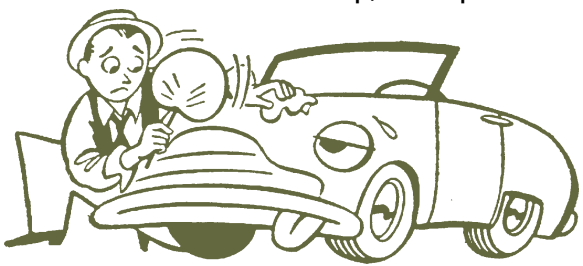
Speed bump

Acceleration-ramp blues on the information superhighway

The signs on the Infobahn say, "Full Speed Ahead"… but some bumps in the road might send unlucky travelers hurtling off the edge and into the ditch. While digital prognosticators see a future in which bandwidth is abundant and cheap, more practical short-term limitations may put this vision five or more years away.



So here's the real scoop on current and future ways of getting bits over the pipe and what we can expect from them—use these details wisely, and you can be ahead of the rest of the crowd of early adopters. It's important to

remember, by the way, that for all the technologies I'm talking about here, you're going to be paying one bill for your phone line (or cable line, or whatever it might be)—which is your physical connection to the Internet—and another bill for the Internet feed you're running over that line—the ability to send data. It's easy to lose sight of that when you're considering what high-bandwidth Net access may cost in future years.

Modems

The end is here—already! Modems (modulator/demodulators) are devices that turn digital information into analog pulses for transmission over the existing voice telephone system. They started life at the 110-bits-per-second (bps) level (also called baud back in those days), crept gradually to 1,200, and then skyrocketed to the present top rate of 33.6 kilobits (kbps) per second.

But 33.6 kbps is faster than the carrying capacity of most voice phone lines in the United States—that is, most lines can't accurately convey information at that speed, and the modems have to "step down" to a lower-speed rate.

A good chunk of American lines can't even handle data traveling at speeds above 20 kbps.

The massive deployment of modems and fax machines and the subsequent increase in numbers of installed phone lines has also meant that local phone companies are squeezed for actual wire back to the phone switches that route the traffic where it needs to go. Telephone companies often install devices that stack multiple voice signals on a single pair of wires. If 33.6 kbps is the maximum that a full voice line can handle, obviously two modem signals compressed over the same wire will handle half or less. The quality of voice calls doesn't degrade much by this technique, however, which is how the phone companies can get away with it.

The fastest modems can talk at a lot of intermediate speeds, so many people buy the top of the line so that they can always be communicating at the highest possible rate. But we'll never see faster modems than today's over voice lines. Okay, you can never say "never" in today's technological climate—but it's true anyway.

ISDN

The great promise of the last several years for fast data access has been ISDN (Integrated Services Digital Network). While you can read way too much about this, the salient facts are: ISDN carries data at a speed of 128 kbps in two separate 64-kbps channels, fully digital, for fees ranging from the cost of regular phone service to hundreds of dollars a month, depending on your part of the world and your usage (some ISDN is metered by the minute; peak rates in other cases run from $25 to $180 per month for full-time usage).

ISDN is still hindered by the difficulty of configuring the lines, by regional phone companies' lack of experienced field personnel to install and test lines, and by a lack of service providers willing to give a user the full 128 kbps. It's possible to set up a "virtual" 128-kbps link, but not many providers are yet configured for that, and some ISDN devices' drivers don't yet support it (a variant on the Internet's Point to Point Protocol allows the two channels that comprise a regular ISDN line—which normally function almost as two separate modems—to be "bonded" into a single virtual channel capable of using

the full bandwidth for a single task, like transferring a file).

ISDN can also cost a bundle for an Internet feed that matches it—from $1 per hour for single-channel usage, to $500 a month for full-time 128 kbps. Not really in the ordinary user's range, in other words.

Cable modems

Cable modems are supposed to take the sting out of the phone company's limitations and costs. These devices would be plugged into coaxial lines installed by cable companies, and could achieve speeds of hundreds to thousands of kilobits per second.

