Ever try to do a file transfer with only one phone line? It's frustrating as can be. First you and the recipient have to agree on modem protocols and configure your machines compatibly. ("Lessee...set your software to 8N1 and Zmodem.") Then you agree on who calls whom and, if you've ever suffered through this before, on what you'll do if you fail, which is likely. ("OK, I'll initiate the call. If we don't connect after three tries, the fourth call will be me on voice. Got it?") Once you get a connection, you have to make sure the other party hits "receive" when you hit "send." No wonder faxes are so popular.

This technical reef has stove in the hull of many cross-platform or voice-and-data groupware products. Inexpensive, cross-platform, voice-and-data communication protocols have simply not made it out of the data or voice communities; ISDN, which promises many of those advances, has been slow to arrive, although it has picked up speed recently. Still, manufacturers of ISDN gear haven't shown much cleverness in their designs, nor have ISDN application developers.

Part of the problem is that they -- and we -- are often limited by antiquated concepts of what it means to communicate with electronic gadgets. It's worth a moment to reflect on the nature of something as simple as a telephone call and the unconscious behaviors associated with it. Some of these assumptions reflect social conventions; others are artifacts of the phone system's original design. Both can change.

Let's see how many assumptions we can violate in one brief scenario. Zoe is on the road and decides to check her messages. She takes out her low-end PDA (no cellular link), plugs it into a public-phone jack, puts a small telephone in her ear and calls her message server. The PDA logs in and gets her message headers, which it displays on her screen in a multi-medium (voice, e-mail, fax) mailbox. With her PDA's handy pen, Zoe selects an e-mail message. The server fields the request and sends the message down the wire to the PDA, and she reads it. She requests a fax message, and the same thing happens: She can view and zoom the fax image (or she could have had the fax forwarded to her hotel).

When she requests a voicemail message, however, there's a subtle technological change, though the
interaction is identical: The server switches to voice mode, then plays her voicemail over the phone in her ear. (This is much more practical than downloading digitized messages to play them locally, and it lets Zoe respond right away...with soft function keys on her PDA screen.) The message server also detects that the caller left an electronic business card, so it can offer her the caller’s identity before she selects the message, and it can allow her to respond by hitting one button. Of course, it offers her the choice of calling, sending a fax or sending an e-mail message.

She decides to return the call live, so she hits the appropriate screen button and a few seconds later has Phil on the line. As she hears his voice, a small icon shows up on her screen and a small chime rings in her ear; this means she and Phil can now use some enhanced features, so she invokes the shared scratch pad. While they talk, she can draw on her PDA and Phil sees the results live on his desktop monitor.

This scenario is not far-fetched, nor does it require particularly expensive technology. It’s all feasible with simple tools that exist today. Of course, someone would have to write some software....

**Small enough to miss...too important to ignore**

This issue of Release 1.01 examines several small and relatively inexpensive telecommunications technologies that are more significant than their size and cost suggest. Perhaps because they are small and cheap, they may find broad acceptance and help widen important bottlenecks in our communications infrastructure. These technologies aren’t as sexy as terabyte multimedia servers that deliver 500-channel nirvana to your set- or desktop, but they may well be more pervasive in five years.

- *VoiceSpan* from AT&T is a modem technology that offers simultaneous voice and data communications, as well as combinations of the two. We will feel its impact first in multi-player games from Sega.

- *VoiceView* from Radish Communications is a low-cost protocol designed to transmit bursts of data during an analog phone call; we first described it in Release 1.0, 1-93. VoiceView can also bring a voice call into an online session, and it can set up and control other technologies, including VoiceSpan. With backers such as Microsoft and the major modem manufacturers, VoiceView could become pervasive quickly.

- *The GeoPort* that Apple now builds into its Power Macintoshes offers a sophisticated yet inexpensive way to unify phones and computers, as well as a common port for other peripherals.

- In-the-ear headsets are more private than speakerphones and more comfortable than traditional headsets. They make mobile communications work. We examine two: the *Earset* from Pan Communications and the *EarPhone* from Jabra.

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1 This issue builds on previous issues on unified messaging (12-92 and 1-93), personal data interchange (9-93) and community (6-93 and 7-93).
Market and social dynamics

None of these solutions is perfect; they all leave open questions, which we attempt to make explicit and explore. Although they may be replaced by other technologies long term, they will help change our perceptions over the next few years.

Our perceptions and behaviors have already been changed by other recent technologies, in ways that are both subtle and obvious. For example, cordless and cellular phones allow us to talk to friends as we sit in the back yard, or drive with more peace of mind because we can call for help if we need it. We use answering machines to coordinate our activities and sometimes hold complete conversations through voicemail. Wireless e-mail units change the way we allocate our time because they let us participate in the flow of messages in our office while we listen to an interesting speech somewhere else.

