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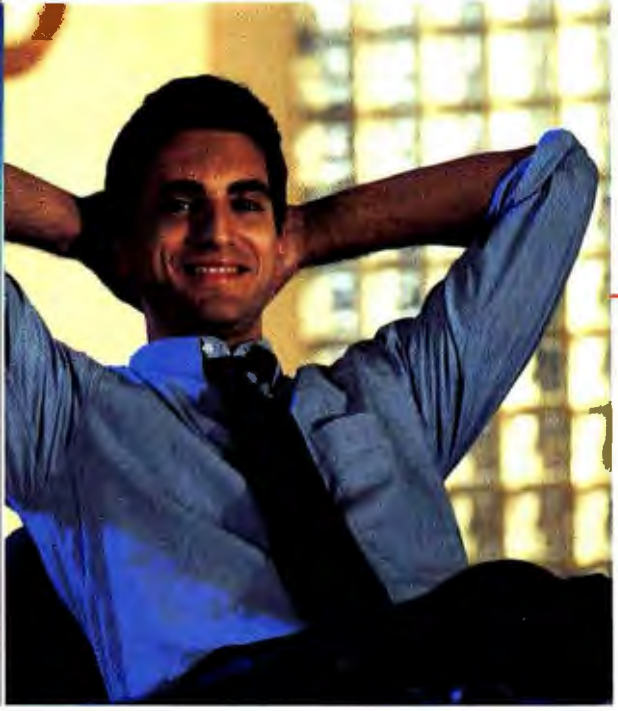

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COVER STORY

ACTIVEX DEMYSTIFIED

By David Chappell and David S. Linthicum

It's invasive. It's ubiquitous. But what, exactly, is ActiveX? Here's the truth about Microsoft's core technologies.

RESELLER

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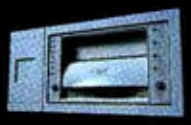

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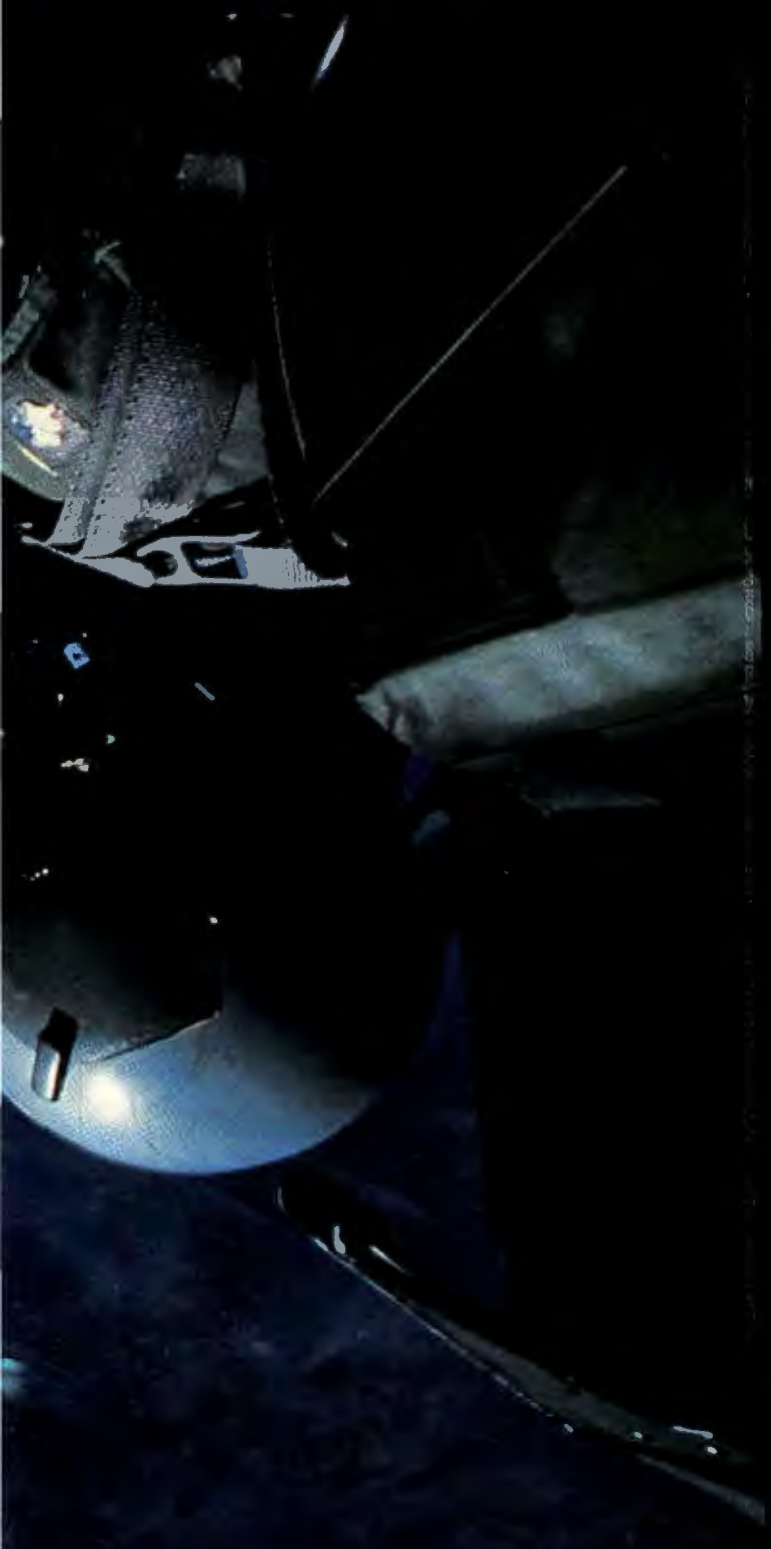

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editorial

The NetPC Blues

The PC architecture is just too cranky. And the technology touted to help—Zero Admin and a cheap computer with no floppy—is not much help at all.

I would have had this editorial written an hour ago, but my computer crashed. Honest. I was running Word, Ecco, cc:Mail, and Netscape when Word seized up. Persistent attempts to restart Windows 95 failed. I undocked my computer, unhooked it from the net, and now it works.

What really bums me out is that the very latest technology touted to solve such problems—a NetPC administered by Zero Administration Kit (ZAK) for Windows—would do absolutely nothing to prevent or remedy this situation, or the millions of events like it that occur every day on corporate networks. It might even have happened with a network computer; no one today can guarantee that network transmissions will succeed.

I didn't mess up my system running shareware, installing unauthorized software, or anything of the kind. I was running a configuration that's approved and stable 98 percent of the time—and inscrutably, catastrophically troublesome the rest of the time. This isn't a function of the apps I use, the computer I use, or what I do with the system. It's a function of an architecture that has grown too complex with too little self-management.

Right now, my PC is sick. When you have a cold, a box of tissues (ZAK or the NetPC) is nice. But it's no cure, and a cure is what I want. So I respond to this summer's "reduced cost of ownership" drum rolls out of Microsoft and Intel with a sniffle and a yawn.

First, the NetPC. Can we get past the trendy moniker and just admit it's a cheap computer with no floppy (or one that can be disabled by software)? Okay, it has a few cool things—LAN wake-up, remote boot—that will be available in most PCs in 1998. We've said many times during this whole cost-of-ownership controversy that one size does not, will not, and should not fit all, and this NetPC solution will fit only some needs. I'll even concede it's something of a step forward, but too small a step to fix the fundamental problems experienced by PC users and administrators daily.

The same can be said of Microsoft's ZAK. Much of it has been available as utilities from other vendors since Windows 3.1. Lacking those, you've long been able to turn off certain menu functions by editing .ini or registry files manually (scary thought). Thank you, Microsoft, for making a single tool to do that for multiple users. And the idea of policies and roles, ultimately tied to directory services, is spot on. But let's not mistake that for a solution to the underlying complexity of PC management.

Intel and Microsoft have created an environment that is wonderfully flexible and horribly cantankerous. Maybe that's the way it had to be, but it's too big a trade-off now. Instead of addressing the environment issues, Microsoft and Intel are essentially blaming the user for experiences like mine. Physician, heal thyself.

In 1992, Microsoft had a vision of an architecture that would address the ad hoc nature of its burgeoning environment and put it all on a solid, object-based footing. While the code name persists, Cairo has become a much more pragmatic and evolutionary (and still worthy) project. As far as ease of management, what remains of the original grand vision are some promising technology pieces that will begin to appear in Memphis and reach full fruition with NT 5.0: limited self-healing and self-updating capabilities for applications, the ability to store machine state on a server, intelligent local caching, and, finally, forbidding app vendors from installing OS components willy nilly. Good ideas all, and in many ways more generally applicable than the pure network computer. In any event, those technologies sure sound a lot more like what we need than ZAK does. Serious inroads into Windows admin costs will depend on their success.

Intel and Microsoft have created an environment that is wonderfully flexible and horribly cantankerous.

Gee, I've gotten to the end of this piece without another crash. Maybe it was just that quirky keyboard connector—I'll never know for sure. Certainly thousands of engineers at Microsoft and Intel can do something to find out besides making a computer dumber.

Mark Schlack

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GUI, NUI, and CUE

I agree that we're approaching a revolution in the design of the GUI ("Good-Bye, GUI—Hello, NUI," July). What it is and where it needs to go are being redefined, beyond the desktop metaphor. You used the term *network user interface*, or NUI, for the new interfaces that are emerging. I would say, however, that even the term *interface* needs to evolve. Think of the term *environment*. People construct environments all around them in the physical world. Why not carry it into the virtual world? The other term, *network*, seems more about the technology—the pipe—than about what's really occurring there, which is collaboration. The network is the next level of pipe that we can collaborate in.

I propose that a more appropriate term would be *collaborative user environment*, or CUE. The next step, of course, is defining the optimum for such an environment.

Rich Kilmer
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Chantilly, VA
rich@rokutech.com

I was pleased to see your article on NUIs. You cover commercial desktop ideas, which is appropriate, but I think your readers might also be interested in more advanced research ideas. You might want to look into our work on Elastic Windows, which support multiple window operations in a way that enables more effective screen management. For more information, check out http://www.cs.umd.edu/projects/hcil/Research/1996/elastic-windows.html. The text of several papers plus images are available there.

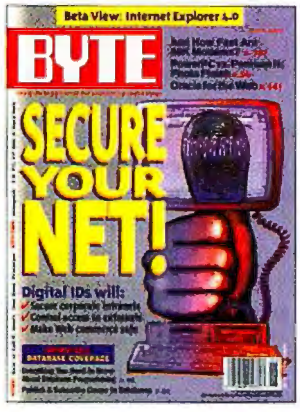
Ben Shneiderman
Human-Computer Interaction Laboratory
University of Maryland, College Park
ben@cs.umd.edu

Why Claudia Schiffer Doesn't Do Data Modeling

I always look forward to your magazine because I can learn a lot from the articles. So I was disappointed by J. L. Weldon's "A Career in Data Modeling" (June). The treatment of data modeling was shallow and facile. If data modeling is so simple, why do so many poor data models cause so much trouble for those companies trying to implement data warehouses? If data modeling is so simple, why do people's eyes glaze over during discussions of data models?

Data modeling is a complex and difficult process fraught with pitfalls. I've been doing data modeling for many years and think that Weldon has done the subject a grave disservice.

Rainer Schoenrank
Data Warehouse Practice
Coopers & Lybrand
San Francisco
rainer-schoenrank@worldnet.att.net



Slay by the Rules

"Play by the Rules" (June) was an excellent overview of business rules. I work with clients applying business rules to system specification and design, and I've found that this approach works for developing new systems as well as for addressing data-quality problems in data marts/warehouses.

Business rules will be next in the series of ideas of how to slay the software dragon. This idea will succeed because it can put business people in the driver's seat, shifting the focus away from technologists. Previous ideas, such as object orientation, didn't deliver changeable systems that met requirements. Just look at the Unified Modeling Language (UML) spec to see why.

Neville Haggerty
Compedia, Inc.
Portsmouth, NH

No Code, No Coin

After reading about the benefits of getting a digital ID and cybermoney ("Who Goes There?," June), I downloaded the CyberCash wallet. OK, I thought, now I'll go and spend some CyberCoins. First I had to load some coins into the wallet. Uh-oh! An error code back from the bank. The card was all right; there was plenty of credit still valid. So what was the problem? I found out that CyberCash accepts credit loads only from a credit card used by a U.S. resident or from a credit card issued by a U.S. bank. But 15 years ago I was able to use a U.K.-issued credit card to buy goods in the States with no problem.

The obstacle I encountered is typical of many commercial ventures with a Web

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presence: If you don't have a Zip Code, you don't exist. Wake up, U.S.A.!
Charles Smith
London

Don't Worry About the Government?

Re: Mark Schlack's editorial, "RIP: Anonymous User" (June): I've been working in the computer-security industry for about 13 years, and I, too, believe that the government needs to resist mandating additional requirements on Internet transactions. Privacy is something that most people in the industry are overlooking. More are concerned with integrity + availability = acceptable state. Having served in the military for 12 years and worked as a government contractor for seven years, I'm aware of the government's needs to view all traffic, or at least have the ability to do so. But I firmly believe that anonymity has its place in cyberspace.
Eric W. Ratliff Sr.
eratliff@kpmg.com

I enjoyed the editorial on personal liberties and anonymity on the Net. We need more people to speak up against government intrusion into every aspect of our daily lives.
Donald Johnson
akgoose@hotmail.com

56-Kbps Modem Problems

Although Robert L. Hummel's conclusions were sound, his "How Fast Is a 56-Kbps Modem?" (June) contained a number of problems and errors:

- "Informal" testing (to use the term in the article) over a single phone line is not a fair general test of 56K technology, because impairments vary widely on different phone lines, and even on different connections from the same phone line, even when that line passes the (imperfect) x2 LineTest. Many people are seeing consistently high speeds (typically in the high 40s); others are not able to make 56K connections at all. Furthermore, K56flex modems might have produced different results.
- x2 upload speeds are actually limited to 31.2 Kbps (not 33.6 Kbps) because the 3429 symbol rate is not used (currently, at least) on x2 connections.
- x2 modems do not "drop down to 33.3 Kbps and then renegotiate back up"; they directly speed-shift up or down (in small steps) from the initial connect speed as line conditions warrant, just as V.34 modems do.

John Navas
Publisher of the Navas 28800-56K Modem FAQ
http://www.aimnet.com/~jnavas/modem/faq.html

I disagree that my informal testing was unfair to 56K technology. U.S. Robotics' documentation clearly implies that if my phone line passes the USR LineTest diagnostic, which it did, it will support x2. I conducted supplemental tests at several locations to incorporate both long and short local loops, different telco central offices, and a variety of long-distance carriers. I also surveyed other x2 users, who reported generally mediocre performance. And, as the article states, K56flex modems were not yet available for testing.

Regarding x2's upload-speed limits, I was referring to the theoretical capability of the technology. The USR FAQ states that "x2 downloads (receives data) at up to 56 Kbps. It uploads (sends data) at up to 33.6 Kbps."

As for the issue of "dropping down," a USR product manager says we both make valid points: x2 servers initially *connect at 33.3 Kbps and then, within a couple of seconds, establish the "initial connect speed"; it's part of the protocol negotiation. x2 clients report only this second, usually higher, speed. There's no dropping down from the initial connect speed to 33.3 Kbps. But the negotiation* starts *at 33.3 Kbps.—Robert L. Hummel*

Creative Mapping Tricks

In July's Inbox, Satyam Bheemarasetti says that "most Windows programs must install some files under C:\WINDOWS. If this bottleneck is fixed, software installation (i.e., distribution) on Microsoft platforms can be as good as it is on Unix and truly capitalize on the Distributed File System (Dfs)."

With a few minor mapping tricks, we run Windows and Windows software on completely diskless computers. Our 160+ desktop PCs boot via boot PROMs to our Novell network. The user then types `Windows` after logging in. Windows runs just fine.

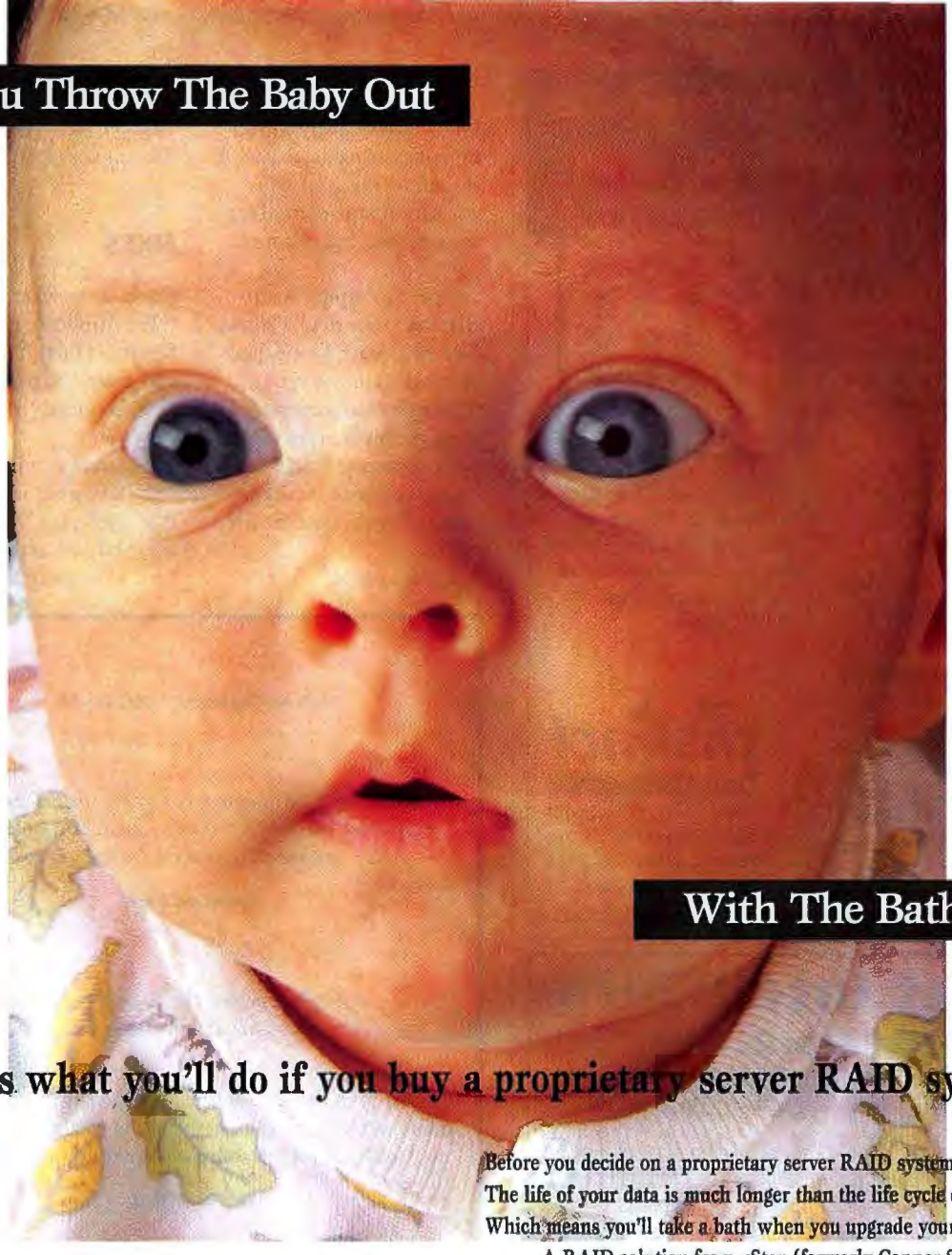
We have one group that holds new software-installation scripts. The user, upon seeing a new install icon, double-clicks on it: The program is installed into his or her user space on the network. Again, no hard, floppy, CD, or other type of drive is needed for this to work.

Our system has been running this way for over a year and is as bulletproof as you can make Windows 3.11. Users can even customize their screen colors, backgrounds, and so forth, just as if Windows were running on a local disk. The funny thing is that, with 10Base-T on a PCI 3Com card, Windows loads faster than it does from my IDE hard drive! Overall performance for memory hogs like WordPerfect is slightly slower, but this is almost undetectable.
Todd Crenshaw
Computer systems management analyst, State of Nevada
todd@innorth.reno.nv.us

Help for the Year 2000

Nice article on the year-2000 problem ("Double Zero," July). I'll share with you some notes on how I handle the problem in my own commercial programs:

1. Pivot points for interpreting two-digit years: I put in a floating pivot point, which is (ThisYear – 50), so the date is interpreted as being within +/– 50 years of the current year. For many applications, this is a permanently workable way to allow the input of a two-digit year.
2. Internal representation: I had originally defined a date structure allowing a byte for the day, a byte for the month, a byte for the year, and a wasted byte. By redefining the year byte and the wasted byte as a signed integer that is an offset from



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Business Editor's Choice

Circle 161 on Inquiry Card (RESELLERS: 162).

1900, I avoided any conversion of existing databases. A variant on this trick will work for many internal representations, but of course not for all.

3. Operator input: In a 10-character date field, I allow date entry with a four-digit year (taken literally) or a two-digit year (interpreted using the pivot point). In an eight-character field, I always require a two-digit year and always use the pivot point.

Joseph Mansfield
TennSoft, Inc.
Chattanooga, TN

FIXES

Contrary to what was said in "Web Applications at Your Service" (July), Lotus Domino Server 4.5a provides POP3 services.

The system pictured in "MMX Power for Desktop PCs" (July) is a Dell Dimension and not, as the caption says, a Gateway 2000 P5-200.

COMING UP IN OCTOBER

BUILDING NETWORK APPLICATIONS

Five Problems You Can Solve with Java Today

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MANAGING DATA

Object-Relational vs. Object-Oriented Databases

A skeptic's view of object-oriented and object-relational databases.

Embedded Systems

Thanks to embedded intelligence, hardware components can now tell you when something's about to go wrong. We look into the brains inside this new technology.

SPECIAL REPORT

Extending the Enterprise: Bandwidth

We look at the technologies, the products, and the implementation strategies that will give you faster LANs, faster WANs, and faster remote access.

High-Bandwidth Modems

This blockbuster roundup of leading-edge modem technologies tests the performance of 56K, ISDN, and ADSL modems.

REVIEWS

300-MHz Power Macs

PowerPC Macs are revving up. BYTE looks at three of the first systems based on the Motorola 603e chip.

Thin Servers

We test the early entries in the emerging category of thin servers designed to speed the performance of thin clients and network computers.

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November 19, 1996
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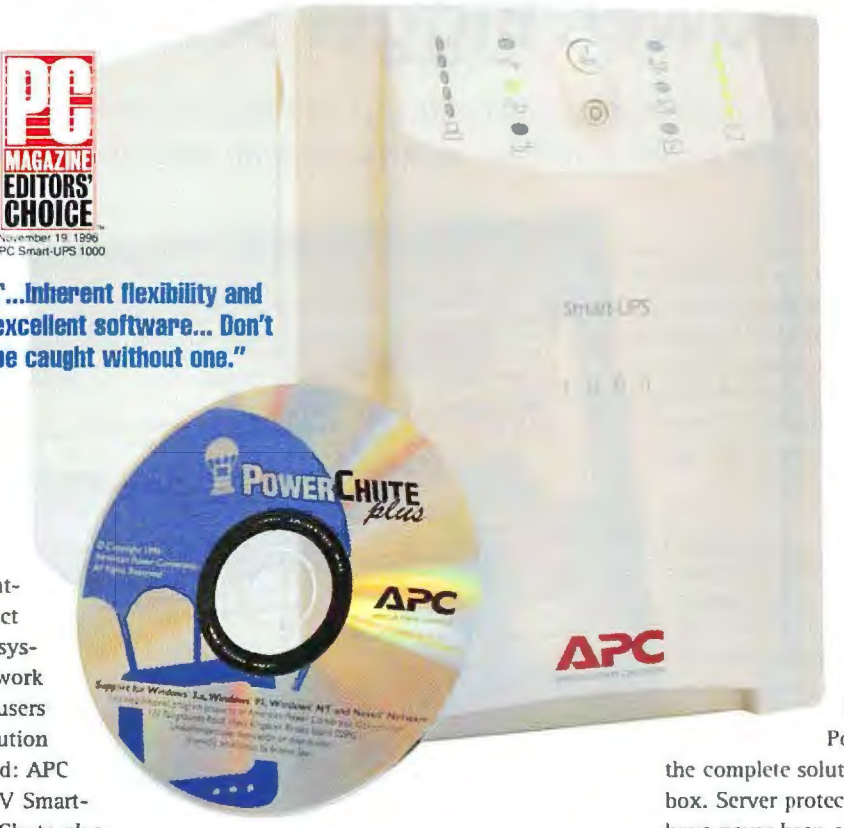

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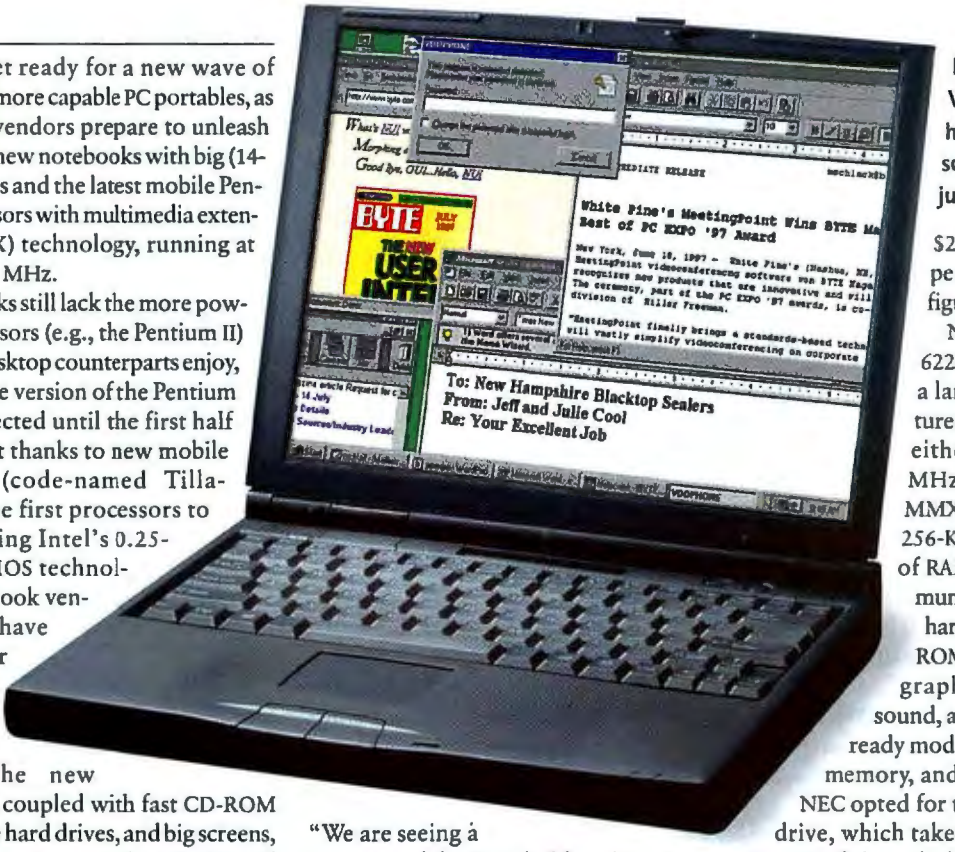
More Power, Bigger Screens to Go

Thanks to bigger screens and 200- and 233-MHz Pentium processors, the newest notebooks are better desktop replacements.



Hitachi's $4999 VisionBook Elite has a 13.3-inch screen and weighs just over 5 pounds.

Get ready for a new wave of more capable PC portables, as vendors prepare to unleash new notebooks with big (14-inch) screens and the latest mobile Pentium processors with multimedia extensions (MMX) technology, running at 200 and 233 MHz.

Notebooks still lack the more powerful processors (e.g., the Pentium II) that their desktop counterparts enjoy, and a mobile version of the Pentium II isn't expected until the first half of 1998. But thanks to new mobile Pentiums (code-named Tillamook)—the first processors to be built using Intel's 0.25-micron CMOS technology—notebook vendors don't have to settle for 166-MHz mobile Pentium power. The new processors, coupled with fast CD-ROM drives, huge hard drives, and big screens, mean that the next crop of notebooks will be even better suited as full desktop replacements.

Vendors are backing these systems in almost all cases with screens that support 1024- by 768-pixel resolution, 32 MB or more of RAM, 3-GB or more hard drives, and, in many cases, a 20×CD-ROM drive. Multimedia capabilities are greatly enhanced, with an emphasis on quality sound, full-motion video, and 3-D graphics support. In fact, as notebook designs mature, it may get harder for vendors to differentiate their products.

"It is getting harder and harder for companies to come up with bust-out, whizbang features," says Bruce Stephen, an analyst with IDC (Framingham, MA). "We are seeing a lot more of the 'cup-holder phase,' where people make small design changes to try and differentiate themselves."

One point of differentiation will be in screens. IBM and Digital Equipment are rumored to be preparing new ThinkPads and HiNote notebooks with 14-inch screens, but both companies declined to comment on unannounced products. Unless they use radical new materials to hold the display, a new notebook format—one that's about an inch wider than current notebooks—will be required.

AST's Ascentia M series will offer up to a 233-MHz Pentium with MMX. Also, AST will pack in a 20×CD-ROM drive, up to a 4-GB hard drive, a 13.3-inch display, and a 56-Kbps modem. Prices will range from $2499 to $5499 depending on the configuration.

NEC's new Versa 6220 series will show a largely similar features list. NEC will use either a 200- or 233-MHz Pentium with MMX processor with a 256-KB L2 cache, 32 MB of RAM (128 MB maximum), a 3.2- or 5.2-GB hard drive, a 20×CD-ROM drive, 3-D stereo graphics with 16-bit sound, a 56-Kbps cellular-ready modem, 2 MB of video memory, and video out ports. NEC opted for the LS-120 floppy drive, which takes either standard 1.44-MB disks or the high-capacity 120-MB LS-120 disks. Prices for the Versa 6220, which ships in October, will be $5199 to $5999. You can expect roughly comparable offerings and prices from the remainder of the established companies as well as newer players such as Hitachi, Fujitsu, and Sony.

In addition to their faster clock speeds, Intel's newest mobile Pentiums consume less power: less than 5 W compared to 7.7 W for the 166-MHz chip. But the potential savings on battery consumption will probably be eaten by bigger screens and faster drives. In fact, many users may opt for notebooks with the smaller 13.3-inch active-matrix thin-film transistor (TFT) screens because they will be less

expensive and consume less battery power. But the good news is that users who want maximum screen real estate should soon have their wishes granted.

On the other side of the spectrum, Toshiba's Libretto has shown there is interest in a return to the subnotebook size or ultraportable, as it is sometimes called. NEC and IBM may join Toshiba in manufacturing these tiny machines.

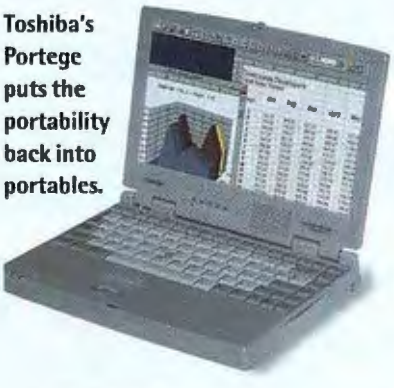
The new ultraportables may be either souped-up versions of Windows CE devices (slightly larger than the current models and with better keyboards) or Libretto-style—smaller notebooks with small screens but running Windows 95. We may even see a new class emerge this year: ultrathin (about 0.7-inch thick) notebooks that use the Tillamook and new battery technologies such as lithium polymer.

The ultimate winners may be those who are interested in machines that don't push either extreme. At the $2500 price point, users will find the so-called value lines with a good mix of equipment and often all-in-one (floppy and CD-ROM drives available simultaneously) styling.

–Jon Pepper

MeetingPoint Wins at PC Expo

White Pine's MeetingPoint videoconferencing software won BYTE's Best of Show award at PC Expo. The award recognizes products that are innovative and will have an impact on information technology.



Toshiba's Portege puts the portability back into portables.

MeetingPoint finally brings standards-based H.323 technology to videoconferencing servers, which will vastly simplify videoconferencing deployment in corporate intranets and through Internet service providers. MeetingPoint also won in the Web/Internet products category.

Other Web/Internet finalists were Interworks Systems' PipeLive, software that offers support agents and customers the ability to interact live, person-to-person, over the Internet, and Lotus's Instant Teamroom, which lets workgroups quickly establish a private workspace outside a corporate firewall on the Web.

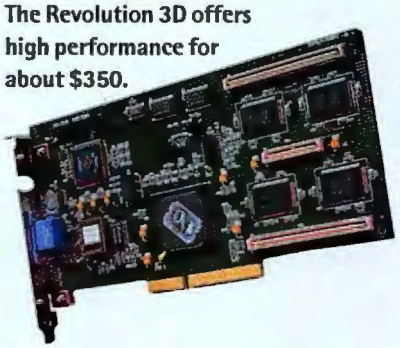
Chili Soft's Chili ASP, which allows ActiveServer applications to run on Web servers other than Microsoft Internet Information Server (IIS), won as Best Development Software. Finalist was Micro Focus's SoftFactory/2000, a year 2000 tool set and methodology.

The winner of Best Applications and Utilities Software was Etak's SkyMap, a complete GPS-guided (Global Positioning System) map and satellite navigation system designed for IBM-compatible hand-held and laptop PCs. The finalists were Visio Maps, a desktop mapping program for Windows 95, and MetaCreations' Kai's Photo Soap, a photo-manipulation program for Windows 95.

Toshiba's 3.8-pound Portege 300CT (starts at $3499) features a 133-MHz Pentium chip and a panoramic 10.4-inch screen. Finalists were Gateway 2000's Solo 9100, a high-end 8.5-pound notebook packed with just about everything you need at prices starting at $4200, and Hitachi's VisionBook Elite, a notebook that has a good balance of power and portability. The Elite costs about $4999, has a 13.3-inch screen, and weighs 5.15 pounds.

The Systems winner was DeskStation Technology's Ruffian RPX Workstation/Server (starts at $5995), an Alpha-based system that incorporates some of the hottest technology available, including a 600-MHz Alpha 21164 processor. Acer's AcerPower Graphics Workstation Series, a power-packed Pentium II system, and Unisys's Aquanta XR/6 Server, which extends Windows NT to as many as 10 processors, were finalists. *continued*

The Revolution 3D offers high performance for about $350.



