

DSL or Cable Modems, Which is Better?

By

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I. Abstract

The purpose of this paper is to determine the technology used, components, and similarities of DSL and Cable Modems. This paper will introduce the history of DSL, Cable Modems, the concepts, industry players, cost, security, and countries where the technologies are currently used. A combination of techniques will be used to gather research information on this paper. At the conclusion of this paper the reader should have a clear understanding of which technology is better, DSL or Cable Modem.

II. History

DSL was first developed in 1989. DSL was designed initially to provide video-on-demand and interactive TV applications over twisted-pair wires. Asymmetric Digital Subscriber Line (ADSL) was the preferred choice because it provided the high downstream rates needed for streaming video. Video-on-Demand was viewed as a service used to support the next generation of networks from telephone companies around the world. Video-on-Demand was expected to be the telephone company's way of competing with cable television providers, and ADSL was the technology to make it possible. Interest in copper-based digital subscriber line services was spurred when fiber-based broadband loops proved to be too costly for widespread deployment. In addition, increase interest came with the passage of the Telecommunications Reform Act of 1996, which allowed local telephone companies, long-distance carriers, cable companies, radio/television broadcasters, Internet/online service providers, and telecommunications equipment manufacturers in the United States to compete in one another's markets.

The history of cable modems is practically invisible, because it has only been in use the past several years. There have been many regulations and standards previously set, but the normal history is non-apparent for the technology overall.

III. What is DSL?

The acronym DSL stands for Digital Subscriber Line. DSL is a high-speed Internet access product for homes and businesses that use existing copper telephone lines. Digital Subscriber Line technology use a copper loop transmission technology that solves the bottleneck problem often associated with the last

mile between Network Service Providers and the users of their network services.

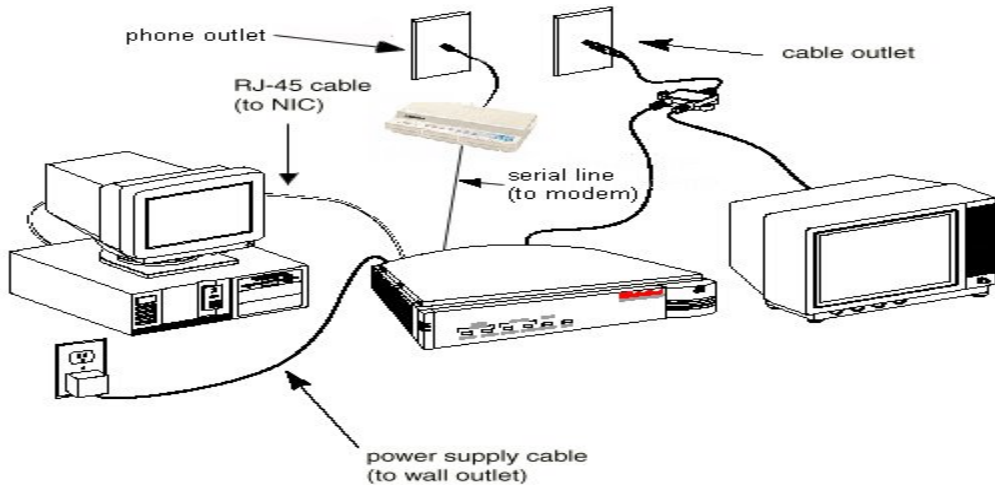
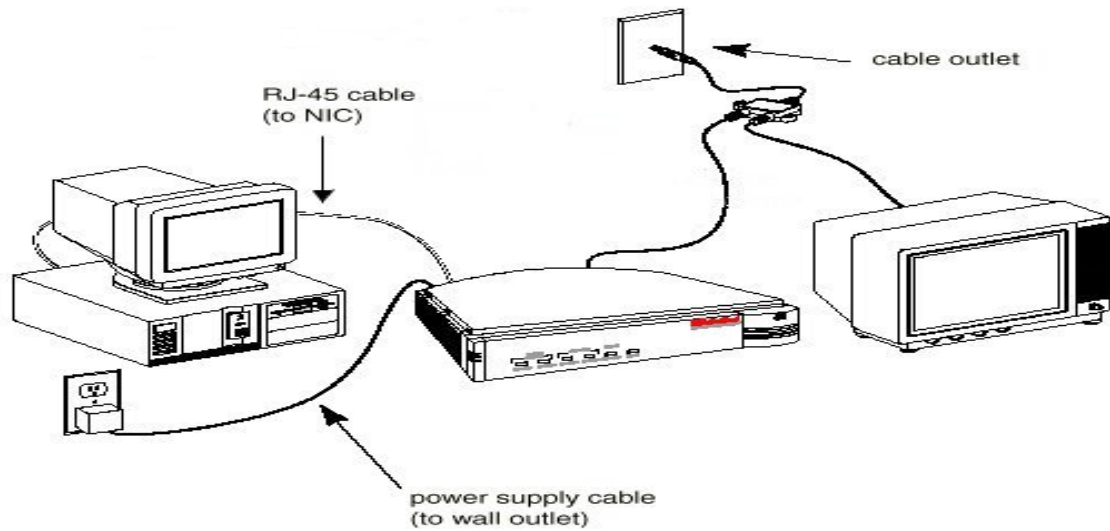
IV. What is a Cable Modem?