The technologies covered in this issue will have similar effects on our behavior. For example, they will help remove the barriers between online games and individual ones so that kids can choose whom they want to play with, not which technology they want to use (page 7); between online services and call centers so that electronic shopping is not as one-way as it now promises to be (page 9); and between personal computers and office telephones systems so we can make better use of all the information we collect and manage our communications more effectively (page 10).

Thank your DSPs

A key driver underneath the behavioral change is microprocessor technology. DSPs (digital signal processors) and CPUs (especially the RISC variety) are now cheap and fast enough to perform many tasks that used to require dedicated chips. That means, for example, that modems can be pure software: A DSP can be a modem at one moment and a speech-recognition engine the next. (Of course, not everything requires DSP power; that's one of VoiceView's strengths. Sometimes the inexpensive, low-tech option is more effective.) As a result, the low-level chip and add-in card markets are becoming more fluid -- more like software markets.

In this model, devices boil away to feature sets implemented in software that may be burned into firmware. The physical devices as we know them melt away, unless we choose to use their original incarnations. For example, a telephone can disappear into a PDA that can connect to a phone line and generate touch-tone sounds. The PDA already has a display, input mechanism and power supply; all you need to add is a headset, handset or speakerphone. Better yet, the phone's owner can use more of the phone's features because developers can make them more accessible with a PC or PDA's development tools and display.

As the feature sets commingle and share their host platform's infrastructure, they also converge. We no longer buy separate fax and data modems, we get fax/modems. Next year's modems may include VoiceView or VoiceSpan features -- or they may be on a floppy disk.

Now all the vendors with signal-processing building blocks are starting to cross into each other's markets. Sound add-in card vendors have their eyes

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on telephony. Call-processing vendors have built links to data servers and previewed multimedia and e-mail capabilities. Modem manufacturers have already made incursions into fax territory and want a piece of the voice market, too. Voicemail and PBX vendors have boosted their computing capabilities.

Amid this chaos, computer vendors try to set their strategies. They make decisions and tradeoffs, and try to affect market dynamics. Handling these dynamics will in large part dictate outcomes in this market. This turmoil is productive: Software developers have many new features at their disposal that should be broadly available. The small-scale but pervasive convergence it heralds may be more useful than the titanic convergences that make the daily news.

**AT&T'S VOICESPAN: A NEW EDGE FOR GAMING...AND MORE**

Normally, voice and data don't coexist on analog phone lines without expensive equipment to digitize and multiplex the signals, then regenerate them at the far end. VoiceSpan, a technology developed by AT&T Paradyne and AT&T Bell Labs, dramatically reduces that cost. Though it is currently embodied in a chip set, VoiceSpan is ultimately the intellectual property behind a set of software algorithms. A VoiceSpan-equipped modem turns a standard phone line into a very flexible pipe that can transmit voice, data and faxes -- simultaneously or in various combinations. You can have all the functionality of a 4.8 Kbps (kilobits per second) fax/modem plus an audio conversation, all over the same line.

The first VoiceSpan product from AT&T is the DataPort 2001 Multimedia Communicator, which AT&T Paradyne introduced in 1993 and now sells for $500. With a DSP from AT&T Microelectronics inside, the DataPort 2001 splits a phone line into a 4.8 Kbps data link, an audio channel with the same properties as a normal phone line, and a low-capacity signaling channel. The audio channel is not digitized; instead, the analog voice signal is added to the digital data signal, then reconstituted at the far end. VoiceSpan can allocate each channel dynamically and can set the channels up or tear them down in milliseconds (though initial synchronization takes about six seconds).²

**Pleasant presentations and handy helpers**

When you have voice and data on the same line, things that are otherwise difficult suddenly get easier. Take, for example, remote presentations. Typically, Phil sends his colleague Zoe a fax or FedEx package, waits until she gets it, then tries to guide her through his hard-copy presentation over the phone with no way to point to things or make sure she's looking where he thinks she is. (Meanwhile, he has changed his version and the page numbers no longer match.)

² If the DataPort 2001 detects silence or if your software needs to (for quick file transfers or other data-intensive tasks), it can burst data at closer to 14.4 Kbps.
With VoiceSpan-enabled software, Phil can show his presentation on Zoe’s monitor directly while they both talk -- and without a special (or second) communications link, with all the complexity that entails. He can use a cursor to point to items or perhaps run an application. (Of course, this is much easier if Phil and Zoe use the same kind of computer, but that’s another problem...er, opportunity.)

It might even pay for a company to supply its audience with VoiceSpan modems and software, much as Redgate Communications has armed analysts with satellite equipment to send them vendors’ broadcasts. Similarly, graphics designers can view and edit copy or art work in real time. If they agree on changes, they can make them on the spot; both parties sign off with a real copy of the document.