Geek Mystique

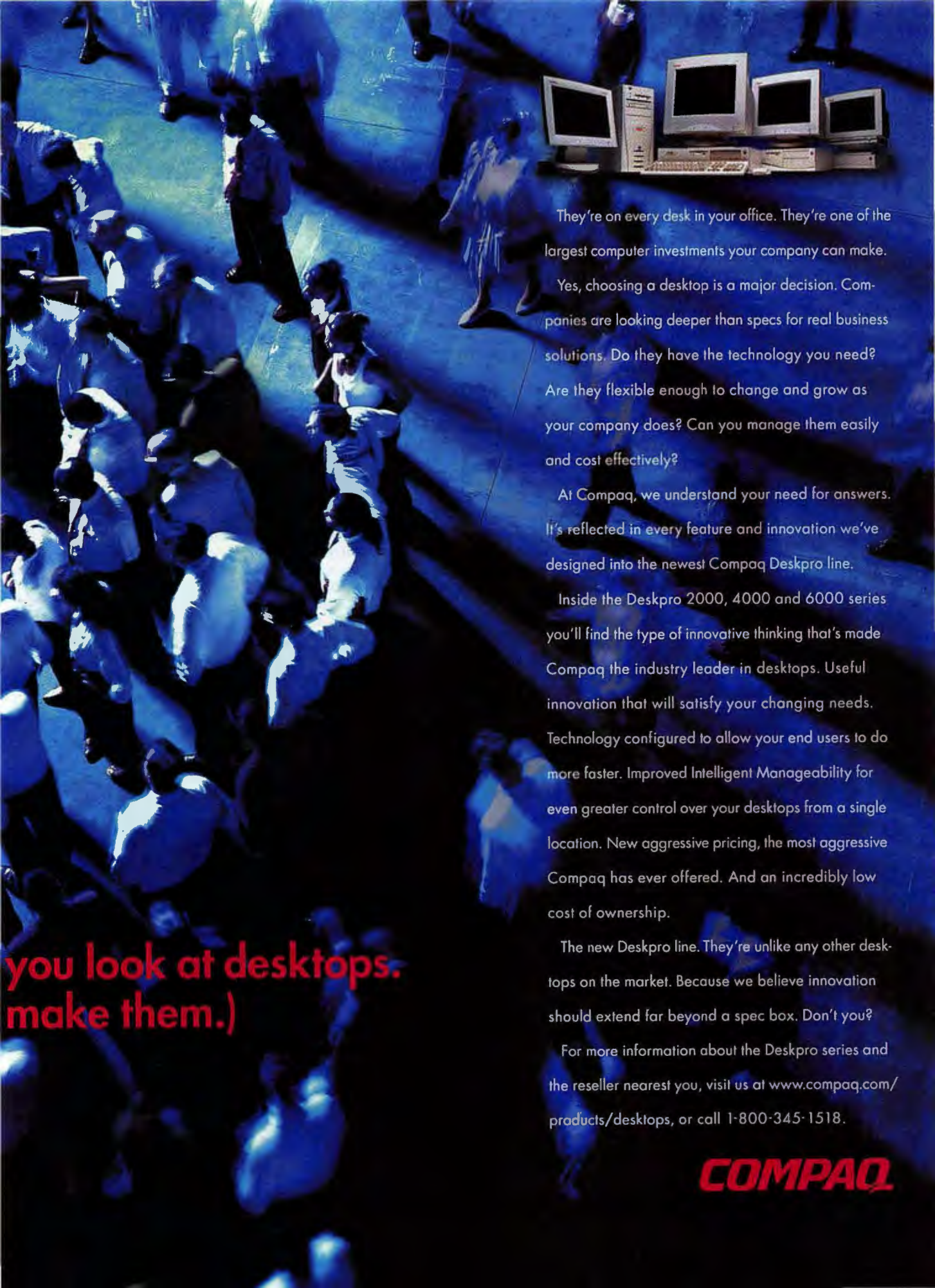
Coming: Info Tech Labor Shortage

Good news, bad news. A recent report from the Meta Group (Stamford, CT), the information-technology (IT) research and analysis firm, says salaries for U.S. IT workers are rising faster than those for workers in other fields, but it forecasts a labor shortage of skilled information workers.

The problem is that increased demands for new information systems and new Internet and electronic-commerce applications are coming at the same time that companies are racing to find and fix all their potential year 2000 problems. Companies can satisfy some of these needs through outsourcing, but many IT departments will still be stretched thin. The Meta Group advises organizations to combat any overcommitments with strict project prioritization, triage, and selective outsourcing.

The good news is that IT salaries are rising at an annual increase of 20 percent, compared to 4 percent in other fields. And the job-growth rate for IT is accelerating: 1987 to 1994 at 9.6 percent per year, 1994 to 1995 at 11.7 percent per year, and 1995 to 1996 at 13.8 percent per year. The Meta Group estimates that about 200,000 jobs in the IT field are not filled.

Contents



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COMPAQ

Number Nine Visual Technology's Revolution 3D graphics accelerator ($349) won as Best Multimedia Hardware for its groundbreaking combination of no-compromise performance and affordability. Finalist was Elms Systems' Digital Versatile Library and Panorama, which offers on-line digital videodisc (DVD) storage and provides a solution for video-on-demand applications.

Best Peripheral was NEC Technologies' MultiSync LCD2000, a 20.1-inch flat-panel monitor with a world-class image display. Finalists were Mitsubishi's DJ-1000 digital camera, which features a slim body and a compact flash-memory card, and Sony's CPJ-D500 LCD Data Projector, a laptop-size portable unit.

Best Printer was Epson's Stylus Color 3000, which lets professional graphic artists and digital photographers produce color proofs and presentations for less than $2000. Finalists were Xerox's Document Centre Series, a family of copiers that you can upgrade for networked printing, scanning, and faxing, and Xerox's DocuPrint C55 Color Laser Printer, a low-cost, full-featured desktop printer for about $3500.

Multimedia Software winner was MetaCreations' Ray Dream Studio 5, a 3-D design-and-animation tool. Multimedia Software finalists were Info Value Computing's QuickVideo Suite, a complete software platform to video-enable the corporate network, and Noise Cancellation Technologies' ClearSpeech PC/COM software, which reduces noise and echo in PC-based applications.

Best Connectivity Solution went to RightFax's Enterprise 5.0, a distributed fax solution that harnesses the Internet and intranet to save long-distance phone charges. Finalists were TenFour's TFS Gateway release 3, which provides security and connectivity to e-mail administrators and users, and River Run Software's Mail on the Run, a provider of

Best of PC Expo Contact Information

Best of Show: White Pine (603-886-9050; http://www.wpine.com).

Best Web/Internet Product: White Pine. *Finalists:* Interworks Systems (914-993-0900; http://www.iworksys.com); Lotus (617-577-8500; http://www.lotus.com).

Best Development Software: Chili Soft (717-290-8346; http://www.versicom.com/chilisoft). *Finalist:* Micro Focus (415-856-4161; http://www.microfocus.com).

Best Application or Utility: Etak (415-328-3825; http://www.etak.com). *Finalists:* Visio (800-248-4746; http://www.visio.com/solutions/maps); MetaCreations (805-566-6200; http://www.metatools.com).

Best Portable: Toshiba (800-457-7777; http://www.computers.toshiba.com). *Finalists:* Gateway 2000 (800-846-2000; http://www.gw2k.com); Hitachi (800-448-2244; http://www.hitachipc.com).

Best System: DeskStation Technology (913-599-1900; http://www.deskstation.com). *Finalists:* Acer (800-551-2237; http://www.acer.com/aac/); Unisys (408-434-2700; http://www.unisys.com).

Best Multimedia Hardware: Number Nine Visual Technology (617-674-0009; http://www.nine.com). Finalist: Elms Systems (714-461-3200; http://www.elms.com).

Best Peripheral: NEC Technologies (800-632-4636; http://www.nec.com). *Finalists:* Mitsubishi (714-220-2500; http://www.mitsubishi-display.com); Sony (800-352-7669; http://www.sony.com/technology).

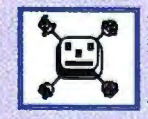
Best Printer: Epson (800-463-7766; http://www.epson.com). *Finalist:* Xerox (800-349-3769; http://www.xerox.networkprinters.com).

Multimedia Software: MetaCreations (800-297-2665; http://www.metacreations.com). *Finalists:* Info Value Computing (914-328-1359; http://www.infovalue.com); Noise Cancellation Technologies (203-961-0500; http://www.nct-active.com).

Best Connectivity Solutions: RightFax (520-320-7000; http://www.rightfax.com. *Finalists:* TenFour (703-716-8364; http://www.tenfour.com); River Run Software (http://www.riverrun.com).

Future Watch

Better Way for Devices to Share Info



Hewlett-Packard is promoting a new communications protocol called JetSend, which will let two devices directly negotiate—without user intervention—the best way to share data. The goal is to enable a new generation of devices that are easier to use and automatically generate the highest-quality output possible, given the capabilities of two or more devices.

When two JetSend-enabled devices communicate, they will not need an intermediary, such as a network server, device driver, or even two people, to translate and process the information exchange. Each device can communicate its capabilities to other devices regarding the range of options it supports. The sending device initiates a conversation and informs the receiver of its capabilities (e.g., resolution or color). A negotiation takes place, and data is output in the format that is most appropriate.

With JetSend, each device, or information appliance, is embedded with device firmware or software that contains information about how it works. The JetSend approach doesn't require a device that wants to share data with peripherals to have a different software driver for each peripheral it talks to, which is one reason why HP thinks JetSend is a good fit for future Internet-connected appliances that need to share data with a wide range of other devices. At press time, HP was discussing with Microsoft putting JetSend in a future version of Windows. HP says its first JetSend-enabled products will likely ship within a year.

HP says it wants to make JetSend openly available to the industry. It has released the specification at http://www.jetsend.hp.com to allow companies to build their own JetSend devices. Or, companies can buy a kit from HP for a onetime cost of about $15,000. –Dave Andrews

access to e-mail for mobile Windows CE users.

Developers Like DHTML, but Many Wait

New-and-improved versions of HTML promise more dynamic Web sites without requiring expertise in writing Java applets or ActiveX controls, but incompatibilities are causing developers to wait for a uniform standard. Both Netscape and Microsoft call the improved versions Dynamic HTML (DHTML). But despite sharing the same name, the two implementations differ substantially.

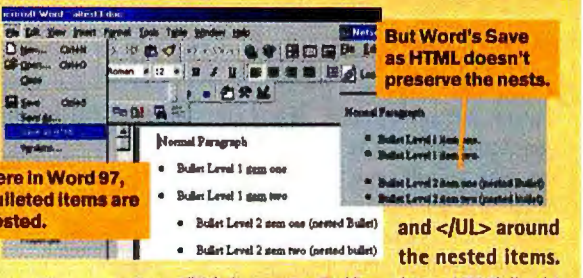
DHTML represents the combination of HTML, cascading style sheets (CSS), and scripting languages. How do the three differ? Basically, HTML specifies elements such as a heading or a paragraph. CSS gives content authors precise control over the presentation of that element. DHTML, through the Document Object Model (DOM), provides a model and API to let an author manipulate the HTML and CSS.

Netscape supports DHTML in Communicator 4.01, which is available for the Mac, Windows, and Unix. Microsoft's support will arrive with the imminent release of Internet Explorer 4.0, but Unix support will follow Windows and Mac support by about 180 days. For more information on the differences between the two DHTMLs, see the table below.

Lauren Wood, chair of the World Wide

Bug of the Month

Empty Nest



Two Webmasters wrote to us to complain that Word 97 destroys nested bullets when you use the Save as HTML option. BYTE reproduced the problem. In the first screen, you can see the nested bullets in Word. The second screen shows the same bullets (without the nesting) after being saved in HTML format using Word 97's Save as HTML.

Apparently, Word forgot to insert a <UL> and </UL> around the nested items. "This is easy to fix if you know HTML," said one Webmaster, who wished to remain anonymous. "But we were hoping to use this feature throughout our company, and I don't have time to proofread everyone's bullets all the time."

Send yours to jkrause@mgh.com!

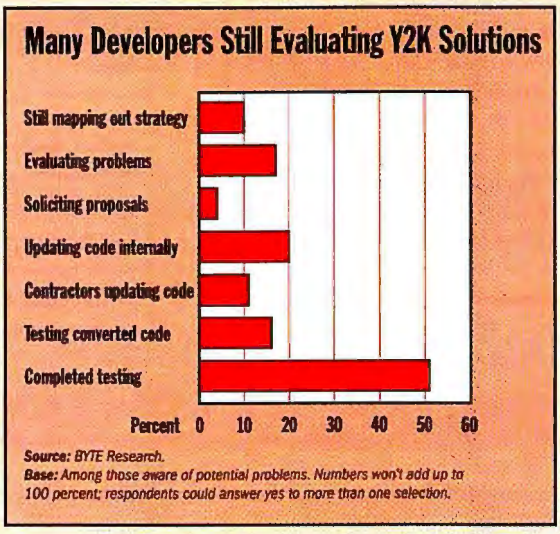
Dynamic HTML Comparisons

Features	Netscape Communicator 4.01	Microsoft Internet Explorer 4.0 Preview
Cascading style sheets (CSS) Level 1 recommendations (CSS gives authors control over document style [e.g., which fonts and colors to use]).	• Can change style with an on-load event. Netscape's implementation allows style changes only as a page loads.	• Can change style during and after an on-load event. Microsoft's approach permits dynamic styles during and after the loading of a page.
CSS positioning (lets authors code drag-and-drop behavior for objects on a page and enables object movement in 3-D).	• Positions HTML elements with CSS. • Also enables positioning through Layers tag.	• Positions HTML elements with CSS.
Document Object Model (a DOM interface lets programs or scripts dynamically access and update a document's content, structure, and style).	• Permitted for a subset of HTML tags and attributes accessible through Netscape JavaScript object model.	• Permitted for all HTML tags and attributes—even characters associated with tags.
Language support (scripts, in any language, manipulate object properties and methods to produce dynamic content in response to user-generated events).	• DOM accessible by European Computer Manufacturers Association (ECMA) standard JavaScript only.	• DOM accessible by ECMA JavaScript and VBScript.
Event bubbling (can reduce code length when you need to manipulate many objects the same way [e.g., drag and drop multiple items]).	• No event bubbling.	• Event bubbling supported.
Data binding (enables faster data-based Web experiences by reducing the need to refresh data from a server).	• No implementation.	• Cache server-based data locally. • Sort and filter data without server. • Supports ODBC, JDBC, and comma-delimited data.

Survey

Many Companies Just Starting to Address Y2K Problem

If you haven't yet completed testing on your year 2000 revisions, you're not alone. A recent survey of 150 BYTE readers conducted by BYTE's research department indicates that just over half of the survey respondents have completed testing their revisions that solve the notorious year 2000 problem. Over 30 percent are still either evaluating possible problems or a strategy or soliciting proposals from consultants on how to fix their problems.



Web Consortium's DOM working group, says preliminary specifications for key elements of the W3C's DOM, a standard for how programs and scripts will dynamically access and update documents, will be available in August. Those elements include functionality for document navigation and manipulation, and possibly style manipulation. However, Wood estimates that the W3C won't issue its final recommendation until sometime in 1998.

"DHTML will permit Web-site development with richer multimedia effects and more interactivity," says Sal Arora, technical products manager at NetObjects. NetObjects markets Fusion, a Web development tool for those who want to spend more time developing content than writing HTML. NetObjects says it is working with Netscape and Microsoft DHTML versions.

However, others are waiting. Ed Foreman, marketing manager at Elemental Software, which markets the Drumbeat dynamic Web-site authoring program, says he is "taking a wait-and-see stance on DHTML" and is recommending the same for his clients. Like many bleeding-edge technologies, DHTML offers significant innovation. Developers who can't resist the call of the wild may find it best suited for small intranets or extranets, where it is possible to mandate the use of a single browser type. Others may want to gain experience with DHTML by experimenting with one version or the other in anticipation of the release of the final specification. **–Rick Dobson**

Mini Displays Get Sharper Focus

New display technologies that feature very high pixel densities in miniature packages enable high-quality displays for portable devices of the future. A variety of products, including hand-held personal-information devices, fax/e-mail viewers, digital cameras, and personal digital videodisc (DVD) players, could soon use these new displays, which all measure less than 0.5-inch diagonal.

Miniature displays are not new. Most of them today are fabricated using polysilicon processing, which offers better-quality images than the amorphous silicon used in most direct-view LCDs that you see today in notebooks. The polysilicon process can produce pixel densities of about 600 dots per inch. For example, Sony already offers a 1.3-inch VGA monochrome display and by this fall is expected to introduce a 1.8-inch XGA monochrome display, primarily for use in projection products. Sony and Seiko Epson offer smaller-size displays, too, such as 0.7- or 0.55-inch diagonal for camcorders or virtual-reality goggles, but the current technology delivers image quality that isn't especially sharp at this resolution and size.

However, the new display technologies, just now maturing, could dramatically change the miniature-display landscape. These devices significantly advance pixel density, in some cases up to 2500 dpi. Consequently, they are being considered for dozens of new applications. Almost all these new displays will be used for virtual displays: displays that are viewed within a few inches of the eye. Virtual displays can be hand-held, head-mounted,

New Mini Displays at a Glance

Company	Pixels/color	Diagonal size (inches)	Type	Delivery
Siliscape 415-424-3900; http://www.siliscape.com	800×600/color	0.36	Polymer-dispersed	Sampling LCD on silicon now
Kopin 508-824-6696; http://www.kopin.com	320×240/amber	0.24	Twisted-nematic LCD on glass with lift-off silicon electronics	Sampling now
DisplayTech 303-772-2191; http://www.displaytech.com	640×480/color	0.40	Ferroelectric LCD on silicon	Sampling now
Planar 503-690-6967; http://www.planar.com	640×480/yellow	0.76	Active-matrix electroluminescent display on silicon	Sampling now

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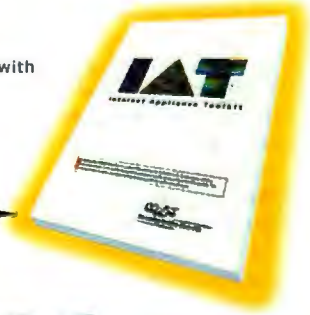

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Circle 139 on Inquiry Card.

or body-worn. Although they are tiny, magnification optics produce a high-resolution virtual image that is similar to viewing a desktop monitor.

Kopin Corp. (Taunton, MA) recently introduced a quarter-inch VGA, monochrome LCD that is just 0.24 inch diagonal. The CyberDisplay has an impressive 1700-dpi pitch, and the company plans to improve that to 2500 dpi by the end of the year. In Kopin's approach, electronics are fabricated on silicon, transferred to glass, and assembled using traditional crystal materials.

Haviland Wright, CEO of DisplayTech (Longmont, CO), says personal-information devices will have to be VGA resolution or better, because this will reduce the amount of scrolling people have to do when viewing information in a virtual display. "People don't want to scroll through information," says Wright. DisplayTech is now sampling a VGA-resolution display that has about 2000 dpi.

Siliscape (Palo Alto, CA), a Silicon Valley start-up, will soon begin sampling its new miniature display. The SVGA device will feature a 2500-dpi resolution and is packaged with a compound optical system that measures only 1.18 by 1.56 by 0.43 inches. "We have no problem showing 10-point test on our displays," boasts Alfred Hildebrand, the president and CEO of Siliscape.

Both Siliscape and DisplayTech produce color images using field-sequential techniques. With this method, red, green, and blue LEDs are used to sequentially illuminate the display at approximately 180 frames per second. Both companies also feature a silicon electronics substrate on which a reflective layer and liquid crystal material are added. Therefore, the display operates in reflective mode. DisplayTech uses a ferroelectric liquid crystal, whereas Siliscape uses a polymer-dispersed liquid crystal.

Kopin's CyberDisplay offers high resolution in a small package.

Planar America (Beaverton, OR) is currently sampling a miniature display based on electroluminescent technology. Here, yellow-green phosphors are deposited on top of the active matrix, which is fabricated in silicon. Applying voltage causes the phospors to emit their own light. Densities of up to 1000 dpi are possible today, with 2000 dpi promised by the end of the year.

An explosion of new wireless handheld personal-information devices could be in the offing. By the end of the year, several wireless networks are expected to support data rates of 28.8 Kbps, enough bandwidth for many applications. Glen Kephart, Kopin's vice president of marketing for display products, says, "We think our displays have the visual quality, low power, and price points (under $30 each in volume) that will work for this market."

DisplayTech's Wright sees even bigger upheavals coming. "We may be at the beginning of a new phase, where convergence and hardware, like miniature displays, will drive product innovation." Many urge caution, however. Products that used earlier-generation mini displays have not fared well. Perhaps the higher densities offered by this new crop will make the difference. **–Chris Chinnock**

Datapro Report

Unix or Windows NT? Both!

Most everyone is screaming for ways to make Unix and Windows NT work together easily and effectively. Softway Systems' easy solution puts them on the same platform. In integrating the two OSes, Softway's OpenNT does more than simply provide integration between Unix and NT: OpenNT provides a complete, native Unix subsystem on top of an NT kernel. OpenNT is so much like Unix that it conforms to Posix.2 standards, and Softway expects that by the end of the year, it will achieve the Open Group's XPG Unix 95 branding. When that happens, OpenNT can be truly called Unix.

OpenNT is more than interoperability software. Other interoperability-software products take one of several strategies, such as cross-platform APIs, Windows emulation for Unix (e.g., Bristol and Mainsoft),or Unix emulation for Windows (such as MKS toolkit or Cygnus's GNU Win32). These other solutions usually have a price, such as reduced performance, limited functionality and compatibility, or high cost. Softway's product solves these problems by running Unix and NT natively together. OpenNT also lets Windows and Unix applications run side by side on a single desktop, making it a strong choice for users who need applications from both systems.

OpenNT 2.0's (http://www.softway.com) supported facilities include:

- Posix.1, Posix.2, and ANSI C interfaces
- BSD sockets mapped to Winsock
- SVID IPC (message queues, semaphores)
- shared memory, memory-mapped files
- ability to execute Win32 applications from OpenNT
- full tty semantics mapped to console windows
- pseudoterminal support
- X11R5 Windowing System clients and libraries
- X11R6 Windowing System display server
- X11R6 fonts and font management
- OpenNTiF (OSF/Motif 1.2.4 window manager, libraries, development kit)
- telnet daemon service (multiuser log-in support)
- file-link support, true case-sensitive filenames
- over 200 Unix and X11R5 commands and utilities
- Unix shells: KornShell, Bourne shell, C shell
- Unix scripting languages: awk, Perl, sed, Tcl/Tk
- full shell job control
- full integration with Windows NT security model
- full integration with Windows NT file systems
- cron service, system service, daemon support
- Internet clients: FTP, telnet, ping, rsh
- integrated tape-device support
- Unix development tools: make, rcs, yacc, lex, cc, c89, nm, ar, strip

Mary Hubley, *principal analyst, Datapro Information Services Group, analyzes the NT and Unix markets. Hubley is manager of* Datapro Analyst: Reports on Windows NT, *which focuses on the Windows NT market and related technologies, including case studies, product and technology overviews, and integration and management strategies. For more information on Datapro reports, call 609-764-0100; fax: 609-764-2814; http://www.datapro.com.*

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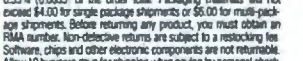

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Book Reviews

Buried in Data

Just when you thought you were safe from viruses, hackers, and the year 2000 crisis, another computer disaster has popped up to menace your organization: data disparity. It stands between you and the rapid, effective, and profitable use of your data. What's worse, you might not even know that you suffer from it.

If you don't have a cohesive, organized collection of data from which you can retrieve current, accurate, and integrated information, you can't support the operation of your business or organization. Disparate data won't let you draw conclusions from different sets of data. Also, it won't accommodate a dynamic business environment. And it won't let you plan for the future.

Teaching you to recognize and manage this latest crisis is the goal of *The Data Warehouse Challenge: Taming Data Chaos* by Michael Brackett and *Data Warehouse: Practical Advice from the Experts* by Joyce Bischoff and Ted Alexander. Both books extol the virtues of the data warehouse—a single integrated data resource that supports your organization's business needs. The two books approach the topic of data warehousing from different angles, but both purport to save you from the pitfalls of being data-rich and information-poor.

In *The Data Warehouse Challenge*, Brackett provides a 579-page comprehensive and understandable guide for planning, designing, and implementing an operational data warehouse. He explains the dilemma of disparate data and points to the business data cycle that creates and perpetuates the problem. He addresses data architecture, taxonomy, and quality, culminating in guidelines for creation of the metadata that powers the data warehouse.

In simple, logical steps, Brackett guides you through the construction of a stable, integrated data resource that will survive and support changing hardware, system software, applications, and business activities. Other topics covered include cleansing, transforming, and distributing data.

Brackett employs copious examples, figures, and boxed notes. As he introduces each new topic, definition, or key design point, he reinforces it with a practical example. Each of the 15 chapters ends with a comprehensive summary and a list of review questions, making the book valuable for initial implementation and ongoing reference.

Divided into six parts, *Data Warehouse: Practical Advice from the Experts* discusses the major phases of a data-warehouse project. It comprises 28 essays by 20 well-credentialed authors, each of whom bring their own experience, style, and perspective to bear on the topic of data warehousing. But while this approach provides a fascinating depth of opinion and scope of experience, it also robs the book of coherency.

Evaluated individually, several of the essays are exceptional. "Real-World Data Warehousing: The Management Challenge" by Howard Fosdick, for example, delves into the reasons why data-warehouse projects fail and how information-technology management can recognize and head off these problems. "Data Quality" by Sid Adelman stands out as well for its point-by-point evaluation of data quality, its impact on practical systems, and its cost.

Overall, this book makes clear the authors' belief in data-warehousing technology, but, despite its title, the book is somewhat light on practical advice for those new to the topic. Newcomers to the topic would be better served by Brackett's book.

Rob Hummel *is a frequent contributor to BYTE. He can be reached at rhummel@cheshire.net.*

The Data Warehouse Challenge: Taming Data Chaos, by Michael H. Brackett, Wiley Computer Publishing, ISBN 0-471-12744-2, $44.95

Data Warehouse: Practical Advice from the Experts, by Joyce Bischoff and Ted Alexander, Prentice-Hall, ISBN 0-13-5777370-9, $50

Java Cyber Class

Java multimedia study hall

Java Multimedia Cyber Classroom lacks the whizbang technical sophistry to do its buzzword-laden title credit, but the CD makes up for its lack of pizzazz with solid information on Java programming, a thoughtful teaching approach, and plenty of excellent code samples.

Cyber Classroom seems a throwback to early multimedia books on CD-ROM. Yes, there is a stand-alone introductory video, pop-up coding tips, and audio clips, but the CD lacks enhancements such as rich Web links and automated application macros. Given the interactive nature of Java itself, such modern flourishes are conspicuously absent. A new edition of the title, slated for September release, is updated to cover the Java 1.1 event model and will be rewritten from the ground up in Java. The new version of this CD-ROM will be more interactive and will run on multiple OSes.

Java Multimedia Cyber Classroom
Deitel and Deitel, Framingham, MA
http://www.prenhall.com;
http://www.deitel.com
$69.95

The current title's best feature, live code, is a storehouse of useful programs (not just code snippets) that you can view, paste into other applications, or launch directly to witness the code in action. This CD seems more like a cyber study hall than an interactive multimedia classroom, but the authors have done their homework. **–Stan Diehl**

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Blasts from the Past

5 Years ago in BYTE

We wondered if Unix were dead. Obviously, it wasn't, and isn't. But Windows NT continues to infiltrate Unix shops. Also: more ecologically sound PCs, photonics, and 386 and 486 notebooks. The status of pen computing was aptly summarized by Nick Baran: many rivers to cross.

10 Years ago in BYTE

We looked at OS/2 and how to program for (then) Microsoft's (then) up-and-coming OS. Emerging printer technologies were also covered in depth. A Kaypro 386-based PC cost $4495—without a hard drive (add $1300 for the 40-MB hard drive).

15 Years ago in BYTE

In an article on computers and the disabled, we said computers should, in addition to providing special assistance, provide access to standard software. And that's still an issue today. A wealth of products provide the disabled with access, but it's still often too hard to get these products such as screen readers to work with off-the-shelf applications. Maybe someday.

20 Years ago in BYTE

The first issue in BYTE's third year of publication featured many articles on computers and music. Carl Helmers predicted that appliance computers (ones that were preassembled and tested, such as the "high-end" Apple II) would dominate in the general-purpose personal-computing field.

INTERVIEW

More Powerful, Flexible Storage

Anders Lofgren, a senior analyst for Giga Information Group, discusses trends in high-end storage.

BYTE: *What are the most important trends in high-end PC server storage?*
Lofgren: Fibre Channel technologies are the most significant development occurring over the next six months to 24 months. The connection between the server and storage devices is, for the most part, SCSI-based today, although some sites have Serial Storage Architecture (SSA) products such as IBM's 7133 SSA disk subsystem. But SCSI has performance and connectivity limitations. For example, Ultra SCSI's performance is up to 40 MBps with a connectivity distance [between server and storage] of about 25 meters. Fibre Channel offers maximum performance of 100 MBps and a distance of 10 kilometers. We're not going to get the 10-kilometer distance initially. You can expect initial products to support up to 500 meters, which will be followed closely after that by 2 kilometers. But I think that just going past that 25 meters is a great advantage for users. Going beyond 25 meters lets you get more of a distributed-storage architecture than you've had in the past, especially in a campus environment, where you can run from one end of the campus to the other.

BYTE: *What are the advantages of that type of architecture?*
Lofgren: The advantages of Fibre Channel are in performance, distance, connectivity, and flexibility. A simple example is physical configuration. If you have multiple servers and multiple storage devices, you need space to store all those systems. There's a physical footprint issue here. If the server can be only up to 25 meters away from the storage device, that really limits where you are physically locating these systems. Because Fibre Channel increases the distance between servers and storage, you can, for example, now put all your storage in one central area. Or, if you're in a campus environment and you want to have some type of failover or backup capability from one part of the campus to the other, Fibre Channel will let you do that.

BYTE: *What is Fibre Channel networking, and how does it make things better?*
Lofgren: Many Fibre Channel discussions revolve around the interconnect and replacing SCSI to give you the performance and connectivity that we just discussed. But I look at that as the first phase. The next big step is going with the networking philosophy. The Fibre Channel interconnect is a point-to-point interconnect (from a server to a storage node). But what happens when you have multiple servers and multiple storage devices? You want to find a way to give one server access to multiple storage devices. You could do that over your LAN, but then the network becomes the I/O bottleneck. But if we put traditional networking components, like switches and hubs, into our storage infrastructure, that lets you connect to multiple servers with multiple storage devices. This will have somewhat the same look that you have in your LAN and WAN environment, except now it's part of your storage infrastructure, your servers and storage devices. A very important point here is the flexibility. One of the things it lets you do is move toward application-specific storage devices. Fibre Channel's flexibility lets you introduce a much more modular building-block type of architecture. We can tune it more toward specific applications.

New systems built around Intel's 300-MHz Pentium II push high-performance solutions in two directions. ***By Robert L. Hummel***

The Pentium II Soars to 300 MHz

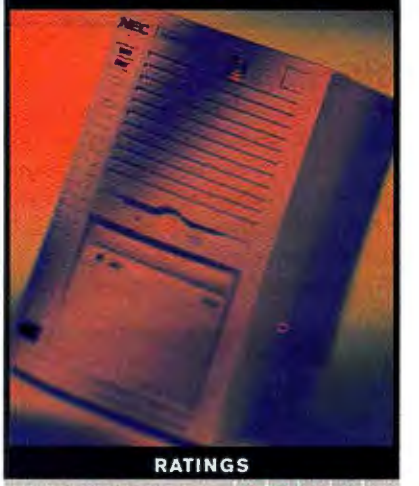
In the never-ending race for speed, Intel has pumped the Pentium II CPU up to an awe-inspiring 300 MHz. However, when we challenged PC vendors to provide systems, only two big-name vendors, Compaq and NEC, stepped up to the plate with 300-MHz systems based on the current 440FX chip set.

Most were unable to ship hardware in time for our deadline. We surmised that the majority of manufacturers are saving their 300-MHz chips for Intel's new high-performance chip set, dubbed the 440LX. The 440LX will add support for the performance-enhancing features, such as synchronous DRAM (SDRAM), Accelerated Graphics Port (AGP), and 33-MBps disk-drive access, that will truly showcase the 300-MHz Pentium II's power. LX-based systems are expected in the fourth quarter.

COMPAQ PROFESSIONAL WORKSTATION 6300

RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★
PERFORMANCE	★★★★★

NEC POWERMATE PROFESSIONAL



RATINGS	
TECHNOLOGY	★★★★
IMPLEMENTATION	★★★★
PERFORMANCE	★★★★

Graphics Diva

Compared to the NEC PowerMate Professional, the Compaq Professional Workstation 6300 is unabashedly a high-end screamer. This dual-CPU-capable workstation is ruggedly built and fast.

Our test unit was packed with 128 MB of RAM, a 4-GB SCSI hard drive, and a 16× CD-ROM drive. It came with Windows NT 4.0 and Service Pack 1. User-serviceable components, such as the CPU and memory, are installed in slide-out modules. The entire expansion-card cage comes out as a single unit, making shuffling expansion cards a delight. The chassis design is extremely user-friendly. You can open the case, remove modules, and install expansion cards and CPUs without using a single tool.

In our BYTEmark tests (which are CPU-specific), the Compaq 6300 scored 4.25 on the integer tests and 4.99 on the FPU tests—exactly what we've measured on other FX-based 300-MHz Pentium II systems (see "First 300-MHz Pentium II Results," July BYTE). The Bapco and Viewperf benchmark results, however, were mixed compared to those of the NEC PowerMate.

Bapco's Sysmark for Windows NT 4.0 loads the system with a mix of applications typical of office PCs and light-duty workstations. In Sysmark/NT 4, the Compaq 6300's scores were lower than either the NEC PowerMate or comparable 266-MHz systems in all but the presentation-graphics category. The 6300 is clearly not optimized for word processing. But when we pushed it to produce high-end 3-D graphics, it truly shined.

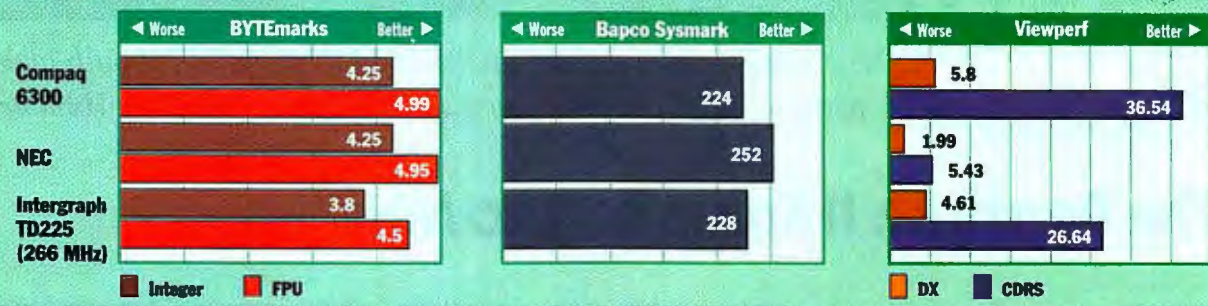
We also ran the DX 3.0 and CDRS 3.0 viewsets under Viewperf 5.0, an industry-standard OpenGL graphics performance benchmark (available at http://www.specbench.org). On DX, the 6300 turned in an impressive frames-per-second score of 5.80. Using the CDRS viewset, the system returned a 36.54 rating. These scores handily beat comparably priced systems reviewed in the December 1996 BYTE and Intergraph's dual-Pentium II 266-MHz TD225 (see "3-D Price Breakthrough," June BYTE). The 6300 is simply the fastest x86 graphics system we've tested to date.