Cable Modem is that intersection between home computing and high bandwidth communication. It connects a computer to the coaxial cable that is provided by a local cable television company. Cable Modem is relative new and refers to a modem that operates over ordinary cable television network cables. Basically you just connect a cable modem to a TV outlet for your cable TV, and the cable TV operator connects a Cable Modem Termination System ([CMTS](#)) at their location. By obtaining this equipment you have the opportunity to have Internet access via your cable line.

V. Concepts of operation

DSL is a high-speed access service delivered through copper wire. The availability of DSL is determined solely by the distance of the copper line between you and the nearest telephone company central office. The outer limit for premium DSL services is about 15,000 feet or three miles. DSL provides faster connection than traditional copper lines. DSL offers two advantages that benefit consumers. One of the most compelling benefits of DSL technology is that it allows the Network Service Providers (NSP) and the service user to take full advantage of existing infrastructures, layer two and three protocols such as Frame Relay, Asynchronous Transmission Mode and Internet Protocol, and the reliable network services they have already come to trust. DSL offers two main advantages. First, DSL is [always-on](#). This provides faster and more efficient use of computers. Second, DSL is the ultimate in "unlimited" service. Billed by the month, no matter how much you use, you pay one flat rate.

A modem is an interface between the computer and the telephone. Cable modems are very different from the standard analog modems that we are accustomed to using. Cable modems operate, as their name suggests, by modulating and demodulating cable transmission signals. However, they are much more complex than a standard analog modem in that they are part router, part bridge and part tuner. Cable Modems can also act as an Ethernet hub. The figures below demonstrates the various configurations of cable modems:



VI. Technology

-DSL Technology currently in use:

DSL is geared to two types of usage. Asymmetric DSL (ADSL) is for Internet access, where fast downstream speed is required, but slow upstream speed is acceptable. Symmetric DSL (SDSL, HDSL, etc.) is designed for short haul connections that require high speed in both directions.

ADSL (Asymmetric Digital Subscriber Line) – **Digital** means a line able to carry data traffic in its original form, as opposed to analog. **Subscriber Line** means the line connecting the individual subscriber (household) to the local exchange. This technology reports a downstream speed, but its upstream speed is

a fraction of the downstream. Primarily used in residential applications and many providers do not guarantee its bandwidth levels.

HDSL and **HDSL-2** (High-Data-Rate Digital Subscriber Line) – This technology has been in use for some years in some countries to provide broadband facilities to business locations via leased line, providing 2 Mbps across the network with distances up to three miles. This technology is symmetrical, but is mainly deployed for Public Branch Exchange (PBX) over a T-1 line.

G.Lite is the informal name for what is now a standard way to install Asymmetric Digital Subscriber Line (ADSL) service. Also known as Universal ADSL.

VDSL (Very-High-Rate Digital Subscriber Line) – VDSL is a new technology not expected to be in use in public networks for some years. It's expected to provide speeds as high as 52 Mbps downstream and between 1.5 and 2.3 Mbps upstream, but over shorter distances than ADSL - 1.3 km at 13 Mbps and 0.3 km at 52 Mps. Please note that by deploying higher performance lines from public branch exchanges to street cabinets, these speeds could be delivered to more homes. Remember, this is a high-speed technology that has a very limited range.

RDSL (Rate Adaptive Digital Subscriber Line) – This technology automatically adjusts the access speed based upon the condition of the line. RDSL to some extent is a "metered" service, an attempt to deliver bandwidth on demand to a large number of users.

SDSL (Symmetric Digital Subscriber Line) – This technology provides the same bandwidth in both directions, upstream and downstream. This service is the only service available at business locations.

SHDSL (Single-pair High-speed Digital Subscriber Line) was developed as a meltdown of several symmetric DSL technologies (HDSL, SDSL, HDSL-2) producing as a result one single internationally recognized industry standard. Unlike an ADSL line that is fine-tuned to the needs of a home user and can download enormous amounts of data but is limited when you need to upload any large amount of data; SHDSL has no problems with "two-way" Internet traffic. With transfer rates of up to 2.3 Mbps, this makes it a perfect high-speed solution for medium to big enterprises, branch offices, as well as high-end residential users.

IDSL (ISDN (Integrated Services Digital Network) Digital Subscriber Line) – This technology is symmetrical, similar to SDSL, but operates at slower speeds and longer distances. If any of the above DSL services are unavailable, you can usually get IDSL at any location. The "I" stands for ISDN, a high-speed access service. IDSL uses the old ISDN lines.

Below is a comparison chart of the various DSL technologies. The chart shows detailed information on the characteristics of each technology.

From Computer Desktop Encyclopedia
 © 2000 The Computer Language Co. Inc.