Online assistance will likely be transformed. A Microsoft product support specialist could ask a confused user, "I can check your autoexec file from here. Is that OK?" Or, with a remote-control program, the support person could take over execution of the PC, never losing the audio link. Tasks that require expensive gear, such as multi-site conferencing, are opportunities for service providers.

Third parties, including modem, phone and PC manufacturers, as well as silicon merchants and independent software developers, will launch VoiceSpan products in the second quarter of 1994. By the end of 1994, AT&T Microelectronics expects to have a one-chip, ROM-coded DSP implementation. Other AT&T divisions will announce products and services based on VoiceSpan, too.

Games on the forefront

But kids are likely to turn on to VoiceSpan before adults do, because this holiday season it will transform multi-player computer games with AT&T’s Edge 16 for Sega Genesis (see box, page 6). Over the past few years, on-screen pyrotechnics have progressed from 8-bit graphics through 16-bit to the 64-bit Jaguar from Atari. Animation has moved from 2-D to 3-D(0), and has begun to include simulated environments and require virtual-reality gear. Sega has introduced a game with a CD-ROM; others are following.

As graphics and animation have improved, so have communications. Games have evolved from single-player to several players in one spot (one machine, two joysticks) to multi-player data-only (point-to-point, as in Spectrum Holobyte’s Falcon, or multi-player, as in AT&T’s ImagiNation Network). The next frontier is multi-player, multi-mode, which means folding audio and perhaps video into multi-way data exchange. The trick is to make this work transparently, inexpensively and over today’s communications infrastructure, so anyone can participate from any standard phone simply by buying the kit at a store and plugging it in. (Contrast this with waiting for ISDN, or for cable tv operators to upgrade their networks to something better than video-on-demand.)

Transparency at last?

VoiceSpan’s easy switching between voice, data and voice/data makes for a smooth user experience. In a game setting it might go like this: Phil calls Zoe using his Edge 16-equipped Sega Genesis unit (with an on-screen soft keypad that autodials). She picks up any phone and hears Phil’s voice.

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PF. Magic + AT&T + Sega = Edge 16

John Scull, managing director of the multi-player game maker PF. Magic, was the president of Macromind from 1988 to 1990. (The identity of the "PF" is a closely kept company secret; the period is a flourish.) Prior to that he was at Apple for five years, including stints on the original Macintosh team and as a desktop-publishing evangelist. In 1992, Scull, PF. Magic's chief technical whiz Dave Feldman and other staffers wanted to make games that were extensible, so they started to design a system called the Edge that used memory cards and an optional modem. After a discussion with AT&T, which had been working on new business ideas with its ImagiNation Network (INN), the modem became central. The catalyst was the addition of VoiceSpan technology and the idea of Sega game machines connecting to the INN. PF. Magic's engineers created a specification for a stripped-down VoiceSpan device and presented it to Sega, which approved it.

AT&T will manufacture and sell the Edge 16, which is a pass-through device that plugs into the game (ROM cartridge) slot in Sega Genesis game machines. Existing ROM cartridges can plug into the Edge 16 unit, which smoothly adds remote-play and -audio capabilities to two-player games. (Edge 16 fools the games into thinking the remote player is using the second joystick.) Amazingly, Edge 16 offers a good user experience even for quick-response ("twitch") games. The games need slight modification, but don't have to be rewritten or rearchitected, though software writers will want to do that to take advantage of the new capabilities and sell upgrades.

There's more. Edge 16 has slots for two memory cards (called Edge Cards), which can record players' preferences, characters and game scores. The cards will sell for around $15. So Phil could go to Zoe's basement and bring his customized characters along. The cards also offer local storage to ROM-based games: The game maker could sell cards with game enhancements such as a new character or capability, or it could download them directly to existing cards. The Edge 16 unit also has a keyboard port. AT&T will sell an inexpensive keyboard, so kids can chat in text mode online. INN is writing a Sega version of its Yserbius dungeons-and-dragons game.

At the 1993 Winter Consumer Electronics Show, Tom Kalinskie, Sega's president, and Bob Kavner, AT&T multimedia group executive, demonstrated the Edge 16 unit. (Actually, shortly into the demo, Kavner's 7-year-old son seized the joystick and took Kalinskie on.) AT&T plans to sell it for $150. PF. Magic's design makes the low price possible by chucking everything that is unnecessary overboard.

Several other companies are developing games that use the Edge 16 card, including GameTek, the ImagiNation Network, Sega itself and US Gold. Others have announced their support of Edge 16, including Acclaim, Crystal Dynamics, EA Sports, Microprose, Spectrum Holobyte and the Software Toolworks.
He invites her to play. If she agrees, she can start her Edge 16-equipped
Genesis unit, and it will automatically start the game and synchronize with
Phil's machine. If something's not working, they can continue to talk on
the the audio channel and troubleshoot the problem together.