The secret to its stunning performance is Diamond Multimedia's latest high-end graphics card, the Fire GL 4000. With 15 MB of RAM for frames and z-buffering and another 16 MB for texture buffering, combining the Fire GL 4000 with the 300-MHz Pentium II is akin to strapping a missile to a rocket.

At $12,600, the 6300 is pricey and clearly in a different category than the PowerMate. More than a third of the cost is due to the Fire GL 4000 board and the 21-inch monitor. But if uncompromised high-performance 3-D graphics is your goal, the 6300 is a bargain. *continued*

PHOTOGRAPH: MICHAEL MAYO © 1997

Paying for Performance



Unsurprisingly, our CPU-isolating BYTEmarks turned out nearly identical for the two 300-MHz systems. The 6300's superfast Diamond Multimedia Fire GL 4000 board helps it ace the Viewperf graphic tests, while the PowerMate, which is positioned more as a pricey office system, bested the graphics-oriented 6300 on Bapco Sysmark application tests. (Note: Viewperf 5.0 tests were run at 1024- by 768-pixel resolution with true color.)

Office Champ

NEC set out to demonstrate that you can inject a 300-MHz Pentium II into a serious business PC without breaking the budget—and it succeeded. The test PowerMate came with 64 MB of RAM, a 3.2-GB IDE hard drive, a 16× CD-ROM drive, and Windows NT 4.0 with Service Pack 3. The machine had an integrated sound system but no network interface. Still, it pushes practical office workstations about as far as they can go today.

Scoring 4.25 on the BYTEmark integer tests (4.95 on the FPU tests), the PowerMate finished in a virtual dead heat with the 6300, which isn't surprising considering that at the CPU level, both machines are essentially the same.

Bapco and Viewperf benchmark results, however, differed markedly. The PowerMate's video chores were handled by Number Nine's Revolution 3D graphics card ($449), which came loaded with 8 MB of RAM. This card is well tuned and appropriately priced for business or low-end 2-D or 3-D graphics applications.

The PowerMate adroitly executes mainstream office applications. Indeed, it beat the 6300 in all Sysmark/NT 4 categories except presentation graphics. But, as indicated by the low Viewperf CDRS and DX benchmarks, the Revolution card is nothing you'd want to design your next animated feature film on.

The PowerMate is a powerful business machine with enough horsepower to pinch-hit as a low-end graphics workstation. With an estimated price of $4625, including a 17-inch monitor, it gets you to the 300-MHz arena without breaking your budget. B

PRODUCT INFORMATION

Compaq Professional Workstation 6300	NEC PowerMate Professional
$12,600	$4625 (estimated price)
Compaq Computer Corp.	NEC Computer Systems Division
Houston, TX	Mountain View, CA
800-345-1518	800-632-4565
281-514-0484	508-264-8000
fax: 281-514-1740	fax: 508-635-4666
http://www.compaq.com	http://www.nec-computers.com
Enter 1020 on Inquiry Card.	Enter 1021 on Inquiry Card.

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TECH FOCUS BOARD DESIGN

Designing at Light Speed

As clock speeds increase, designers are having an increasingly difficult time crafting methods to exchange signals reliably between the processor, the chip set, and other components on the system board.

A typical signal on a printed circuit board travels at over 118,000 miles per second—64 percent of the speed of light. Although that's fast enough to circle the earth in about 200 milliseconds, the same signal in a 300-MHz system requires a full CPU clock cycle to cross a 12-inch circuit board. Signal timing becomes the overriding concern during board design.

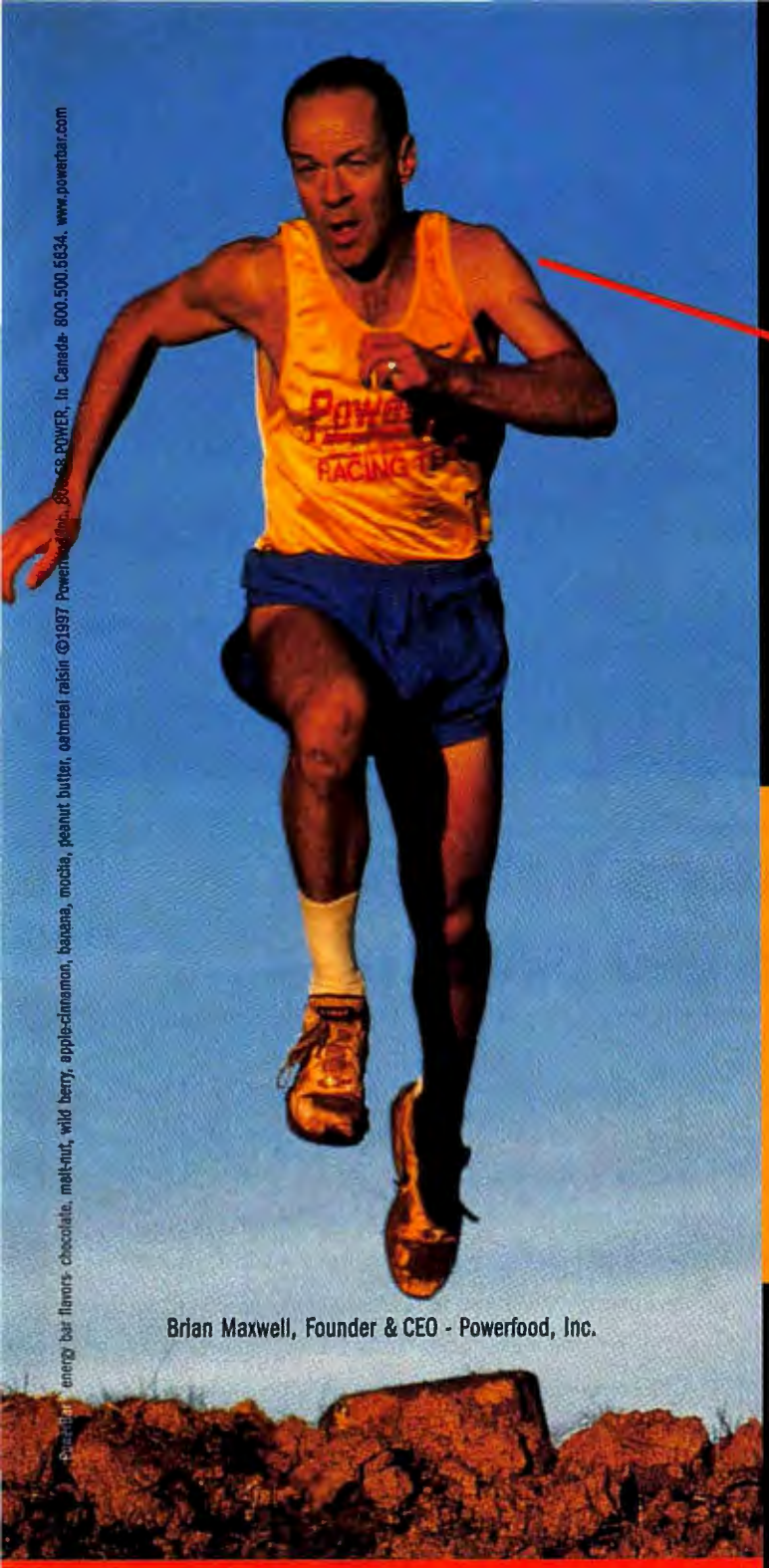
To ensure that signals arrive at their intended location at the right time, board layout must take into consideration trace lengths, component placement, and even the delay in routing the clock trace from the processor edge fingers, through the substrate, and to the processor core.

As bus speeds climb into the UHF RF spectrum, digital design techniques merge with analog, because the copper traces on the circuit board begin to act like wave guides and antennas. Each pulse rings and overshoots, and is subject to cross talk and interference from adjacent signals.

When the processor sends out a signal into an ideal load, the signal voltage ramps up smoothly from its low value to its high value. When the signal is pumped into a real load, specifically a socket, circuit-board trace, and receiving component, the timing changes radically. By the time the signal arrives at the target component, it has been mutated by reflections, cross talk, and propagation effects.

To make a bad situation worse, the Pentium II's GTL+ (Gunning Transceiver Logic) bus uses low-voltage-swing I/O buffers. Although using a lower-voltage swing enables higher signal speeds, it also creates correspondingly tighter noise and timing tolerances than in older PC technologies.

Finally, due to the large number of transistors and high internal clock speeds, the Pentium II generates large average current swings between low and full power states. This can cause the supply voltages on the circuit board to sag below their nominal value. Failure to anticipate these swings during board design can change the signal timing and fatally damage the components.



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Plus, the new UltraDaytona RAIDarray is twice as fast as previous versions, and supports up to 128 MB of SIMM-based data cache for even higher performance. It's available in several configurations, and features an optional expansion chassis for up to seven additional disks.

Each UltraDaytona includes CMD StorageView™ Lite, an easy-to-use GUI for setting up and monitoring the subsystem, as well as alarms that tell you when something needs attention. That way, you can address problems before data goes off-line, which makes the UltraDaytona a surprisingly stress-free storage solution.

With that it mind, it should come as no surprise that CMD technical support is available 24 hours a day, seven days a week, 365 days a year. Just one more way owning an UltraDaytona will put your mind at ease.

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Scalability and reliability are the watchwords for Microsoft's newest Web server. By Steve Gillmor

IIS 4.0 Scales New Heights

Microsoft's Internet Information Server (IIS) started out as a strategic partner for Internet Explorer. Their mission: put Microsoft back in the Internet game. IIS 4.0, shipping as a feature of Windows NT Server, integrates key transactional and management technologies from the forthcoming NT 5.0. The resulting server provides scalable Web-based applications for Internet service providers (ISPs); and for organizations, enhanced security features simplify entry to the emerging e-commerce marketplace.

For scalable Web application services, IIS can fold application invocation and scripting logic into a Microsoft Transaction Server (MTS) application. Now, Active Server Pages (ASP) scripts can run inside a transaction, so if any portion fails, the entire transaction is rolled back. Applications can also run in a separate memory space from the Web server, protecting the server, the site, and other applications from an isolated application crash. When I triggered an ActiveX component that generated an illegal divide-by-zero, IIS 4.0 kept everything else running and automatically restarted the crashed component on the next request.

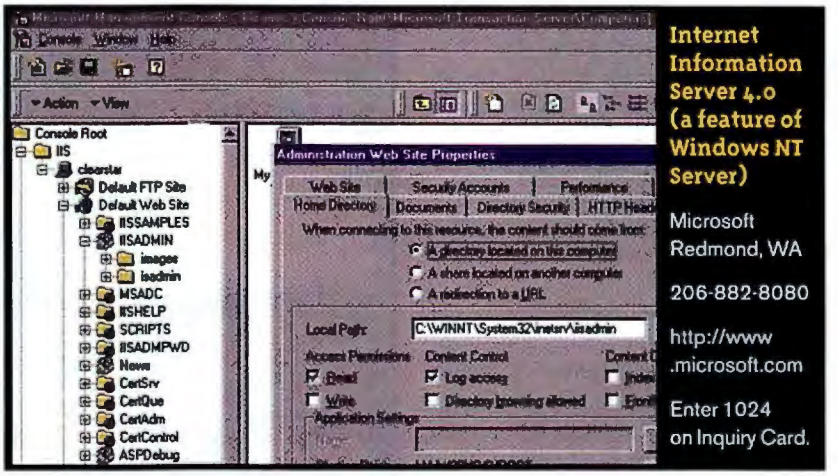
Out-of-process components can be dynamically loaded and unloaded without bringing down the Web server. NT Server Enterprise Edition 4.0 administrators can use its clustering services to offer failover service between Web sites on different servers. IIS 4.0 uses the Microsoft Script Debugger, so you can set breakpoints; run server-side scripts a line at a time; locate and fix run-time, syntax, and logical errors; and view variables, properties, or array element values.

The new Microsoft Management Console (MMC) administers IIS, MTS, Index Server, and very limited mail and newsgroup tools from supplied snap-ins that can be packaged, saved, and e-mailed to delegate tasks. IIS does SMTP mail, though it's a far cry from a functional e-mail server. Likewise, though you can create NNTP discussion groups, IIS won't replace a real news server.

Certificate Server manages X.509 digital certificates, now emerging as a requirement for Internet commerce, and maps these (or other third-party certificates) to NT accounts for secure access without a user name and password.

A browser-independent implementation of host headers allows ISP administrators to run multiple Web and FTP sites, with different host names and domains, from a single IP address. Support for HTTP 1.1 lets any client improve performance by exploiting pipelining and persistent connections. Administrators can allocate bandwidth so that popular sites don't throttle less-visited sites.

It appears Microsoft has done it again with IIS 4.0, packing in lots of must-have services that give you more reasons to buy NT. If they don't mind selling their souls to Microsoft, organizations deploying traditional client/server applications on the Web can now robustly and securely exploit Microsoft's ActiveX-based rapid application development tools. B



Internet Information Server 4.0 uses Microsoft Management Console to configure global Web site properties.

TECH FOCUS

Transaction Services

IIS creates one Web Application Manager (WAM) for each app configured on the server. Each WAM runs in a "package," which can be either in or out of process; clients share in-process apps, but the server creates an instance of the application every time a browser requests an out-of-process app. Microsoft Transaction Server manages processes as well as threads and database connection pools.

RATINGS	
TECHNOLOGY	★ ★ ★ ★ ★
IMPLEMENTATION	★ ★ ★ ★ ★

Steve Gillmor is a consultant for Southern Digital. You can send e-mail to him at **sgillmor@southerndigital.com.**

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

Netscape's stab at a Web/desktop GUI is a snappy comeback to Microsoft's preemptive IE 4 strike. By Pete Loshin

The Webtop Rolls Out on Netcaster

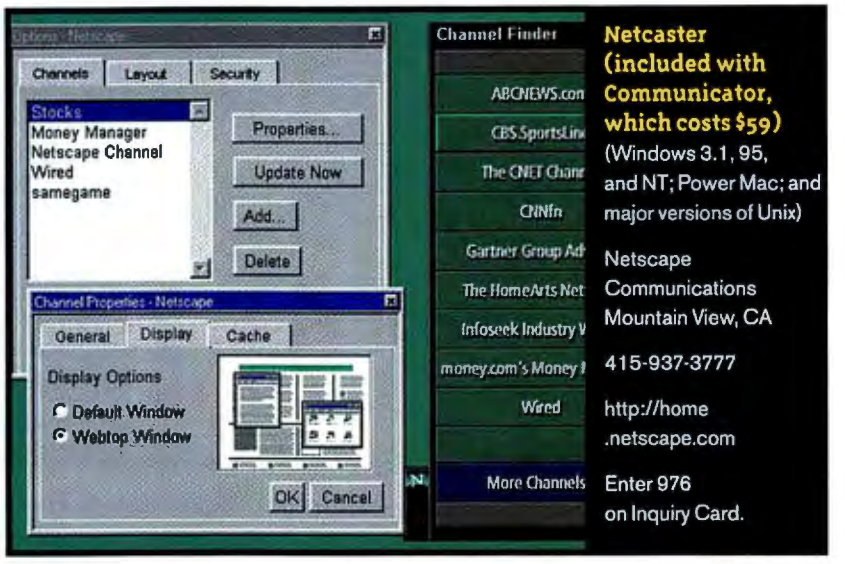
If you go around picking fights with bullies, you'd better have a secret weapon. Netscape may have the chops to beat any other Inter/intra/extranet software vendor, but with Netcaster the company is trying to beat Microsoft at the operating system game—and no one beats Billion Dollar Bill on the Windows desktop.

Netcaster is Netscape's first pass at turning Constellation, a dazzling, high-concept technology demoed at Comdex last fall, into a product. The idea: make every Internet (and intranet and extranet) resource look local. Integrate Web objects with the desktop, pour data from Web sites into banners and boxes and all other kinds of cool desktop containers, set up a portable persistent desktop that can follow you from one computer to another. And do it all with a GUI that moves beyond hierarchical folders and too many windows. It's the same idea behind Microsoft's new Internet Explorer 4.0, which lets you manipulate Web objects on your IE 4.0 desktop, thus turning Windows itself into a real Webtop with a uniform look and feel throughout.

The Netcaster reality is slightly disappointing, if only because I expected so much more. Subscribing to push content with new Netscape channels, with Marimba channels, or even just simple HTML pages is much easier than with IE 4.0, and it works well for off-line browsing. The Netcaster tab sits on the edge of your desktop and pulls out a selection panel, with standard channels displayed at the top and a pull-up panel that you can use to store your personal channels.

RATINGS	
TECHNOLOGY	★ ★ ★ ★
IMPLEMENTATION	★ ★ ★ ★

However, once you set up a channel as your Webtop, the result is like throwing a plank of plywood over your desktop: Direct access to desktop icons, as with IE 4.0, is denied, and you've got to shuffle open application windows up to the top of the Webtop to make them visible and accessible.



Netcaster channels have a handful of properties, most notably the option to turn a Web page into a Webtop.

Netcaster's channel selector panel can be configured to pull out from either the right or the left of the screen, but the tab itself won't go away; there's also a small toolbar with browser control icons for navigating through Webtop content (or back to the normal desktop). Adding channels is easy: Click on one of the preset ones shipped with Netcaster or choose the "more channels" option to go to Netscape's updated Channel Finder Web page.

Depending on what you put on the Webtop, clicking on a link on it may open yet another Navigator window, or it may simply rewrite or modify the Webtop. And though you can subscribe to as many channels as you like, only one Webtop can be active at any given time, and each non-Webtop channel takes up at least one more window and lots of system resources. After three or four channels, I got lost in all the open windows.

With a little coding, you can create neat intranet Webtop channels, putting in tickers and other objects and letting users activate these as their desktops. Communicator is still one of the two best Internet client suites, and Netcaster adds very impressive and easy-to-use Web page subscription. While slightly less ambitious than IE 4.0, the Netcaster beta I used was more robust than the Microsoft competitor, and the Netscape product was expected to be available sooner. Netcaster is a nice addition to an already feature-rich Communicator. B

Pete Loshin (**ploshin@mgh.com**) *is technical editor for software reviews and author of* Extranet Design and Implementation *(Sybex, 1997).*

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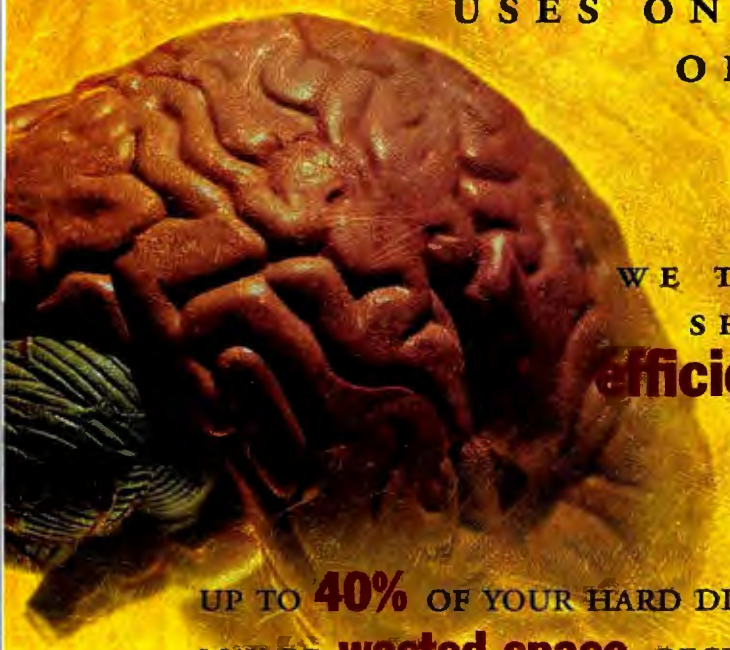

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You can integrate text searches and relational data with ConText Cartridge and Oracle universal data server. By Ann O'Leary

Managing Mission-Critical Text

Over the past decade, organizations have invested heavily in systems that enable rapid access to structured data stored in relational database management systems (RDBMSes). Surprisingly, this information represents only about 10 percent of a firm's data, while the other 90 percent exists as text in documents, manuals, reports, e-mail, Web pages, faxes, and presentations. Until recently this textual data couldn't be accessed with the same ease and efficiency as structured data could be accessed.

Traditionally, organizations that needed access to both of these types of data used SQL-based relational databases to access structured data, while text was stored in flat file systems and accessed through customized search/retrieval engines. But such engines typically lacked key data-management functions found in major relational databases, such as security and transaction integrity. Another problem with this scheme was that any text stored in relational databases could not be searched natively using SQL. Such dual-system solutions are expensive, often requiring custom middleware to coordinate data changes and queries between the text-search engine and the database system.

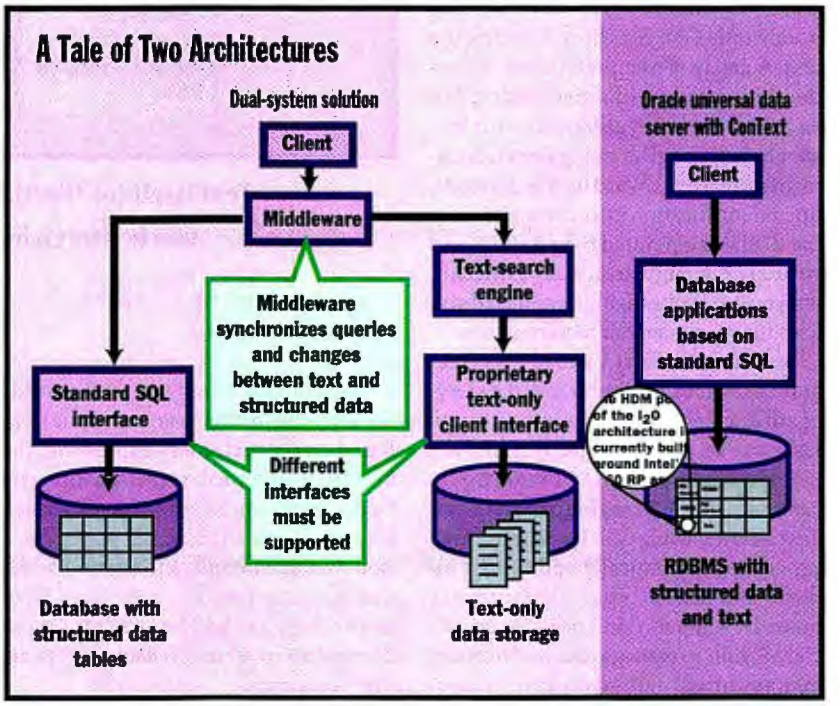
Oracle resolved this dilemma with its ConText technology, which makes text a native data type of an Oracle RDBMS. This eliminates the costly dual-system approach, since the same scalable and secure relational database houses both the structured data and the text. It also provides a unified interface where textual information can be rapidly searched and retrieved through SQL queries, often combined with associated relational data.

Getting There from Here

Oracle's ConText Cartridge enables full text retrieval within Oracle's universal data server. ConText accomplishes this by processing text into a format usable by an RDBMS and accessible via SQL (see the figure below). It also provides linguistic capabilities that deal with the ambiguities and language dependencies of text. The term *Cartridge* indicates that the ConText engine is a software module that extends a database's capabilities to manage the new text data type.

The ConText Cartridge supports several different document-storage methods. The simplest one is the *direct data store*, which enables text storage in a *text column* of a database, with one document—or any logical body of text—per row. Depending on the column types chosen, each row can contain a text string as brief as a few names or as long as a book containing hundreds of thousands of pages.

Another storage method involves keeping the documents in a file system or anywhere on the Web. In this type of situation, the text column stores only the file-system or URL pointers to those documents. ConText searches and retrieves the text contents at the end of these point-



ConText eliminates the dual-system design often used to integrate a text search with relational data.

ers. While storing text in the database provides more robust data integrity, keeping files on the Web or in the file system may be more expedient. This feature is especially useful for constructing intranet search applications without having to copy existing Web pages to a central location.

As the database stores the text document, ConText builds a text index that contains critical information about the

document's contents, as illustrated in the figure at right. Multiple ConText servers can run in parallel to reduce the index-generation time for large documents. The index is stored and managed as a set of relational tables in the database, which enables ConText to search and retrieve text information as rapidly as it can retrieve relational data.

The index's relational tables contain information about every word contained in the documents, such as which documents a certain word comes from, how many times it occurs in each document, what other words it's near, and by how much. Because text searches execute against these indexes (rather than directly against the full text), they can be as rapid as relational queries.

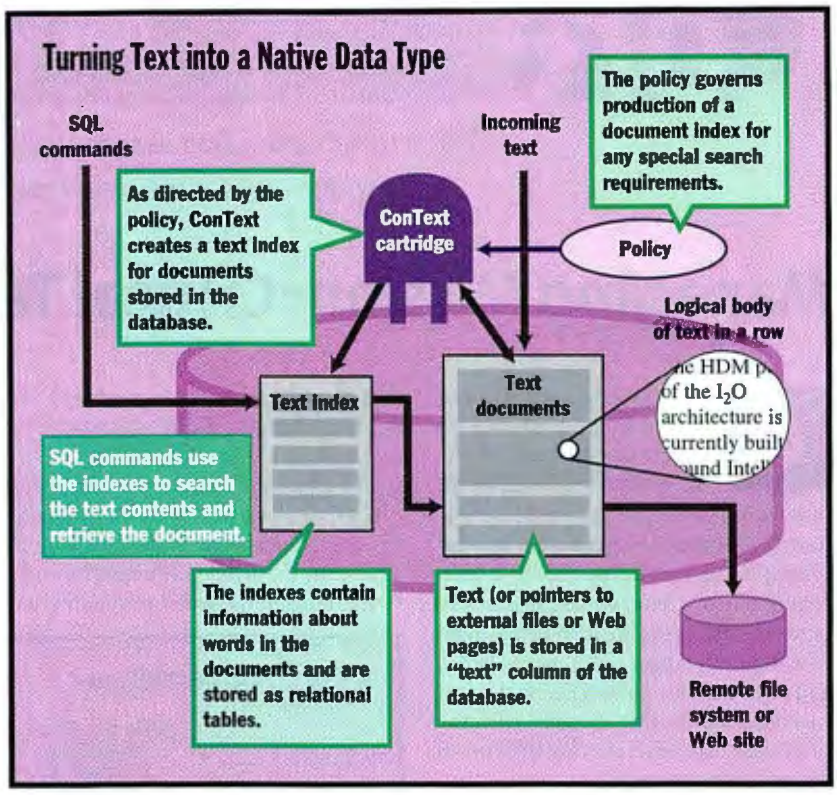
The generation of a text index is governed by a user-designated or default text *policy* supplied with ConText. The policy tells ConText how to index the text. A group of user preferences defines the characteristics of a given index. For example, there are preferences for languages (e.g., English or Japanese), document format (e.g., Word or WordPerfect), document-location information (e.g., in the RDBMS or pointed to by a URL), and so on. The defaults are usually sufficient, but you can create highly customized policies for special search requirements.

Because ConText Cartridge is integrated into the Oracle universal data server, all development and administration tasks can be accomplished through the use of straightforward SQL and PL/SQL calls. Oracle's SQL engine handles ConText queries, while ConText background processes automatically update text indexes and handle other administrative tasks. Developers don't need to use special API calls to manage text, and they can take advantage of the data server's capabilities, such as scalability and security.

Using ConText

The primary method of accessing ConText is through the `CONTAINS` function, which enables SQL to query the contents of a document. This function can be included in a `WHERE` clause that also includes conditions that are based on structured fields. Here's a sample SQL call that uses this function:

```
SELECT title
FROM docs_tbl
WHERE organization = 'Support'
  AND CONTAINS(docs_tbl.text,
'WebServer') > 0;
```



Text itself (or file/URL pointers to text files) can be stored in database columns.

The column `docs_tbl.text` holds the documents that you wish to search. Based on the text-query expression, the `CONTAINS` function returns a numeric "score" that indicates the degree to which a given document matches the expression. In this example, the expression requests an exact match on the word *WebServer*; the score will be higher for those documents in which *WebServer* appears the most times.

The SQL call above simply returns the title of every document in which the target word *WebServer* appears at least once, given that the document also meets the structured field condition (`organization = 'Support'`). When the user chooses from the title list, the application then retrieves and displays the specified document.

To rank the results of a query according to the score, the `SCORE` function can be used, as in the following example:

```
SELECT SCORE(0), title
FROM docs_tbl
WHERE organization = 'Support'
  AND CONTAINS(docs_tbl.text,
'WebServer',0) > 0
ORDER BY SCORE(0)
```

This call returns an ordered list of documents. (The argument to `SCORE` is simply an index, which is included as the third argument to the `CONTAINS` function. It places no restriction on the rows returned.) For more complex ConText searches, the text-query expression can get more complicated, and the SQL call might have multiple `CONTAINS` clauses.

ConText has been designed to easily upgrade existing Oracle-based applications with text-search capability, thus offering users direct access to text that's already stored in Oracle databases. Electronic-commerce applications that manage quantities, prices, and product-ID numbers can be upgraded to include searches on text descriptions of content or to offer the text data itself for sale. B

Ann O'Leary, a senior manager at Oracle, is responsible for marketing the Oracle universal data server and the ConText Cartridge. She can be reached at **aoleary@us.oracle.com.**

An interface from emWare lets you control and monitor devices with a Web browser. *By Michael Howard and Chris Sontag*

Managing Devices with the Web

The Internet is an ideal medium for device control. Its ubiquity and protocol standards make low-level device communications easy to implement and inexpensive. However, the Internet's real advantage lies in its well-known graphical interface that's delivered by Web browsers. Using a Web-based front end simplifies the programming job, and it lets anyone—from any platform—manage a device through a familiar interface.

Having said that, operating devices this way can prove to be an expensive proposition. This is because device manufacturers have frequently used a skinny client/fat server paradigm. The Web-browser client had limited functions. The embedded device had to house not only its own intelligence, but also Web-server software that includes a file system, a TCP/IP stack, and interface components. This generally precludes the use of popular low-cost microcontrollers that have only 1 to 4 KB of ROM and less than 100 bytes of on-chip RAM.

The company emWare, a developer of embedded devices, took a hard look at the problem, discarding the traditional assumptions about the client/server mechanism. The resulting Embedded Micro Interface Technology (EMIT) can potentially make Web-based device control practical and inexpensive.

Role Reversal

Instead of the device incorporating all the necessary hardware and software resources, EMIT pushes as many tasks as possible onto a Windows- or Unix-based host machine—a skinny server/fat client design. The device gains access to the resource-intensive tasks on the client through a lightweight distributed-computing architecture implemented by emWare.

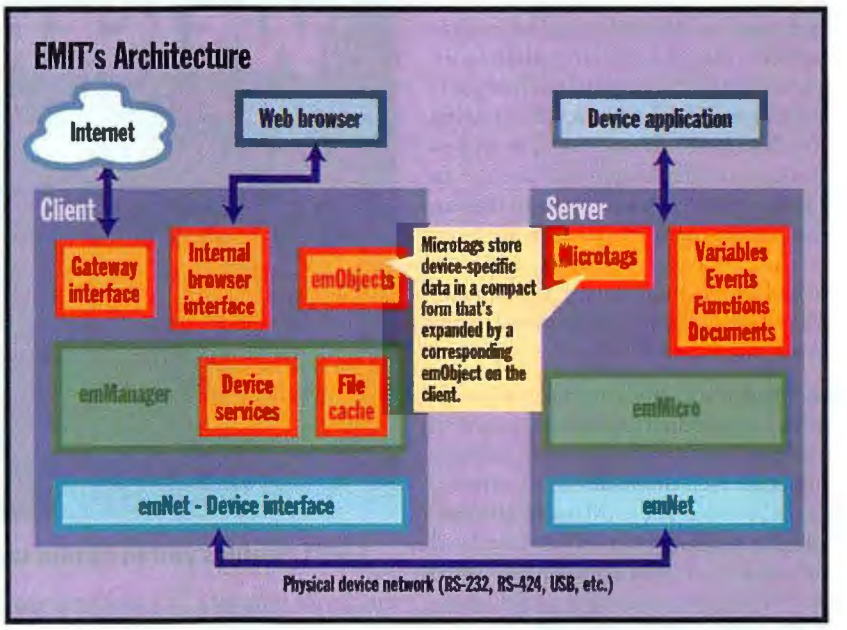
Thus, EMIT's device-resident Web server requires only 30 bytes of RAM and 750 bytes of ROM to operate, which lets it run on a host of low-cost embedded microcontrollers all the way up to the largest microprocessors. Because of the server's tiny memory footprint, EMIT can use on-board EPROM to manage additional device data (e.g., logging information) or store JavaScript class files and HTML documents.

On the client side, the host system uses a library of preprogrammed functions. These functions minimize the device's use of resources by assembling the device's graphical interface in the browser and helping manage communications with device-specific functions. For example, the embedded device stores compressed information as special tags in HTML files, and the desktop computer handles all the data expansion of the tags.

EMIT's Architecture

EMIT provides the following services: file storage and retrieval, device subroutine invocation, security, device variable access, and device events. The first three services are normal Web-server features. For example, you implement device security through the use of well-established Web protocols.

The last two services EMIT handles. Variables are data objects on the device. Access to them is accomplished through a secondary socket-server process. Java applets launched on the client can create a connection to the variable server and read and write variables through this service. Events are messages the device passes to the client. The receipt of an event message can trigger an executable function on the host workstation. These



An embedded device uses HTML files and compressed data tags to communicate with a Web browser.

functions can then log data to a database, send e-mail, or communicate with other devices.

You create the client's Java-based user interface (UI) through an HTML file that invokes a container applet. The file specifies which generic interface components are part of the Web page, what they look like, where they go, and to which embedded variables or functions they are connected. The data on the device controls the interface and its operation but is not burdened with the cost of storing these large interface components.

EMIT provides five modular software components, as shown in the figure "EMIT's Architecture." Starting on the client side, they are:

- The emObjects are a function library composed of JPEG/GIF graphics or Java applets. The Java container applets implement the client's UI. Such objects include standard Abstract Windowing Toolkit (AWT) components, as well as device-specific components such as an LED bar graph, a seven-segment display, and an analog meter. There are even transparent buttons that can overlay an actual image of the device. Certain emObjects also execute in response to events the device returns.

