ADSL Essay, Research Paper

Overview

Asymmetrical Digital Subscriber Line

(ADSL) uses the plain twisted pair wiring already carrying phone service

to subscribers’ homes to transmit video signals and high-speed data

to the home. ADSL uses adaptive digital filtering to overcome noise and

other problems on the line. Initially, the telephone companies hoped to

use ADSL to provide Video on Demand service in competition with cable

pay-per-view and neighborhood video rental stores. But ADSL can also offer

a wide range of other applications, including Internet service, work-at-home

access to corporations, and interactive services, such as home shopping

and home banking. In addition, ADSL could make at-home educational access

affordable for consumers.

Early Development

As early as 1991, Bellcore, the

research company associated with the seven regional Bell operating companies,

began touting ADSL to expand the transmission capacity of the copper-based

telephone networks. This was originally seen as the telephone companies’

answer to CATV’s encroachment into telephone service and their entree

into providing video on demand to telephone customers. Both the cable

companies and the telephone companies were itching to get into each other’s

businesses, but their networks were totally different, each with its own

strong points and shortcomings. The telephone companies had greater access

to homes in the United States (more than 90 percent), but the cable companies

had more bandwidth capacity going into homes. The telephone companies

were set up for two-way communication, but lost video quality over distance.

The cable companies had better quality but limited upstream capacity.

Both industries knew that their ultimate solution would be fiber-optic

networks connecting everyone, but realistically this was not possible.

Although fiber has been run by both cable companies and telcos over the

vast majority of their network, taking it from the curb to the customer’s

residence or business was the problem. The cost alone would run into the

billions, and nobody could afford to keep laying fiber in hopes that the

home they went to would use all of the capabilities fiber had to offer.

Enter ADSL. ADSL allows a standard copper telephone line to carry a high-speed

digital signal while simultaneously transmitting a voice conversation.

The asymmetrical part of the service refers to the fact that the high-speed

transmission of data is one-way, from the central office to the home or

business. Since most homes or small businesses only need the speed to

receive information, not transmit it, this works very well. And, initially,

ADSL permitted transmission at 1.5 megabits per second (Mbps) over copper

wire for up to 18,000 feet. The vast majority of small businesses and

residences easily fell within 18,000 feet of a telephone switching office.

Because of the poor initial success of the last great plan to use the

telephone companies’ copper wire, Integrated Services Digital Networks

(ISDN), ADSL was met with skepticism. Many telcos, as well as manufacturers,

originally developed a wait-and-see attitude before investing in the new

service. But, in 1993, a tiny California company called Amati

teamed up with Northern Telecom

to prove that ADSL could be used to send 6 Mbps of full-motion video down

a conventional telephone line. Suddenly the telephone companies had a

weapon, albeit an interim one, that could be used against the cable companies.

Big companies, like Bell Atlantic,

realized that ADSL could be used immediately to stay in the game, removing

the pressure to replace the copper wire with fiber. Instead of spending

time and money to bring hybrid fiber/coax (HFC) or fiber-to-the-curb (FTTC)

into a large area for an unknown number of users, the telcos could now

target specific users who were willing to pay for the equipment necessary

to make the service work.

ADSL Today

By 1994, ADSL development provided for 7 Mbps of downstream bandwidth

and up to 576 kbps of return bandwidth. This enabled the telcos to use

the copper wire paths to offer basic telephone service, ISDN, full-motion

video, and videoconferencing. AT&T

began its own development process using a carrierless amplitude and

phase (CAP) modulation alternative to the discrete multitone (DMT) developed

by Amati for ADSL. Although DMT appeared to be the best of the two alternatives,

CAP was available more quickly. Eventually, it was clear that either alternative

could be used by an operating company, they just couldn’t’t be mixed

in the same system.

The first trials of ADSL were relatively simple. There was a box at each

end of a conventional telephone line, that is, one in the customer’s

home/business and one in the phone company’s switching office. The

box divided the phone line into multiple paths, one to carry compressed

video signals to the customer, a second to carry questions and commands

back to the signal provider, and a third for normal telephone service.

Additional paths could be added to support services such as videoconferencing.

The major drawback was the cost of the boxes, up to $1000 each.

As interest in ADSL continued to alternate back and forth in the United

States, companies in other parts of the world quickly snapped it up. Developing

countries attempting to compete in the new world couldn’t afford

high-tech fiber pathways. Established cities, such as Rome and London,

faced almost insurmountable problems if they wanted to dig up the streets

and replace copper with fiber. ADSL quickly gained supporters around the

world.

By early 1995, ADSL could provide high-speed data over a single twisted

copper pair at the rate of 1.544 to 6.144 Mbps downstream (central office

to customer) and 16 to 640 kbps upstream (customer to central office)

for up to 18,000 feet. By shortening the distance to 9000 feet, ADSL could

provide four compressed video channels to the user. These channels could

then be used for video on demand, instant replay, broadcast TV, interactive

games, home shopping, and educational data bases. But the cost of the

boxes to provide the service was still high.

In mid-1995, a new version of ADSL, called V-ADSL, was introduced. V-ADSL

was designed to work in conjunction with FTTC network architecture. As

telcos brought fiber closer to the homes, the telcos could use V-ADSL

as the last connection to the home or business. With shorter distances

being covered by copper wire, V-ADSL could provide higher bit rates, 51

Mbps for distances of about 1000 feet and 25.6 Mbps for distances of 3000

to 4000 feet.

