

The Future is Now With

Asynchronous

# ADSL

Digital

Subscriber

Line

It's 6 a.m. on a Tuesday in early 1999. You're up and working because your boss just called to tell you to be ready for a presentation to one of your most important customers at 8 a.m. It seems that they were having cocktails last evening, and the boss happened to mention your newest and as yet unannounced product, and volunteered a presentation. The customer had a short window of opportunity this morning, and the appointment was made. Your boss was sorry about the short notice, but hey, that's what bosses are for.

You've been briefed on the product and can handle the discussion. You're really handicapped, however, because you haven't received the sales material yet. You know that headquarters has a really neat PowerPoint presentation on its server, but it incorporates color photos, and the file size is nearly 30 megabytes.

Transmission by modem will take at least three hours, and, because of the color and detail, faxing is out of the question. Fortunately your company, with help from BellSouth, offers a solution. You boot up your PC and click onto an icon labeled BellSouth® FastAccess™. A personal Web page appears providing a menu of presubscribed services (in your case,

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# If you think ISDN is fast

By Bill McNamara

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an Internet service Provider, an on-line service, and your company's intranet). You click on your company's intranet icon, are connected, log in, and are authenticated. You page to the appropriate server, find the PowerPoint file, and request a download to your PC. Fifteen minutes later you are leaving home with a floppy disk containing the file, and with enough time to stop for coffee before reaching the office and making the color transparencies for your presentation.

This was possible because your company connected its main office to BellSouth's high-speed broadband packet-switched (ATM) network and gave you personal high-speed connectivity to that network from your home. That was possible because of a new technology called Asymmetric Digital Subscriber Line (ADSL).

## What is ADSL?

ADSL is the latest development in the evolution of high-speed digital access technologies developed for existing copper telephone lines. Beginning with public packet network access products introduced in the late 1970s, these technologies have progressed from speeds of 9,600 bits per second (bps) to as high as 50 million bps on short transmission lines. Even higher speeds are possible if you're within about 1,000 feet of a serving central office. But the applications of most interest to telephone companies have been those which would be available to most of their customers. Until now, the most useful have been the 160 kilobits per second (kbps) digital subscriber line service (DSL) used for ISDN access, and the 800 kbps high-rate DSL (HDSL).

While advances were being made in the speed of ordinary voiceband modems, signal processing advances were being applied to the compression of voice and video signals. Of particular importance was the realization that entertainment-grade motion pictures could be transmitted at data speeds as low as 1.5 megabits per second (mbps), while providing better perceived quality than consumer VCRs. It didn't take the communications industry, comprising entrepreneurs and capitalists, long to recognize that if a DSL could be developed to deliver at least this much bandwidth over reasonable distance, a major new business opportunity could be developed. That opportunity came to be known as video-on-demand.

A standards project was undertaken in the same organization which had previously developed the ISDN, DSL, and HDSL technologies. As with the earlier developments, alternative technologies were proposed and evaluated against agreed-upon criteria. This process led to the selection of a modulation technique known as "discrete multi-tone" or DMT, and an American National Standard, ANSI T1.413, was developed and approved. This standard forms the basis for BellSouth's ADSL offering.

The main advantage of DMT is nearly unlimited flexibility in adapting to the transmission environment of the metallic cable pair to which it is applied. The maximum rates achievable are in excess of one megabit (mbps) upstream and eight mbps downstream.

The actual data transfer rate available is dependent on the transmission environment provided by the metallic facility. These are very skinny wires bundled tightly together, and are subject to a number of impairments, signal loss, and ingress noise in particular. If the facility is short, the signal-to-noise ratio will be high for most tones, and the achieved rate can approach the maximum. If the telephone line is long, the signal-to-noise for the highest frequencies, at least, will be poor, and the achievable rate will likely be much less.

## Serendipity!

Even before the standard was complete, manufacturers began to introduce early products to the market. The video-on-demand bug severely bit both manufacturers and service providers. A few providers made industry headlines with aggressive service rollout announcements. A couple of well publicized trials demonstrated the feasibility of the concept, and customer acceptance was better than expected. Unfortunately, overall costs were much higher than expected, and the luster of ADSL for video-on-demand soon evaporated.

As often happens with technology, a solution developed to answer one question is found to be a far better answer to a completely different question. Similar to video-on-demand, Internet access is typically a highly asymmetric information application. Short queries are typically followed by downloading very large data files. Additional upstream communication is usually limited to short acknowledgements. ADSL is ideally suited to this application, and BellSouth's service is built wholly as a data-access vehicle.

## Putting it to gether

ADSL is provisioned as a data-over-voice technology, using the same pair of copper wires used to provide both voice telephone service and high-speed data service. Because the service does not bear the incremental cost of an additional facility (line), BellSouth will be able to provide it at a price consumers will find very attractive.

An ADSL modem is required to interface between the ADSL line and the user's equipment. This can either be a stand-alone device with an Ethernet interface or directly integrated into a customer's computer. In either case, the PC arrangements will soon be supported directly by most major providers of PC hardware and software, and can be expected to be available as part of preconfigured packages at local computer stores. Because of this support, ADSL will soon be as easy to use as voice-band modems.

## The Future Is Now

BellSouth began a market trial of FastAccess ADSL in Birmingham, Alabama, in September 1997 and completed the initial commercial rollout in seven metropolitan markets during the last part of 1998. Early results have been encouraging, and BellSouth is planning to introduce this service in 28 other metropolitan markets, including Memphis, Nashville, Knoxville, and Chattanooga, in 1999. Although it will be available to most customers in these areas, this technology pushes metallic facilities to their limit. Not all facilities will support it at this time, so until at least mid-year 1999, ADSL will be offered only to customers whose existing facilities are suitable.

Also, depending on the customer's location, the attainable data speeds will vary. Even at the lower end of the range of achievable rates, however, the link provided by FastAccess ADSL to the BellSouth ATM network will far exceed the capabilities of ordinary modems. Consumers will have continuous, on-line access at rates heretofore achievable only through expensive, high-capacity private lines.

***As you reach your office fortified by that cup of coffee, you've taken for granted a task, putting the sales presentation together remotely in a few minutes, that wouldn't have been possible before FastAccess ADSL. ■***

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