In principle, VoiceSpan works over an X.25 network, but without the real-
time voice capability. To solve that problem, AT&T Paradyne recently
 teamed with multisite data-conferencing vendor DataBeam and teleconferenc-
 ing-bridge vendor MultiLink to develop and market what they call multipoint
audiographic conferencing technology.

Alone, with friends or with new friends

With VoiceSpan, one game can offer a wide range of connectivity options
(that is, social choices). Kids can play alone, with a local friend, with a
nearby or distant friend point-to-point, or with distant friends or stran-
gers in an online service such as the ImagiNation Network (INN). Edge 16
makes the transitions seamless. This will be a relief for parents now
watching their children pay huge monthly fees for online services. In fact,
it may attract more parents since it is a more balanced and natural approach
than pure single-player games or online services -- and their fees.

Online services may well hesitate to offer such a service, since they will
see some game traffic go off-net. But they add value that is not available
elsewhere. (INN, for example, has an explicitly social structure: You
can't play many of its games by yourself or against a simulated opponent
You must invite someone to play, which makes you meet other participants.
In fact, often you have to wait in a queue to play, while the clock ticks.)

Phone companies should be both thrilled and terrified. On one hand, multi-
player games increase the flow of data on telephone circuits and open poten-
tial opportunities. Long-distance carriers will enjoy extra revenues. The
games also prevent traffic from going to the ever-threatening cable tv fran-
chises. On the other hand, it's not clear what those opportunities could be
and how carriers can capitalize on them. Worse still, most local-exchange
carriers offer unmetered local service and rely on traditional conversa-
tional habits. These patterns are likely to change to the carriers dis-
advantage if these games catch on. In the extreme case, this situation
could force carriers to install more circuits to accomodate more simulta-
neous users. It could also force the end of unmetered local service.

"I know this sounds crazy, but I think phone companies will
find that multi-player, voice-and-data game traffic is huge.
There'll be lots of three-hour game sessions, which, by the
way, may spell the end of unmetered local phone service."

-- Aaron Getz, Microsoft

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We first covered Radish Communications last year under the topic of personal data interchange (Release 1.0, 9-93). At the time, we described its principal asset, the VoiceView protocol, as a way to transmit bursts of data, such as a screenful of stock quotes or flight schedules, between terminals during an analog phone call. We suggested its use (among others) as a convenient way to send electronic calling cards between devices to announce the caller's presence to the called party, or to pass one person's address information to the other during the call.

**VoiceView vs. VoiceSpan**

VoiceView and VoiceSpan are complementary, with some overlap of functionality. Both come from hardware backgrounds but are licensing raw technology that could be manifest as pure software. Each protocol has traits that make it more suitable to certain applications: VoiceView is a switched (vs. simultaneous) protocol, so it is less expensive to implement and requires less power. It will fit on smaller platforms such as PDAs and personal communicators. An inexpensive adapter that taps into the line between the handset and desktop unit of an ordinary office phone allows VoiceView to work through most PBXes. AT&T's VoiceSpan does simultaneous voice and data, which opens new application areas.

Although the two protocols are not currently compatible, in a couple of months AT&T and Radish expect to announce some interoperability that will allow devices with one of the protocols to negotiate and use the most effective common capabilities with devices that have the other protocol. Both protocols are compatible with analog cellular technology, although they will have to be tuned.

(Another voice-related protocol is AT+V, a voice enhancement to the now-standard Hayes AT modem command set. AT+V is designed to turn a PC into a personal answering machine inexpensively. It digitizes and plays back voice signals, which is a different application from VoiceView and VoiceSpan.)

Since then, we've realized that VoiceView has more interesting and varied uses. For example, you can flip the original premise (data bursts during a phone call) around. Say you are online doing some electronic shopping and get impatient because there's something you'd like to know about the product you're inspecting that the text-and-graphics interface just can't answer. You click on a "help me, someone" button and presto, a human voice from a telemarketing center comes on the line. Or, perhaps, the marketing person

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3 We described a precursor protocol, Bellcore's Analog Display Services Interface (ADSI) in Release 1.0, 1-93. ADSI seemed to be a promising transit technology on the road to ISDN. Since then, however, companies that have evaluated ADSI found it to be underpowered and lop-sided. Sorry, we found ADSI before we had found and understood VoiceView.
could ask to help you unbidden, much as store clerks approach shoppers today and offer to help. (Of course, you'd offer the standard, "Just looking -- thanks!") Telemarketers are extremely interested in this application.

Beyond bursts of data in a voice call or vice versa, think of VoiceView as a ubiquitous, general-purpose, extensible protocol that can set up, change and tear down a variety of connections over ordinary phone lines. It's available whether you start with a phone call or a login script.