ASYMMETRIC DSL (Can share line with analog phone.)				
Type	Maximum Upstream Speed	Maximum Downstream Speed	Cable Pairs	Maximum Distance
ADSL	1 Mbps	8 Mbps	1	18000 ft.
RADSL	1 Mbps	7 Mbps	1	25000 ft.
G.Lite	512 Kbps	1.5 Mbps	1	25000 ft.
VDSL	1.5 Mbps	13 Mbps	1	5000 ft.
	3.2 Mbps	26 Mbps	1	3000 ft.
	6.4 Mbps	52 Mbps	1	1000 ft.
SYMMETRIC DSL (Cannot share line with analog phone.)				
Type	Upstream and Downstream Speed		Cable Pairs	Maximum Distance
HDSL	768 Kbps		2	12000 ft.
	1.544 Mbps (T1)		2	12000 ft.
	2.048 Mbps (E1)		3	12000 ft.
HDSL-2	44 Mbps (T1)		1	18000 ft.
	2.408 Mbps (E1)			18000 ft.
SDSL	1.5 Mbps		1	9000 ft.
	784 Kbps		1	15000 ft.
	208 Kbps		1	20000 ft.
	160 Kbps		1	22700 ft.
IDSL	144 Kbps		1	26000 ft.

- Cable Modem Technology Employed

There are two basic types of cable modem technology in use today. These technologies are Hybrid\ (one-way) and two-way cable modems.

One-Way (or Hybrid) allows users to dial with their existing analog modem to send or "upload" information to the Internet, and the receipt of "downloaded" information. One-way modems use cable-wire (coaxial) for downstream data, and ordinary telephone lines—via a 33.6 Kbps modem built into the cable modem itself—for upstream data. Coaxial cable runs from the node center at the cable company to the subscriber. The coaxial cable is generally a trunk-and-branch configuration.

Two-Way service utilizes a cable modem and cable lines for both sending and receiving information. There is no need for having an analog modem in the two-way configuration, as packets are transmitted both up and down through the cable line. A two-way modem uses the cable wire (fiber-optic or coaxial) for both downstream (to user computer) data and upstream (from the users computer) data. Two-way cable-modems effectively provide a permanent Ethernet connection to the Internet.

Some one-way and two-way accounts dynamically allocate IP addresses (via DHCP at each connect) to the computer on the account, like most Point-to-Point Protocol (PPP) dial-up accounts. In this case, the computer can run as a server (unless a firewall gets in the way), but have to inform those who wish to access it of their IP address each time they log on.

VII. What are the usages for DSL and cable modems technologies?

- Multi-user dimensions (MUD)

A MUD is a structured environment operating over Internet Protocol and managed by a computer program. MUD involves a loosely organized context or theme, such as a castle with multiple rooms. As a user enters a MUD, he or she is represented within the program as an animated character visible to all of the users. Depending on the capabilities and nature of the MUD, users can communicate in real-time via text, chat or voice, and engage in activities within the environment such as playing a game or fighting.

- Internet Protocol Telephony

Internet Protocol Telephony in its simplest form converts voice (via a super-compression algorithm) into a data stream, which is carried over a less expensive dedicated data network, using Internet Protocol (IP) software, then converted back to voice at the far end. Analysts estimate that IP Telephony is currently a \$40 million business in the U.S and \$8 million international. Several US-based telephone and data magazines are devoting more advertising space to articles about IP Telephony, which is being pushed by new telecommunication carriers, rather than the entrenched long distance networks.

IP networks will allow service providers to deliver a host of unique value-added features, such as integrated voice mail, e-mail messaging and real-time provisioning of additional telephone lines without rewiring a home.

- Internet Access

The cable that brings you MTV and CNN can also bring you the Internet. Several cable companies have expanded their services to include high-speed Internet connections for home users. DSL provides much faster transmission rates than analog modems and ISDN. DSL offers tremendous connection speed for Internet access.

- Home Monitoring/Security

Cable networks can be used to monitor homes for fires, break-ins, and medical emergencies. The available bandwidth of a cable network combined with the system's "always-on" characteristic enables emergency information to be quickly transmitted. DSL and cable modems wired homes can contribute to numerous security protection applications including the use of intelligent lighting controls, monitoring systems and motion detectors. Security systems can be linked with PCs, intercoms, heating/air conditioning controls and lighting systems to give the homeowner optimum control and flexibility.

- Telemedicine

The biggest obstacle telemedicine program planners face is deciding among telecommunications options. They must choose between satellite, wireless, POTS-based, LAN-based, ISDN, ATM, and frame relay. The choices depend on the program's current

and projected needs, finances, and the shifting innovation of technology.

Many telecommunication companies are partnering with healthcare systems to "beta test" digital distributed networks that can support voice, data, and video. For example, PacBell has deployed CalREN, funded with \$25 million to encourage new applications for high-speed digital service. Sprint is working on its Navigen system. Additionally, GTE and PacBell are working on Asymmetric Digital Subscriber Line trials, which will support WAN-like capabilities over large areas, at low cost.

