U.S.Robotics®

Technical Paper

Digital Subscriber Line (DSL): Using Next Generation Technologies to Expand Traditional Infrastructures

USB ADSL Modem

Contents

Digital Subscriber Line (DSL): Using Next Generation Technologies to Expand Traditional Infrastructures

With competing and emerging technologies that allow for increased bandwidth of all kinds, the home and small office markets have needed an inexpensive, reliable, and unobtrusive conduit to data, entertainment, and communication. Cable and ISDN are competing with traditional phone companies and gaining inroads into those markets. Digital Subscriber Lines (DSLs) give phone companies a means to compete with cable and ISDN providers in the broadband supplier market while utilizing traditional twisted-pair copper telephone lines, making installation relatively simple and inexpensive.

DSL is a broadband technology that allows for high-speed Internet connectivity over traditional twisted-pair copper telephone lines, thus eliminating the need for costly infrastructure upgrades common with other technologies. The ability to implement DSL service within the confines of existing telephone lines makes it both affordable and practical for small businesses and residential homes, allowing for high-speed connectivity for interactive gaming, on-demand streaming audio and video entertainment, and for downloading huge files in seconds instead of minutes. Being able to deliver multimedia entertainment, information, and services will become increasingly important as phone companies and Internet Service Providers (ISPs) look to new markets and new applications for continued revenue growth and increased customer demand for fast, reliable access to data and entertainment.

How does DSL work?

DSL allows for greater bandwidth by utilizing more of the bandwidth available on a common analog line and connecting digitally on both the uplink and downlink connection. DSL modems can provide downlink connection speeds greater than 6 Mbps and uplink speeds of 640 Kbps, or as much as 1.1 Mbps in both directions. This makes DSL not only much faster than 56K analog modems, but also faster than ISDN and rivaling cable modems in bandwidth. This allows phone companies to compete with cable Internet Service Providers. Because many of the expected applications for DSL involves digital, compressed video, forward error correction is employed to reduce impulse noise error with symbol-by-symbol error correction to counteract continuous noise.

DSL is not a bus-related technology like analog or cable modems. With DSL, bandwidth rates available are more consistent to the end user. There is a geographic requirement that the end user must be within 18,000 feet of the central office or signal degradation will become too great and DSL unfeasible.

The family of DSL technologies, known as xDSL, includes CDSL, UDSL, VDSL, HDSL, IDSL, SDSL, RADSL, VADSL, G.SHDSL, and ADSL. Each DSL technology provides different data communication speed capabilities. The U.S. Robotics USB ADSL Modem specifically utilizes ADSL technology.

Asymmetric Digital Subscriber Line (ADSL)

Asymmetric Digital Subscriber Line (ADSL) is an “always on” high-speed broadband technology that operates off existing twisted-pair copper telephone lines. The asymmetric nature of the data transmission means that most of the channel bandwidth is allocated for the downstreaming of data with a relatively small portion of the channel bandwidth allocated for upstreaming. This produces incredibly fast download speeds of up to 8 Mbps and upload speeds of up to 640 Kbps with the U.S. Robotics USB ADSL Modem – that’s up to 145x faster than a 56K analog modem, making ADSL an ideal tool for telecommuters and virtual office employees.

How does ADSL work?
ADSL modems are able to pack more information over the same phone lines used for analog voice because of signal processing techniques that utilize those frequencies that are not used for standard voice service, thus optimizing the traffic of digital data onto the same analog line by creating multiple channels. Multiple channels are created using Frequency Division Multiplexing (FDM) and echo cancellation to make full use of the bandwidth.

Generally speaking, FDM creates two broad bands, one for upstream data, and the other for downstream data. Each band is then divided, or multiplexed, further. Echo cancellation allows for both the upstream band and the downstream band to overlap one another while using echo cancellation to separate the two. A POTS (Pain Old Telephone Service) splitter, which is installed at the user site, segregates the digital data from the voice signal, allowing for uninterrupted voice calls and faxing without impacting data traffic rates. Chances are, if a business or household has standard RJ-11 phone jacks, then there should be sufficient wiring to, along with a DSL modem, provide high-speed Internet access.