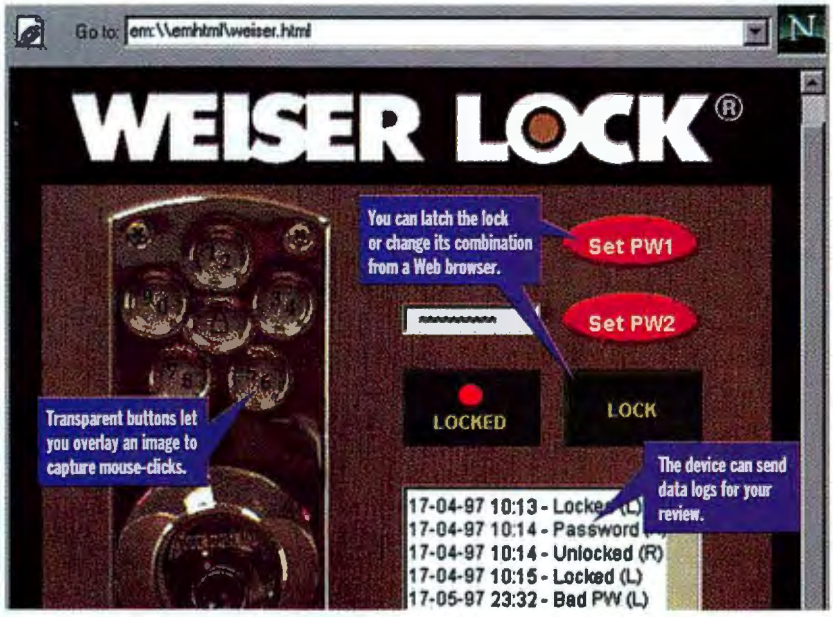
- The emManager coordinates the client's locally stored GUI components with items on the device, thus providing a coherent view of the device's operation in the browser. The emManager also handles the privilege and validity checks of all requests. A polling mechanism (used for the simplest devices) or a token-passing mechanism maintains the status of device variables. A socket-server process makes this data available to Java applets.

When the status of the device changes, it returns an HTML page that contains microtags (described below) to the client. The emManager substitutes each microtag with its corresponding emObject, and the browser creates the interface from this combination of HTML and emObjects. Because emObjects can be Java applets, you can use the interface to issue commands back to the device.

- The emMicro is the device's small, special-purpose Web server. It works in conjunction with the emManager to provide file, variable, and function access on the device. You access all device resources via tables. For each service the device supports, there is a table of name/attribute information. (Typical device services are functions, variables, events, static documents, and dynamic documents.) Commands the client sends are processed by a command interpreter that looks up function addresses or variables through these tables. Sample commands are `GetVariable`, `GetStaticDocument`, `SetByteVar`, and `InvokeFunction`.

- Microtags are small (1 byte or more) packets of highly condensed information that define device controls (e.g., switches, buttons, and LEDs). Microtags are embedded in the HTML page that represents the device interface. It's relatively easy for manufacturers to create custom microtags to match the capabilities of any particular device.

- The emNet is an efficient, adaptable serial protocol that lets developers use a lightweight communications protocol for building small applications. The emNet is a message-based master/slave protocol that uses a combination of packets and stream data. All data is sent as binary values with prefix-encoded commands. The emManager and emMicro operate on top of any network transport that can deliver emNet's small packets.



EMIT enables you to obtain logging information from a device.

Applications for EMIT

Companies are currently developing a number of applications that exploit EMIT. For example, agricultural equipment manufacturers are adding EMIT-enabled devices to monitor all kinds of farming equipment, such as tractors, combines, and irrigation systems. Weiser Lock is adding EMIT to its electronic door lock to monitor the lock via an exact replication of a lock's touchpad, as shown in the screen below. Not only does EMIT let you change a lock's status, such as unlock at 8:00 in the morning and lock at 5:00 in the afternoon, it also provides the ability to view historical data, such as how often a lock was enabled and disabled.

EMIT can provide a means for medical professionals to monitor all types of medical equipment remotely, such as fetal and heart monitors, and intravenous infusion systems. This technology can significantly reduce medical costs, while at the same time providing a more efficient way to manage such systems. Further examples of EMIT-enabled devices are available at http://www.emware.com.

These are only a few sample applications that companies are developing that can use EMIT. Until now, applications such as these have been very difficult because of the resource requirements at the device. This technology will simplify the development of the next generation of remote-controllable networked embedded electronic devices. B

Michael Howard is the architect of EMIT. Chris Sontag is president of emWare, Inc. You can reach them at **eng@emware.com.**

Organizing your ATM network into a hierarchy will make for efficient routing and allow for expansion. By Jeffrey Fritz

Routing and Switching in ATM Networks

Like the monarchies of old, asynchronous transfer mode (ATM) switches can run under hierarchical relationships. A hierarchical relationship means that some ATM switches are placed in address positions subordinate to other switches in the network. This differs from a flat approach, in which every switch is at an equal level with every other switch.

You assign the address hierarchy of the devices during the initial network design, but you should plan for it to change over time—because invariably it will. Therefore, consistency in address numbering while ordering (moving up and down) the hierarchy is important. So is leaving room in the hierarchy for growth: When you add switches to the network, there will be available address ranges for additional hierarchies. In a sense, this is like assigning subnets in an IP network, where you want to leave room to add subnets and add hosts to current subnets.

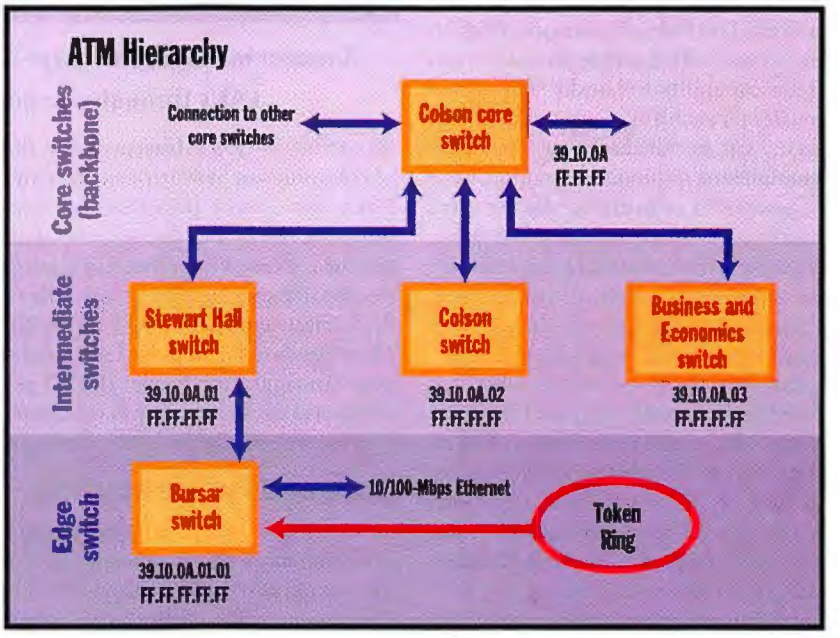
It's in the Address

An ATM hierarchy is created through the assignment of the Network Services Access Point (NSAP) address. The NSAP address is 20 bytes long. It includes a 13-byte (104-bit) prefix, a 6-byte media access control (MAC) address, also called an *end system identifier*, and a selector byte that serves as a subaddress. The network uses the information in the 13-byte prefix to create the hierarchy. At 1 bit per level, this means the system administrator can create as many as 104 hierarchical levels. Practically, most networks will do just fine with three to five hierarchical levels.

It is also important to give each switch a unique address prefix, different from the address prefixes assigned to other switches and devices in the same network. Furthermore, all subordinate switches and ATM devices connected to a particular switch should be based on the address of the primary switch in the hierarchy.

The figure "ATM Hierarchy" shows how a section of an ATM network hierarchy might be configured. Notice that in this hypothetical campus network arrangement, the NSAP address 39.10.0A is assigned to the Colson building core switch, with a mask of FF.FF.FF. The intermediate switches (Stewart Hall, Colson, and Business and Economics) are assigned NSAP addresses that are subordinate to the related core switch. For example, the Stewart Hall switch is assigned as 39.10.0A.01, with a mask of FF.FF.FF.FF. That makes the switch subordinate to the Colson core switch. Similarly, the Bursar edge switch is assigned 39.10.0A.01.01, with a mask of FF.FF .FF.FF.FF. That makes it subordinate to both the Stewart intermediate switch and the Colson core switch.

In simple ATM networks, establishing a hierarchy may not be necessary. However, in larger networks, a hierarchy becomes essential. Besides creating a logical ATM addressing structure, the hierarchy makes ATM call routing simpler and more efficient by providing a logical address path through the ATM network. Hierarchical addressing also positions the ATM network to participate in the Private Network-to-Network Interface Phase 1 (PNNI-1) when it becomes available. The PNNI-1 protocol supports the concept of peer groups. Each peer group consists of multiple ATM switches operating in the same hierarchical level. They communicate through a peer group leader with switches in other hierarchies. All of this is based on hierarchical address structure.



A hierarchical arrangement of ATM switches directs a packet through the network fabric.

continued

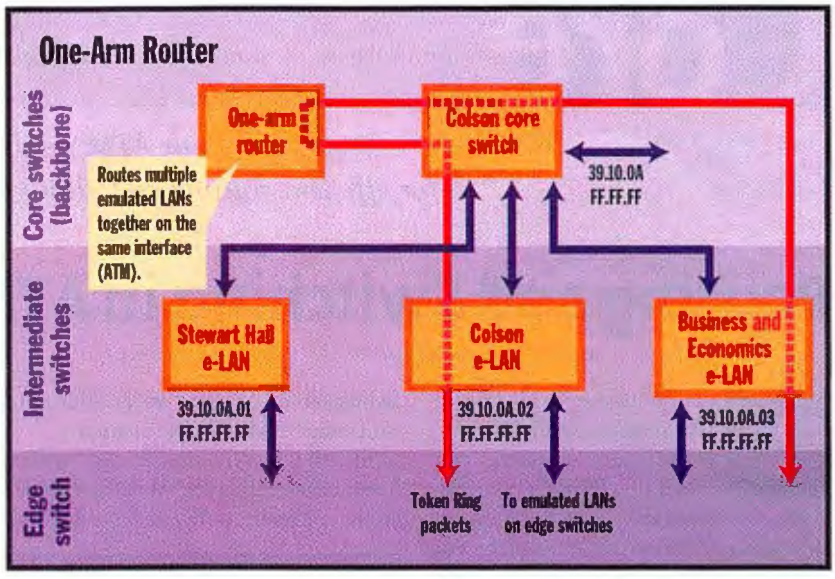
Until the full implementation of PNNI-1 appears, there is no standard way in which ATM switches can automatically learn the network topology. This means that the hierarchy must point the way through the ATM switching maze. Using hierarchical call routing, cells on the backbone intended for a device located in the Bursar's LAN will be directed through the Colson core, the Stewart intermediate and, finally, the Bursar edge switch.

Switching Issues

The best place—perhaps the only place—to locate the core switches is in the backbone. Core switches are responsible for the heaviest traffic flow and the largest number of call setups. Consequently the core switches should never be oversubscribed. Oversubscription occurs when more bandwidth heads to the switch than it has capability to handle. This is not much of a problem in edge switches; in fact, it can be advantageous. Statistical multiplexing techniques operating in the edge switch can easily handle the extra traffic load. However, oversubscription is deadly in the core switches because they must switch all the network traffic across the backbone. They are also the easiest to bog down if they are required to run additional services. For example, while it is possible to provide support for legacy networks, such as Ethernet or Token Ring, via LAN Emulation (LANE) services in the core, it is usually best to run them in the edge or the intermediate switches. This allows the core switches to concentrate on backbone call routing.

Intermediate and edge switches are located between the user and the backbone. An edge switch is at the end of an ATM network. Typically it is an ATM switch feeding legacy networks via LANE services. In the figure on the previous page, the Bursar switch is an edge switch. For smaller networks, an intermediate switch may not be necessary. In that case, the edge switch can connect directly to the core. As its name implies, an intermediate switch lies between the backbone and an edge switch. For example, the Stewart Hall switch, located between the Colson core and the Bursar edge switch, is an intermediate switch.

The decision as to where LANE is running depends on the particular ATM implementation and on how the individual ATM devices handle the LANE processes. For networks that have highly



A router manages the Layer 3 protocols for multiple emulated LANs through one point on the ATM network.

departmentalized infrastructures, the LAN Emulation Server/Broadcast and Unknown Server (LES/BUS) services should be run in the edge switches. This gets the LANE services physically close to the departments that are connecting to the various emulated LANs (e-LANs). There needs to be only one LAN Emulation Configuration Server (LECS) per ATM network, so it can run in whichever intermediate or edge switch you choose.

Once and Future Routing

LANE 1.0 operates strictly in a bridged environment. This begs the question of why we need to route at all in LANE 1.0. The answer is that routing is not necessary in a single e-LAN environment. However, it is not a good idea to design an enterprise network with only a single e-LAN. Doing so creates a large broadcast domain that can overload LANE services. Therefore, just as routed networks have multiple subnets, most ATM networks have multiple e-LANs.

Every e-LAN functions as a separate group using its own LES/BUS. Interconnecting multiple e-LANs requires a router typically called a *one-arm router*. It is called this because there is only one physical interface (usually 155-Mbps OC3 fiber) from the ATM switch to the router. As the figure above shows, instead of routing between multiple physical interfaces, the one-arm router simply routes the Layer 3 protocols onto multiple e-LANs connected through the same interface. The router can be a card that is inserted into an ATM switch, or it can be a stand-alone router.

This scenario will change dramatically when LANE 2.0 and Multi-Protocol Over ATM (MPOA) 1.0 arrive. Routing is accomplished through MPOA using a technique known as *virtual routing*. To do this, MPOA uses the Next Hop Resolution Protocol (NHRP). NHRP allows address queries to be passed between different subnets without requiring physical routers. While LANE 1.0 requires a router to connect different e-LANs, with LANE 2.0 a router will be necessary only to span different ATM networks.

Designing for the Future

It is always a good idea to design for today with an eye toward tomorrow. Establishing switching hierarchies that are well thought out and paying careful attention to routing in your ATM networks will pay big dividends now and in the future. Attentive network design will result in solid network performance and pave a good migration path toward MPOA and PNNI-1. Building networks that function efficiently today but also link to the technology of tomorrow should be every network administrator's goal. B

*Jeffrey Fritz (**jfritz@wvu.edu**) is responsible for advanced network technology at West Virginia University. He's author of* Remote LAN Access: A Guide for Networkers and the Rest of Us *(Manning/Prentice-Hall PTR).*

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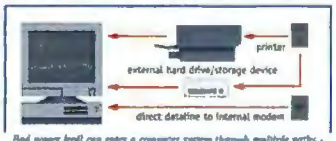

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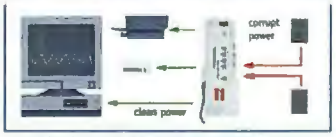

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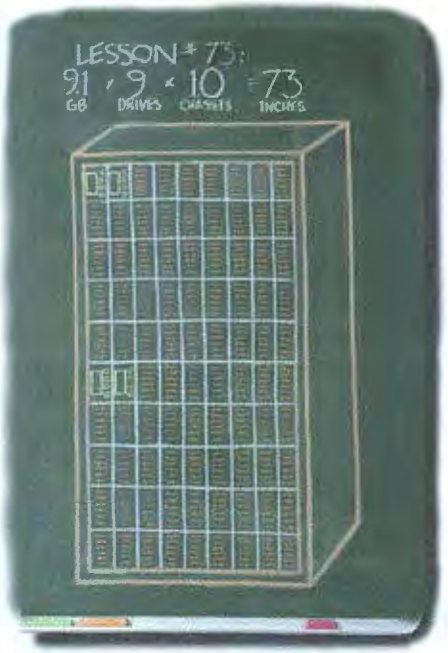

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Circle 153 on Inquiry Card.

It combines the Pentium Pro's architecture and MMX instructions into a package for low-cost systems. By Clive Maxfield

The Pentium II Revealed

I first started playing with microprocessors back when 1 MHz was considered state of the art. Today, a 200-MHz Pentium Pro doesn't raise any eyebrows, and Intel's Pentium II is available in 233-, 266-, and 300-MHz flavors.

In addition to its high frequencies, the Pentium II features a dramatic new packaging style. While this is primarily of interest to circuit-board designers, its impact on desktop-system designs and costs can make you think twice about purchasing a Pentium Pro system. For programmers and users, the Pentium II offers the MMX instruction set, which is of use in multimedia, digital-video, content-creation, and games applications. This article examines the differences between the Pentium Pro and the Pentium II.

Architectural Differences

When the Pentium Pro first became available, it sported a number of significant enhancements over its predecessor, the Pentium. For example, the Pentium Pro featured a concept called the Dual Independent Bus (DIB) architecture, which addressed existing system-bandwidth limitations. It did this with two buses: a processor-to-main-memory bus and a processor-to-L2-cache bus. The processor could access both buses simultaneously for better throughput.

The Pentium Pro can execute up to four instructions per clock cycle. It also features dynamic execution, which incorporates the concepts of out-of-order and speculative execution. The Pentium Pro has a 12-stage superpipeline, as compared to the Pentium's five-stage counterpart (or six stages for a Pentium with multimedia extensions [MMX] technology).

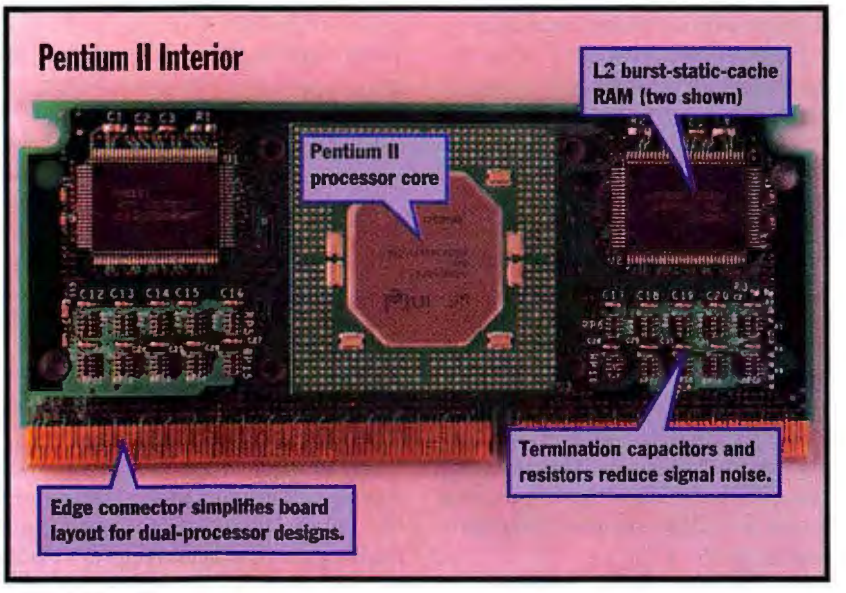
It employs multiple branch prediction based on both past history and knowledge as to how each op code is typically used. While still compatible with existing x86 applications, this branch-prediction logic improves the Pentium Pro's performance over the Pentium's.

The Pentium II inherits the Pentium Pro's superpipeline and DIB architecture. However, the biggest change is in its internal logic: the Pentium II has larger L1 caches and supports Intel's MMX instructions. These 57 new instructions enable 64-bit data words to be treated as two 32-bit, four 16-bit, or eight 8-bit chunks. This permits the same operation to be performed on each chunk simultaneously, thereby facilitating features such as full-screen video. (See "x86 Enters the Multimedia Era," July 1996 BYTE, for more information.)

Also, unlike the Pentium Pro, which operates at 3.3 V, the Pentium II operates at 2.8 V, thereby allowing Intel to run it at higher frequencies without unduly increasing its power requirements. While a 200-MHz Pentium Pro with a 512-KB cache consumes about 37.9 watts of power, a 266-MHz Pentium II with a 512-KB cache burns 37.0 W.

Processor Packaging

The Pentium Pro consists of a multichip module containing two dies: the processor core and the L2 cache. This module is supplied in a pin-grid array (PGA) package. This is inserted into a zero-insertion-force (ZIF) socket, known as Socket 8 on the circuit board; the pin attributes were defined by Intel.



The Pentium II uses industry-standard L2-cache parts.

At first glance, the Pentium II appears to be radically different from the Pentium Pro, but it is conceptually very similar. From the outside the Pentium II appears to be huge because it's packaged in what Intel refers to as a single-edge-connect (SEC) cartridge. It plugs into a connector called Slot 1 on the motherboard.

In fact, the Pentium II is a cross between a multichip module and a hybrid using an FR4 (printed circuit board) substrate, as shown in the figure above. Intel dou-

bled the processor's on-chip L1 cache (two separate 16-KB caches for data and instructions, for a 32-KB total). The company also separated the processor core from the L2 cache. The result is six individually packaged devices on the SEC cartridge substrate. These devices consist of the processor, four industry-standard (i.e., low-cost) burst-static-cache RAMs, and one tag RAM, which was previously integrated on the L2 cache die. The L2 cache chips and the tag RAM are presented in conventional quad flat packages (QFPs), while the core processor is packaged as a leadless grid array (LGA).

The SEC cartridge conveys further design advantages. The Pentium Pro's PGA package requires 387 pins, while the SEC cartridge uses only 242. This one-third reduction in the pin count is due to the fact that the SEC cartridge contains discrete components, such as termination resistors and capacitors. These items provide signal decoupling, which means that far fewer power pins are required.

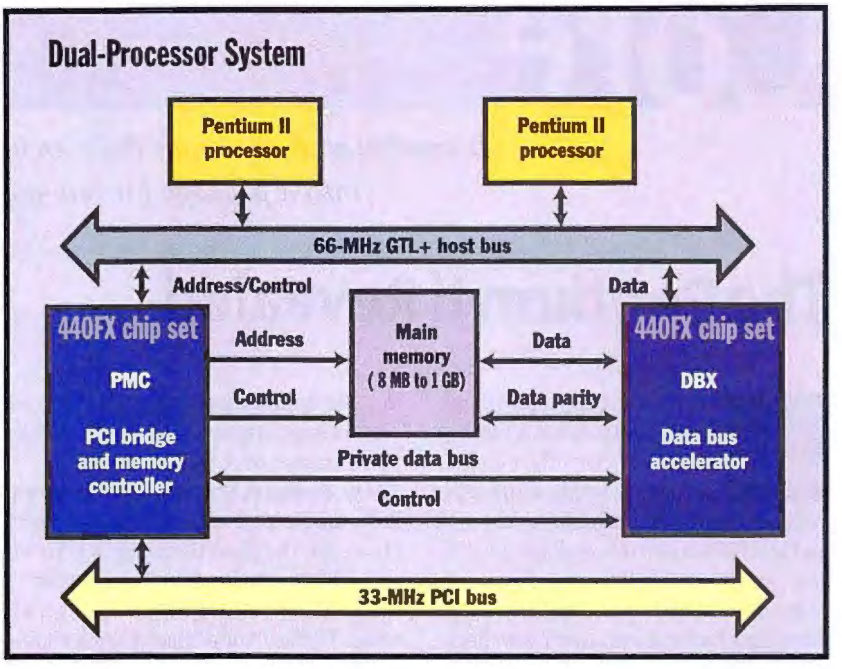
Furthermore, laying down the system-bus traces between multiple Pentium Pro processors using the Socket 8 style is extremely arduous and typically forces board designers to increase a board's layer count. The SEC cartridge's in-line pin arrangement dramatically improves circuit routing, which lets designers employ less-expensive four-layer boards.

Supporting Cast

As the figure above shows, the Pentium II employs a gunning-transceiver-logic (GTL+) host bus that offers glueless support for two processors. This provides a cost-effective, minimalist two-processor design that allows symmetric multiprocessing (SMP).

The two-processor limitation is not imposed by the Pentium II; rather, it's dictated by the supporting chip set. However, by initially limiting the chip set to a dual-processor configuration, this allows Intel and workstation vendors to offer dual-processor systems in a timely and economical manner. Power users demanding the ultimate in performance can expect a quad-processor version of the Pentium II chip set to appear in the future.

In the figure above, note the PMC and DBX chips, which are collectively referred to as the 440FX chip set. The 450KX (low-end) and 450GX (high-end) chip sets used by the Pentium Pro support only fast-page-mode (FPM) memory devices, so these chip sets are obliged to provide memory interleaving to reduce memory cycles. The problem with interleaving is that all the memory slots have to be occupied, which increases the cost to the user for memory upgrades. The 440FX chip set doesn't offer memory interleaving, but it does support extended data out (EDO) DRAM, which improves memory performance by reducing clock latencies.



Support for two processors and EDO DRAM reduces system costs.

System Issues and Performance

Many Pentium II–based systems offer only X-3-3-3 memory timing. This means that, when a block of data is read from memory, the first access requires *X* clock cycles to set up the initial access. *X* for the 440FX chip set equals seven, nine, or 12 cycles, depending on whether the system gets a page hit, page hit/row miss, or page miss, respectively. Subsequent accesses take only three clocks per access, as implied by the 3-3-3 moniker.

Access in this context refers to reading a 64-bit chunk of data, known as a *quadword*. But vendors who pay attention to signal-integrity issues and employ high-quality components, such as buffers and terminators, can actually wring a faster X-2-2-2 timing out of the processor. Intergraph's 440FX-based TD and TDZ Pentium II systems, for example, are built to deliver this memory timing.

Also, Intergraph's designers have built an SEC look-alike "gender-bender" cartridge that sports a Pentium Pro. Thus, users can buy a Pentium Pro–based system and then upgrade the gender-bender cartridge(s) to full-fledged Pentium II SEC cartridges in the future. The only requirement is to exchange a couple of jumpers that modify the frequency and voltage levels of the system clock.

At 266 MHz, the Pentium II delivers a SPECint95 of 10.8 and a SPECfp95 of 6.89. For those who don't run exotic benchmarks for a living, how does this realistically measure up? Intergraph's internal evaluations reveal that a 266-MHz Pentium II runs real-world applications anywhere between 5 percent and 30 percent faster than a 200-MHz Pentium Pro (both with 512-KB caches). For a large number of these applications, the performance improvement falls in the 20 percent to 25 percent range.

Considering this performance improvement and the potential of system vendors passing the Pentium II's cost savings on to their customers, I'd say that Intel has done us proud. B

Clive Maxfield is on the technical staff at Intergraph Computer Systems (Huntsville, AL). He is the coauthor of Bebop BYTEs Back (An Unconventional Guide to Computers) *(Doone Publications, 1997). You can contact him at* **http://ro.com/~bebopbb.**

A look at back-end database access for Office 97 applications and batched server updates. ***By Rick Dobson***

Using ODBCDirect's Advanced Features

I launched a discussion last month of ODBCDirect, a client/server technology that especially targets Office 97 developers. It provides at least three benefits to corporate developers.

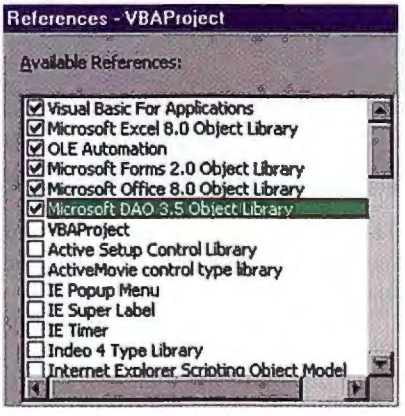
First, it delivers more remote data-processing flexibility in a smaller footprint than going through Access's database engine, Jet. Second, ODBCDirect's tight integration with the Office 97 applications enhances the worth of Data Access Objects (DAO) and Visual Basic for Applications (VBA) programmers by letting them serve up back-end data to corporate desktops like never before. Third, the licensing of VBA to dozens of third-party firms broadens the selection of routes for tapping ODBCDirect's power. This article builds on last month's Programming column by going beyond the basics to showcase a collection of advanced ODBCDirect features.

How does ODBCDirect contrast with other back-end database-connectivity options? ODBCDirect links to ODBC data more quickly and with fewer resources than going through Jet. However, Jet has its own special benefits, including heterogeneous database joins, bound forms, and controls. Developers must choose which projects will benefit most from ODBCDirect's speed and finer-grained functions versus Jet's traditional and easy route of ODBC access.

From Back End into Excel

My first sample application drops data from a SQL Server data set into an Excel spreadsheet. This shows how to drop back-end data into friendly environments and illustrates interesting ODBCDirect development issues. While this example works with Excel, it sets up the ODBCDirect workspace and connects to the Pubs database with the same code I used last month for Access. This sharing of common code among Office 97 applications shows VBA's ability to dramatically reduce development time.

Two additional points merit attention besides the actual code. The only way to derive the benefit of ODBCDirect's small footprint is to use it outside Access. This is because Access loads Jet, even when you use ODBCDirect workspaces exclusively. For Excel or other applications



You must explicitly reference DAO 3.5 to use ODBCDirect outside of Access.

that rely on ODBCDirect to avoid using Access inadvertently, you must reference the DAO 3.5 Object Library explicitly. In Excel, choose the Tools menu and select References. Then scroll to Microsoft DAO 3.5 Object Library and select its check box before closing the References dialog box, as shown in the screen above.

The listing "From the Back End to Excel" on page 54 begins by creating a string, `stSQL`, that contains the SQL for the data that it will download. A querydef, `qdfYTD`, relies on this string. The `OpenRecordset` method for the querydef returns the rows from SQL Server to the workstation's local recordset, `rsYTD`. After some spreadsheet maintenance, a `While...Wend` loop copies the values from the DAO recordset to Sheet1, the active sheet. Offset methods move the active cell to the proper spreadsheet location before a simple assignment statement performs the copy.

Cached, Batched Updating

One of ODBCDirect's more advanced features is its ability to perform cached, local updating of server-based data. ODBCDirect introduces batch optimistic updating. This facilitates the downloading of a recordset that's used to cache the local updates and the subsequent batch updating of those records on the server.

Other database users can edit records between the time you download your records for local processing and upload them back to the server. When the edits of others conflict with yours, the two versions collide on the server. ODBCDirect includes several built-in mechanisms for facilitating collision reconciliation.

First, batch optimistic updating automatically detects, counts, and marks collisions. Second, ODBCDirect provides simple techniques for overriding other changes with your own. Third, properties permit you to compare and contrast the various values of a collided field on a record. The example illustrates how to get started coding this capability.

Batch optimistic updating requires a minimum of six steps. First, you create an ODBCDirect workspace. Second, set the workspace's `DefaultCursorDriver` property to `dbUseClientBatchCursor`. Third, forge a link to a server database via an ODBCDirect connection or database object. Fourth, create a local recordset based on server-based data with the `OpenRecordset` method. You must specify `dbOptimisticBatch` for the `lockedits` argument. Fifth, perform edits as necessary to the local recordset cache. Last, use the recordset's `Update` method with a `dbUpdateBatch` type argument.

continued

ODBCDirect Features

From the Back End to Excel

```
'Create row-returning recordset from server
stSQL = "SELECT titles.title_id, titles" & _
    ".title, titles.ytd_sales FROM titles"
Set qdfYTD = conPubs.CreateQueryDef("", _
    stSQL)
Set rsYTD = qdfYTD.OpenRecordset
'Insert column headings
Sheets("Sheet1").Cells(1, 1).Value = "Title"
Sheets("Sheet1").Cells(1, 2).Value = _
    "YTD_Sales"
Sheets("Sheet1").Cells(2, 1).Activate
'Copy rows
While Not rsYTD.EOF
    ActiveCell.Value = rsYTD!Title
    ActiveCell.Offset(0, 1).Activate
    ActiveCell.Value = rsYTD!ytd_sales
    ActiveCell.Offset(1, -1).Activate
    rsYTD.MoveNext
Wend
```

Cached, Batched Updating

```
'Make connection
Set wspPubs=CreateWorkspace("PubsSession", _
    "admin", "", dbUseODBC)
wspPubs.DefaultCursorDriver _
    = dbUseClientBatchCursor
stConnect = "ODBC;DSN=Pubs;UID=sa;PWD=;" & _
    "DATABASE=Pubs"
Set conPubs = wspPubs.OpenConnection _
    ("", , , stConnect)
'Create cached recordset
stSQL = "SELECT Stor_id, Ord_num," & _
    "title_id, qty FROM Sales"
Set rsSales = conPubs.OpenRecordset(stSQL, _
    dbOpenDynaset, 0, dbOptimisticBatch)
'Modify local cache and attempt
'to update server
While Not rsSales.EOF
    rsSales.Edit
    rsSales!qty = rsSales!qty + 3
    rsSales.Update
    rsSales.MoveNext
Wend
rsSales.Update dbUpdateBatch
'Force in changes even if there
'are conflicts
intIterations=rsSales.BatchCollisionCount _
    - 1
For j = 0 To intIterations
    rsSales.Bookmark = _
        rsSales.BatchCollisions(j)
Next j
rsSales.Update dbUpdateBatch, True
```

The second, fourth, and sixth steps are critical ones. Batch optimistic updating requires that you set the `DefaultCursorDriver` property to `dbUseClientBatchCursor`. The use of `dbOptimisticBatch` for the `lockedits` argument in step four enables batch optimistic updating. The `dbUpdateBatch` parameter for the type argument in step six instructs ODBCDirect to send the local cache to the server as a batch of records.

My code excerpt "Cached, Batched Updating" has four code blocks. First, it makes the back-end server connection. I show this code so you can see precisely how and where to specify the `DefaultCursorDriver` workspace property.

The second block creates a recordset, `rsSales`, and completes the invocation of batch optimistic updating by referencing `dbOptimisticBatch` in an `OpenRecordset` method. You also need a recordset type that is not read-only, as the code shows using the `dbOpenDynaset` argument.

The third code block performs a series of edits to the cached data in its `While...Wend` loop. The `Update` method inside the loop caches the changes locally. The `Update` method outside the loop sends these updates from the local cache to the server.

The fourth code block illustrates a simple collision-reconciliation rule. It overwrites all collisions on the server with those from the local cache. After the initial batch update at the end of the third block, ODBCDirect marks those records in the local cache that collide with the server. It also retrieves the conflicting server values. The code shows how to copy data from the local cache to the server and then update them en masse. The last line uses a `dbUpdateBatch` argument that sends all the changes to the server. The `True` parameter forces those changes over the server data.

Asynchronous Operations

ODBCDirect can open asynchronous connections, querydefs, and recordsets. ODBCDirect also lets you move asynchronously to the last record in a recordset. Each of these functions can take a while: Consider moving to the last of 2,000,000 records—on a remote server.

ODBCDirect's asynchronous capabilities let you use this time locally while you are waiting for a remote server to respond to a command. However, you will have to write code that checks when the asynchronous activity concludes. An object's `stillExecuting` property permits you to run tasks while you wait for the property to turn false or cancel the operation if it takes too long.

Always wrap your updating code statements in a transaction when running tasks that can modify a remote database. This permits your program to "roll back" any completed updates if the task gets canceled, or if it didn't complete the operation within a specified maximum duration.

ODBCDirect offers powerful ways to add value to back-end databases. VBA and DAO developers have new opportunities to serve up back-end data to users in familiar, friendly environments. I hope Microsoft sees fit to upgrade ODBCDirect with events, so that it's easier to manage asynchronous functions. B

Rick Dobson, Ph.D., is president of CAB, Inc., a database and Internet development consultancy. You can send e-mail to him at **Rick_Dobson@msn.com.**

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ActiveX DEMYSTIFIED

It's invasive. It's ubiquitous. But what, exactly, is ActiveX?

By David Chappell and David S. Linthicum

If you use a computer, Microsoft's ActiveX is probably part of your life. Whether you like it or not, the ActiveX technologies have become an essential part of Microsoft applications and tools; they are even finding their way into Microsoft operating systems. What impact is ActiveX having? How does it affect the millions of Microsoft-oriented developers and the tens of millions of Microsoft users? Answering these questions first requires addressing another question, one that turns out to be surprisingly hard to answer: Just what exactly is ActiveX?

First of all, get rid of the idea that the label "ActiveX" refers to some well-defined technology or group of technologies—it doesn't. Instead, ActiveX is a brand name, like Calvin Klein or Ford. As with other brand names, what it's applied to can vary over time.