A registry with a view

Radish is well positioned to have VoiceView become the de facto registry of communication protocols over analog phone connections. If VoiceView is widely adopted, that means any two pieces of terminal equipment (e.g., phones, modems, faxes) will be able to use VoiceView to negotiate the most efficient use of the equipment at hand -- even if it means turning the session over to another company's technology, such as AT&T's VoiceSpan.

It works roughly like this: An application uses a call-control protocol such as Microsoft's Telephony API to dial the phone. VoiceView identifies itself to the remote terminal, negotiates how to use the bandwidth and offers a way to burst data efficiently. If the remote device speaks a specialized or more powerful protocol, VoiceView will hand the session off. VoiceView already includes a capabilities query and is extensible to encompass new official (open) and private protocols.

The market is primed for a product like VoiceView, and Radish has momentum: Microsoft recently gave VoiceView a strong endorsement, and Radish has closed licensing deals with most of the major modem vendors, for whom VoiceView is a low-cost, high-value feature (modem supporters include Hayes, Intel and US Robotics, among other suppliers at the circuit and board levels, such as Rockwell and Dialogic). That means that VoiceView, which is now available only in gear from Radish itself, will be manifest next as firmware built into popular vendors' modems and other communication devices arriving in the third quarter of 1994. Meanwhile, Microsoft's Telephony API crew is out evangelizing VoiceView in the industry; TAPI is part of the Windows Open Services Architecture.

Microsoft's talk is backed with action: VoiceView has become an integral part of the Microsoft at Work architecture, which will embed it in fax machines, telephones, copiers and other at-Work-enabled devices. Bill Gates himself is demoing VoiceView in his keynote speech at EMA 94.

Microsoft sees VoiceView as a capabilities-request mechanism that it can help make ubiquitous partly because it's so simple and low-key that others have ignored it, even within Microsoft. Karen Hargrove, general manager of Microsoft's digital office systems group, says, "The only reason we've been able to make this work everywhere is that nobody cared about it!"
As computer communications grow increasingly important and service providers upgrade their infrastructures, many people will upgrade or buy modems for the first time. When they do, many will get VoiceView at little incremental cost to the device manufacturer. And because VoiceView requires no changes to the phone-system infrastructure (as ISDN does), it is useful immediately.

Good dynamics

If Microsoft and Radish succeed, VoiceView should create opportunities for everyone (even PBXes!): PDA vendors can incorporate it in low-cost, low-power modems or as code in a DSP; PC vendors can use it to integrate telephony functions. Call centers can add VoiceView functionality driven by the links between their call distributors and data servers. Such links are typically too expensive for general offices now, so workers will probably have individual units. As such links become more common, PBX and voicemail vendors can incorporate VoiceView modules and spread the cost over multiple users. And, of course, VoiceView gives modem vendors new features to tout and buyers a reason to upgrade that dusty old 2400-baud unit.

Microsoft knows that with VoiceView propagated across many devices, the software industry will be able to write applications that facilitate cooperative work and better integrate computers and telephones. That's why TAPI will support VoiceView. Also, VoiceView-enabled WinPads will overcome some of the problems that have hamstrung early PDAs, because WinPads will be able to send and receive information easily and inexpensively, instead of forcing people to use inadequate interfaces for high-volume data entry. We hope all personal electronics devices support it.

Some parties have reason to be less than enthusiastic. Because it works completely outside the phone system (as opposed to Caller ID or ISDN), VoiceView by-passes the carriers. The carriers are also quite invested in ADSI (the Analog Display Services Interface), which was developed by Bellcore, the Baby Bell's common research arm. But alert carriers can offer services that make use of VoiceView on their platforms (your centrex voicemail could let you hit the asterisk key to autodial anyone who had left you a VoiceView business card). Carriers may also hope that VoiceView can sell people on the benefits of ISDN before ISDN service and devices are available -- though people might find that they are satisfied with extensions to the existing phone system. Whatever happens, VoiceView will coexist with and persist beyond ISDN.

APPLE'S GEOPORT: DETENTE BETWEEN PCS AND PBXES

Look behind a fully configured PC and you'll see an opportunity in the tangle of cables and profusion of different-sized ports -- or a headache, if you're a network manager. Install some communications software (or multimedia hardware and software) and the problem comes into sharper focus: different applications fight over the same port, the ports can't handle the device speeds (most PC serial ports max out at 9.6 Kbps), interrupt settings cause conflicts with other ports and processes and more. It's ugly.

It gets worse if you try to link telephones and computers in a large office, because most businesses have key systems or PBXes that require people to buy handsets from their particular PBX vendor. That's why many early computer-
telephone integration products have focused on the small-office, home-office market: They don’t have to mess with PBXes.4

There’s a big buzz these days about desktop videoconferencing and computer-based telephony, but how will they plug in? The serial port is too slow and is limited to one session; the parallel port is one-way; and SCSI (the Small Computer Systems Interface, used to connect external hard disks and other devices) is fast and getting faster, but it’s cumbersome and expensive.