The great problem here is that most cable companies' systems are simply not up to the job of delivering data at that speed. The difficulty generally starts at the distribution points ("head ends") where the cable companies split their signals into hundreds of separate lines that run into individual homes. Everything might be fine up to

these distribution points—though it often isn't—but from there to an actual home, there's no guarantee of a decent, "noise-free" signal. So for all practical purposes, most cable systems in the country don't have enough quality wiring to use cable modems. If you want proof, walk outside and look up at the pole where a bunch of coaxial cables are plugged into splitters; in many neighborhoods, installations meant for three or four houses now serve many more.

Another twist here is that although the devices might have "throughput" of megabits per second, you would be sharing the available bandwidth on that particular spur with everyone else in the neighborhood. So prime-time Internet usage might still only yield you modem-like speeds. No one knows yet what the final cost per month might be for individual users, but it will almost certainly be more than basic cable.

And, since large-scale tests with cable modems are just

beginning, this is all purely theoretical anyway. Cable modems are years away from wide deployment—if they work.

ADSL

When ADSL was announced, *Wired* and several other computer publications went berserk about the bandwidth—without noting that Asymmetric Digital Subscriber Line technology required that phone companies install the equipment on their switches, or that equivalent technology exists today at a cost too high for consumers. (It is true, however, that ADSL requires phone companies to buy and install a lot less equipment than, say, ISDN.)

ADSL is asymmetric; that means that more data can go in one direction than the other. The technology appears to support a data speed of about 6 megabits (Mbps) per second one-way and as much as 250 kbps in the other direction. For home users, this would be perfect: you'd be retrieving huge amounts of data, but not sending very much.

The biggest advantage of ADSL is that it runs over two wires, or a single

"twisted pair," as it's called in the telephone biz. The vast majority of businesses and residences in the United States have wiring already installed that would support ADSL. But, just as modem manufacturers had to forge agreements on specifications before modems could be made that all "talked" to each other, phone companies have to agree to standardize on ADSL technology before it gets widely deployed.

Moreover, it hasn't been widely mentioned that, for two reasons, both cost-related, ADSL is not really an appropriate consumer technology. First, you can buy something very much like ADSL today, called HDSL (high data rate DSL), which is what a T1 line runs on. T1 speed is symmetrical—1.544 Mbps in both directions—and it requires two twisted pairs of wires, or four wires in all. However, a T1 line costs anywhere from hundreds of dollars per month to thousands, depending on both its distance from telephone company equipment and the region it's in. That's a big bite, and there's no indication that ADSL—which, remember, is similar in many ways—will be cheaper.

The other price issue is that what you pay for your feed to the Net is

separate from the bite the phone company gets for carrying the data. A Net feed at T1 speeds costs from $1,000 to $3,000 per month, depending, again, on location.

ADSL may bring the cost of high-speed transmission down for businesses, but it's probably not a consumer technology for some years to come. It will simply cost too much.

Where do we go but up?

The expense of getting a signal from consumers to services (and vice versa) shouldn't be confused with a limitation on getting it from one service to another. Bandwidth is ever-increasing and ever-cheaper (at least to some degree) for the high-speed lines that buzz around the world. And technologies like ADSL will push the price down further.

A few exotic transmitters like satellites and wireless modems aside, the real battle for the hearts and minds of consumers is going to be waged between cable and telephone companies. Both have technologies that can

bring the bandwidth home, but neither can deploy fully at the moment. (Of course, dozens of independent telcos and cable companies are involved, each with its own agenda; some are allied with media companies, which have their own, separate, plans of attack.)

The ultimate arbiter will probably be price: the rush onto the Net either caused or was abetted by the drop in modem prices and the rise in speed, and the same may be true of the next wave of bandwidth technology. The cheaper the service to start with, the more users at the outset, and—usually—the lower the price during the next phase, with competition and purchases by all the early adopters pushing prices down even further for more widespread sales. So whatever technology can drop in price fast enough to be affordable by the average consumer could win the whole shmeggegeh.

Me, I've got a T1 line in my office. And an ISDN link into the house is starting to sound, well, almost reasonable.

Continued

URLS

An excellent resource for materials on bandwidth technology, with articles, links to companies, and background information:
http://plainfield.bypass.com/~gzaret/hiband.html

A URL with great definitions of the terms used in this column:
http://www.sbexpos.com/sbexpos/associations/adsl/adsl_glossary.html