Still, the technologies grouped under the ActiveX umbrella aren't completely random. Many of them (but by no means all) are somehow related to the Internet and the Web. More important, all ActiveX technologies are built using Microsoft's Component Object Model (COM). But the obvious next step—defining ActiveX to encompass all COM-based technologies—is wrong. COM has found its way into almost everything Microsoft does these days, including Microsoft Office and Windows itself, and clearly these products aren't part of the ActiveX family. Annoying though it may be, we have to learn to live with this fuzzy, marketing-oriented notion of ActiveX—it's the only one that's accurate.

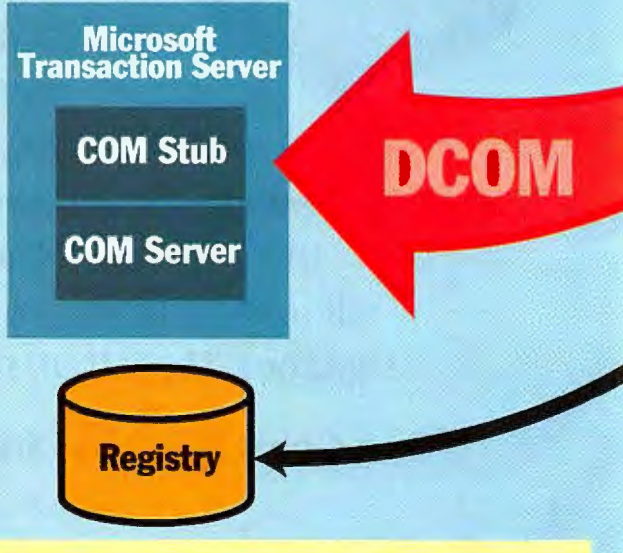
But didn't ActiveX grow out of Object Linking and Embedding (OLE), Microsoft's compound-document technology? In fact, wasn't ActiveX just a new name for what was once called OLE? The answer to both questions is, "Well, sort of."

The Four Ways of ActiveX

The core technologies that enable ActiveX include COM/DCOM (the object model), ObjectRPC (the transport), the registry (a database of component locations), monikers, automation, and structured storage. All ActiveX components can be

1 In-Process Server

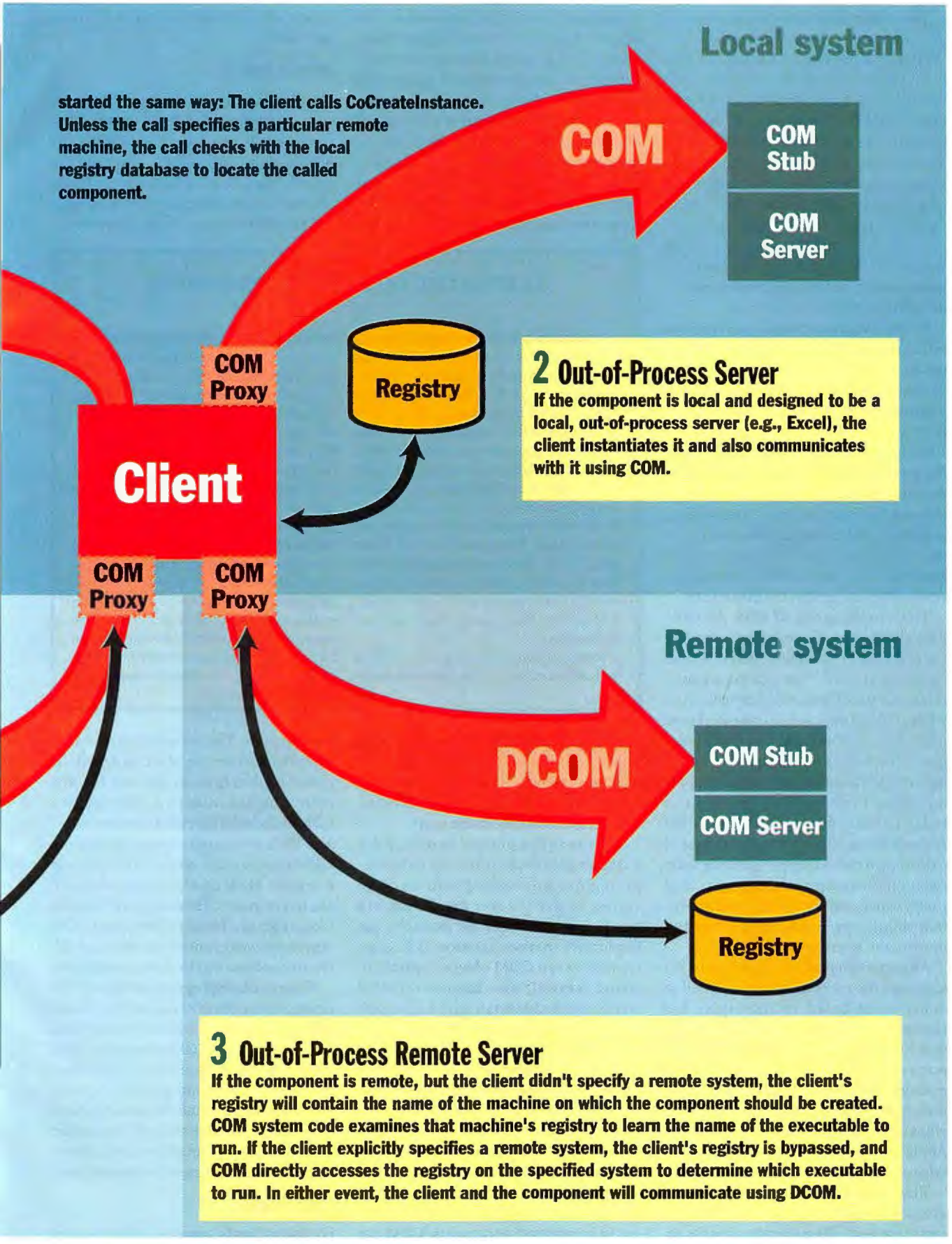
If the component is local and designed to be an in-process server (e.g., an ActiveX control), the client instantiates it and communicates with it using COM.



4 In-Process Remote Server

If the remote component has been written to take advantage of Microsoft Transaction Server, it can run in-process to the transaction server but still use DCOM to talk to the client.

started the same way: The client calls CoCreateInstance. Unless the call specifies a particular remote machine, the call checks with the local registry database to locate the called component.



2 Out-of-Process Server

If the component is local and designed to be a local, out-of-process server (e.g., Excel), the client instantiates it and also communicates with it using COM.

3 Out-of-Process Remote Server

If the component is remote, but the client didn't specify a remote system, the client's registry will contain the name of the machine on which the component should be created. COM system code examines that machine's registry to learn the name of the executable to run. If the client explicitly specifies a remote system, the client's registry is bypassed, and COM directly accesses the registry on the specified system to determine which executable to run. In either event, the client and the component will communicate using DCOM.

The story begins with OLE, a technology for creating compound documents. While OLE's first release was focused solely on compound documents, the next release, OLE 2, introduced COM. COM grew out of the OLE architects' desire to provide a more general mechanism for allowing one piece of software to provide services to another. Accordingly, while OLE 2 was the first technology to use it, COM isn't really tied to compound documents in any significant way. Very quickly, then, COM began to be used in technologies that had nothing whatsoever to do with compound documents.

So now Microsoft had a nice, general infrastructure technology—but it's not a product—and needed a brand name. The company's marketing wizards, perhaps unfortunately, chose to use "OLE" as that brand name. Deciding that the term should no longer be viewed as an acronym, Microsoft began adding the "OLE" tag to every technology that used COM. Most of these technologies, of course, had nothing at all to do with compound documents, so the company spent several years trying to convince all of us that "OLE" no longer referred to just compound documents.

Then, in the spring of 1996, the company changed its collective mind one more time. A new brand name, ActiveX, was chosen, and "OLE" was again deemed to refer only to compound documents. And while OLE had once been a common brand name for nearly all COM-based technologies, COM had by now become so widely used that it was no longer possible to apply one name to everything. The result is today's undeniably confusing situation: ActiveX refers to a loosely defined set of COM-based technologies. OLE once again refers only to compound documents. And COM, which was always the most important thing anyway, gets used more and more in the Microsoft world.

An important point to make here is that although the marketing label applied to many COM-based technologies has changed, COM itself has not. "The core spec for COM has been stable since 1993," according to Joe Maloney, COM group manager at Microsoft. "We've added additional functionality, but the definition of what COM is has remained consistent." Applications written against COM's initial release still work unchanged today.

The idea of an object model that's divorced from a programming language can seem odd. We understand what an object is in C++ or Java, but what's a COM object? A straightforward way to think about COM is as a packaging technology, a group of conventions and supporting libraries that allows interaction between different pieces of software in a consistent, object-oriented way. COM objects can be written in all sorts of languages, including C++, Java, Visual Basic, and more, and they can be implemented in DLLs or in their own executables, running as distinct processes. A client using a COM object need not be aware of either what language the object is written in or whether it's running in a DLL or a separate process. To the client, it all looks the same.

Having such a general approach for packaging software turns out to be surprisingly useful. Two applications cooperating to give the user the illusion of a compound document, for example, can implement that cooperation as interactions between COM objects (which, of course, is exactly what happens with OLE compound documents today). Code that's downloaded from a Web server to run inside a browser can appear as a COM object to the browser, providing a standard way to package downloadable code (which is what ActiveX controls do).

Even the way an application interacts with its local operating system can be specified using COM (and new APIs for Windows and Windows NT are now often defined as COM objects). Despite its origin in compound documents, COM can be usefully applied to a host of software problems.

Persistence

Creating a COM object by loading the right code is all very well, but is it enough? For some objects, the code is all that's really needed, but many objects also need the correct data loaded into them. These objects need to load their persistent data.

COM supports a number of persistence mechanisms. The simplest is file-based persistence, where an object just loads its persistent data from an ordinary file. For more complex situations, there's also a COM-based solution called *structured storage*. With structured storage, something analogous to a file system is built inside every file. Made up of *storages*, which are like directories, and *streams*, which are like files, structured storage allows many COM objects (possibly running inside many different applications) to share a single file.

When a client program creates a COM object, it's the client's responsibility to tell that object where to find its persistent data (if it has any). For COM objects that need to load persistent data, then, clients must do two things: Create the object itself, then tell it where to find the persistent data. COM supports other kinds of persistence, too, but ordinary files and structured storage are among the most commonly used.

Monikers

For many clients, creating and initializing

Transactions and Components

A traditional transactional application tells a transaction server that it should begin a transaction, makes changes, then tells the transaction server to commit or abort all of those changes. But this traditional approach doesn't work when the transactions are being performed by components. Why? Remember that the primary goal of component-based development is to allow building applications from independently created parts. If each component were always used alone, the traditional "Begin Transaction, Do Work, Commit or Abort" structure would work just fine. But if you want to combine multiple components into a single transaction, each component cannot contain its own Begin Transaction request.

Microsoft Transaction Server's solution is to disallow a component to determine when a transaction begins. Instead, each component can be administratively configured to require a transaction. When a client creates a transaction-required component, MTS automatically starts a transaction. If that component then commits or aborts the transaction, MTS carries out the component's request. If the component creates another component, and the new component also requires a transaction, MTS can automatically include the changes made by the new component in the transaction. When this second component commits or aborts its work, MTS takes note but doesn't end the transaction. Not until the parent component commits or aborts does MTS end the transaction. This approach allows the same component binary to be used in its own transaction or combined with others into a single transaction. **–David Chappell**

Active Platform

Active Platform is Microsoft's view of the world. It uses ActiveX controls as a mechanism to interact with users and to automate everything from COM-enabled transaction processing (TP) monitors to Web servers. It has two parts: Active Server and Active Client.

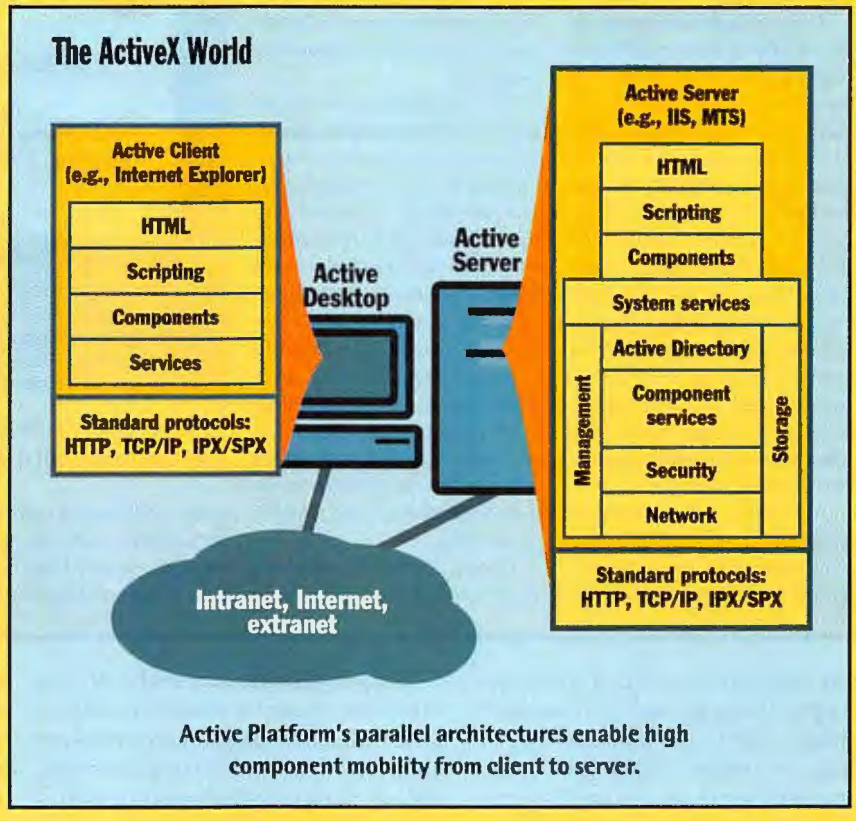
Active Server is really the middle tier, providing the location for business logic and primary application processing using components or Active Server Pages (ASP). The core technologies of Active Server include NT Server, Microsoft Transaction Server (MTS), data management services, directory services, Web services, and network services. MTS combines traditional TP monitor features, such as thread pooling and database multiplexing, with the Microsoft component-based programming model.

Other components of Active Platform, such as data management services, leverage OLE DB and ODBC to access data sources like DB2, Oracle, and SQL Server. Active Directory provides the directory services layer around Distributed COM (DCOM), allowing remote objects to find each other on the network. The Web services are built around Internet Information Server (IIS), providing scripting mechanisms through ASP for server-side Web application development. Network services are built around DCOM, allowing the controls to connect over the network through the synchronous MS-RPC.

The Active Client is cross-platform. Microsoft is hoping to deliver technology to a broad range of operating systems, albeit on its own terms. The plan is to use standard HTML, Microsoft's flavor of the Java virtual machine (JVM), and a scripting engine using Microsoft's VBScript and JScript (Microsoft's version of JavaScript). So where do you find the Active client? It's built into Microsoft Explorer 3 and 4, and it can be part of your client/server application through ActiveX.

For Windows shops, Active Platform provides a sound and scalable server-side application development platform. Since Active Server leverages commodity tools and technologies even with high-end products such as TP monitors, small workgroup or intranet applications won't exceed the capacity of Active Server. While Active Platform targets different environments, it's too dependent on Internet Explorer to drive the client. Explorer is appearing on some non-Windows platforms, but Windows is receiving the best support and the latest versions.

– David S. Linthicum



Active Platform's parallel architectures enable high component mobility from client to server.

a particular object instance is a perfectly acceptable thing to do. In some cases, though, it's just too much to expect a client to do this. An object might require very complex initialization, for example, or a client might need to use many different kinds of COM objects, each of which has its own idiosyncratic requirements for creation and/or initialization. To hide this kind of complexity, COM defines the notion of a *moniker*.

A moniker is a COM object like any other, but it has a special function: Each instance of a moniker object knows how to create and initialize exactly one other specific COM object instance. Monikers do what clients could do for themselves—object creation and initialization—but they hide the details from their clients.

But wait—monikers are themselves COM objects, and they have their own persistent data (if they didn't, they'd have no idea what object they referred to). To use a moniker, then, a client must first create and initialize that moniker, then ask it to create and initialize the object it refers to. This seems patently stupid. Why can't the client just create the ultimate target object itself? What benefit does the moniker provide?

In many cases, the answer is "Nothing." Clients of COM objects often create and initialize those objects themselves, eschewing monikers entirely. But there are times when creating and initializing a COM object is so complex, so idiosyncratic, or just so painful that relying on a moniker can simplify a client's life. One example is connecting to a linked document in OLE, which was the first use of monikers, but there are many others. Microsoft's Internet Explorer, for example, relies on monikers every time a user accesses a URL.

Automation

Like other kinds of objects, COM objects provide methods that their clients can call. Those methods are provided through interfaces that group methods into uniquely named collections. COM objects today can choose to expose their methods through two different kinds of interfaces. The first option, called *vtable interfaces*, works very well when the clients that will call those methods are written in C++. The second choice, called *dispatch interfaces* (usually shortened to *dispinterfaces*),

ActiveX Security

Downloading executable content from unknown Web sites might be risky. Who knows what this little application is going to do once it's on your system? Two main security concepts have emerged to combat malicious executables: code signing and the sandbox model.

ActiveX uses code signing, specifically the Microsoft Authenticode technology. Authenticode allows you to verify the origin of a control and thus assess its reliability and safety. If a control destroys your system, at least you'll know whom to beat up. Independent certificate authorities (CAs) like VeriSign issue the digital signatures to mark the code. Developers have to pay for the certificates, and in order to be considered for a certificate you must pass through a screening process. The digital signature is 1024 bits and thus essentially impossible to reverse engineer.

Authenticode is based on Microsoft's code-signing proposal now being evaluated by the World Wide Web Consortium. Authenticode uses X.509 v3 cryptography certificates as well as the PKCS #7 and #10 signature standards. The digital signature uses both a public key and a private key, known as a key pair. Only the private key owner knows the private key, while the public key is available to the world. The private key is used to generate the signature, and the public key is used to validate it.

The Java sandbox, in contrast, provides highly restrictive security. An applet can't perform unauthorized system functions (e.g., allocate memory) or read and write from disks or other devices. Because some developers have found the sandbox too restrictive, recent versions of the Java Development Kit also support code signing and different degrees of protection. Consequently, if an applet is signed and trusted, it might be able to exit the sandbox into another protection domain where it may be able to do file I/O, for example.

Cost is also an issue. If you're going to add a signature to your code, you have to pay the CA. While larger software development shops won't feel the pain, those that create shareware in their basement might not be able to afford the certification or pass the CA's background check.

–David S. Linthicum

Authenticode warns you that you're about to install some bit of software, but it doesn't protect you after you click Yes.

works very well when clients are written in simpler languages such as Visual Basic (although they're also usable from C++ clients). For reasons related again to marketing, exposing methods using dispinterfaces has become known as *automation*.

The name "automation" was applied because of how dispinterfaces were first used. Developers of desktop applications wanted to allow other software to make use of their applications' functions. This is a situation tailor-made for COM, since its raison d'être is to allow one piece of software to expose its services to another. Because most of the code that would make use of those applications' services was expected to be written in Visual Basic, the applications' developers chose to expose their methods using dispinterfaces rather than vtable interfaces. And since doing this allowed writing programs that could automatically carry out, say, repetitive spreadsheet tasks that would otherwise have been done by hand, using dispinterface methods came to be known as automation.

Today, dispinterfaces are used in all kinds of situations, many of which have nothing to do with automating the use of a desktop application. Still, the name has stuck, adding one more confusing term to an area that already has more than its share.

Distributed Computing

COM's first incarnation assumed COM objects and their clients were running on the same machine (although they could still be in the same process or in different processes). From the beginning, however, COM's designers intended to add the capability for clients to create and access objects on other machines. Although COM first made its way into the world in 1993, Distributed COM (DCOM) didn't appear until the release of Windows NT 4.0 in mid-1996. Unquestionably an important part of the ActiveX family, DCOM is now available for Windows 95 as well (but don't hold your breath waiting for a Windows 3.1 version—Microsoft says that's not going to happen).

DCOM really doesn't change much about how a client creates and interacts with a COM object. In fact, it might not change anything at all—a client can use exactly the same code to access local and remote objects. In many cases, though, a client might choose to use a few DCOM extras (although these extras also work for local objects—COM's designers have worked hard to let clients remain unaware of where their objects are running). DCOM also includes a distributed security mechanism, providing authentication and data encryption. Windows NT 5.0, scheduled for release next year, will add support for Kerberos and other security protocols to DCOM. And to locate COM objects on other machines, DCOM today can make use of simple directory services such as the Domain Name System (DNS). Again, NT 5.0 will broaden the choices, adding support for Microsoft's Active Directory, which is based on DNS and Lightweight Directory Access Protocol (LDAP).

DCOM's traditional nemesis has been the Object Management Group's Common Object Request Broker Architecture

(CORBA), which is embodied in many commercially available products, such as Iona's Orbix and Visigenic's VisiBroker. More recently, Java's Remote Method Invocation (RMI) has emerged as another choice for supporting distributed objects. Unlike CORBA and DCOM, both of which allow communication between objects written in various languages, RMI is focused on communication between objects implemented in Java. This limitation certainly adds some constraints, but it also makes RMI very simple to use. Furthermore, RMI's developers had the luxury of designing their protocol specifically for Java, allowing them to make it an excellent match for the language's features. (COM, on the other hand, must deal with translations among the type systems of various languages, something that's almost never pleasant.)

Writing a DCOM server that can handle only a couple of clients is relatively straightforward. However, building a DCOM server that can effectively handle a couple hundred clients, or a couple thousand, is much more complex.

To make writing scalable DCOM servers easier, Microsoft has released the Microsoft Transaction Server (MTS). While MTS does provide support for transactions, it also provides services such as automatic threading and intelligent object reuse. Even applications that don't need transactions can benefit from using MTS since it makes writing scalable servers much easier; in fact, Microsoft encourages developers to write their MTS applications in Visual Basic, hardly a traditional choice for people creating industrial-strength servers. Every MTS application must be written as one or more COM objects, implemented in DLLs. To a client, MTS is typically invisible—the client just creates and uses COM objects as always.

Standards for Components

Component-based application development holds the promise of building applications the same way we assemble electronics: out of prebuilt component parts. COM-based components for the desktop are known as ActiveX controls. (A very common terminological mistake is to confuse "ActiveX," a label for a broad family of technologies, with "ActiveX controls," a specific technology in that family.) An ActiveX control is just a COM object that follows certain standards in how it interacts with its client. For example, an ActiveX control must expose its methods via automation, i.e., using dispinterfaces. This standardized interaction allows the same control to be used in many different contexts. Behind its standard interfaces, an ActiveX control can do virtually anything, and controls implementing all kinds of functions are available from various software companies today.

ActiveX controls are written as DLLs, and so they must be loaded into some kind of container—they can't run on their own. The archetypal container for ActiveX controls was Visual Basic (why do you think controls were required to use dispinterfaces?), but today there are many more choices. An especially important example of a control container today is Microsoft's Web browser, Internet Explorer. In fact, the realization that a Web browser could be a control container (and recognition that Java applets might otherwise come to own this market) caused Microsoft to significantly change both the technology and the name applied to COM-based desktop components.

What are now known as ActiveX controls were originally called OLE controls, and they were required to implement a large number of methods. This made them big, but so what? They were loaded off a machine's local hard drive into a container such as Visual Basic. Whether a control was a few hundred kilobytes or a couple megabytes made no significant difference, went the logic. But if a control were loaded into a Web browser, there was an excellent chance that that control would first be transferred across a slow phone connection to the Internet. Now, a control's size mattered crucially, and to require its creator to implement any more than the required minimum would needlessly increase its download time. Accordingly, at about the same time it changed the name, Microsoft decreed that what were now called ActiveX controls could implement only those features that were absolutely necessary for that control—no more needless obesity was required.

For several years, the primary competitor to ActiveX controls was OpenDoc, promoted by Apple and IBM. Today, however, both of OpenDoc's sponsoring orga-

Java and ActiveX

The debate rages on: Java versus ActiveX. To understand the debate, though, it's important to remember that both "Java" and "ActiveX" are labels applied to a broad range of technologies.

ActiveX controls and JavaBeans are definitely competitors, however, and developers must make a choice when creating a component. But they're not mutually exclusive: Each is suited to particular situations.

Both ActiveX controls and Java applets and Beans support the "download once run many times" architecture. In the case of Java applets, the Java virtual machine (JVM) interprets the bytecode and controls access to system resources. The JVM removes the applets from the details of the host OS, and thus applets can run on any platform that supports the JVM. Most do. ActiveX controls, by contrast, have to register themselves with the Windows registry and execute as native Windows applications.

The trade-off is portability versus native look and performance. Any version of Java code is cross-platform as long as the JVM supports that platform. But Java's performance is less than stellar, and by default the security subsystem of Java does not allow access to native features such as file I/O and devices. Thus, Java is the best bet for those shops that have to support a hodgepodge of operating systems and processors and don't mind having to write an application around the security features.

While Java is the jack-of-all-trades, ActiveX is the master of one: Win32. ActiveX controls function exactly like native Windows applications and thus have access to all native features such as print queues, file I/O, and even memory. For security, ActiveX depends on Microsoft's Authenticode system (see "ActiveX Security," page 60). The use of the native features of Windows means that ActiveX controls run at native speed, typically faster than their Java counterparts. Moreover, most popular client/server tools, such as Visual Basic, Delphi, and PowerBuilder, now support ActiveX control development using the native languages of the tools. Finally, many Windows tools and applications can make use of ActiveX controls, so they aren't confined to your browser.

Which is for you? Consider them both for their strengths and their weaknesses. It's okay to leverage ActiveX controls for homogenous Windows applications, while Java is a finer fit for cross-platform situations. It's better than force-fitting applications in the name of a standard, or worse, a religious crusade.

–David S. Linthicum

nizations have officially declared it dead. Instead, most of the anti-Microsoft forces have lined up behind JavaBeans, a Java-based component architecture. Unlike controls, which are largely tied to Windows and distributed as machine-specific binaries, a JavaBean can run anywhere. The trade-off, of course, is that a Bean can't take full advantage of its local environment without compromising that portability. For many applications, such as writing a component that can be downloaded from the public Internet, JavaBeans is an excellent choice.

Today, there is a large and rapidly growing market for desktop components, nearly all of which are built as ActiveX controls (relatively few JavaBeans are available now). Standards for server components have been slower to arrive, however. On the desktop, Web browsers and programming environments such as VB and PowerBuilder are obvious choices for containers, but what should a server container be? Well, one excellent choice for a server-side component container is a transaction server—and Microsoft is touting its own, MTS.

Microsoft's competitors are loath to see MTS and NT gain substantial ground. The most promising of their efforts to create a standard for server-side components is an extension of JavaBeans called Enterprise JavaBeans. This specification defines interfaces to a transaction server, not unlike MTS, and its supporters hope to convince independent software vendors to write their server components as Beans rather than COM components. Microsoft is ahead in this market—MTS shipped in late 1996, while the Enterprise JavaBeans specification is quite new, and products supporting it aren't yet available.

The Future of ActiveX

It's fair to say that the ActiveX technologies will always be most at home in the

Tools for Building Controls

As ActiveX becomes more popular, more ActiveX control development tools are appearing. Since ActiveX is language-independent, almost any traditional development tool can build and deploy ActiveX controls. The most popular tools include Borland's Delphi, Powersoft's PowerBuilder, and the arsenal from Microsoft, featuring Visual Basic, Visual C++, and Visual J++.

Frameworks

There are several ways to create ActiveX controls using 3GLs, including:

- Using the Microsoft Foundation Classes (MFC)
- Using the ActiveX Template Library (ATL)
- The BaseCtrl Framework

Most current ActiveX development uses MFC because MFC has been around the longest and many C++ developers know it. Also, unlike the other techniques, MFC enables developers to concentrate on the behavior of the object rather than the interface. The downside (especially for Internet distribution) is the size of the controls and the need for a run-time DLL to exist with the container.

ATL is able to generate code each time you need it using templates. Thus, you don't need libraries or DLLs that have to ship along with the control. ATL requires that you derive a class from several base classes existing as templates. Typically, developers will use the ATL wizard to create the classes automatically. ATL also has drawbacks. It's much more difficult to deal with interfaces using ATL since you must create each interface you need for your application. Also, ATL does not support the Class Wizard that's able to automatically keep the Object Description Language and interface definition language files in synch with your code. The wizards leave a lot to be desired.

BaseCtrl is a lightweight library, very much like ATL, but without the templates. BaseCtrl is so lightweight, in fact, that Microsoft does not support it. Several skeleton controls come with BaseCtrl. While BaseCtrl provides an easy-to-understand ActiveX control development model, it's not that much easier than ATL, and it does not provide as much flexibility. For now, it's a poor choice for ActiveX control developers.

Tools

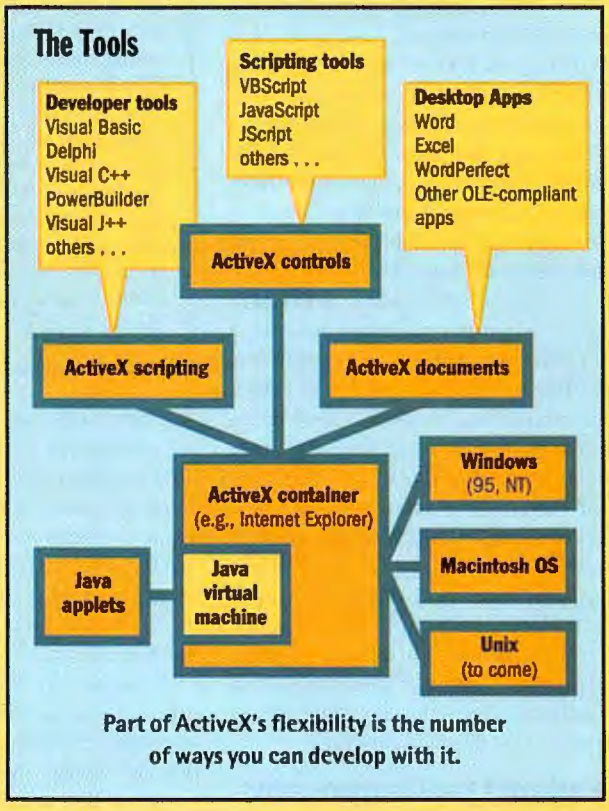
Microsoft's Visual C++ was the first tool to provide capabilities for creating ActiveX controls. Today it provides the most control for ActiveX developers. Visual J++ can also create ActiveX controls. This keeps many Java purists up at night, and it's a good comeback for Microsoft when arguing the ActiveX-versus-Java issue.

Although two of Borland's development tools—JBuilder and IntraBuilder—get much attention, Delphi 3.0 and C++ Builder are the only Borland tools able to create ActiveX components. Borland calls Delphi's ActiveX development features Active Inside. The idea is to turn any Delphi Window into an ActiveX form. Active Inside prepares your new control for deployment on the Web. Delphi is also able to link your control to COM or DCOM for links to other objects.

PowerBuilder 5.0 is a client/server development tool redone for use as an ActiveX factory. PowerBuilder is able to deploy Data Windows (the core of PowerBuilder application development) as ActiveX controls, and it allows current PowerBuilder developers to use familiar features such as the PowerScript programming language.

Microsoft has probably the best tools for creating ActiveX controls. Visual Basic 5.0, for example, allows developers to use the friendly visual programming environment of VB and the native Visual Basic for Applications language to create controls.

– David S. Linthicum



Part of ActiveX's flexibility is the number of ways you can develop with it.

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world of Windows and Windows NT. But no matter how much Microsoft pushes its operating systems, most organizations will always have some diversity—single-vendor environments just aren't in the cards. Accordingly, Microsoft is working to make COM, DCOM, and some other parts of the ActiveX family available on other operating systems. Microsoft already provides ActiveX support for the Macintosh, including support for ActiveX controls (since Microsoft Office now depends heavily on COM, Microsoft had little choice but to support COM in that environment). Software AG is porting these technologies to various flavors of Unix and to IBM's OS/390 (the current name for the venerable MVS operating system). Digital and HP have also committed to providing these technologies on their systems, again by porting Microsoft's code.

COM has become a crucial part of the software infrastructure in the Windows 95 and Windows NT environments. But there are still plenty of uncertainties about the future. Will Microsoft succeed, for example, in making COM a viable multiplatform technology? Fitting Windows NT servers into existing enterprises will all but require that DCOM and other distributed services be available on non-Microsoft platforms. The process has taken longer than expected, and while many organizations have made promises in this area, not much code is actually shipping. Meanwhile, both CORBA-based products and Java's RMI are successfully running in multi-OS environments today. The more time passes before multiplatform DCOM becomes a reality, the larger CORBA and RMI's lead will become.

What about the contest between ActiveX controls and JavaBeans? Componentware is the next great wave in software development, whether that software runs in a Web browser or somewhere else. ActiveX controls are ahead today, but with the demise of OpenDoc, all of Microsoft's opponents have rallied behind a single competitor. If only because of users' desires to avoid monopoly, JavaBeans will very likely acquire some market share.

COM has grown to play a key role in Microsoft's Internet strategy, its applications, and even its operating systems. And as with all living software technologies, enhancements to COM are on the way. But whatever label is applied to the core COM-based technologies—originally OLE, now ActiveX, and tomorrow perhaps something else—COM's importance shows no signs of declining. As long as Windows and Windows NT are important operating systems, the ActiveX technologies will play a significant role in our lives. B

Who Owns ActiveX?

A key factor in the move to make ActiveX a multiplatform technology is Microsoft's much-publicized dealings with the Open Group. Formed from the merger of X/Open and the Open Software Foundation, the Open Group is one of the last remaining organizations from the heyday of open systems. It's been widely reported that Microsoft was giving control of core ActiveX technologies to the Open Group. But a careful reading of what Microsoft has actually said on the subject makes clear that this isn't the case.

The initial Microsoft press release on this topic, dating from July 1996, begins, "Microsoft Corp. today announced plans for fulfilling its vision of openness for ActiveX by transitioning specifications and appropriate technology to an industry-standards body." This is not quite the same thing as giving control. Later that year, Microsoft group vice president Paul Maritz stated that the goal of the process was to "make sure that the technology is made available to the industry in an open manner and ensure that there is an efficient, open process for the future."

In the October, 1996, announcement reporting the results of a vote taken by potential participants in the ActiveX standardization process, Microsoft states, "The Open Group has been selected by Microsoft ActiveX stakeholders to provide leadership in the evolution and deployment of ActiveX core technologies." Note again that the word "control" is never used. The announcement goes on to say, "The Active Group, to be formed under the auspices of The Open Group, will manage the evolution of ActiveX technologies. It will take advantage of The Open Group services ..."

What seems most likely here is that the future direction of COM and ActiveX technologies will still be determined by Microsoft. The Active Group will be composed of companies that want to promote and proliferate COM and DCOM technologies. The Active Group will, as Microsoft has stated, make use of the Open Group's services where relevant or needed, but they will not be under its thumb. For example, the Open Group has a mechanism in place for licensing software on an equal basis to all comers, and Microsoft has allowed them to license the code for COM and DCOM to other vendors. But the Active Group's primary purpose will be proliferation and promotion, not providing a formal venue for defining the future of ActiveX.