Telecommunication companies can play an important role in this "growing industry" if they really pay attention to assuring that the necessary infrastructure is in place, affordable, and reliable. This is true regardless of the technology used, i.e., ISDN, DSL, POTS, or cable.

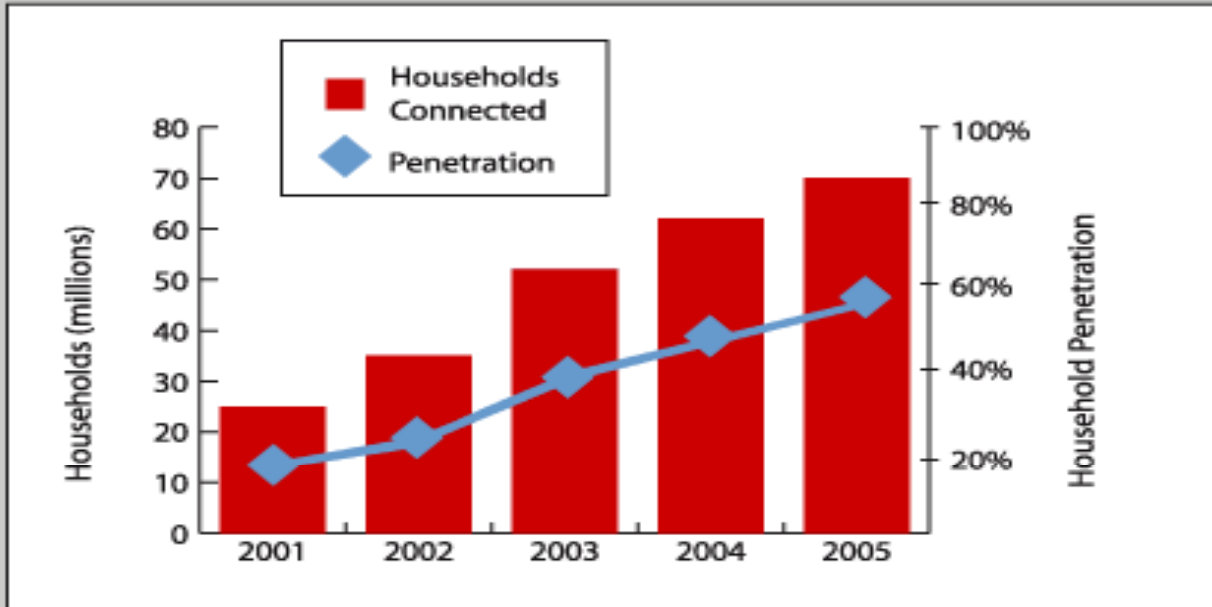
France Telecom announced that on September 7th, 2001 a 68 year-old woman in Strasbourg, France became the first patient in history to receive a complete telesurgery procedure performed by surgeons nearly 4,000 miles away. Operating from a France Telecom/Equant center in New York, Professor Jacques Marescaux, M.D. of the European Institute of Telesurgery (EITS) and Dr. Michel Gagner of New York performed a complete gall bladder removal on the patient in Strasbourg, France at the Hospital Civil/I.R.C.A.D.

Cable companies may be in a greater position to take advantage of the need for reliable, cheap, switchable bandwidth to the home and business. Their organizational structure and technology is not fully supportive of interactive real-time dial-up connections except in a few test cases.

- Interactive Television

Interactive television (iTV) is taking off in Western Europe; it is expected that 68 million households will subscribe to iTV by the year 2005. Interactive television is an application that is delivering the Internet and pay-TV to homes across Western Europe. In its most basic form, iTV will allow consumers to watch a live broadcast or broadband content while at the same time having the option to uplink via a two-way connection. Basic iTV service includes video selections, e-mail, games, voting, home banking, and shopping. Below is a growth chart depicting the rise of iTV in Western Europe:

Majority of Western European Households Will Tune into iTV by 2005



Source: Pyramid Research

www.pyramidresearch.com

VIII. Cost

- Monthly cost for DSL

According to [Deutsche Telekom](#) Service Center, in Germany, the monthly cost of DSL range from a low of 15 Deutsche Marks (about \$7.50) to a high of 49 Deutsche Marks (\$25.00). On the low end of the price range, you get three hours of DSL Internet service per month. By paying 49 Marks monthly you can receive unlimited Internet access. Additionally, telecommunication companies in Germany have much wider variations in price, suggesting a high degree of experimentation by service providers to meet the consumer needs. The reasons for these price variations are due to telecommunication regulators introducing full local loop unbundling relatively early and taking a strong pro competitive stance on price and network access.

In the United States, the price of DSL varies depending on location. For example, [Bell Atlantic](#) offers what it calls Personal Infospeed DSL at speeds of 640 Kbps downstream and 90 Kbps upstream for \$39.95 a month, or \$59.95 a month including Internet access. Professional Infospeed also offers speeds of 1.6 Mbps downstream and 90 Kbps upstream at \$59.95 per month, or \$109.95 per month with Internet access. Finally, Bell Atlantic offers Power Infospeed that provides up to 7.1 Mbps downstream

and 680 Kbps upstream for \$109.95 per month, or \$189.95 per month with Internet access.