If PCs are ever to become real platforms for communications, they need new ports and adapters. More specifically, they need a new high-speed port that can handle multiple simultaneous datastreams, including some that are time-sensitive such as live voice or video. Even Apple, with its reputation for clean engineering, needs new answers. The good news is that a new generation of ports is on the way. Here we focus on Apple’s solution: GeoPort, which started as Apple’s Telephony Interface.

Apple’s port strategy

The ports on Apple’s future desktop systems will include the current SCSI, Ethernet and Apple Desktop Bus (ADB). (The ADB, introduced on the Macintosh II and SE in 1987, is for low-speed peripherals such as keyboards and mice.) A new high-performance port, FireWire, is under development for storage, desktop publishing and high-end multimedia applications. (Apple developed FireWire and has sponsored it as a cross-platform IEEE standard for a high-performance serial bus.) The first FireWire chipsets are available now; the technology will be available for Power Macs later this year.

The old printer and modem serial ports are now GeoPorts, and are intended for medium-speed asynchronous and time-sensitive communication streams, including telephone control. Apple first shipped GeoPort in August 1993 with its Quadra AV (audio-visual) machines; every Power Macintosh has two.

GeoPort has two parts: the multipurpose 2 megabit-per-second5 port built into the host computer (or on an add-in card) and an external adapter module. The port, which provides power, can handle several dozen simultaneous, independent data streams (e.g., a control channel, an async data session and a real-time session). The adapter varies with the equipment used, which could include telephones, digital cameras, scanners, Newtons, fax/modems or videophones. One adapter can also be designed to support multiple devices.

Thinking outside the box

The same hardware adapter will work on all host machines that use GeoPort, which should save peripheral manufacturers money on development, inventory

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4 The extreme view is that PBXes pose more obstructions than solutions and that computer-telephone integration vendors will bypass them. To do so, they will move their functionality onto inexpensive, open PC platforms that can do telephony functions using standards such as MVIP (the Multi-Vendor Integration Protocol) and SCSA (the Signal Computing Systems Architecture).
5 The port speed is limited by the host computer, and can range from 2 Mbps to over 6 Mbps.

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and support. GeoPort is designed to be inexpensive and portable; it doesn’t need terminators, configuration IDs or bulky cables, as SCSI does. Although you can’t daisy-chain several GeoPort devices, as you can with SCSI, one adapter can perform multiple functions. GeoPort configures itself, using platform-dependent driver software that adapts to the capabilities of the local host computer and links data streams with local processes or devices automatically.

The principal advantage of an outboard adapter is that users or system administrators don’t have to open PCs and fiddle with their innards, which is risky and costly. Moreover, because it isolates PCs from telecom equipment, GeoPort simplifies product certification for export. It also makes it easier to sell PCs that perform telephone functions in parts of the world where the local PTT has a monopoly on telecom gear. These are significant advantages in a fast-moving business, where technology can be obsolete before it has been approved.

Great opportunity or last chance for PBXes?

For some time, the telephone-system and computer industries have wrestled with the problem of a cost-effective way to hook PBXes and their proprietary hybrid interfaces to computers and their messy ports and networks. Apple’s GeoPort model is a way for PBX vendors to make the most use of their proprietary protocols without having to publish them, much less open them up.

To play, a PBX vendor must develop and field a single GeoPort adapter that is signal-compatible with its gear, as well as driver software for multiple host platforms and PBX models. When users plug the adapter between their phone and computer, they can install applications that use telephony functions and get to work. Application developers write to each platform’s telephony APIs (e.g., Microsoft’s TAPI, Apple’s Telephone Manager and IBM’s Callpath). GeoPort delivers data discreetly from PBXes and other devices to those APIs and back.

GeoPort allows PBX vendors to move incrementally and economically (without a different model of connector for each model of computer in the market) -- as long as everyone adopts GeoPort. Even if PC and workstation vendors don’t incorporate GeoPort, third-party card vendors likely will, thus bringing GeoPort connectivity to all major bus architectures.

Unfortunately, PBX vendors are bent on defending old turf instead of staking out new ground. They should open up their interfaces, cooperate, and participate in changing the nature of the industry. If they don’t, they will be bypassed by those who do. Instead, PBX vendors are trying incremental approaches that more often frustrate developers and users than help them.

