

# ADSL chip sets trip down with G.lite

Slow to reach its deployment goal, ADSL tries a consumer-friendly G.lite diet. With computer and telephone companies pushing the G.lite standard, ADSL chip vendors are upgrading their products for consumer-grade modems.

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**H**igh costs and confusion over industrywide standards have stalled consumers' ability to gain access to the Internet via asymmetrical-digital-subscriber-line (ADSL) technology. As a result, cable modems have surged ahead of ADSL in providing home access to the information superhighway. Now, that situation may change: The Universal ADSL Working Group (UAWG) is rallying around the International Telecommunications Union's (ITU's) ADSL G.lite specification for a lower cost, longer reaching ADSL standard that employs no splitters. By solidifying a global standard, G.lite enables ADSL chip vendors to optimize their chips and software to produce consumer-grade modems; nevertheless, questions still remain about the widespread deployment of ADSL.

ADSL is not out of the Internet-access race, however. For example, Incumbent Local Exchange Carriers (ILECs), such as US West (www.uswest.com) and GTE (www.gte.com), and Competitive LECs (CLECs) are now deploying ADSL services for Internet access. In Europe, Video on Demand, the original driver for ADSL, remains a viable business (see sidebar "Europe checks out

ADSL"). However, questions remain on whether a single worldwide standard for ADSL is possible. These questions revolve around the myriad regional telephone systems and consumer handsets that such a standard would have to accommodate. Even so, ADSL boosters are urgently rallying to G.lite because they see cable-TV operators pushing ahead in broadband access. They may be right: Analysts estimate that, by 2000, vendors will sell 3.7 million standards-compliant cable modems (Reference 1).

In contrast, analysts predicted in December 1996 that 5 million ADSL connections would exist by 2000, but this year analysts place that number closer to 1.4 million. This significant drop in forecasted connections, although not unusual for an overhyped technology, results from several problems. For example, the lack of standard end-to-end network protocols and the quandary over whether carrier-amplitude-phase (CAP) or discrete-multitone (DMT) line coding would prevail caused access-network and service providers to be hesitant

## ADSL MODEM CHIPS

about rolling out products. In addition, the much-publicized ADSL field trials proved that widespread deployment was more expensive than anticipated because of problems qualifying the twisted-pair cable plant for ADSL service and spectrum compatibility between signals in the cable plant.

On the bright side, an apparent end to the ADSL line-code battle is the broad acceptance of DMT as the standard. However, numerous trials have shown not only DMT's technical merits, but also its need to mature as a reliable standard line code. Also, in February, the G.lite working group agreed to use DMT line coding. However, the ITU will not complete the G.lite specification until late this year. Even then, it is uncertain whether G.lite will decrease the modem and deployment cost, and it will not provide end-to-end protocols.

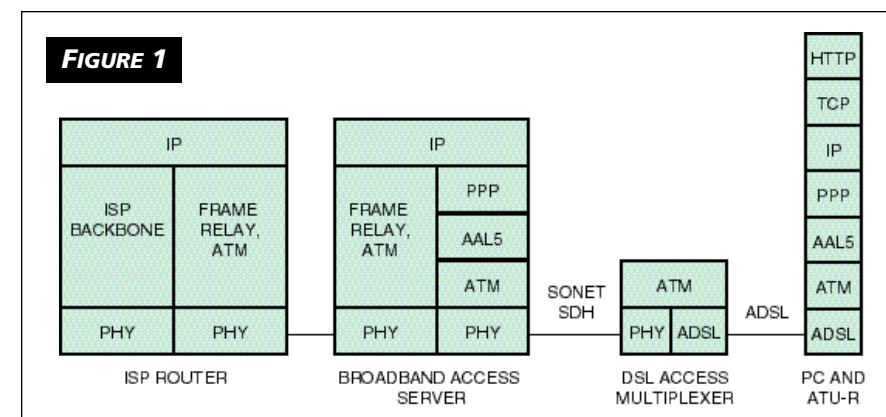
End-to-end compatibility is essential for consumer applications to communicate seamlessly with Internet service providers, content providers, and corporate networks. The consensus is that asynchronous-transfer-mode (ATM) transport protocols can provide such network compatibility. Both the proposed ADSL Forum's Point-to-Point Protocol (PPP)-over-ATM-over-ADSL recommendation and the ANSI T1.413 Issue 2 with its ATM transconvergence-layer specification form the framework for end-to-end compatibility over an ATM network (Figure 1). ATM trans-

convergence is optional in the ANSI Issue 2 specification, but it is a good fit for systemwide interoperability. ATM's ability to scale bandwidth matches well with the rate-adaptive features of ADSL. Also, ATM supports guaranteed bit rates and latencies that provide the quality-of-service (QoS) and class-of-service features that ADSL network providers can price according to services supplied to consumers and businesses.

After establishing the ATM connection, PPP—a de facto standard for host dial-up connections—authenticates and configures the session-setup and -release phases. In addition, PPP performs multiple operational functions, including encryption, compression, and billing. Companies such as Harris & Jeffries, Virata, and Trillium are exploring opportunities to provide the connecting software needed for PPP and ATM end-to-end compatibility.

Besides the interoperability issues, expensive installation procedures and costly modems also hampered ADSL deployment. Installing full-rate ADSL required technicians to remove load coils and bridge taps from local loops between central offices (COs) and customer premises and to inspect and repair wiring inside the premises. Inadequate loop-condition records—placement of coils and bridge taps, length of loop, and gauge of wire—made loop qualification even more difficult.

After qualifying the loop, the technician installed a splitter to separate the analog voice signal from the ADSL signal. Another technician would then



The PC-to-Internet-service-provider end-to-end protocol stack includes PPP over ATM over ADSL (courtesy Harris & Jeffries).

## @a glance

- Widespread deployment of ADSL is far behind last year's predictions. The high cost of modems, expensive installation procedures, and a lack of end-to-end standards are to blame.
- PC industry, networking, and telecommunications companies formed the Universal ADSL Working Group (UAWG) to make recommendations to the ITU G.lite working group to facilitate quick deployment and adoption of ADSL.
- The UAWG plans to build on the ANSI T1.413 ADSL standard for simplified, low-cost, and splitterless consumer modems.
- Doubts exist on the technical feasibility of splitterless ability. High-speed data may require inline filters at each phone, fax, or other appliance on home wiring systems to isolate transient noise.
- Silicon vendors are offering programmable chip sets that will not become obsolete as the standards evolve into efficient products.

install a network-interface card inside the customer's computer and finally configure the software. Add all this labor expense to the fact that ADSL standard-compliant modems were expensive and immature—partly because of the complexity of DMT line coding and first-generation chip sets to implement it (Reference 2).

Another problem that sidetracked deployment, though not a showstopper, was the spectral compatibility with other signals in the cable plant. Even though the ADSL standards group analyzed DMT signals with a maximum number of disturbers, such as analog T1, integrated-services digital network (ISDN), and high-bit-rate digital subscriber line (HDSL), real-world evidence pointed to problems. Putting too many digital-subscriber-line (DSL) cables in one bundle reduces the reach for all of them. In addition, ISDN compatibility is important in Europe, where one twisted-pair wire carries both services (see sidebar