[US West](#) plans to charge \$40 a month for 256 Kbps (twice the data rate of ISDN), \$65 a month for 512 Kbps, \$80 a month for 768 Kbps, and \$100-150 a month for service in the 1 Mbps range.

[GTE Corporation](#) has offered ADSL to 1,000 residences in Marina del Rey, California since November 1997. Their downstream data rates are up to 1.5 Mbps and upstream up to 384 Kbps. The residences are charged \$99 a month for this service.

[NET Inc.](#), a Canadian company, is deploying ADSL in Hamilton, Ontario. The downstream data rate for the service is up to 7 Mbps and upstream up to 1 Mbps. The service cost about \$50 per month.

[Wanadoo](#), a subsidiary of France Telecom provides ADSL to residential and small business customers with a subscription to the Netissimo in France. Wanadoo ADSL costs 165 francs (\$25.00) per month.

British Telecommunications of England first unveiled its Digital Subscriber Line service called [BTopenworld](#) in July 2000. Home users were charged £39.99 (\$60.00) per month including VAT but the current price is £30 per month. Due to increase competition in the telecommunication market prices are steadily declining in England. An installation fee of £150 (\$225.00) is charged for downstream speed of 500kbps and upstream speed of 250 kbps.

Another company offering DSL service in England is [Telewest](#). Telewest's Blueyonder broadband Internet service gives high-speed, unlimited Internet access for £33 (\$49.50) per month or £25 (\$37.50) with subscriptions to other Telewest services.

In Italy [KPNQuest](#) and Telecom Italia are the only two service providers of DSL. These two companies have a mutual agreement that started in January 2001 to unbundled the local loop lines in the cities of Milan and Turin. KPNQwest offers three types of DSL service. The three services are ADSLINK 640, ADSLINK 2048, and HDSLINK. ADSLINK 640 provides users with 640 Kbps downstream and 128 Kbps upstream speeds at a cost of Lit.180.000 (\$85.26) per month with a Lit.350.000 (\$165.80) installation fee. ADSLINK 2048 provides users with 2 Mbps downstream and 512 Kbps upstream speeds at a cost of Lit.220.000 (\$104.00) and an

activation fee of Lit.550.000 (\$260.00). This is a flat rate for the complete installation. HDSLINK service cost Lit.270.000 (\$127.91) for 2 Mbps downstream and 2 Mbps upstream speed plus Lit.550.000 (\$260.00) activation fee. HDSLINK is not a flat rate and additional costs are associated with this service.

Below is an illustration of the DSL services offered by Ultimate Internet Access in California:

- 1 YEAR MANDATORY CONTRACT -



UIA PLAN	SPEED DOWN/UP	MONTHLY CHARGE	ACCOUNT SETUP FEE*	EQUIPMENT FEE**
GP-1	768K/128K	\$50	\$0	\$49.95
GP-2	384K/384K	\$89	\$0	\$49.95
GP-3	768K/768K	\$99	\$0	\$49.95
GP-5	1.5M/128K	\$119	\$0	\$49.95
GP-6	1.5M/384K	\$159	\$0	\$49.95



UIA PLAN	SPEED DOWN/UP	MONTHLY CHARGE	ACCOUNT SETUP FEE*	EQUIPMENT FEE
CP-1	608K/128K	\$79	\$0	\$225
CP-2	1.5M/384K	\$99	\$0	\$225

* Setup Fee waived for a limited time only.

** Verizon equipment fee price effective through September 30, 2001.

- Additional IP Addresses: \$10 each/month - not available on CP-1 and CP-2 plans
- Additional Email Addresses: \$2 each/month
- Taxes added to monthly fee.

- Monthly cost for Cable Modem

The cable operator decides the cost for cable modem service. In Germany approximate figures are not yet available due to limited availability.

In the USA the situation is completely different. At present the price of a cable modem is about 250.00 to 300.00 US Dollars. The basic fees are between 29.95 and 62.95 dollars per month, depending on the respective service package. In some instances the installation costs are included in the monthly fee, in other cases a non-recurrent payment for installation must be made (currently between 80.00 and 150.00 dollars).

Cable modem Internet access in England is cheaper than ADSL service. Cable modem service cost (around £25-£33 (\$37.50-\$49.50) a month on average) less than ADSL, which cost a whopping £40 (\$60.00) a month. Telewest and NTL offer cable packages covering 37 per cent of the UK and Ireland, providing connection speeds of either 64 or 512 kbps.

IX. Industry Players

- **DSL**

[Lucent Technology](#) manufactures the CellPipe™ 20 digital subscriber line modem. This customer base modem enable small business, small office/home office, and residential users to use existing local copper loop infrastructure to utilize high-speed DSL services at speeds 200 times faster than traditional dial-up modems. The CellPipe™ 20 modem can be used with ADSL, SDSL, and G.Lite DSL. Lucent DSL modems enable service providers to offer their customers the speed of a T1 line at about half the cost.