This arrangement is reminiscent of the Java world, where a single vendor (JavaSoft, i.e., Sun) takes input from other vendors and users, then determines technology directions based on that input and on its own desires. Both leading object technologies—ActiveX/COM and the Java environment—are now controlled by single vendors. Our industry has finally learned a crucial lesson: Technologies controlled by slow-moving standards bodies can't keep up with rapidly changing markets.

–David Chappell

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Publish or Perish

Solutions to overworked networks and unruly software distribution are just part of P&S.

By Richard Hackathorn

A large stock-brokerage firm on Wall Street has difficulty getting the right data to its traders. It implements a publish and subscribe (P&S) trading system to distribute general news and stock information. A successful software vendor of CAD tools has a big problem with handling customer support. It designs a P&S problem-tracking system to manage the daily flow of thousands of customer requests. A global manufacturer of oil-drilling equipment has a messy situation tracking material and finished goods on its shop floor. It installs a P&S materials-handling system that tracks jobs at each step in the manufacturing process.

Notice a pattern? All these involve complex business processes with ever-changing objectives. Sounds a bit like your business? If so, P&S may solve your problems.

No More R&R

For 30 years, the basic paradigm of computing has been request and reply (R&R). An application requests specific data or services, and a subroutine replies with it.

But the R&R paradigm is running out of gas. In the dynamic and uncontrolled environments of present-day enterprise systems, an application no longer has the luxury of knowing when and what to request.

P&S coordinates the components of distributed applications. The concept started hundreds of years ago with newspaper publishing. Recently, it has been applied to a variety of products that coordinate complex distributed applications or replicate diverse information content. P&S is a connectivity paradigm that separates the role of producer from consumer via an intermediary, called the broker (see the figure "R&R vs. P&S" on page 66). The broker manages the interactions so that neither the producer nor consumer need know much about the other. The architecture is decoupled or loosely coupled.

With P&S, a relationship is maintained by the broker to couple producers with consumers, as contrasted with a momentary interaction of R&R. This relationship is called a *channel* (or subscription, subject, or buffer). By reversing the ordering from R&R, the producer initiates the interaction by publishing a message to the broker.

The traditional way of linking data producers with data consumers is to design the system so that those links are static—hardwired into module linkages and procedural calls. As we move into increasingly dynamic and complex environments, we no longer have the luxury of hardwiring those links. Producers and consumers often appear and vanish. We need a mechanism to efficiently match producers with consumers in a dynamic fashion. Adding flexibility and adaptation to system architectures is the role that P&S is fulfilling.

Three Business Problems

Because the P&S arena is emerging from several complex technologies, it is very confusing. The terminology is nonstandard, and everyone uses the terms *message*, *channel*, and *event* with subtle variations in meanings.

To understand the technologies and terminology better, you must understand the business problems that P&S aims to solve: coordinate processes, replicate content, and inform people (see the table "P&S Solves Business Problems" on page 67).

Coordinate processes. Typically, this means tracking a business activity. Cutting quite deep, P&S has become an alternative to traditional application-development methodologies—a different way of thinking about system architectures. Rather than catering to a logically centralized database, P&S is used as the event-driven coordination of applications through the distribution of messages. The focus is on significant changes that occur in business processes, such as a customer ordering a product.

continued

Once the message flows from the producer to the consumer, it is treated as nonpersistent (i.e., thrown away).

Replicate content. Somewhere there exists a persistent data store, such as a relational database or Web site. The information stream is closely linked to some part of that persistent store and represents the changes that are occurring within it.

Inform people. This is the essence of newspaper publishing, but P&S shifts the activity into a global scope and customizable context.

These three areas are similar in many respects. "We distinguish between content-push versus process-push," says Mike Kennedy of the Meta Group.

Coordinating processes often assumes that a database is part of the system. Fulfilling a customer order assumes a database of customers and inventory. Replicating content is driven by events that change the database. The inventory database changes because customer orders are being fulfilled. And informing people assumes a common knowledge base and a world that is constantly changing.

Coordinating processes usually requires a strongly typed message structure and may or may not be closely associated with a common database. Replicating content usually assumes a strong linkage to a database of some sort. It can vary greatly in the degree of message structure (from SQL INSERT statements to refreshed Web pages). Finally, informing people usually has a low message structure, which may or may not require a common database to understand messages.

The Emerging Architecture

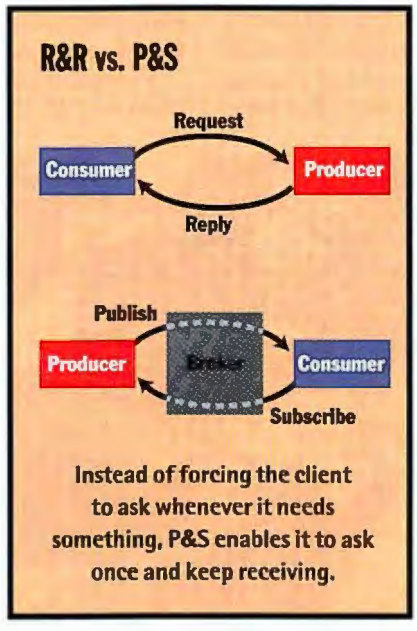
P&S is a coordination mechanism that matches and links producers with consumers mediated by a broker. Producers are sometimes called providers or publishers, and consumers are sometimes called subscribers.

"The role of broker is critical with P&S," states Mitch Kramer of the Patricia Seybold Group. "It decouples producers from consumers so that they don't need to know about each other."

The broker establishes a channel to manage a stream of similar messages. Channels relieve the burden for the producer or consumer to maintain currency (see the figure "Free Subscription" on page 67). The broker maintains a channel as long as a producer publishes or a consumer subscribes. This duration may last from a few seconds up to a few years.

By decoupling the producer-consumer relationship, the security of both parties can be enhanced, allowing either one to participate anonymously. Producers could also share or transfer subscriptions to balance loads or specialize in certain areas. Further, the P&S mechanism could form multilevel value-added chains in which a consumer can add value to the data and republish the result to another group of consumers.

A message is usually divided into a header—structured data common to all message types—and a body—variable data specific to a certain message type. The body may contain free-form text, HTML Web pages, attribute-value pairs, and such.



Finally, a market is formed when a high level of activity occurs among a group of producers and consumers over one or more channels. Like the dynamics of normal markets, the dynamics of markets in P&S systems are a major indicator for directions to evolve these systems.

Basic Interactions

Here's how it works (see the figure "The Publish and Subscribe Architecture" on page 68). A producer registers with the broker for a specific channel. This action may cause the broker to create the channel and establish its characteristics. Consumers inquire about available channels. If a desired one is found, the consumer subscribes to it. Later, the producer publishes a message to a channel. The broker delivers the message to the proper set of consumers subscribing to the channel.

In some situations, direct interaction between a producer-consumer pair is desirable. Such a direct link is required for highly volatile or massive data, along with applications requiring efficient high-volume transactional semantics.

A final aspect of the above interactions is the possible monetary exchange among producers, consumers, and the broker. As critical systems extend beyond the boundaries of a company, an explicit financial incentive must be established to ensure stable operations. Although electronic commerce is rapidly increasing in various areas, no examples of monetary exchange with P&S have occurred.

Practical P&S

There are several key issues to resolve in any practical application of P&S. How do you define channels? Set level of service? Privileges?

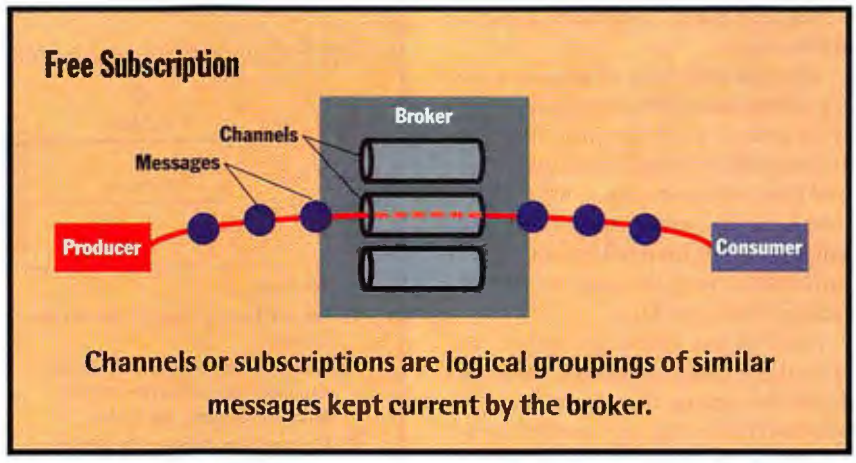
Channels and namespace. The first issue is defining channels, especially the namespace. A channel represents a stream of important business events or information resources. Defining your channels implies defining your business processes. Likewise, naming (or addressing) your channels implies how the P&S applications will support your business processes. Most argue that the naming should be federated, so that there is a shared responsibility among producers and the broker, similar to domain names in the Internet.

The message header usually contains a structured field for a subject (or object type name). If the naming of messages uses this subject field, the P&S mechanism is subject-based. In contrast, if the naming is dependent on the content of the message body, it is content-based. Subject-based is more efficient, while content-based enables more flexibility for the consumer to specify which messages are processed. Content-based naming may also imply that the message body has some self-defining format so that the broker can filter on various equivalence operators in addition to simple string matches.

QoS. The second issue is the level (or quality) of service, usually dependent on the reliability of message delivery. The typical levels of service are best-effort, reliable, guaranteed, and transactional. Best-effort implies that the broker uses an efficient (but without error correction)

transport, such as UDP. Reliable implies that the broker uses a less efficient (but with error correction) transport, such as TCP. Guaranteed implies that the broker queues the message on permanent storage until it is ensured that the consumer has received the message.

Finally, transactional implies that the broker manages a transaction among the producers and consumers, so that any actions by all parties are committed or aborted in unison. Among the various products, the scope of the transaction boundary is confusing and depends on whether the perspective is from the producer or consumer viewpoint.



Pull vs. push. The topic of push protocols has received much industry visibility recently as the preferred alternative. The problem occurs when the broker sends a message to the consumers that have subscribed to that message. If the number of consumers is small, each one can pull its message from the broker via periodic polling, or the broker can send the message multiple times, once for each consumer. As the number of consumers rises to millions, both approaches rapidly degrade network performance. In other words, approaches using pull and also simple push do not scale. Mark Bowles of TIBCO notes, "Scalability is poor for simple point-to-point solutions."

The essence of true push for P&S is twofold. First, the consumer receives its message asynchronously. An interrupt occurs at some level to switch the consumer's attention to the new message; there is no background polling by the consumer. Second, the message is multicast by the broker to many consumers. The broker initiates a message that is efficiently distributed to the proper consumers. Efficient multicasting implies hardware assistance buried in network routers, hence limiting networks to homogeneous equipment. At the heart of the debate over efficient multicasting is IP multicasting for TCP/IP (see "Multicast to the Masses," June BYTE).

Privileges. The fourth issue is specifying and managing privileges for producers and consumers. Like that of a database system, it is necessary to have a secured environment in which all parties are authenticated and then assume a set of privileges that limit their actions.

Configuration. The final issue is the configuration for the P&S architecture. Vendors typically describe their implementations in terms of bus, hub and spoke, and snowflake (see the figure "Lay of the Land" on page 70).

Key Players

P&S is emerging from many diverse product categories (see the figure "Where They Fit" on page 70). There is a rapid blurring among categories caused by normal market pressures. As P&S matures, these categories may become useful only for historical background.

Messaging. Messaging transports (also called message-oriented middleware, or MOM) start with simple protocols for sending a message packet from point A to point B in a reliable and efficient manner. The inherent store-and-forward mechanism of message transports has been extended in numerous ways, one of which is P&S. As an outgrowth of sending one message from point A to many point Bs, the idea of shared buffers and subscribers emerged.

Some products are TIB/Rendezvous, from TIBCO; Velociti, from Vitria; SmartSockets, from Talarian; NEONet, from New Era of Networks; and ActiveWeb, from Active Software.

Since 1986, TIBCO (formerly Teknekron, now part of Reuters) has established a client base in the trading systems of Wall Street with its The Information Bus (TIB) middleware. Using a subject-based naming scheme, TIB/Rendezvous multicasts packets so that only selected destinations receive the packet, usually by the hardware-assisted IP multicasting.

Vitria's Velociti is a newcomer that takes a direct aim at TIBCO. It broadens protocol support beyond IP multicasting by adding support for Common Object Request Broker Architecture (CORBA) IIOP. "The key issues are defining the channel and event scheme, along with specifying the required quality of service,"

P&S Solves Business Problems

	Coordinate Processes	Replicate Content	Inform People
Information stream	Messages representing significant business events	Change statements to synchronize persistent data stores	Information items having a common subject or topic
Producers	Applications that detect and capture business events	Log manager for updated database	Content provider
Subscribers	Applications that should react to business events	Replication agent for database copies	Knowledge worker
Level of reliability	Low to high	High (transactional)	Low
Level of security	Medium in an intranet environment	Low	Low to high

states Dale Skeen, cofounder and chief technologist.

SmartSockets, from Talarian, an industry veteran since 1989, emphasizes its ability to provide fault tolerance and unlimited scalability in traditional mainframe and Unix environments, along with NT. Tom Laffey, cofounder and CTO of Talarian, says, "For load balancing, SmartSockets can push messages to the subscriber that is least busy."

NEONet has a message broker controlled by a rule-driven engine that transforms the message flow. Consumers create subscriptions that are based on message content, rather than predefined naming or categorization by the publisher.

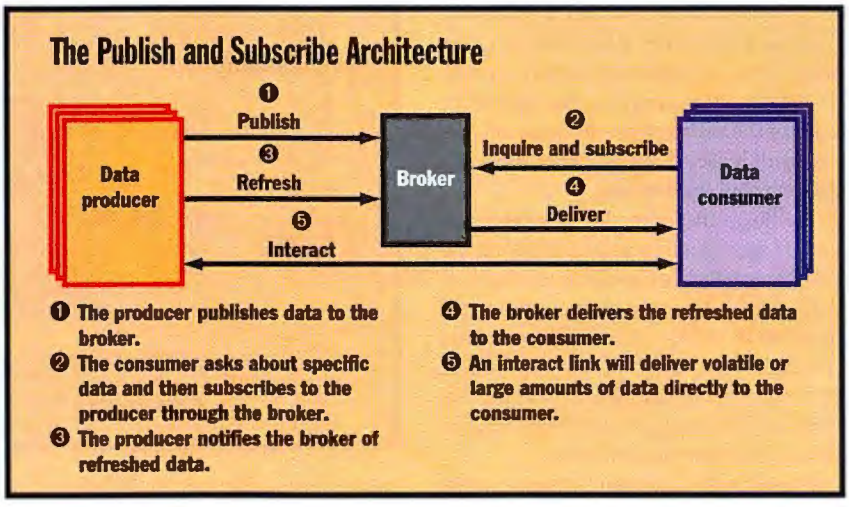
At the fringes of messaging is ActiveWeb, which adopts a strong Web flavor with Java-based tools. Rafael Bracho of Active Software says, "The focus of ActiveWeb is on attacking the heterogeneity problem by integrating diverse legacy systems and loosely coupled information resources." The configuration is hub and spoke, with the spokes as a variety of adapters into information resources.

As Evan Bauer of Giga notes, "The most frequent implementation of P&S à la messaging is the homegrown variety using IBM MQ." A popular alternative for many knowledgeable customers is to take a mature messaging product and add P&S functionality in your application. IBM recognizes this situation and is increasing the P&S services in MQ.

Distributed objects. The concept of a broker achieved industry visibility with the Object Management Group's (OMG) specification for CORBA, which built on the classical remote procedure call (RPC). The OMG extended CORBA to include a large set of object services, two of which are relevant to P&S: Object Event Notification Service (push/pull events to/from channels) and Object Naming Service (bind IDL-like [interface definition language] names to a context similar to a Unix directory tree). The OMG is considering several proposals to flesh out these services for full P&S support.

Examples of object request brokers (ORBs) include Orbix, from Iona Technologies; Entera, from Borland Open Environment; and DataBroker, from I-Kinetics. Several have extended the Object Event Notification Service within CORBA to support P&S, such as Open Horizon's Ambrosia.

Nicholas Zaldastani, CEO of Open Horizon, emphasizes that its focus is on handling significant events that affect your business. "Developers must learn to exploit event-based infrastructures and properly design the namespace for event routing," he remarks.



In a six-step process, a consumer can find out what a producer offers and start receiving it.

Another contender for distributed objects is Microsoft's Distributed Component Object Model (DCOM), which forms the foundation for the ActiveX technology. Currently, there is no indication that ActiveX is adopting the P&S approach, although Microsoft's MSMQ (formerly Falcon), SQL Server Replication, and CDF-based Webcasting (described below) are close.

Transaction monitors. Transaction monitors evolved from database and large transaction-processing systems, such as IBM's IMS and Customer Information Control System (CICS) suites. The focus is on distributed transactions across multiple sites based on two-phase commit protocols (2PCs).

Tuxedo, now from BEA Systems, is a classic example of this category. In a way similar to CORBA object services, the event management of Tuxedo has been extended. "The 2PC is integrated into P&S and can coordinate among a variety of resources," states Ed Felt of BEA. "The provider can post a message to a broker that acts as a consensus taker. If all subscribers agree, the provider is allowed to commit its transaction." In addition, BEA has partnered with Digital Equipment to incorporate MessageQ, ObjectBroker, and SAP R/3 Wrapper into its product line.

Application Integration Server from Intermezzo Systems has a message broker driven by a transaction-processing monitor that coordinates several applications to accomplish a business activity.

Newsgroups. Lest we forget, good old e-mail has had P&S elements for a long time. Via group mailing lists, a producer (sender) can multicast a message to multiple consumers (recipients), who receive the message asynchronously. Add to that the concept of a BBS, and we have the Internet newsgroups, which are alive and healthy amid Web frenzy. Newsgroup creation and threaded messages are important concepts to be absorbed into P&S.

Work flow. Work-flow (or groupware) systems track a work item as it flows through the functional units of an organization. Through some combination of a centralized control database and structured e-mail messages, the responsibility for a work item passes from one person to another. There is now a strong convergence of traditional work-flow systems with messaging and distributed objects, thus solving the problem of implementing large-scale work-flow systems in an adaptive and incremental fashion.

As a P&S pioneer, Apple designed its Interapplication Communication (IAC) around a P&S variation for document management. A publisher shares a section of a document (e.g., a spreadsheet). A subscriber obtains this content for another document. The Edition Manager maintains the shared section within an edition container. Thus, users can change a document, and the changes are propagated to subscriber documents.

continued

STATISTICA

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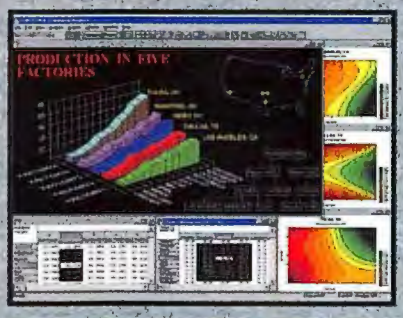

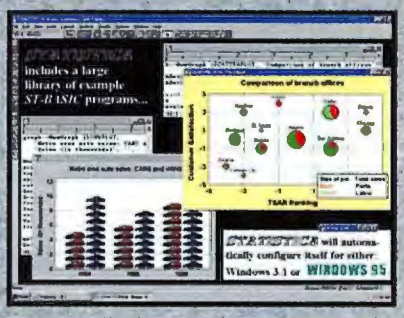

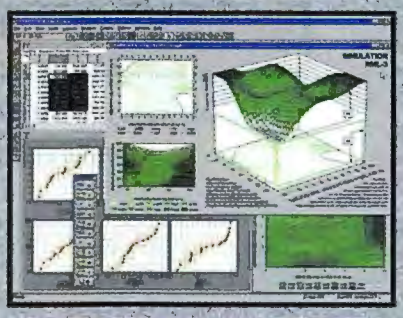

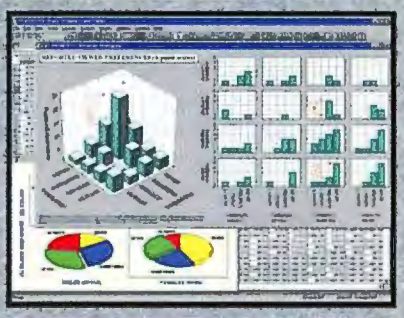

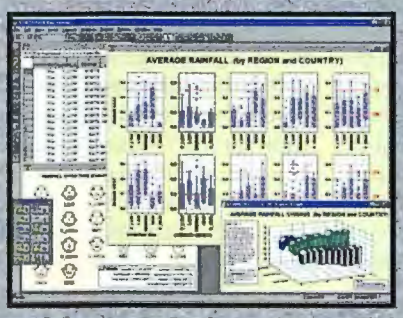

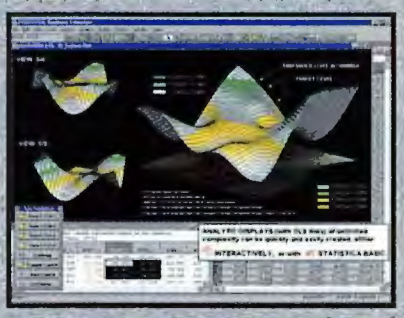

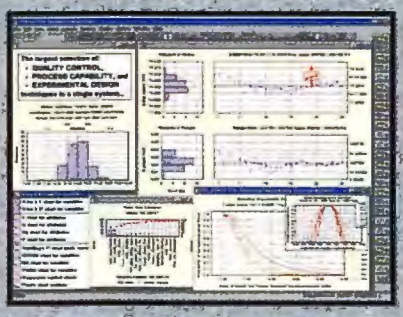

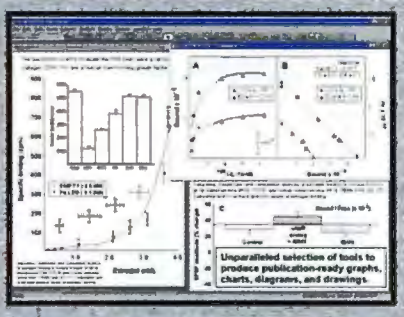

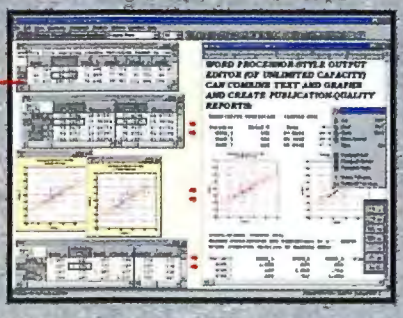

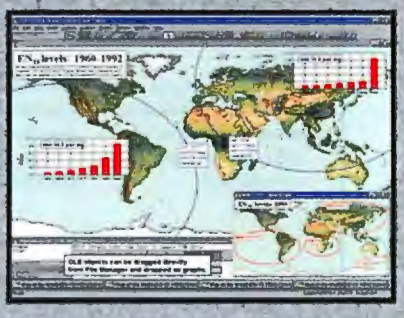

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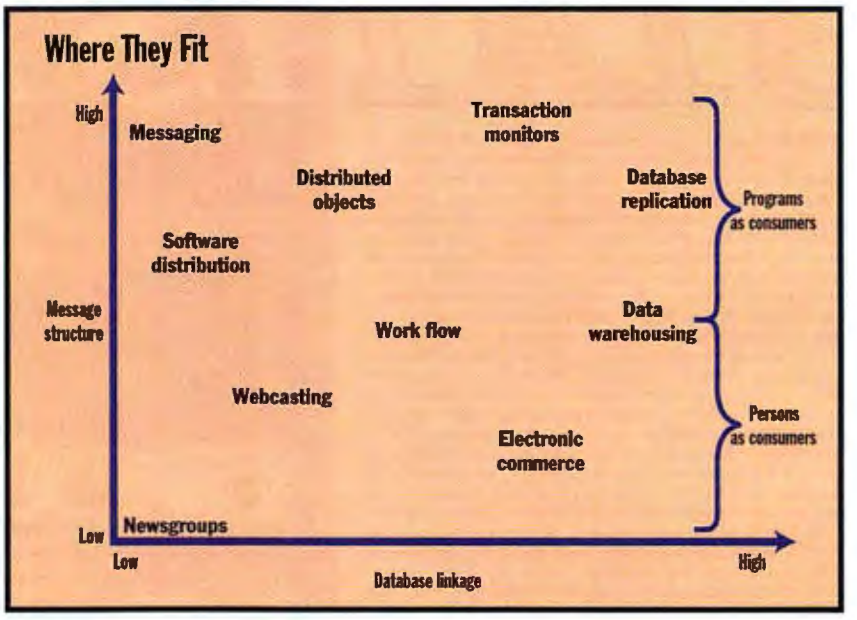
Another product is NewsStand from Lotus. It extends Notes onto the Web by publishing Notes templates and managing the security and approval of subscriptions. Several publications, such as BNS's *Banking Report*, use NewsStand for their electronic distribution.

Webcasting. This category has been "pushed" into the industry's limelight recently. Webcasting (or Web publishing) is using Web technology to deliver recurring information through a push protocol. Products are PointCast, Marimba's Castanet, BackWeb, I-Fusion, and DataManager.

DataManager, from DataChannel, is adopting TIBCO's technology and emphasizes its ability to efficiently multicast TCP packets, thus allowing scalability within large intranet environments. David Pool, president of DataChannel, says, "But what is very elegant architecture is the way that TIBCO sends out one packet and everybody listens for it. It is very lightweight and economical."

Recognizing the importance in standardizing Webcasting, Microsoft has submitted a proposal to the WWW Consortium (W3C) for its Channel Definition Format (CDF) technology that uses the Extensible Markup Language (XML). The proposal separates Webcasting into three levels: basic, managed, and true. Basic is simply the periodic probing (crawling) of specific sites of interest. Managed and true Webcasting use a CDF file, so that a consumer has a road map to the site as defined by the content provider. As stated in the Microsoft CDF white paper, "The CDF allows an author to optimize, personalize, and fully control how a site is Webcast." To Webcast a site, the content provider would create a CDF file at the root Web directory to sketch a road map to key topics at the site.



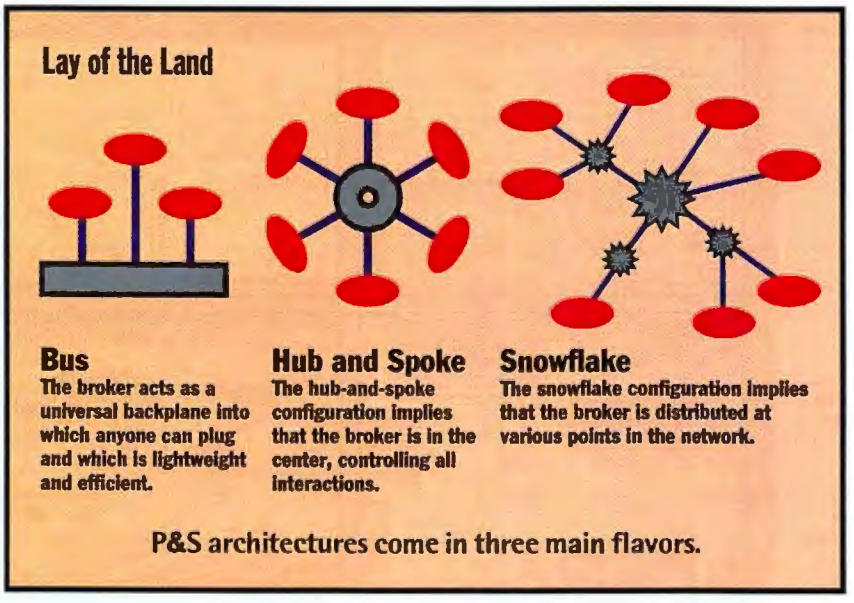
P&S software is described by how structured its messages are and how tight its database integration is.

Database replication. Distributed database systems that need to synchronize with a primary version require a replication scheme that reliably distributes a mixture of full-image and delta-image copies. Products are Data Propagator, from IBM; Replication Server, from Sybase; and SQL Server Replication, from Microsoft.

Software distribution. This category is a major thorn in the side for network and PC managers. As the number of workstation software suites soars, the need for effective software distribution enterprise-wide also soars. P&S seems to be an appropriate paradigm for software distribution, because a channel is a specific package while a consumer would subscribe to the software operating on its workstation. One Webcast product, Castanet, handles software distribution like Web content. A tuner at a workstation polls the transmitter server for differential updates to software modules (even to the tuner software itself).

Data warehousing. P&S has a big potential with information delivery in data warehousing. The issue goes beyond delivering the proper information to the right people. The issue is how to sustain a flow of the proper information and let any consumer add value and republish the information. Applying P&S to data warehousing will move us into a whole new market-driven dynamic for information dissemination. Products are deliveryManager, from VIT; Tapestry, from D2K; and Aclue, from Decision·ism.

VIT's deliveryManager reaches beyond the data warehouse to any information source in the enterprise. "The focus must be on the consumer," remarks Subhash Chowdary, founder and CEO of VIT. "The consumer creates the demand and drives



P&S architectures come in three main flavors.

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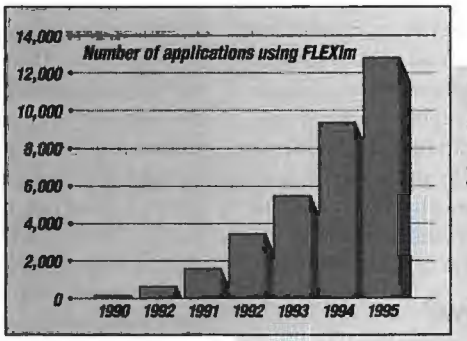

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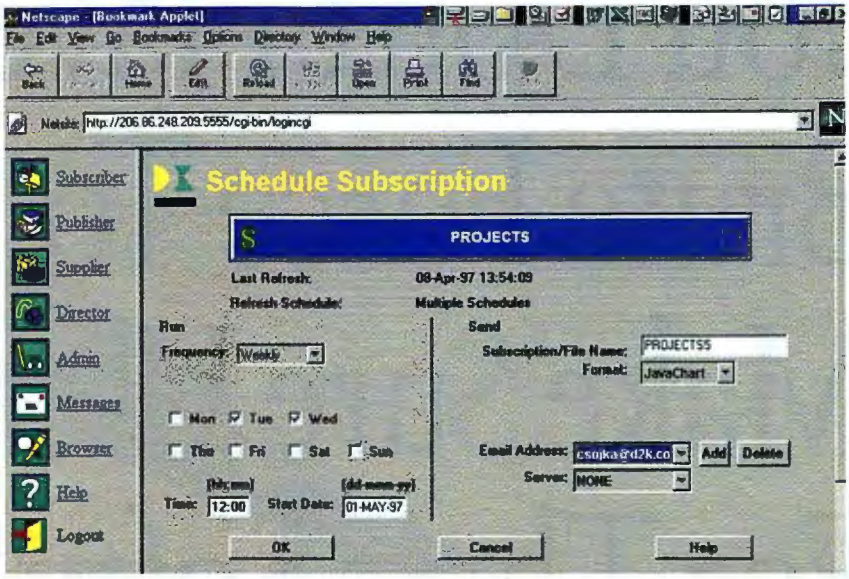
the content from any persistent store, like that of an information supply chain."

Tapestry has a Subscriber Interface with which analysts can examine the meta-catalog and place subscriptions via the Web. Content can be delivered in a variety of formats (e.g., Excel, Word, Lotus 1-2-3, and Java chart) and scheduled periodically (see the screen to the right).

Tapestry has a unique separation in the producer roles. A supplier acts as a data administrator and maps available data sources into one or more data marts. A publisher acts as a business analyst and specifies various views to which people can subscribe. For example, a supplier could build data marts from host databases, while the publisher would publish views from those data marts.

Aclue focuses on the Arbor Essbase community, using P&S to distribute cubes consistently across the enterprise.

Electronic commerce. At first analysis, it may seem that electronic commerce has little to do with P&S; however, both share common technology (e.g., reliable and secure messaging) and common objectives (e.g., matching producers with consumers). P&S can benefit from the experiences with easy and reliable monetary exchange, and electronic commerce can benefit from the mechanisms for recurring transactions to similar interest groups (like that of the Book of the Month Club).



D2K's Tapestry has a Web interface for scheduling delivery of subscription information.

Where to Now?

As a coordination mechanism for distributed systems and people, P&S has the tremendous potential for flexibility, adaptation, and evolution. In complex, large-scale situations where requirements are constantly changing, P&S may provide the fertile ground on which to grow those systems. Also, the standardization and commercialization of P&S technology have the potential to create global markets for information exchange and commerce, far beyond what we can presently imagine.

P&S, however, needs a few years to mature. First, the OMG and other standards groups must get serious at defining what it is. Second, the infrastructure of P&S is not all there yet. We still need to put into place the supporting technologies for reliable messaging outside the limited intranet context, efficient multicasting transport protocols, and universal monetary exchange. Third, the critical weakness is the lack of system management across the enterprise. "It's easy to add a little at a time, but who is going to watch over it [the P&S system]," remarks Ian MacFadyen, vice president of technology management for Chase Retail Banking Systems. "There is no place in the organization responsible, since P&S intermingles the host, servers, network, and who knows what else."

Even when mature, P&S of itself is not a turnkey solution. There is still the difficult work of understanding your business processes, specifying an effective representation for events, and designing the proper database schemes. P&S will only provide more powerful tools and enlarge the set of possible options. "There is not a lot of experience with this stuff; it will probably take 10 years to absorb, like the batch to on-line transition," predicts Roy Schulte of the Gartner Group. "The big vendors will start to play [in the P&S marketplace] in two years."

Any P&S solution still requires skilled professionals who can appropriately apply it. For many years to come, the education of these professionals will be the limiting factor in the adoption of P&S. B

WHERE TO FIND

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Richard Hackathorn (**richardh@bolder.com**) *is president and founder of Bolder Technology, Inc. (Boulder, CO), a company specializing in enterprise connectivity and data warehousing. You can get a copy of the complete technology report on P&S via* **http://www.bolder.com.**

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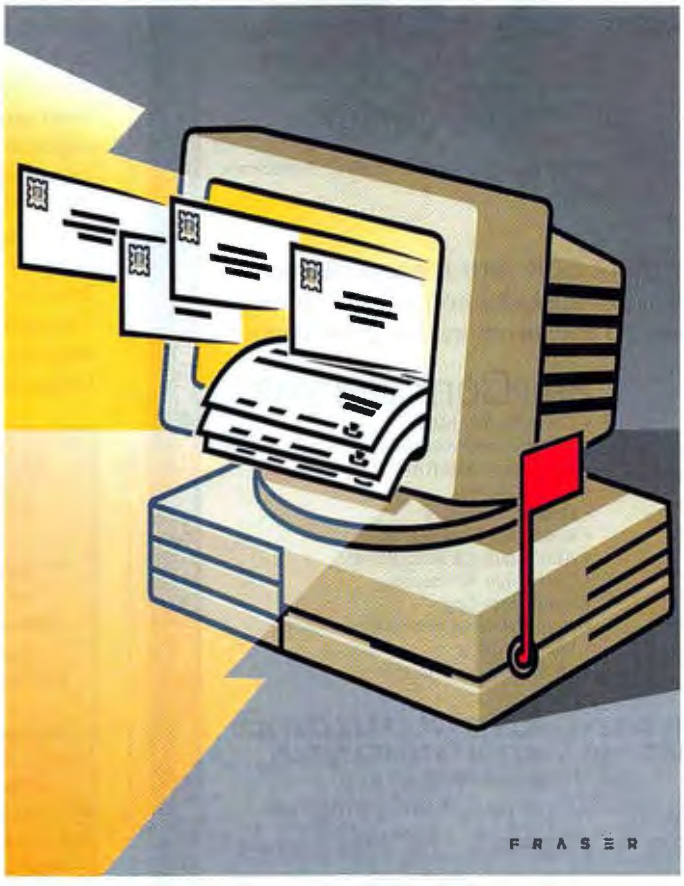
The Universal Inbox

Get all your e-mail, faxes, and phone messages with a single interface.