Tricky dynamics

Apple hopes that GeoPort will catalyze the computer-telephone integration market the way the ISA bus catalysed enhancements for PCs. (Of course, Apple doesn’t want to inflict ISA’s complexity on the market.) If few vendors adopt GeoPort, third parties will be just as confused by multiple standards as before, and developing applications that integrate computers and telephones will remain an obscure art form.
When Apple first approached other companies to use GeoPort, Apple R&D was under orders to turn a profit with each of its creations and to retain control over it. Companies rebuffed Apple’s initial pitch, which they felt was far too expensive and gave Apple too much control over the GeoPort standard. Now Apple has opened the architecture and sharply lowered the license fees it seeks. It has also enlisted neutral intermediaries such as Boston-based Aox to develop reference designs for the PC market.

With GeoPort, Apple has delivered a host serial interface solution that is inexpensive yet sophisticated, speedy and flexible yet compact enough to work on PDAs, and innovative yet compatible with current devices. Despite Apple’s rough start with it, there’s no comparable offering yet. The industry would do well to adopt it.

**EARPHONES -- A FLEA IN YOUR EAR**

Remember the EO? The phone-equipped EO looked comical because of the ungainly handset mounted across its top. How were you supposed to slip this thing in your briefcase, or even sling it under your arm and walk down the hall? The EO kit included an optional headset, but that too was hard to stow and use.

Imagine instead a headset that is nearly invisible: One so small and light you might forget you have it along. One that allows you to talk while riding a bicycle or walking comfortably in a park. One roughly the size of a single in-the-ear Sony Walkman earphone, but with two-way capabilities. Several such phones exist today, and they are about to change the way we think about communications. Such a unit may also help reduce fears about radiation, since users would no longer hold radio gear up to their heads.

**How and where we speak**

Not that everyone will suddenly drop conventional handsets and rush to in-the-ear models. Instead, earphones will offer consumers new and subtly liberating choices for how to communicate. Some people will stay with handsets out of habit, or because they like the device’s heft and the sense of intimacy it offers cradled beside the face. Many people already use speakerphones in a closed office or car, but not in public places or when someone else is in the room or car with them.

Headsets are popular only with die-hard callers. Many people find them uncomfortable or impractical to put on and take off; some feel self-conscious wearing them (and they do look funny!). In-the-ear headsets such as the ones we describe here are different, and we expect many people to adopt them, particularly the Walkman generation. The latest such headsets reduce ambient noise and pick up high-quality voice signals admirably. That makes them more useful for noisy environments and speech-recognition applications than the open microphones that now ship with some computers.

Application support will help, too, as will integration with mobile radio platforms, telephone services, speech-recognition systems -- and portable stereos. After all, why shouldn't you be listening to your favorite music one moment, and a phone call the next? The key, of course, is integration. In-the-ear headset phones should participate cleanly in all your audio activities and complement other audio gear as you desire.

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Stick these in your ear

Four companies offer small, in-the-ear headsets: Plantronics, Sony, Pan Communications and Jabra. Plantronics sells a unit called the Ear-Bud Headset. Andy Grove sported a customized version of this short-stem unit in Business Week as he demoed Intel's ProShare desktop-conferencing system. Sony sells a cellular phone in Japan with an earpiece headset. The phone is designed for the earpiece: It folds back into a compact unit with the keypad and display always visible. It is likely that Sony's new venture to manufacture CDMA cellular phones for the US market with Qualcomm will incorporate such an earpiece into new phones.

The latter two are small specialists with different approaches to the market. Pan Communications (PanComm) sells the Earset, a hardware device with high voice quality and noise/echo cancellation. Jabra (page 14) sees its EarPhone as an element of a software system, and emphasizes integration with its host platforms and their applications. Jabra's Earphone is bundled with Apple's AV computers; another version plugs into a few cellular phone models. It expects to field an indoor wireless unit in 1995.

PAN COMMUNICATIONS' EARSET

PanComm is a Tokyo-based venture founded by Masao Konomi in 1981 to develop a Walkman-type phone, a long-time dream of his. Until recently, Konomi worked with hand-built prototypes. Now he has contracted Ashida Sound, a headset manufacturer for leading US vendors, to make his Earset phone, which can function as a complete handset replacement. He expects to get the first engineering-sample Earset units from Ashida this month. Konomi, who claims that his Earset performs better than competitive models, is now actively courting desktop and cellular phone manufacturers and computer companies to incorporate the external-mike Earsets in their product plans.

Prototype Earsets for desktop telephones require a box roughly the size of two stacked decks of cards between the telephone and the earpiece. The box contains circuitry that is adjustable to different models of office telephone system. Production units will be smaller. Eventually, the external unit will be smaller than a matchbox, with a volume-control thumbwheel and a mute button.

Abiding auditory ambitions

Konomi has dual careers as an inventor and investment banker. (In fact, he has also invented a bone-conduction headset, which is described on the following page.) He began his career at Mitsubishi Electric designing weapons-control systems for jet fighters, then earned a Harvard MBA and joined Morgan Stanley in New York City as a corporate finance associate. He later became a vice president in its Tokyo office, where he stayed until 1981, when he formed the investment banking firm that goes by his name and focuses on investments into and out of Japan.