[Cisco Systems](#) manufacture the Cisco 627 ATM-25 asymmetric digital subscriber line modem. The Cisco 627 provides home users, telecommuters, small offices, and branch offices with fast, affordable, and easy-to-use access to the Internet and corporate networks. The modem is designed to provide cost-effective access to high-speed ADSL services. Designed for worldwide deployment, the Cisco 627 modem allows ATM services and applications to be available to the office router or to the desktop. Cisco leading architecture and the compact design of 627 makes it a low-cost, high-value DSL solution. The modem is Plug-and-Play ready also. The Cisco 627 is simple and easy to use, no modem configuration or service provider instruction procedures are needed to install and operate the modem. In the event of a power outage or failure condition the Cisco 627 will not interrupt voice telephone service, a capability known as lifeline basic telephone service. The 627 can operate at full rate ADSL and G.Lite speeds, making it an ideal choice for both business and residential needs.

The [Dell'Oro Group](#) announced [Alcatel](#) as the Number One supplier of digital subscriber line modems for Fourth Quarter 2000. Alcatel has shipped 1.6 million DSL modems, achieving a 34.9 percent share of the worldwide DSL modem market. This was the third year in a row Alcatel has achieved a leadership position in the worldwide DSL market. The nearest competitor followed with an 18.6 percent share. Alcatel manufacture the

Speed Touch family of DSL modems supporting multi-line voice and data service over a single telephone access line.

[Nortel Networks](#) leads the industry in splitter less digital subscriber line (xDSL) technology deployment with the 1-Meg Modem. For end users, the 1-Meg Modem allows for Plug-and-Play installation, requiring no service call to the home, and works with existing in-home wiring. The 1-Meg Modem delivers cost-effective bandwidth to residential subscribers, small office/home office users, telecommuters and both the hospitality and educational marketplace. Equipped with the 1-Meg Modem, existing copper lines can support simultaneous data and voice/fax on a single line, with always-on data connectivity. The 1-Meg Modem delivers data rates up to 1.28 Mbps downstream and 320 Kbps upstream allowing quick access to the Internet at faster speeds. The 1-Meg Modem supports the following operating systems Windows 95, 98, Macintosh, and Linux.

- **Cable Modem**

According to Motorola riding the Internet wave just gets better and better. Introducing [Motorola's](#) new SURFboard® SB4100 cable modem. With software upgrades accessible over the network and USB network connectivity, users no longer need to purchase additional software or open their PC to install a standard Ethernet card. The SB4100 offers both Ethernet and USB interface connectivity to help ensure compatibility with almost any PC or Macintosh network-ready computer system. What's more, a front panel stand-by switch has been added for additional end-user security. It disconnects the USB and Ethernet connection to the customer premises equipment (CPE) without disconnecting the cable modem from the Radio Frequency (RF) networks, providing security, flexibility and performance. The SB4100 includes all of the enhanced features of previous SURFboard cable modems, including: incredible speed, high-performance processors, advanced RF design, operator-friendly diagnostics, and top-notch field reliability. The modem is compatible with Windows 95, 98, 2000, NT, Mac, and UNIX. It also supports up to 32 users, which is ideal for home and small businesses. Finally, the modem can provide 32 Mbps downstream and 10 Mbps upstream speeds.

The [Toshiba's](#) DOCSIS Cable Modem offers the highest performance in cable data modem technology. Utilizing the same Hybrid Fiber Coax (HFC) interface as cable television, the DOCSIS Cable Modem provides residential and small business users with a faster, more powerful two-way interface to the Internet.

With phenomenal data transfer rates; a typical 10Mb file can be downloaded in 75 seconds versus over 20 minutes with the latest 56K analog modems.

[Samsung](#) Cable Modems are fast, flexible and easy to use. Samsung cable modems are designed to interface with any computer that has a network interface card and support for TCP/IP. The InfoRanger USB model modem, including the SCM-120R and the SCM-130U, will support Windows 98, Windows 2000, Windows 95 and Windows ME when loaded on a desktop, laptop or palmtop computer. The modem also supports two-way simultaneous data transmission, which lets you download and upload data at the same time.

[Com21, Inc.](#) is a leading global supplier of system solutions for the broadband access market. Com21 products enable cable operators and service providers to deliver high-speed, cost-effective Internet and telephony applications to corporate telecommuters, small businesses, home offices, and residential users. As of June 30, 2001, Com21 had shipped over 1.5 million cable modems worldwide.

[Terayon](#) manufacture several types of cable modems, which provide high-speed, high performance equipment that delivers a full duplex data rate of up to 14 Mbps. One Terayon TeraPro cable modem can support multiple PCs, which allows networking of workgroups and small offices. The equipment has a small footprint that enables both horizontal and vertical installation. These cable modems will operate on Mac OS or UNIX workstation.