By Mike Hurwicz

The average person in a large corporation receives 178 messages each day, according to the Gallup Organization. Plus, it is common to get messages via multiple e-mail accounts, fax machines, a voice-mail system, and a pager. And you're probably above average.

To users assaulted from all sides by messages, a "universal inbox" sounds like a life-saver. A universal inbox is a single user interface, usually based on e-mail client software, that lists all incoming messages. These messages can include e-mail, voice mail, fax mail (faxes that come through a fax server and arrive as e-mail), and more. From the universal inbox interface, the user can read, delete, or file all types of messages. (You "read" voice mail by playing it over the phone or on a multimedia PC.) The same interface inevitably contains functions for responding to messages, too—although outbound messaging is not an inbox function.



The universal inbox simplifies life by defragmenting the messaging environment. It's faster to check one inbox than multiple e-mail accounts, fax machines, and voice-mail systems. Training requirements also diminish since you learn only one interface. The universal inbox may also eliminate delays in message reception that are due to the user's not checking a particular source (such as an e-mail account where you seldom receive any mail) frequently enough. Furthermore, the universal inbox lets you organize fax and voice-mail messages in the same way—in fact, in the same folders—that you organize your e-mail. Not only is there value in unifying multiple filing systems, but e-mail folders may offer a better filing system than those that come with voice-mail and fax-mail products. Also, the universal inbox could offer multimode retrieval. For instance, through text-to-speech conversion, it could "read" your e-mail over the phone, so you don't need to find a telephone wall jack for your modem.

The universal inbox can certainly simplify life—but not for all users. And although vendors have been working on universal inboxes for years, the technology is still maturing, so products might lack features you want. Moreover, while the universal inbox provides a single front end for disparate message types, it may do little to integrate administration, directories, or data stores on the back end. In addition, you must consider what you need and anticipate needing. It's best to go for a single package that has everything you are likely to need. You don't want to be in a position of patching together disparate systems, each providing a little of what you want, to get all the capabilities you need. Heck, that's what you're doing now. On the other hand, you don't want functionality that you won't use, either.

With the stampede to the Internet, browser vendors imagine using their products as universal inboxes. Today, however, browsers simply provide an interface to multiple functions, including, perhaps, e-mail and fax. Popular browsers, such as Netscape's and Microsoft's, do not provide a single inbox for all messages. In fact, standards are only now emerging to support a universal inbox.

Conceptually, the universal inbox is simply a client capable of receiving messages from multiple sources in multiple formats. Most commonly, the fundamental building block of the universal inbox is an e-mail/groupware client. To the e-mail/groupware client software, you add software that allows the client to receive faxes from a fax server and voice mail from a voice-mail server.

Generally, companies want universal inbox functionality based on their current or anticipated strategic e-mail products. Shared-file e-mail systems, such as MS Mail, seldom have the message store performance or capabilities to support heavy voice-mail and fax-mail access. So the back end is usually a high-performance e-mail/groupware server, such as Lotus Notes, Microsoft

Exchange, or Novell GroupWise. Here, the vendor of the fax server or voice-mail server often provides unified messaging.

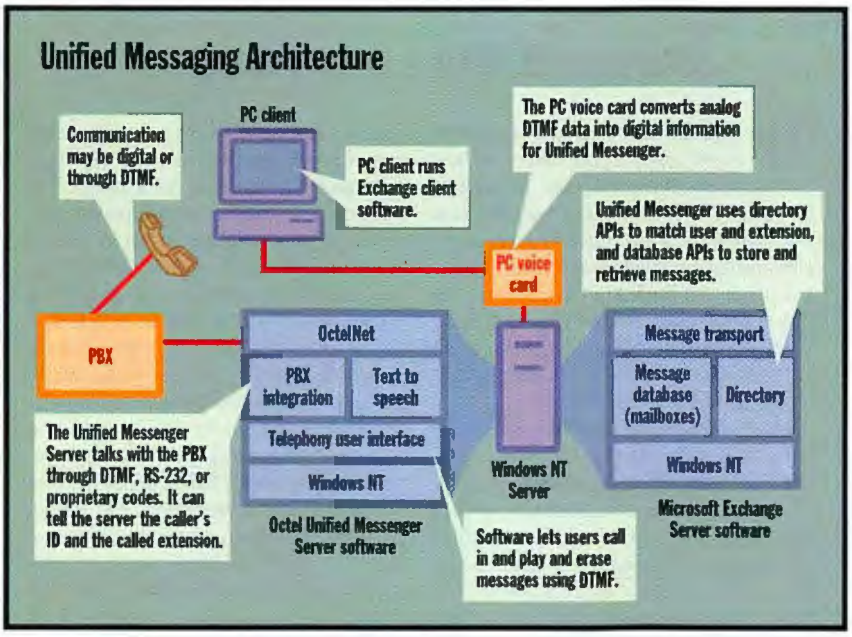
Products from Lucent Technologies and Octel Communications (the former of which made a $1.8 billion bid for the latter in July) are among the popular examples of this approach. Octel Communications is primarily a voice-mail company. Octel's Unified Messenger, which adds voice mail to Microsoft Exchange Server, runs on a new NT-based Octel voice-mail server. Fax will be part of the next version of Unified Messenger. Octel has announced that Unified Messenger will support Lotus Notes, probably around mid-1998.

Similarly, Lucent Technologies, formerly the communications systems and technology unit of AT&T, is (not surprisingly) primarily a telephony company. Lucent's Intuity is a voice-mail system that uses Lotus Notes to create a unified messaging solution. Intuity provides both voice mail and fax. Plus, Intuity's Multimedia Messaging Server (MMS) has its own e-mail. Later this year, Intuity will add support for Microsoft Exchange and Internet mail products such as Eudora. Through Internet mail, Intuity will also support Lotus cc:Mail. Support for GroupWise is still an unknown, although

Unified Messaging Is Outgoing

The universal inbox addresses only inbound communications. Integrated messaging also deals with outbound communications. By applying the e-mail paradigm to other forms of outbound communications, unified messaging can make it easy to do things that were difficult or impossible before: voice mail, for a dramatic example.

Suppose you get a voice-mail message and must inform many people of its contents. Today, you have to make many calls, or send an e-mail message to a distribution list. With unified messaging, you can forward the voice mail itself to the distribution list. The same applies to other types of messages. Fax files coming in through a fax server can be forwarded as fax mail. Received fax mail can be "printed" directly to a local fax machine. You can forward e-mail as e-mail, as a fax, or (through text-to-speech conversion) even as voice mail.



the Internet mail support might do the job.

Lucent and Octel are now both focusing increasingly on computer telephony integration (CTI). Voice mail is part of such CTI solutions, but by no means the primary focus. Fax and e-mail are still further removed. CTI vendors offering unified messaging solutions include Applied Voice Technology (AVT), Tobit Software, and CallWare Technologies. AVT's Call-XPressNT stands out with its features that facilitate picking up e-mail and faxes over the phone. Tobit's David is the operating system of a multifunction messaging server and runs as a NetWare loadable module (NLM) under NetWare 3.11 and later. It manages and controls databases that can contain different object types (e.g., e-mail, fax, voice, files, and links). This information can be accessed in various ways, including via LAN, phone, fax, or Web.

CallWare, from CallWare Technologies, is a CTI product designed specifically for the NetWare environment. For instance, it is an NLM and integrates tightly with Novell Directory Service (NDS).

Octel and Lucent provide both voice-mail and fax services. By bolting these products to an e-mail system, you get the three major functions of unified messaging: e-mail, voice mail, and fax. AVT provides voice mail and fax as separate products. CallWare, on the other hand, does not provide fax services. Thus, users must integrate a separate fax server, such as ZetaFax from Equisys or FaxServe from the Cheyenne division of Computer Associates, to use fax with CallWare.

Although the trend is toward offering universal inbox functionality based on existing e-mail/groupware clients, there are also e-mail clients that specifically aim at universal inbox functionality. That's the case, for instance, with EMail Connection, from the company of the same name. Introduced in 1992, EMail Connection has an installed base of hundreds of thousands of seats, the vendor says. EMail Connection is billed as the first e-mail client that supported every major messaging interface, including not only Microsoft's Messaging API (MAPI) but Novell's Message Handling Service (MHS), Lotus's Vendor-Independent Messaging (VIM), and Internet standards. It can be a client to a variety of on-line services, including AOL, Prodigy, CompuServe, and MCI. MAPI-compatible fax servers can send faxes, using e-mail addressing.

EMail Connection does not currently integrate voice mail, thus it falls short of full universal inbox functionality. However, EMail Connection 3.1 is compliant with Multipurpose Internet Mail Extension (MIME), which will provide a basis for voice mail in the future, and voice-mail integration is currently under way in the EMail Connection development group.

The Urge to Merge

Some e-mail, fax, and voice-mail vendors have agreed to get their products to work together. For instance, one common universal inbox solution consists of Notes Mail and Intuity Multimedia Messaging

Server (MMS), linked by the Lotus Telephony One-Stop.

Novell has long promoted Computer Associate's FaxServe (from CA's Cheyenne division) as the recommended fax solution for GroupWise. FaxServe integrates tightly with the Novell Directory Service, and you can manage it as an NDS object under NWAdmin. Importing users from NetWare to GroupWise and FaxServe is quite straightforward, eliminating the need to manually add users in multiple places. Together, GroupWise, CallWare, and FaxServe make one of the more manageable unified messaging solutions, largely because NDS ties them all together. A further level of management integration is possible through Novell's ManageWise. Novell and CA have also announced enterprise-level management for GroupWise, IntranetWare, NetWare, and integration with Novell's ManageWise. This integration would use CA's Unicenter TNG (The Next Generation), CA's end-to-end management solution, which also offers management of NT servers. Eldon Greenwood, Novell senior director of product strategy, says customers can expect "major leaps" in management integration. "NDS will be available on NT around the end of the year," he said. "Then NDS will be available on the three major platforms where GroupWise runs: NetWare, NT, and Unix.

Microsoft Exchange, however, seems to be the environment most unified messaging vendors are eager to support, or to increase support for. Thus, for instance, Octel started supporting Exchange only, while Lucent is adding Exchange support. Although Notes/cc:Mail continue to be the e-mail market leaders, many observers see more growth potential with Exchange.

Drawbacks

The universal inbox does not suit all users. In particular, if all you are doing is combining multiple mailboxes, you might want to think about what the advantages are. If each mailbox goes with a different job function, for instance, it could be better to keep them separate organizationally.

The universal inbox might be even less suited to the user who is not e-mail-centric. For example, "an accountant who 'lives' in Excel might prefer the ability to send e-mail and faxes directly from Excel, and might be content to pick up voice mail the old-fashioned way," says David Marshak, a senior consultant with the Patricia Seybold Group, in Boston. Also, if receiving spreadsheets regularly, using a particular directory might be better than using e-mail to get them.

Network managers should also be aware that many universal inbox solutions suffer from fragmented administration and message stores. For instance, you may have to add a new user to the operating system for basic network log-in, to the PBX, to the voice-mail system, and to the e-mail system, each as a separate manual operation.

All the vendors mentioned other than Octel also implement separate message stores rather than storing voice mail in the

Standard APIs and Protocols

The universal inbox begs for standards to knit together e-mail, fax, and voice-mail products from different vendors. Microsoft's Messaging API (MAPI) has emerged as the dominant API in the Windows environment, allowing fax and voice-mail vendors to place messages into any MAPI-compatible inbox. Other APIs, such as Common Mail Calls (CMC) or Vendor-Independent Messaging (VIM), find use in non-Windows environments, as well as under Windows.

MAPI enables client/server communications through the MAPI subsystem, a standard part of Windows. The subsystem transfers requests between the client and a MAPI service provider: a small software module, also running on the client machine, that is provided by the service's vendor (for e-mail, fax, or voice mail). The service provider, in turn, talks to the service: In a client/server environment this runs on the e-mail, fax, or voice-mail server machine. Multiple service providers may be running on a single client machine, with MAPI acting as a multiplexer/demultiplexer for the service providers.

From the user's perspective, MAPI lets the client talk to an e-mail service. But MAPI actually describes only the way a client talks to a subsystem and the way a service provider talks to a subsystem. MAPI does not define the protocols used for client/server communications, nor does it address server/server communications. Internet standards are evolving to address this void.

One common Internet standard to implement a universal inbox is Multipurpose Internet Mail Extension (MIME), which can send various types of content with the Simple Mail Transport Protocol (SMTP). Work on voice mail that started in 1994 has culminated in Voice Profile for Internet Mail (VPIM), which is currently a draft standard of the Internet Engineering Task Force (IETF). IETF will probably adopt VPIM version 2 as a full standard sometime this summer. Although VPIM began just for voice, the standard now embraces fax as well. Plus, it is a standard not just for voice-mail or telephony servers but for fax and e-mail servers as well. The VPIM working group is also developing directory services to translate phone numbers into Internet e-mail addresses.

In a typical use of VPIM, a user connects to a voice-mail system, records a message, and enters the recipient's phone number. The voice-mail system sees that the number does not belong to a local user. A non-VPIM system would typically give up here. VPIM, however, uses the Lightweight Directory Access Protocol (LDAP) to look up the e-mail address that receives voice messages for that phone number. Then the system sends the voice mail over the network as a MIME/SMTP message. On the receiving end, the message could go to a VPIM voice-mail system or to any SMTP/MIME e-mail system.

Since VPIM uses the Internet or an intranet to transfer voice and fax, it could reduce long-distance charges dramatically, finally enabling cost-effective color faxing, for instance. It also lays a solid groundwork for "intentional voice mail" (as opposed to a message that a caller left only because the callee did not answer the phone).

Vendors such as Lucent, Nortel, Octel, and Siemens Rolm demonstrated VPIM v. 1 products at the 1996 EMA show, proving that the concept worked. But the public never saw the products themselves. VPIM v. 2 products, mostly in beta at the 1997 EMA show, are expected this year from these same vendors.

Theoretically, you can use Internet standards besides or instead of MAPI or similar APIs. MAPI today can successfully receive VPIM content but not send it, according to Greg Vaudreuil, Octel's systems architect for messaging and author of VPIM v. 1 and coauthor of VPIM v. 2.

VPIM is strictly a server-to-server protocol, addressing only message transport. For client/server interactions, Internet Message Access Protocol version 4 (IMAP4) will also be important for universal inboxes. IMAP4 lets you view a list of message headers before selecting what to access. An attractive feature with ordinary e-mail and fax mail, this is even more desirable for voice mail, where playing every message is more time-consuming. IMAP4 also lets you download selected parts of a message—again, very desirable if messages contain large amounts of data like voice and fax. IMAP4, not yet widely implemented, will probably replace POP3, the current favorite, over the long haul.

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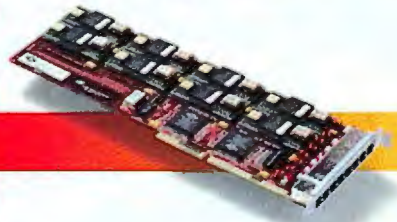

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e-mail message store. Only Octel uses the e-mail message store (Exchange, in this case) to store all types of messages, a more manageable and efficient architecture. (It does create a single point of failure and might not be desirable if the voice-mail server would otherwise be significantly more reliable than the e-mail server.) As Robert Wohnoutka, Octel senior product manager for unified messaging, describes: "In many other systems, if you delete a message, and it is stored in two places, the system has to coordinate those two places. Some can't do it in real time. With a single store, there are fewer delays and fewer opportunities for problems."

Other potential drawbacks include cost and support. Universal inbox functionality itself can cost as little as $40 a seat beyond the price of hardware and e-mail, voice mail, and fax mail. However, "it's often difficult to prove a return on investment for the universal inbox," says Michael Durr, chief analyst with Michael Durr and Associates (Cape Coral, FL), a marketing research and consulting firm.

Further, he says, vendors typically have expertise in either e-mail or telephony; few are truly expert in both. "If you have to choose," says Durr, "traditional wisdom says it's easier for a telephony vendor to learn e-mail than vice versa."

For these reasons, the universal inbox, though appealing, has not been widely implemented. However, unified administration should become more common, particularly as Microsoft evolves its directory technology. Unified message stores, too, will become more available. Costs will come down, and vendors will gain expertise. Thus, there is hope for users suffering from messaging mania. B

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Unclogging the PC Bottlenecks

Major changes coming to Wintel PCs over the next 18 months will help relieve internal bottlenecks and radically improve graphics performance.

By Tom R. Halfhill

Computers evolve in fits and starts. After a period of five years of relative stasis, Wintel PCs are about to get their first major improvements since the appearance of the PCI bus and 66-MHz motherboards in 1992. These changes will significantly affect buying decisions for anyone purchasing new systems over the next 18 months.

Why is this happening now? Because without an overhaul, the bottlenecks in today's system architectures would greatly cripple the performance of new microprocessors that are soaring to 300 MHz and beyond. In addition, new technologies such as digital videodisc (DVD) and the growing use of video and 3-D graphics are overwhelming the ability of main memory and the PCI bus to keep up.

The coming changes will also alter the PC industry. They'll probably strengthen Intel's influence, weaken Intel's rivals, reduce the number of component vendors, and replace some open standards with proprietary solutions. Here's what to expect:

- CPU I/O buses, now limited to 66 or 75 MHz, will accelerate to 83 and 100 MHz by early next year.
- To match the higher bus frequencies, memory such as fast-page DRAM and extended data out (EDO) DRAM will give way to synchronous DRAM (SDRAM). Starting in 1999, SDRAM will yield to even faster memories, such as SyncLink DRAM (SLDRAM) or Rambus DRAM (RDRAM).
- New systems that will be introduced late this year will move the graphics controller off the PCI bus to a private channel called the Accelerated Graphics Port (AGP). This will immediately double or quadruple the graphics throughput.
- The 32-bit, 33.3-MHz PCI bus will gradually migrate to a 64-bit bus that will be running at 66.6 MHz, especially in high-end PCs.
- All new Intel CPUs will address their L2 caches over a private bus to keep traffic off the main I/O bus. Intel will also phase out the industry-standard Socket 7 in favor of its proprietary Slot 1 and Single-Edge Connect (SEC) cartridges. In response, Intel's rivals may resort to in-line caches or an entirely new CPU interface.

ILLUSTRATION: JOHN BLECK © 1997

Driving Faster Buses

Modern CPUs usually operate at two clock frequencies. The core (which contains the execution units and the L1 cache) runs at one speed, while the I/O bus (which interfaces the core to memory and peripherals) runs at a slower speed. Users tend to focus on high core speeds without grasping the importance of bus speeds. In the latest microprocessors, the buses lag far behind the cores, seriously impairing the flow of data.

CPU bus frequencies have been stuck at 66 MHz since Intel introduced the Pentium processor back in 1992. Cyrix's 6x86 and 6x86MX processors can drive their buses at 75 MHz, but only a few systems can support that frequency. However, now there's an industrywide push to speeds of 83 and 100 MHz.

Industrywide is the key word here, because faster buses require much more than faster CPUs. Virtually the entire system has to change—including the core-logic system chip set, the motherboard, and the DRAM.

The system chip set consists of two chips that regulate traffic among the CPU, main memory, the L2 cache, the PCI bus, and other peripheral buses—ISA, SCSI, PC Card, universal serial bus

(USB), and 1394. Vendors of these chip sets must redesign their components to accommodate these higher frequencies.

Some chip sets already support 75 and 83 MHz. AMD favors 83 MHz as an interim step. "There's no reason why we have to leap directly from 66 to 100 MHz," says Vinod Dham, vice president of AMD's computation products group. "We favor a staircase approach that goes from 66 to 83 to 100 MHz. This will make it easier for third-party suppliers and still will yield a significant performance advantage."

Still, Intel thinks 100 MHz is the next logical step. And it commands about 90 percent of the market for CPUs and 80 to 90 percent of the system-chip-set market—and it's the leading motherboard manufacturer, as well. Early next year, Intel plans to release a chip set called the 440BX. It will support bus speeds of 100 MHz with the Pentium II. The 440BX will accompany Intel's introduction of a Pentium II–class processor code-named Deschutes, which will debut at a core frequency of about 350 MHz.

One reason Intel prefers 100 MHz is the impact on the PCI bus. PCI normally runs at a synchronous clock frequency of 33.3 MHz. If the CPU bus rises to 100 MHz, PCI can continue to run synchronously at 33.3 MHz with an even clock multiple of 3×.

When the CPU bus runs at 75 MHz, PCI either slows down to 25 MHz (3×) or 30 MHz (2.5×) to maintain a synchronous clock rate or runs asynchronously at 33.3 MHz. All those options hurt performance. Some Cyrix 6x86 systems drive the CPU bus at 75 MHz and the PCI bus at a synchronous 2× frequency of 37.5 MHz, but that's too fast for reliable operation with some PCI cards. If the CPU bus runs at 83 MHz, PCI can run synchronously at a 2.5× multiple of 33.2 MHz. But current Pentium chip sets do not support that multiple.

Intel also argues that 100 MHz is inevitable anyway, so the industry might as well take one big step instead of two smaller steps. "From the performance standpoint, we think 100 MHz makes more sense than 83 MHz because it has more headroom," says Jag Bolaria, the marketing director of Intel's platform components division.

Intel's jump to 100 MHz will force the industry to go along, but it will also leave some companies behind. There are formidable challenges to making reliable 100-MHz motherboards. They need better power supplies, voltage regulators, and fans to keep the high-wattage CPUs running smoothly. (A 300-MHz Pentium II dissipates 42 W, compared to 17 W for a Pentium-233.) They need shorter traces between critical components to avoid timing delays. Also, they require many improvements to keep internal and external noise from interfering with data signals.

To reduce noise, for example, circuit designers must add more capacitors and run their traces in zigzag patterns to avoid long parallel lines that would act as antennas. In the U.S., the 100-MHz bus frequency falls within the FM radio band. A CPU would be confused if it requested some data from memory and instead received a song by Smashing Pumpkins.

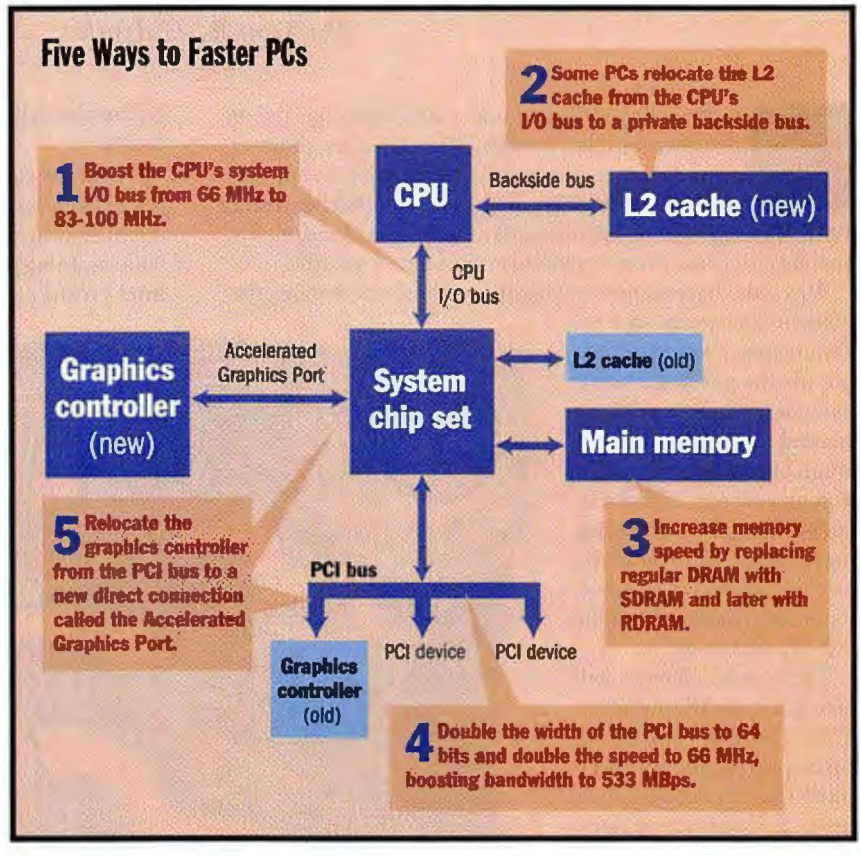
"It's going to be much harder for the schlocky clone guys to design motherboards at this speed," says Larry Barber, president of Tyan Computer. To squelch noise, Tyan's latest motherboards, and others like them, are sprouting electrolytic capacitors like mushrooms.

Jogging Memory

Memory has to keep up with faster bus frequencies, as well. Regular DRAMs can't cut it. There is already a migration to SDRAMs, which need wider 168-pin slots on motherboards for dual in-line memory modules (DIMMs) instead of the familiar SIMMs. With today's EDO DRAMs on a 66-MHz, 64-bit bus, peak memory bandwidth is 533 MBps. With SDRAMs running at 100 MHz, memory bandwidth will rise to 800 MBps—a healthy boost of 50 percent.

Memories will get even faster by 1999. The two most likely successors to SDRAM are SLDRAM and RDRAM. Intel may be the deciding factor here, too, because it has thrown its support behind RDRAM by forging an alliance with Rambus and investing in the company. Rambus does not actually manufacture any RAM; instead, it designs and licenses a proprietary high-speed memory interface to nine leading RAM vendors.

Rambus can drive its special 16-bit memory bus at speeds of up to 600 MHz and is adding about 100 MHz per year. By the time RDRAM enters the mainstream, peak bandwidth on a 16-bit bus should be 1.6 GBps—twice as fast as SDRAM at 100 MHz. On a 32-bit bus, bandwidth doubles



New PCs introduced in coming months will relieve five internal bottlenecks.

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again to 3.2 GBps. Rambus says its memory bus will eventually run at 1000 MHz (1 GHz), yielding 4 GBps of raw bandwidth.

SLDRAM is a proposed open standard backed by 22 companies, including Apple, Hewlett-Packard, IBM, Motorola, NEC, and Texas Instruments (but, so far, not Intel). Although the standard isn't final, SLDRAM will be capable of gigabyte transfer rates, too.

Ultimately, however, Intel's position as the leading CPU, chip-set, and motherboard supplier will probably determine which one of the memories rules. "If I were betting money, I'd bet on SLDRAM from the technical standpoint and on RDRAM from the political standpoint," says Dean Hays, marketing director at VIA, a chip-set maker.

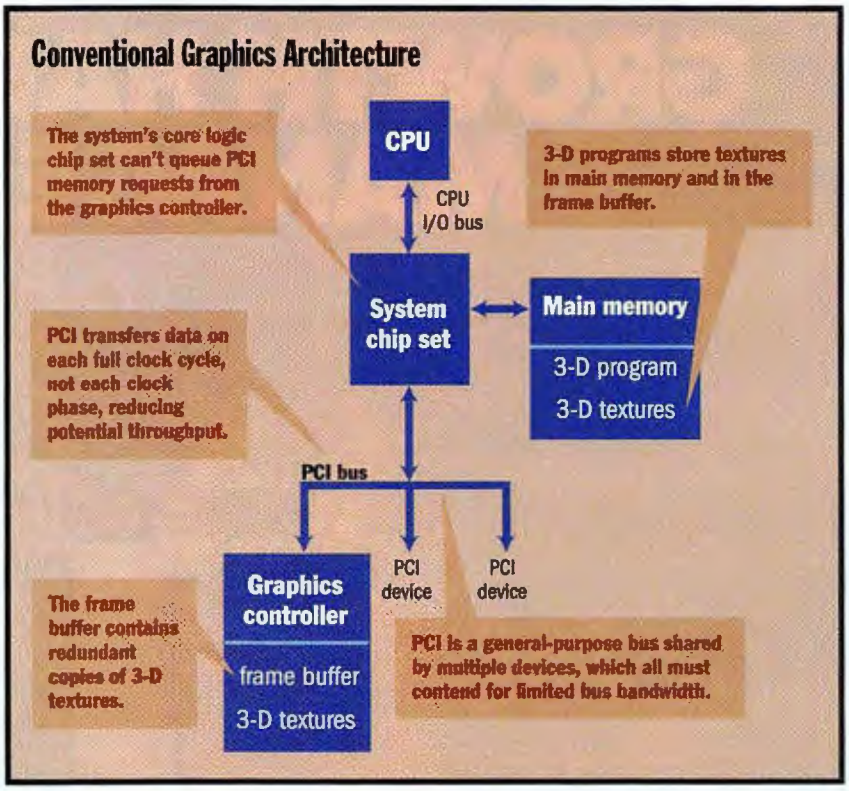
Graphics Detour

Another bottleneck in today's PCs is the PCI bus, which Intel introduced in 1992 to relieve the bottleneck that was caused by the ISA bus. PCI isn't keeping up with the growing traffic between the CPU, the graphics controller, and main memory. Users are running higher-resolution screens with more colors, full-motion video, and 3-D graphics, saturating the 133-MBps PCI bus. It doesn't help that the graphics controller must share the bus with other PCI cards.

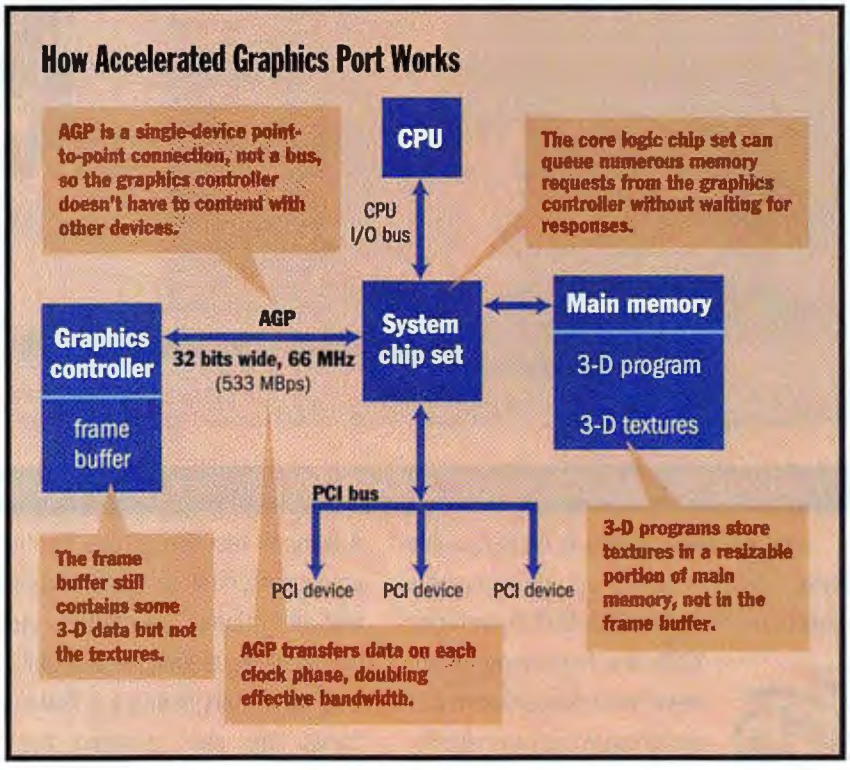
One solution is to widen PCI from its current 32-bit pathway to 64 bits. Another is to double the PCI clock frequency from 33.3 to 66.6 MHz. Each improvement would double the bandwidth, and each is inevitable, but right now they are too costly for most PCs. Doubling the bus width is particularly expensive, because it requires more pins on system chip sets, more traces on motherboards, and more complexity on PCI cards. The 66.6-MHz clock frequency is more economical and will restore some balance to systems with superspeed CPUs.

However, Intel is pushing a third alternative: AGP. This solution moves the graphics off the PCI bus altogether and detours the traffic onto a dedicated point-to-point channel between the graphics controller and the system chip set. AGP isn't a bus, because it's not shared by anything but the graphics controller. The controller will have the whole 32-bit channel to itself.

The downside is that AGP requires changes to the entire system architecture of Wintel PCs: motherboards, system chip



There are several problems with the graphics architectures of today's PCs.



AGP bypasses the PCI bus. Thus, the graphics controller can access memory four times faster.

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SDRAM is faster than EDO DRAM, especially when transferring bursts of data in a two-bank configuration. (Source: Texas Instruments)

Bits transferred per page access	EDO DRAM	SDRAM (one bank)	SDRAM (two banks)
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2 bits	1.1×	1.2×	2.4×
4 bits	1.2×	1.6×	3.2×
8 bits	1.4×	2.2×	4.0×
16 bits	1.5×	2.7×	4.4×

sets, graphics controllers, and graphics cards. Motherboards need a special AGP slot for the new cards, chip sets need a new 32-bit-wide I/O port for the new slot, and graphics controllers and cards need to switch from PCI to AGP protocols. Today's PCs—even the latest multimedia extensions (MMX) systems—aren't upgradable. AGP also needs OS-level support that will not be coming from Microsoft until the next version of Windows (Memphis), which appears to be delayed until 1998.

One bright spot is that AGP's protocols are similar to PCI's, somewhat simplifying the design of new chip sets and graphics cards. It's safe to say the hardware will be in place when the software arrives. For instance, Intel will support AGP with its new 440LX chip set, which should debut this fall. Unfortunately, the 440LX works with only Socket 8 (Pentium Pro) and Slot 1 (Pentium II) processors. Intel says it has no plans to support AGP for Socket 7 (Pentium-pin-out) processors—not even the newest MMX Pentiums. Fortunately, other companies (e.g., AMD and VIA) will support AGP on Socket 7 motherboards by releasing new chip sets late this year.

Intel's definition of AGP is rather loose, leaving some room for differentiation among chip-set vendors. So-called baseline AGP (or AGP-1x) doubles the graphics bandwidth to 266 MBps (compared to 133 MBps for regular PCI) by doubling the data channel's clock frequency to 66.6 MHz. This minimal implementation will appear in some of the first AGP chip sets and graphics controllers, such as S3's ViRGE/GX2.

In 1998, newer graphics controllers and chip sets will implement full AGP (or AGP-2x). This version will quadruple the effective bandwidth to 533 MBps by transferring 32 bits of data on both the rising and falling edges of a 66.6-MHz clock signal, a technique that's known as *double pumping*. In 1999, AGP-4x will increase the effective bandwidth to more than 1 GBps (eight times faster than regular PCI) by cranking up the AGP clock frequency to 133 MHz.