By early 1996, the benefits of using ADSL for Internet access were being

explored. GTE Corporation began

a test in the Dallas-Ft. Worth area in February using residential customers,

high-traffic public areas, and small businesses. In the third quarter,

US West began a trial in Denver and

Boulder, Colorado and Minneapolis-St. Paul, Minnesota. US West’s

trial was designed to link users to the Internet and corporate intranets.

New Competitors Line Up

With the success of these trials and the potential cost savings being

demonstrated, several additional vendors began developing the transceiver

boxes necessary to support ADSL. In May, 1996, Motorola

announced plans to release a single-chip device designed to enable video-on-demand

and Internet access by early 1997. Motorola’s ADSL chip would be

capable of speeds up to 8 Mbps.

In July of 1996, Bell Canada announced

that it would be offering widespread ADSL service by early 1997 and Amati

Communications Corporation previewed its Ethernet-compatible ADSL modem.

Amati’s modem provided bit rates of 8 Mbps at distances up to 12,000

feet and 1.5 Mbps up to 15,000 feet. In addition, Amati announced the

development of a very-high-speed digital subscriber line modem which could

provide bit rates of up to 60 Mbps at 1000 feet and 12 Mbps at 6000 feet,

which it planned to release in the first quarter of 1997. Unfortunately

for most subscribers, the cost is still prohibitive, with Amati’s

device coming in at $2500. Other manufacturers, such as Northern Telecom,

Motorola, Ericsson Inc., Teltrend,

Aware, Inc., Analog

Devices, Inc., and Alcatel Data

Networks, have also announced products for delivery in 1997, which

should lower costs.

ADSL service, which was originally delegated to the background and frequently

ignored, has suddenly become the means for the telephone companies to

compete in the information delivery business. Faced with an outmoded network

of noisy copper lines, the telephone companies appeared to be in a losing

battle with the cable television industry and its coaxial network and

cable modems. Now ADSL has allowed the telephone companies to use their

existing networks to provide expanded interactive and video services to

their subscribers. Ultimately, both industries want to replace their networks

with fiber or fiber/coax, but realistically, this could take 15 to 20

years. In the meantime, ADSL will provide subscribers with another option

for high-speed data service.

Bibliography

Newton, Harry

"Newton’s Telecom Dictionary" Flatiron Publishing Inc.,

New York, 1994

www.prnewswire.com,

August 22, 1996

www.prnewswire.com,

August 27, 1996

www.prnewswire.com,

August 28, 1996

Schroeder,

Erica "ADSL Answering Threat of Cable: Vendors Speed Field Trials"

PC Week, July 8, 1996

McCarthy,

Shira "Vendors Exploit New Interest in ADSL" Telephony, June

24, 1996

Dvorak, John

C. "It’s the Internet, Stupid" PC Magazine, June 11, 1996

Surkan, Michael

"A New Twist for Old Telephone Wire" PC Week, June 3, 1996

Woods, Bob

"Cable Modem Market to Almost Double" Newsbytes News Network,

May 29, 1996

Woods, Bob

"High Speed Multimedia Via Copper Wiring Undergoes Trials" Newsbytes

News Network, May 22, 1996

Hardie, Crista

"Motorola Readies ADSL Video IC for ’97 Entry" Electronic

News (1991), May 6, 1996

Schroeder,

Erica "US West, GTE Kick Off ADSL Technology Trials" PC Week,

April 8, 1996

Kopf, David

"Internet Makes Case for ADSL" America’s Network, April

1, 1996

Schroeder,

Erica "ADSL is Gathering Telco Adherents" PC Week, March 25,

1996

McCullough,

Don "FTTC the Right Choice in the Long Term" America’s

Network, February 15, 1996

Vigoda, Arlene

"Speedier Access: Cable and Phone Companies Compete, Internet Future

Rests on Rival Technologies as Users Express Frustrations with Delays"

USA Today, 1996

Machrone,

Bill "ADSL Delivers High-speed Hope" PC Week, September 11,

1995

O’Shea,

Dan "Aware/ADI Raise Curtain on DMT Technology First" Telephony,

August 28, 1995

Krause, Reinhardt

"Improved ADSL Compression Lures Semiconductor Firms" Electronic

News (1991), April 10, 1995

Krapf, Eric

"Bell Atlantic Video Trial Gives ADSL First Big Test" America’s

Network, March 1, 1995

Lefkowitz,

Mike "The Last Mile: Linking Fiber and Copper" Communication

News, January 1995

Nak-Hieon,

Kim "Goldstar Develops World’s Second ADSL" Electronics,

November 28, 1994

Steward, Alan

"Telcos Finding Virtues of Video Over Copper" America’s

Network, October 1, 1994

Vittore, Vince

"ADSL: Overhyped or Well-kept Secret?" America’s Network,

August 15, 1994

Huthseesing,

Nikhil "Copper Highway?" Forbes, June 6, 1994

Kastre, Michael

"Fast Lane on the Information Superhighway" Hispanic Engineer,

March 31, 1994

Stewart, Alan

and Stoffels, Bob "Can ADSL Rescue Copper from Oblivion?" America’s

Network, March 15, 1994

Karpinski,

Richard "ADSL: Alive and (Seemingly) Well" Telephony, March

14, 1994

Gilder, George

"The Death of Telephony" The Economist, September 11, 1993

Brody, Herb

"Information Highway: The Home Front" Technology Review, August

1, 1993

Blankenhorn,

Dana "Bellcore Says TV, Voice Can Share a Phone Line" Newsbytes

News Network, June 6, 1991