X. Countries using broadband technologies

Broadband usage is currently four times higher in North America than in Europe. According to research by Strategy Analytics, subscription to high-speed internet service will only rise to just over three percent of European homes by the end of 2001, compared to 14 percent in the US and Canada. The United States is ranked number two in broadband use worldwide. Europe is already in the broadband slow lane and will still lag behind in 2005 according to Strategy Analytics. "Europe is falling rapidly behind North America in the race to deploy broadband Internet," said David Mercer, vice-president, consumer practice at Strategy Analytics. "The local loop unbundling issue has obscured the fact that broadband uptake must be encouraged initially at the telco/cable level."

Additionally, a stronger cable industry in North America is

rapidly deploying cable modems, which causes the domestic telecommunications industry to respond by rolling out DSL services. In Europe, the relatively weak cable industry has provided little competition to telecommunication companies.

The chart below depicts the status of broadband connections among the countries currently using the technology.

Breakdown of broadband connections:

	Cable %	Satellite %	ADSL %	T1/Leased line %	Total broadband %
Korea	18.6	0.1	38.6	0	57.3
US	7.6	0.5	2.8	0.2	11.1
Hong Kong	6.0	0.9	1.2	0	8.1
Singapore	6.6	n/a	0.5	0	7.1
Taiwan	3.5	0.1	2.6	0	6.2
France	4.0	0.3	1.7	0	6.0
Denmark	3.4	0.0	2.4	0	5.8
Germany	2.7	0.1	2.2	0	5.0
Spain	1.8	0.2	1.1	0	3.1
UK	2.3	0.3	0.5	0	3.1
China	0.2	n/a	0.2	0	0.4

The United States currently has over 55.1 million households connected to the Internet. Approximately 9.4 million have either cable or DSL connections to the Internet an increase of nearly 100 per cent over the last six months, according to a study by Statistical Research in April 2001. Statistics show that 6.6 million homes subscribe to a cable modem service and 2.8 million to DSL. The study also found that most of these users family incomes totaled more that \$50,000 annually.

Researchers predict that cable will continue to dominate the U.S. residential broadband market over the next four years. The reason for this domination is because cable operators are uniquely placed to drive broadband penetration throughout the United States. This does not mean cable has a monopoly on the residential broadband market. By the end of 2005, approximately 15.7 million households will subscribe to cable modem service.

By comparison, it is predicted that DSL will grow to 10.5 million households.

At present, Germany based [Deutsche Telekom](#) is on the way to building one of the most expansive ADSL networks in the world. DSL is currently not available in every community in Germany. By the end of March 2001 Telekom had managed to connect around 850,000 DSL lines. The goal is to connect almost 90 percent of households in Germany to connect to their [T-DSL](#) network by the end of 2001. According to Deutsche Telekom, all areas in Germany should be DSL compliance by the end of 2002. I inquired about DSL service in my village of Rodenbach, Germany. The representative stated that she required my home telephone number to determine if DSL was available in my area. She informed me that DSL was available in Rodenbach, however it would be four weeks to establish service or get connected. The representative stated that there are only 100 ports available per village. In other words if I require DSL service I needed to respond quickly. Deutsche Telekom is opening the door to a multimedia future and putting Germany right in the middle of it as Europe's Number 1 broadband nation. DSL in Germany is essentially complete, with 558 installed co-locations, of which 239 are fully ready for service.

Cable modems in Germany are mostly still in the trial phase. Some universities are operating cable modems for campus networks. There are also some network operators who for some time have been acquiring experience with the use of cable modems. Nation-wide cable modem coverage will surely take some time in Germany. Depending on the regional conditions, some cable operators or city network operators will upgrade their cable TV networks into bi-directional interactive networks and thus will be able to offer their customers high-speed Internet access in the future.

The United Kingdom is among the lowest in the broadband access league, with only one in 32 of online UK households equipped with high-speed connections, whether cable, satellite or ADSL. ADSL is the broadband technology of choice in the UK. The only source of high-speed DSL Internet connections for many Britons is British Telecommunications ([BT](#)). BT states that more than 60 percent of all households could now receive its broadband service. The company has 1,000 exchanges equipped to handle ADSL technology. Britain has one of the lowest penetrations of broadband connections in the industrialized world, a situation many blame on a slow rollout of the technology by BT. According to BT, one reason for the slow

rollout of ADSL is that other operators are still working on the technical side. Most DSL lines in England are used for testing. Additionally, BT states ADSL is new to the company and it's harder for operators to get everything working. The relatively high price of broadband in the United Kingdom is also seen as a reason for the slow rollout. BT has connected more than 80,000 customers to ADSL so far. BT is currently upgrading branch exchanges to improve accessibility from 3.5 to 5.5 kilometers for their users.

Cable modem technology in the United Kingdom is more popular than DSL technology. The UK currently has 12.7 million households subscribing to cable. NTL and Telewest are the only providers of Internet access via cable. Currently cable modem service accounts for 15 percent of the broadband market in the United Kingdom offering downstream speed of 512kbps and upstream speed of 128 kbps.