JABRA'S EARPHONE

Norris Communications invented what is now Jabra's EarPhone in 1983. But at Norris, an imaginative R&D outfit that does more R than D, the invention was stalled. Late in 1992, Randy Granovetter left Blyth Software, where she was
president, and joined Norris as senior vice president to develop a business strategy to introduce the EarPhone. With her background in speech and language development, she saw the technology’s promise and decided to build a business around it.

With Brean Murray Associates’ backing (Brean Murray is the chairman of Jabra), she bought the patents and intellectual property rights from Norris, and founded Jabra in January 1993. They were quickly swamped with attention from the media and prospective buyers.

PanComm’s bone-conduction Z-phone

Konomi has also created a unit that picks up the wearer’s voice by capturing vibrations inside the auditory canal, a method called bone conduction. Years ago he saw a bone-conduction microphone that fit inside the human ear, and decided to couple it with a small speaker device. The challenge was to achieve natural, two-way sound: to pick up the wearer’s voice, but keep the microphone from picking up the sounds coming from the in-ear speaker, as well as echoes and ambient noises. After several years’ effort, Konomi created such a unit, the Z-phone, which picks up the wearer’s speech (and not much else) from the vibrations of the auditory canal walls.

Picking up sounds inside the ear offers great insulation from ambient noise at the expense of some voice quality. It’s impressive: While testing the Earset, we were able to sit next to a tv turned full blast and hear and be heard clearly. To function properly, it must be seated well in the ear, so Konomi expects that it will be used by professionals in noisy environments.

They also encountered many technical hurdles: Echoes and ambient noise caused problems. Cellular phones were obvious candidates for EarPhones, but few had the right connectors; Jabra sold some units to that market. Configuring EarPhones for office use behind PBXes was difficult.

Apple’s new Quadra and Centris AV computers were natural platforms, but Apple was slow to create and deliver telephone software toolkits and Jabra’s engineers seemed to be one step ahead of the Apple engineers in integrating telephony with the PlainTalk speech-recognition system that comes with the AV machines. After much work, Jabra figured it out. Apple now bundles an EarPhone and Jabra Dialer, a 20-number speech-activated autodialer application, with its GeoPort telephony adapter.

Reset; think big

Faced with a compelling business opportunity but many obstacles, Jabra invested heavily in its own R&D. Its engineers scrapped their early prototypes and went back to the drawing board. Jabra set a goal to design a product line that would support a variety of connection options (including PDAs and wireless), identify host phone systems automatically, include useful software and integrate deeply with speech-recognition features and higher-level agent software.

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To meet those goals, the engineers wrote new echo- and noise-cancellation software, which Jabra wants to license to others. They designed a base unit with a DSP that will detect what kind of phone it is connected to and configure itself accordingly. They developed more comfortable earpieces after extensive human-factors study. Despite much press to the contrary (and not helped by Jabra's somewhat ambiguous product literature), all of its Ear-Phones have external, unidirectional microphones.

Jabra is also working on a software toolkit that will allow any application to dial through a GeoPort using AppleEvents, as well as on integration with cellular phones and PCMCIA modems. Jabra is developing a plug-in modular unit for use by PC developers, and expects to field such modules this fall that are compatible with Creative Labs' SoundBlaster card and others. Signal Resources in Edinburgh, Scotland, is developing a wireless indoor model for Jabra. ETE, a San Diego consultancy and integration house, is integrating Jabra's EarPhone in a docking station for Apple's and Sharp's Newton PDAs. The station, to be available later this year, will include fax/modem, cellular, mobile-data and global-positioning capabilities.

Some of these efforts should soon pay off. Jabra's new DSP-based EarPhones for PBXes are about to go into beta test; Granovetter expects them to hit the market this October for $300. The wireless unit uses spread-spectrum technology that will allow several hundred people to be using wireless Ear-Phones in same area without interference, but it is moderately expensive at a price estimated at between $350 and $450. Jabra is clearly aiming for high-need, high-margin applications. It perceives its value in the integration it brings with advanced user interfaces that rely on voice activation and intelligent agents.

Conventional telephone headsets have been around for a long time; nevertheless, this nascent corner of the industry is promising. So far, host platform vendors haven't built a place to plug in-the-ear phones in, much less the specifics of what kind of connector to use (RJ-11? Minijack?) or what signals it should support. As cellular networks go digital and new flavors of hybrid devices come out, manufacturers will be able to add such a connector inexpensively. If the earphone players can agree on connector standards, manufacturers will be able to design platforms to incorporate them all and everyone's market will grow.
RESOURCES & PHONE NUMBERS

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