G.Lite
G.Lite (or ADSL Lite, officially known as G.992.2) is considered the standard way to install ADSL and supports downstream data rates up to 1.5 Mbps and upstream rates of 512 Kbps. Because G.Lite runs at a slower rate than standard ADSL, neither requires a POTS splitter, nor a service call from the providing telephone company, which in turn saves money. Voice and data operate in a manner similar to ADSL.

DSL vs. cable modems and shared bandwidth
DSL has advantages over high-speed cable modems, in that DSL lines are dedicated lines running from the user directly to the Central Office (point to point). Cable modem bandwidth is a shared resource, meaning that the given bandwidth is split up among the users in a given community, so the theoretical connections of 10 Mbps uplink and 30 Mbps downlink will not be possible for everyone on the local network. This shared bandwidth includes cable modem users as well as those utilizing cable television programming. Problems similar to those using 56K analog modems can be encountered in that heavy community usage during peak hours can have a dramatic effect on data rates actually experienced. Because of the "shared resource" aspect of cable modems, actual rates will vary according to traffic conditions and the type of modem being used; security could also be an issue for some users of cable modems.

Typical Setup
Typical adopters of DSL (and ADSL) technology are expected to include small businesses and private residences. Connecting the DSL modem to the computer itself involves either using a computer with an Ethernet Network Interface Card (NIC) or USB connection. A common setup might consist of the following basic equipment/software depending on whether the computer is set up for Ethernet or USB:

Ethernet
- 10 Mb or 10/100 Ethernet Network Interface Card (NIC)
- Twisted-pair Ethernet cable RJ-45 (crossover)
- Twisted-pair RJ-11 cable
- Ethernet-supportable computer
- Web browser
- DSL modem (commonly provided by DSL service provider)

USB
- USB cable
- Twisted-pair RJ-11 cable
- USB-supportable computer
- Web browser
- DSL modem (commonly provided by DSL service provider)

The U.S. Robotics USB ADSL Modem is equipped with the convenience of a USB connector. Being USB bus-powered, no additional dedicated power source is required.

Conclusion

DSL service provides broadband technology solutions to both the small business and consumer to deliver the multimedia entertainment, information, and services that are continually becoming a larger part of both our workplace and home environments. DSL, through its ability to provide high-speed Internet access over ordinary telephone lines, gives phone companies new markets and new applications for continued revenue growth by providing the means for fast, reliable access to data and entertainment.

A brief recap of the advantages of DSL include the following key points:

- Unobtrusive way to build a high-speed network utilizing common twisted-pair telephone wiring.
- High-speed network that's both faster than ISDN and without the pitfalls of shared bandwidth and security issues of cable modems.
- Convenience of using a single phone line for voice calls and Internet access simultaneously without degradation of voice call quality.
- ADSL's ability to exploit the predominantly downstreaming of Internet data with an emphasis on high download rates.

The benefits of DSL and the convenience in which it can be applied to both businesses and residential households make it ideal for a variety of applications and solutions.

U.S. Robotics continues to develop solutions to provide data access to both the business sector and to consumers. The U.S. Robotics USB ADSL Modem is just one of many of our latest developments in keeping people in contact worldwide – with information, entertainment, and each other.

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About U.S. Robotics

U.S. Robotics is the world's leading modem provider, bringing the Internet into millions of homes and businesses around the world. For three decades, U.S. Robotics has been at the forefront of modem technology, and in the 1990's was the first to boost analog modem speeds to the V.90 56K standard. U.S. Robotics has reemerged as an independent company and will continue its tradition of making the most reliable, simple and innovative Internet access solutions available. All U.S. Robotics resources — from engineering to consumer support — are dedicated to fulfilling that commitment. U.S. Robotics is a privately held company headquarters in Schaumburg, IL.

To learn more about U.S. Robotics products visit our website at www.usr.com