The development of France's high-speed communication network is behind schedule according to government and technology representatives. Most telecommunication companies in France are going bankrupt or taking enormous losses trying to implement broadband communication. As a result, local officials are under pressure to take responsibility for broadband network development. The French government hopes its \$1.6 billion dollar grant spread over the next five years will help accelerate the construction of broadband networks. According to Tactis, Inc. President Stephane Lelux only 20 percent of France's territory is equipped for high speed Internet access. Mr. Lelux also stated that only 10 percent of French territory is sufficiently equipped with infrastructure to allow consumers to choose from several high speed Internet offers and different types of Internet connections, such as ADSL and cable. The remaining 80 percent of France, roughly 25 percent of the country's population, have no high-speed infrastructure at all.

According to recent data, Finland is the country with the largest per capita of Internet usage in the world. Several service providers deliver amazingly fast Internet access made possible by running the data through existing two-way cable TV lines. Of Finland's 5 million people, 2.15 million are online, giving it one of the world's highest Internet penetration rates, about 43 percent, according to the Finnish research firm Taloustutkimus, which conducts quarterly tracking polls. The latest survey was in January and February 2000. According to Michael Denmend of [Analysys](#) Finland has begun a large-scale deployment of DSL networks.

The development of broadband DSL networks built in the Netherlands has been increasing at a very fast past. There are currently 54 co-locations installed of which 6 are ready for service. The remaining networks are expected to be completed by the end of 2001, bring the total number of networks to 105 co-locations covering a potential market of 225,000 customers.

The cable modem market in the Netherlands is beginning to take off. Wanadoo, NL is providing Internet access via cable modem to a large portion of Holland.

Although Italy has been generally slow in adopting broadband telecommunications technologies, Italy's fiber optics and [DSL](#) broadband market is set to explode over the next five years, according to a recent research study by [Colt-IDC](#). Italy's broadband market is expected to grow from \$113.5 million to \$2.5 billion dollars in 2006. It is also estimated that the number of broadband users will increase from around 10,000 current users to 7 million by 2005. The study also revealed that over the next 4 years the Italian broadband market would account for 16 percent of the European market. This would rank Italy as the fourth largest player in Europe's broadband market.

Research shows that Asia is leading the way in broadband connection. Almost three-quarters of Korean households used their Internet connection to view downloadable and streamed audio/video content. Korea is leading the way in the world's broadband penetration race, according to a report by the Organization for Economic Co-operation and Development (OECD). According to the report, there are 10 high-speed Internet access routes per 100 people in Korea. This number is ahead of both the United States and Canada in term of the number of broadband connections per person. The research shows that Canada had four out of every 100 and the US had 3 out of 100. The OECD attributes Korea's broadband penetration to fierce competition within the country's domestic industry. The report also suggested that the latest findings might encourage other member countries to follow Korea's footsteps in getting digitally connected.

Several years ago the Swedish government stated that 98 percent of Swedish homes should have fast broadband Internet access by the end of 2001. The Post and Telecommunication Board ([PTS](#)) currently states that the government's goal will actually be reached within 3-5 years. The number of homes in Sweden that subscribe to a fast cable or ADSL Internet connection have doubled since January 2001, according to the PTS. Presently 10

percent of Swedish homes have fast Internet connections. The underlining message here is that out of the 3.8 million homes connected, 400,000 have broadband Internet access. Local Internet Service Provider [Telia](#) has installed 100,000 ADSL modems this year, making ADSL technology more widely used in Sweden.

XI. Security Comparison Between DSL and Cable Modems

Network security is probably the most controversial issue of all when comparing DSL and Cable Modems. DSL and cable modems both have security disadvantages. The primary disadvantage that both technologies encounter deals with the "always-on" feature. The always-on feature means that users utilize the same network address for Internet connections. For example, they use the same static IP address for the entire time they are connected. Using static IP addresses provide hackers with a fixed target thus increasing the users vulnerability. Recently several DSL and cable service providers started offering Dynamic Host Configuration Protocol (DHCP) address assignments. DHCP automatically changes the user IP address each time a connection is made to the Internet. Using DHCP is only a minor improvement over static IP addressing because if you are connected for long periods the vulnerabilities are identical to that of a static IP address.

Cable modems also have additional security issues. The greatest security weakness one might experience when using a cable modem is the possibility that their neighbors can see what they are doing on the Internet. The problem according to ISP security managers is that the current technology creates a sort of local area network within a neighborhood. Stated another way, anyone who has a cable feed into their home has the potential to pick up and read someone else's data. DSL does not experience this problem because it uses a dedicated telephone line that is not shared.

XII. Conclusion

During this paper a comprehensive view has been taken to show the various broadband technologies in use today. This paper focused on DSL and cable modems. DSL and cable modems are two of the latest technologies to be introduced in the broadband communication market. My thesis statement asked the following question: Which is Better DSL or Cable Modems? DSL in my opinion is the better of the two technologies. Based on the

information provided readers of this document should be able to answer this question also.

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