, television and data signals originated by common carriers (broadcasters and distributors of broadcast), and cable TV program material. High-speed Internet access via satellite provides consumers another wireless alternative and is ideal for businesses and consumers who can't subscribe to traditional high speed Internet access methods, such as people residing in remote areas.



Over the past few years companies have developed a line of service that fills the need for high speed Internet connections in rural and remote locations. Using satellites that orbit far above the earth's atmosphere, companies are able to offer satellite Internet access, including two-way internet service (the satellites both send and receive data) that is affordable for most homes and businesses. Because the systems work both up stream and down stream, there is no need for a phone line in order for these services to work.

The download and upload speed for satellite internet access depends on several factors including: the satellite internet provider, the consumer's line of sight to the orbiting satellite, the service package purchased, and the weather. Typically a consumer can expect to receive about 500 kilobits per second (kbps) download and approximately 80 kbps upload. While this type of connection is slower than many Internet access services provided using CM and DSL connections, it is about 10 times faster than a dial-up modem.

Setting up satellite Internet access today can be more costly and more involved than obtaining high-speed Internet access using DSL or Cable Modem. A user must have: a two or three foot dish (or base station as it is often called), a satellite internet modem, and a clear line of sight to the provider's satellite. The dish will most likely account for the largest part of the startup cost.

Advantages and Disadvantages of Satellite

Satellite access to the Internet is an alternative to DSL service and CM service, and in particular, its major advantage is its ability to reach areas that other alternatives can not. The line of sight is required for a satellite dish in order to see the satellite. In extreme weather conditions, the service may get impacted. The cost of satellite equipment and installation is higher than other alternatives, and sometimes, providers absorb the cost with various contractual and marketing promotions. Due to long haul satellite links, the transmission delay may be higher than other alternatives. This should not cause any problem for current Internet applications which are mostly Web surfing and e-mail applications.

Fiber to the Home (FTTH)

A fiber optic connection is another transmission technology that may be used to provide high-speed Internet access to some consumers. Fiber optics (optical fibers) are long, thin transparent fibers of glass or plastic about the diameter of a human hair and arranged in bundles called optical cables. They are enclosed by material in which Light-Emitting Diodes (LEDs) send light through the fiber to a detector that turns the light into an electrical signal. They are used to transmit light signals over long distances.

New equipment and techniques are making it feasible to add fiber to the home at a lower cost than ever before. In fact, installation costs for fiber are almost equal to costs to install copper. While costs can vary, fiber-to-the-home installations average \$2,100. Once the fiber connection is made, however, providers can offer communications packages that include phone, digital and basic cable TV, video-on-demand, pay-per-view services and high speed Internet access.

Optical fiber is lightweight, flexible, and the connection is extremely fast; however its availability and use are limited at this time.



Power Line Broadband

Power Line Broadband (also known as Power Line Communications) is the delivery of data communications over the existing electric power distribution network. It is another way of accessing the Internet, which would allow consumers to surf the Web and read their e-mails with speeds much higher than dial-up access, and comparable to the speeds of DSL and CM. Power Line Broadband transmits the user signal over the low voltage (110/220V) and medium voltage (4-20KV) power distribution grid. It also uses the existing electric wires and outlets for delivery of the user signal at home. Other means of signal delivery at home can be WiFi as an extension to Power Line access.

Power Line Broadband is an emerging broadband access technology and is currently under various development and field trials. Its major advantage is its ability to reach virtually every household in the nation since the power lines are installed virtually everywhere. The service is anticipated to be gradually available to consumers at an affordable price in the coming years.

For general information on other telecommunication-related issues, you may contact the FCC's Consumer & Governmental Affairs Bureau in the following ways:

Internet at www.fcc.gov/cgb
Consumer Center: 1-888-CALL-FCC (1-888-225-5322) voice
1-888-TELL-FCC (1-888-835-5322) TTY
Address: Federal Communications Commission
Consumer & Governmental Affairs Bureau
445 12th Street, SW
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