Maximizing AGP

But there's much more to AGP than faster clocks and double pumping. One option is *sideband signaling*, which transmits control signals on separate lines instead of on the data channel. This frees up the entire 32-bit channel for graphics—an improvement over PCI, which mixes control signals with data on its 32-bit bus. Not all AGP implementations will have sideband signaling, so this will let vendors differentiate their products.

Another AGP option is *memory pipelining*. This allows the system to handle multiple memory requests from the graphics controller. PCI forces graphics controllers to suspend memory requests if an earlier request is pending—a delay that lengthens the already-long latencies for memory accesses. AGP's pipelining minimizes those delays by queuing the requests. The depth of the queue will be another variable feature in system chip sets; a typical queue might handle possibly a dozen requests.

The ability to queue memory requests is particularly important, because AGP graphics controllers can store some data, such as 3-D textures, in main memory instead of in video memory. This might seem illogical, because the specialized memory chips on graphics cards are much faster than ordinary DRAMs. However, some highly detailed 3-D textures are outgrowing video memory, and adding memory to a graphics card is expensive. So AGP lets the graphics controller store the textures in main memory and retrieve them at AGP speeds.

When the graphics controller needs to retrieve this data, it sends a request to the system chip set. To save time, the chip set can cache frequently accessed memory addresses in a translation look-aside buffer (TLB), which is similar to the TLBs in microprocessors. If the chip set finds the memory address in the TLB, it quickly jumps to that address and fetches the data—thus requiring only one memory access.

If the chip set can't find the requested address in the TLB, it refers to another resource called the graphics address translation table (GATT), also known as the graphics address relocation table (GART). Unlike the TLB, the GART is in main memory, not on the chip set. So it will take one memory access to fetch the address from the GART and another to fetch the data. Obviously, chip sets with larger TLBs are better, because they will hit the cache more often and avoid unnecessary memory fetches.

Of course, storing graphics data in main memory means you will have less RAM for programs. But RAM is relatively cheap, and AGP makes the most of it by storing the graphics in small (4 KB), noncontiguous blocks allocated at run time. A single graphics object, such as a large 3-D texture, might span several blocks.

It remains to be seen how much graphics data AGP controllers actually store in main memory. For one thing, even the specialized memory chips on graphics cards are getting cheaper. Also, graphics controllers are adopting wider and wider I/O interfaces to their dedicated frame buffers. As these interfaces grow from 64 to 128 to 256 ports, the controller chips must grow in size to accommodate the additional pins. They probably won't need all the extra die area for logic, so they could use the leftover space for local memory to cache textures. Still, AGP's

Quadrupling Graphics Bandwidth

	PCI	AGP
Bits per transfer	32	32
Transfers per clock cycle	One	Two
Clock cycles per second	33.3 million	66.6 million
Bandwidth	133 MBps	533 MBps

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ability to store graphics in main memory is a useful option.

AGP can also extend the life of the PCI bus. By detouring the graphics onto a dedicated pathway, AGP removes the biggest hog of PCI bandwidth. Intel's Bolaria says the application that demands the most bandwidth is video capturing—it consumes 40 to 50 MBps all by itself. That's more than a third of the bandwidth available on PCI. When AGP shoulders that load, PCI will have more capacity for other things.

Slots vs. Sockets

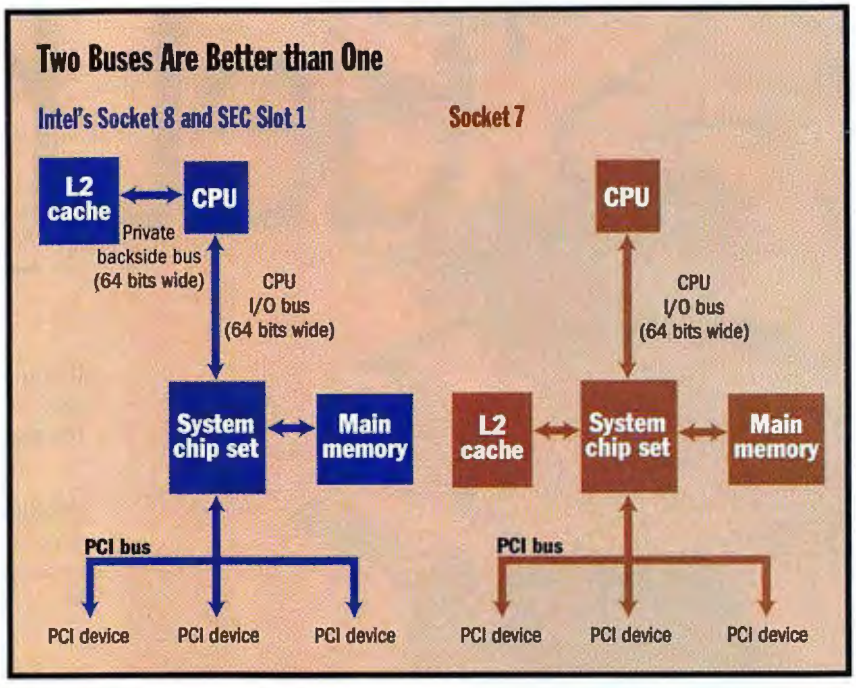
Intel's move to a proprietary CPU interface is the final big change coming to Wintel PCs over the next 18 months. The Pentium II and future Intel x86 processors abandon the industry-standard Socket 7 in favor of the Intel-patented Slot 1 and SEC cartridges. (The Pentium Pro fits Socket 8, which is also proprietary to Intel.) Intel's Pentiums and all other x86-compatible processors still use Socket 7, but Intel wants to phase it out as soon as possible.

Motherboard manufacturers can license Socket 8 and Slot 1 from Intel; CPU makers cannot. The chances of reverse-engineering those interfaces without provoking legal action from Intel are almost nil, and engineers say it's not practical to put both on the same motherboard. Therefore, motherboard makers must choose between Intel as their sole CPU supplier or Intel's rivals: AMD, Cyrix, and Centaur.

It's not much of a choice. With Intel controlling about 90 percent of the CPU market, few companies can afford to bet everything on the competition. Also, Slot 1 and Socket 8 have a technical advantage: They can address an L2 cache over a private bus that runs much faster than the CPU's regular I/O bus. Socket 7 does not have a private cache bus.

AMD and Cyrix downplay that difference, but as CPU frequencies escalate, the advantages of a faster L2 cache will become more apparent. One alternative is to compensate by expanding the CPU's L1 cache, but that enlarges the die and the manufacturing cost. Another option is for Intel's rivals to devise their own next-generation CPU interface. Even if they can overcome their own political differences, they will still have to rally support from motherboard and component vendors.

A likely stopgap solution is an in-line L2 cache. In this scheme, a daughterboard containing the CPU, L2 cache, and cache controller would plug into Socket 7. External oscillators would overclock the CPU bus for the L2 cache while synchronizing with the motherboard at the usual clock speed. Apple and some Mac-clone vendors are already resorting to this solution to overcome the Mac's slow system bus. The latest Mac clone from Umax runs a PowerPC 603e processor at 300 MHz, an in-line L2 cache at 80 MHz, and the motherboard at 40 MHz. Wintel PCs could do even better, clocking the motherboard at 83 or 100 MHz and the in-line cache at perhaps half the CPU's core frequency.



Socket 8 and Slot 1 have two independent 64-bit buses, improving cache access bandwidth over Socket 7.

These issues probably won't become critical until 1999. For at least the next year, Socket 7 motherboards will continue to dominate the market, and Socket 7 processors will still offer competitive performance for their target applications.

Tidal Wave

Major changes come in waves, and Wintel PCs face a tidal wave. Even more innovations are coming, too: NLX motherboards (a 1-millimeter-pitch, 340-pin card-edge device), device-bay expansion slots, and the long-awaited eclipse of ISA, to name just a few. But those changes are mostly for the sake of convenience.

The technologies that are outlined here—faster CPU buses, faster memory chips, faster/wider PCI, AGP, and new CPU interfaces—will significantly improve system performance to match the capabilities of superfast microprocessors. They're long overdue, and they'll restore some balance to the overtaxed architectures of today's PCs. B

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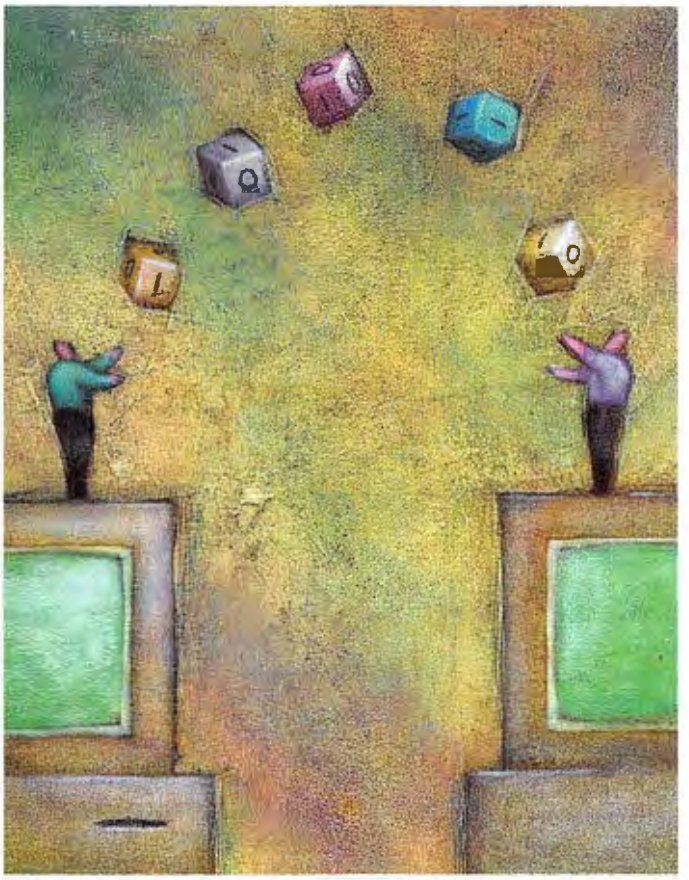
OLAP by Web

Using Web-based applications to perform on-line analytical processing builds on the strengths of both technologies.

By Udo Flohr

On-line analytical processing (OLAP) may be the most important new computing paradigm of the decade—next to the Web. Joining the two makes for a powerful technology.

A *data warehouse* is a central, consolidated database repository for all the data in an organization. It typically allows access to this information by presenting it in a metaphorical *data cube*, a multidimensional storage model that allows many different views and combinations of the data. After correlating arbitrary parts of a corporation's data, managers should then be able to see previously hidden emerging patterns—the trees in the forest, as it were.



OLAP programs make up a category of business software that lets users manipulate a data cube. Typical OLAP operations include consolidate, drill-down (i.e., query refinement), slice, dice, and pivot. Results can be reported in traditional or tabular database formats, as well as in graphical charts. Although this output might be in a fixed format, it often allows the user to directly manipulate the data for further analysis, such as identifying trends, correlations, or time series.

A Marriage Made in Cyberspace

Most OLAP and data-warehousing packages either already do or shortly will have a Web interface, allowing users to access an organization's data via an intranet or the Internet. In a recent report, Wayne Eckerson, a senior consultant at the Patricia Seybold Group (Boston, MA), concluded that by 1998 a Web browser will be driving half of all OLAP and decision-support applications. Despite a number of related problems, Eckerson believes that "the Web is a perfect medium for business-intelligence activities." Here he applies what's called the 80/20 rule: 80 percent of all users have simple query and reporting requirements that Web applications can satisfy. The remaining 20 percent either need high-performance, interactive access to large data sets, or they're developers who require authoring capabilities. This 20 percent segment will, for the time being, continue to use dedicated tools.

One major benefit of deploying OLAP systems using a Web interface is the cost savings. Traditional OLAP packages typically start from $10,000. Web browsers, on the other hand, are ubiquitous. Furthermore, most organizations are at least starting to get some kind of intranet structure, complete with servers, in place. Thus, Web OLAP should allow almost all users in an organization access to at least some analysis functionality. Thanks to the Net, the universal access might also extend to outside users. For example, customers or suppliers could have access to some company information.

The universal Web-browser interface may also help reduce training costs. Most users are already familiar with the process of pointing and clicking on links, and the OLAP query-and-manipulation process is similar.

Another advantage is that the Web is a cross-platform environment for users and developers alike. Users find a familiar environment regardless of their OS, and developers are able to port Web applications.

Thanks to its centralized architecture, the Web helps reduce the cost for client-side distribution and support. The latest version of the client software—the browser—can be put on all desktops in an enterprise, and components, such as Java applets or ActiveX controls, take care of their own downloading.

Snags in the Web

A number of drawbacks balance these advantages, however. For example, the Web was originally a medium for the distribution of static files. Therefore, its main problem is that it treats each interaction as a new, anonymous connection. It does not intrinsically remember who you are or what query you were just refin-

ing. Furthermore, HTTP, the main Web protocol, does not maintain the state of a session. Programmers have to use tricks to help a server remember users' identities and how far they've progressed in their process. Initiatives are under way to remedy this problem in a standardized fashion.

Another often-cited problem is security. The Net is open to virtually anyone, and Net traffic in its basic form is not encrypted. Companies have therefore been reluctant to put sensitive information on the Net. Since a data warehouse contains the crown jewels of a company's information about its business, there's understandable hesitation about making such data available on the Net.

But that's about to change with the introduction of secure communication tunnels across the Net. These tunnels will enable users to gain secure access to remote data. Firewalls and other authentication systems can also help cordon off internal intranets by restricting access to certain sites.

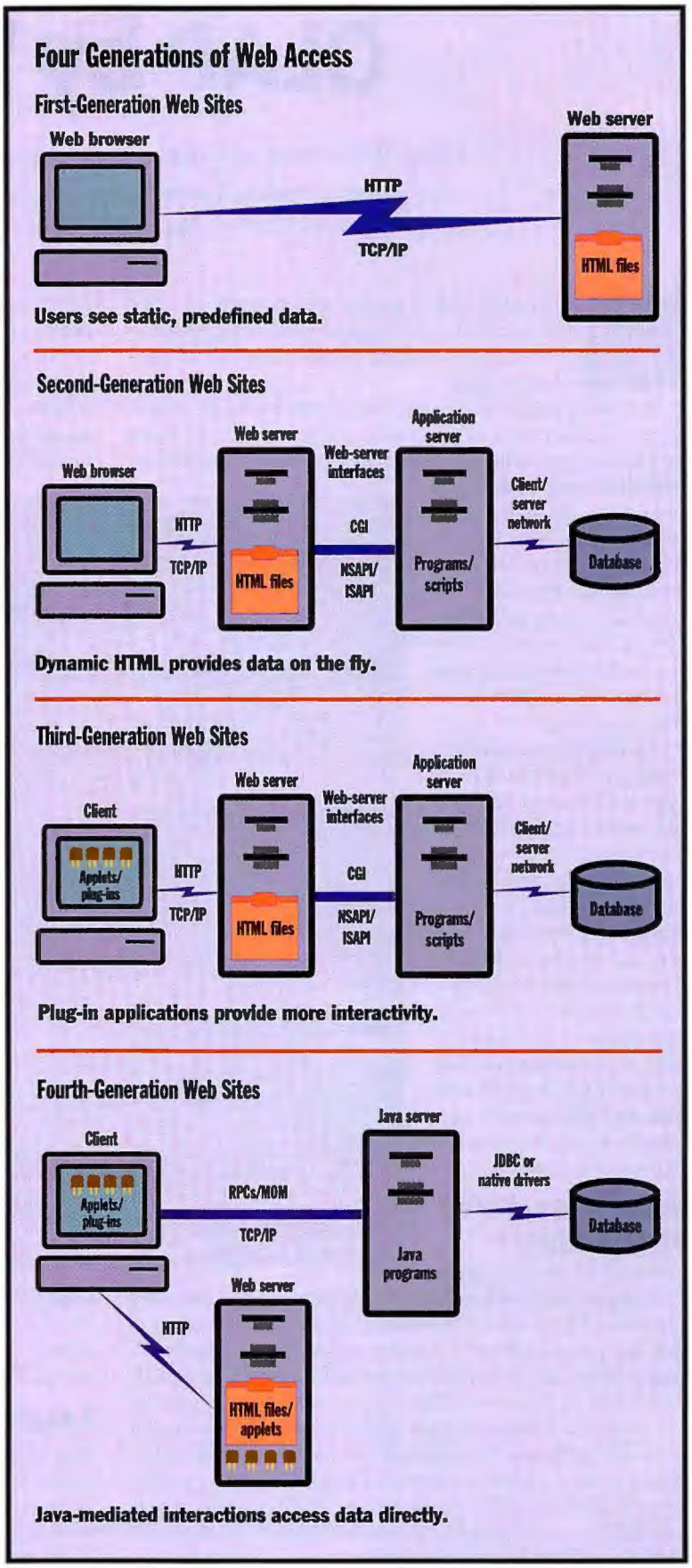
The Web consists of a number of protocols that make it open and easy to integrate. However, for some OLAP applications, this simple architecture may be too simple. For example, using a dedicated OLAP application to perform a drill-down operation leaves staggered windows on a user's screen that correspond to the stages of the stepwise refinement of the query. These are useful, since the user might want to zoom out again and focus elsewhere. But a simple Web browser does not lend itself easily to such a multiple-document approach: Each new page contains HTML code that is displayed, typically wiping out what was already there.

Web Generations

Some Web sites lend themselves to OLAP better than others. For instance, from the point of view of online query-and-analysis tools, Eckerson's study distinguishes four generations of Web architectures: file distribution, dynamic HTML publishing, Java-assisted publishing, and dynamic Java publishing. Most business-intelligence tools currently support first- and second-generation architectures.

First-generation Web sites (see the figure "First-Generation Web Sites" at right) use a two-tier architecture to provide basic file distribution. Dedicated off-line OLAP tools create reports and store them as HTML files, which might contain text and bitmapped images, on the Web server. From their standard browsers, users can view or print these static documents, but no interaction is possible. For an updated view, someone has to generate a new report. Hyperlinks might simulate a certain degree of interactivity. For example, by clicking on a link labeled "Northeast Region," a user could navigate to a report providing data for that particular geographical area.

Eventually, though, the growing collection of files will lead to the administrative headaches typically associated with large Web sites. The main



Vendors and Products

Application Consulting Group's OLAP Suite
This package uses ActiveX to deliver OLAP functionality, including drill-down, rotation, and advanced data selection. Users can create live OLAP database reports and graphs from the browser. It uses the Oracle Express metadata standards. (http://www.acgi.com)

Applix's TM1
This third-generation, four-tier-architecture, OLAP server solution features a Java-based spreadsheet. TM1 Anywhere allows dynamic query access to TM1 Server, the multidimensional database engine. The package's spreadsheet imports ODBC data. (http://www.applix.com)

Arbor Software's Essbase Web Gateway
This second-generation OLAP server product uses a multidimensional OLAP database. Its four-tier architecture uses CGI to interface to NT or Unix programs. Users request reports by selecting parameters in an HTML form; output is also in HTML. Various OLAP operations, as well as data entry, are supported through HTML. This package also has the ability to use Infospace's charting applet. (http://www.arborsoft.com)

Brio Technology's Web.Ware-House
The product's scheduler generates static HTML reports. A browser plug-in supports its decision-support package, BrioQuery Enterprise. Users interactively query the relational database server. (http://www.brio.com)

Business Objects
A first-generation desktop OLAP tool that allows dynamic viewing of native (non-HTML) business-objects reports with helper applications. The server works with relational databases; its tools create reports interactively, or Document Agent schedules reports. (http://www.businessobjects.com)

Comshare's Commander DecisionWeb
A multidimensional OLAP server, this package's four-tier architecture provides direct OLAP controls using Java applets for drill-down and rotation. Output can be in HTML or Excel format. It requires Arbor's Essbase engine and uses Microsoft's ISAPI standard. (http://www.comshare.com)

Dimensional Insight's DataFountain and CrossTarget
DataFountain creates multidimensional data models (MDMs) on the Web server. CrossTarget uses them to get RDBMS information when a browser user requests a report. The reports are generated in HTML. (http://www.dimins.com)

Information Advantage's WebOLAP
This is the four-tier, CGI-gateway Web interface for Information Advantage's DecisionSuite Server. Query-parameter input and output are via HTML; users perform drill-down using hyperlinks. (http://www.infoadvan.com)

Information Builders' WebFocus
This four-tier, third-generation architecture accesses Unix, Windows NT, or MVS report engines with a CGI gateway. Users create reports and charts with Java applets. Output formats are HTML and Excel. The package is compatible with over 60 databases. (http://www.ibi.com)

Informix Software's MetaCube
This is a family of decision-support software for large-scale data warehouses. The Web version currently generates HTML reports offline. A Java interface is in the works. The package supports drill-down, charts, and Excel export. (http://www.informix.com)

Infospace
The first genuine Java-based fourth-generation query-and-analysis tool uses a three-tier architecture, with

disadvantages of this approach are that users can see only predefined reports, which age quickly, and that all operations have to be predefined.

Second-generation Web sites (see the figure "Second-Generation Web Sites" on page 82) employ dynamic HTML publishing: Applications create HTML documents on the fly in response to user requests. The environment is actually a four-tier architecture, consisting of Web browsers, Web servers, application servers, and databases.

To query databases and other resources, users fill out HTML forms that their browsers then submit to the Web server. The result is a dynamically generated, but still static, HTML file. Users get the latest data through reports executed live. They can customize the results to a certain extent by changing the values of parameters, which the site designer sets up for them. The Web server itself holds only templates and metadata. The metadata parameters tell the server which information to send to the browser. However, the metadata can also generate HTML tag information that, among other things, helps to maintain state and authentication data over a session.

The Web server submits the user's request to the application server through a gateway. This translates the HTML requests into SQL statements or other database calls. The application server also formats the result for the Web server. For linking such external programs to the Web server, most architectures use CGI.

This approach does not always yield the desired performance, especially in large installations where scalability is an issue. For this reason, native Web-server interfaces, such as Netscape Server API (NSAPI) or Microsoft's Internet Server API (ISAPI), are becoming popular. As opposed to CGI, which forks off a new process for each call, NSAPI and ISAPI use lightweight threads. The downside is that an application written for one of these APIs will not work with the other (or with other servers). CGI, on the other hand, is portable. A more portable alternative is FastCGI, which has many of the advantages of CGI but, as its name implies, improves performance by cutting down on invocation time.

Third-generation Web architectures, according to the Patricia Seybold Group model, follow the "Java-assisted publishing" approach (see the figure "Third-Generation Web Architectures" on page 82). These architectures supplement second-generation frameworks with Java applets, ActiveX controls, plug-ins, or other client-side programs. These can provide a better, more interactive user experience that might support local processing of the downloaded data.

This architecture is able to communicate more user-interface events to the application servers on the other end, alleviating many of the shortcomings of HTTP and HTML. The supplementary client-side software can also be a helper application, such as a spreadsheet. The result should resemble a traditional client/server application more closely while retaining the thin-client, Web-based philosophy.

The jury is still out on whether ActiveX controls or Java applets are the right strategy to enhance a browser with more functionality and interactivity. Some perceive Java as slow. ActiveX components, which correspond to the basic building blocks of a Windows application used by hundreds of thousands of Visual Basic programmers, provide a richer

and perhaps more mature development environment.

Being currently confined to Microsoft clients and servers, however, ActiveX components are not as portable as Java applets, since they are closely tied to the Windows (and specifically the Win32) architecture. ActiveX components are also heavier than Java because they may bring their own run-time environment of DLLs. At the moment, Java still seems to have the upper hand in this competition.

Finally, fourth-generation sites use a full-blown Java approach. They employ a standard three-tier architecture, dividing processing among a Java application server, Java applets downloaded to the client, and a database or resource manager (see the figure "Fourth-Generation Web Sites" on page 82). The Web server's remaining task is to supply Java applets. After a download, these communicate with the Java server directly, mostly using remote procedure calls (RPCs). The Java server communicates with the back-end resources using Java-clad native database drivers or Java Database Connectivity (JDBC).

Since this type of application is entirely for and on the Web, it circumvents the constraints of HTTP and HTML. The Java server might generate HTML, but it typically outputs data in a proprietary format for direct viewing with the client-side Java browser. Using the latter approach, it has the ability to encrypt communications to improve security.

Points to Consider

Rich Carickhoff of the Application Consulting Group, an organization that specializes in custom OLAP solutions, suggests that when evaluating systems to move to the Web, you should check the application type. "Information-centric applications migrate nicely to the Web and stand to gain much value from its architecture," he explains. "Systems that present information with a low level of functionality, in multiple formats, and to a broad audience are the success stories."

But he advises against using the Web to deploy function-intensive applications for specialized users. There's too much additional software to administer on the server, too much data has to travel over the various servers to the browser, and there might still be too little interactivity.

In his recent report, Eckerson also concludes that interactivity, potentially including support for tables, charts, maps, and other visual output, is most important when specifying requirements for Web-based OLAP tools. Nearly as important are performance and the number of functions the Web-enabled version includes. Most tools, he says, currently don't allow browser users to apply new calculations to a result set. Other aspects to consider include scalability (which may require load-balancing) and support for a wide variety of back-end databases.

A final aspect to consider is the pricing model: Does the vendor charge per seat, or does it take the number of concurrent users into consideration? Eckerson concludes that the fourth-generation business intelligence tools to succeed will be the ones that simulate a client/server architecture over the Web. B

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Java applets communicating with a Java server. It fully maintains a session's state for the back-end database. The Java server (AIX, HP-UX, NT, and Solaris) caches data for improved performance. It outputs Excel, HTML, Java, VRML, and other formats. Users can create multipage presentations with interactive multimedia elements. (http://www.infospace-inc.com)

IQ Software's IQ/LiveWeb

This second-generation four-tier reporting tool employs CGI to access Unix or NT servers. Users view static HTML reports that the IQ/Objects and IQ/SmartServer tools generate using a Web interface. Hyperlinks implement operations such as drill-down. (http://www.iqsc.com)

MicroStrategy's DSS Web

This is a second-generation, four-tier CGI Web interface for MicroStrategy's decision-support system, DSS Server. The product supports parameter queries and static viewing, including hyperlink-based drill-down operations. Input and output are via HTML. The package uses the relational OLAP model. (http://www.strategy.com)

Oracle's Express Web Agent

This interface for the Oracle Express Server multidimensional database is a second-generation, four-tier OLAP server with a CGI gateway. It creates HTML output. Hyperlinks implement features such as rotation and drilling. The package also graphs using VRML. The development kit uses stored procedure code. Using Oracle's Web Publisher, it can also use Java or ActiveX. (http://www.oracle.com)

Pilot Software's Pilot Internet Publisher

This is a Web interface for Pilot's decision-support suite. It accesses multidimensional Pilot Analysis Server using ActiveX, HTML, or Java. (http://www.pilotsw.com)

Planning Sciences International's Gentia Web Suite

A third-generation, CGI-based interface to the Gentia relational OLAP server package and many third-party SQL databases. The package uses HTML, but it supports charts and Java applets. (http://www.gentia.com)

Platinum Technology's InfoBeacon Web

This is a second-generation ISAPI interface to Platinum's relational OLAP server, InfoBeacon. Users get live access to the NT-based server. Operations such as drill-down and pivot are supported using HTML forms. (http://www.platinum.com)

Seagate Software

The Crystal Reports and Crystal Info reporting tools use ISAPI or NSAPI interfaces to NT programs. Crystal Reports uses ActiveX controls to view and manipulate. Holos accesses the Holos multidimensional database server, using HTML input and output for drilling and pivoting in the browser. (http://www.img.seagatesoftware.com)

Speedware's Media/Web

This is an OLAP decision-support tool for data access and analysis over the Web. The Media OLAP server stores in a multidimensional database and delivers query results to the Media/Web server, converting results to HTML. Users get parameterized queries and OLAP functions, such as drill-down. (http://www.speedware.com)

Syntell's Perspectives-Web

This HTML server is the Web interface to Perspectives-Zoom. The package interfaces to Syntell's Perspectives multidimensional back end as well as to Informix, Oracle, Sybase, and other ODBC-compliant relational databases. (http://www.syntell.com)

Xense's DB Publisher

DB Publisher accesses databases on any platform and location. The client supports any Java platform. The server requires Win 95 or NT. It accesses Oracle and Sybase databases with native drivers, Informix, and others using ODBC. Users define queries and reports in the browser. A customizable Java form pops up values and validates inputs. Load balancing improves scalability. (http://www.xense.com)

Jon Udell

Web Project

HTML + NNTP = Groupware

HTML-enabled e-mail and NNTP conferencing will make hypertext authoring and collaborative data management a routine way of life for everyone.

Since 1985, BYTE staffers have used BIX, a terminal-based conferencing system, to share news, contacts, story ideas, and manuscripts in progress. A few months ago, that long tradition ended. The successor to BIX is NNTP conferencing, deployed mostly behind a firewall on a private IP network that links our three primary locations.

Version 2 of Navigator, the standard Internet client (what we call a browser), was really a suite of applications: browser, mailer, and newsreader. Living in the shadow of the famous browser, the mailer and newsreader failed to attract much attention. But even then, these messaging apps were doing something extraordinary: They could render, transmit, and, to a limited extent, compose HTML.

In version 3 of both Navigator and Microsoft Internet Explorer (MSIE), the messaging apps became slightly more HTML-aware. In version 4, they are dramatically more so. You can easily construct a mail message that uses rich text, tables, images, and hyperlinks. And yet when I show people how I use these capabilities to collaborate with my team, with the whole BYTE staff, and with participants in our public conferences, they're invariably surprised.

Why? The context in which NNTP discussion and HTML messaging become compellingly useful isn't yet apparent to many people. So let's spell it out.

An NNTP Server Is a Read/Write Web Server

Thanks to the Web, millions of people have become consumers of hypertext. Relatively few produce it, though, because the Web is primarily read-only. The writable equivalent of the Web is the Usenet, where millions of people exchange billions of words every day. But while the latest newsreaders can compose and view HTML, the Usenet's vast ocean of text will for some time retain its plain-ASCII look. Post an HTML message to rec.crafts.rubberstamping, and you'll likely get flamed. Usenet credo demands universal access to content. True, messages can contain both plain text and HTML. But legacy newsreaders display these hybrid messages awkwardly, naysayers complain, and the extra bulk saps bandwidth.

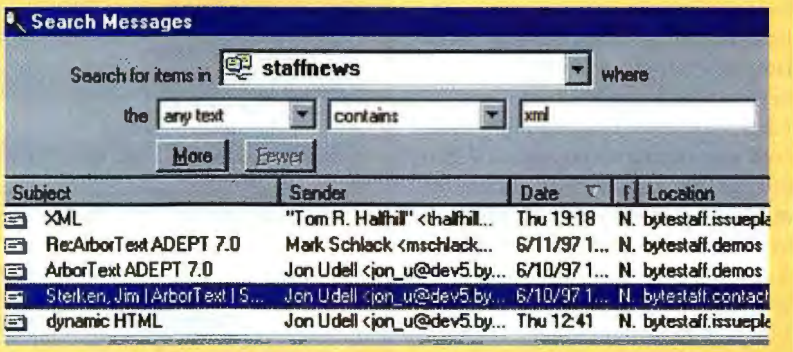
I'm all for universal access. As it is currently constituted, the Usenet quite properly takes a conservative stance toward HTML messaging. But there's terrible irony in the bandwidth argument. The inside-out architecture of the Usenet, whereby tens of thousands of newsgroups replicate to tens of thousands of servers every day, is a far more egregious abuse of bandwidth.

Discussion data no longer needs to propagate around the world by way of replication. It's 1997, not 1977. News servers, like Web servers, are now directly accessible from all points on the Internet. News clients can hop instantly from server to server, just as Web clients can. News servers, like Web servers, can house deep, richly structured, densely interwoven, searchable collections of documents. And everyone—not just designated producers of content—can help build those collections.

This scenario may or may not ultimately prevail on the Usenet. Either way, you can create an alternative public or private version of the Usenet using a stand-alone news server. When I started doing this 18 months ago, I had to climb the admittedly steep learning curve associated with INND, the server app that powers most of the Usenet.

Today it's much easier. In addition to INND, I'm running the latest news servers from Netscape (Collabora Server 3.0) and

Full-Text Search with Netscape Collabra



We're using Collabra as a free-form contact manager. Careful use of message headers lends structure to the newsgroup. Full-text indexing of attachments makes the newsgroup a powerful tool for information storage and retrieval.

PHOTOGRAPH: KELLIE WALSH © 1997

Microsoft (Internet News Server). Both vastly simplify the process of setting up and using NNTP conferences. Both, in conjunction with the new generation of HTML-aware newsreaders, propel NNTP technology into the space formerly owned by proprietary groupware platforms, such as Lotus Notes.

NNTP Newsgroups Are Simple Document Databases

A newsgroup is really just a directory with a bunch of text files in it. Each file starts with headers (Newsgroup:, Subject:, Date:, and Sender:) and continues with the stream of ASCII text that is the message.

Newsreaders can order your view of a newsgroup by the primary headers: subject, date, and sender. But that's not too useful if you're pointing your newsreader at alt.rec.rubberstamping. Why order by date, for example, when there's nothing newer than last night's feed?

In a private newsgroup, though, these ordered views become very useful. When I finish the first draft of this column, for example, I'll post it to an internal news server. Weeks later, when the final proof reaches my desk, I may want to refer back to the original copy. No problem. I'll select the newsgroup, order by date, scan for mid-June, and look for postings from me.

With a bit of group discipline, you can make these views of shared data even more useful. Here's a simple but powerful idea: Treat the subject header as a row in a database. For example, we use several newsgroups as simple contact managers. I invite staffers to post subject headers to this group in the following form:

```
Davidson, John | Network Telesystems | TCP/IP, VPN
```

The idea here is that records in this contact database are categorized in three ways: by name, by company, and by keyword. Order the newsgroup by its Subject: headers, and you've ordered the database by name. Yes, I realize this isn't perfect. You can't order by company or by keyword, as you would with the equivalent Lotus Notes database. But here are some points to consider.

Full-text search. There isn't yet an NNTP standard for the full-text search of newsgroups, but Netscape implemented one in its new Collabra server and client.

The body of the message is a white paper on virtual private networking that John Davidson sent me by way of e-mail. I know I'll be able to find that document three months hence by searching our newsgroup for the term *vpn*. What's more, I know that any other BYTE staffer looking for contacts or material on that subject will also be able to find it.

Direct e-mail integration. To enter this record into our contacts database, I forwarded John's e-mail message into the newsgroup, rewriting the Subject: header as I've shown. Data entry doesn't get any easier than this.

I've built and used a few multiuser contact databases over the years. Data entry is always the bottleneck. Like all so-called knowledge workers, I process a flood of information at top speed all day long. If I have to fire up a data-entry screen and fill out a set of fields to log each event, I just won't, nor will my colleagues, and it's no use pretending otherwise.

The data-entry threshold has to be very low, and now it is. A lot of information comes to me by way of e-mail that will matter to me or my team, but not today or next week. It takes literally 2 seconds to tag these messages and forward them to a shared-document database where they will be seen once and can be found later.

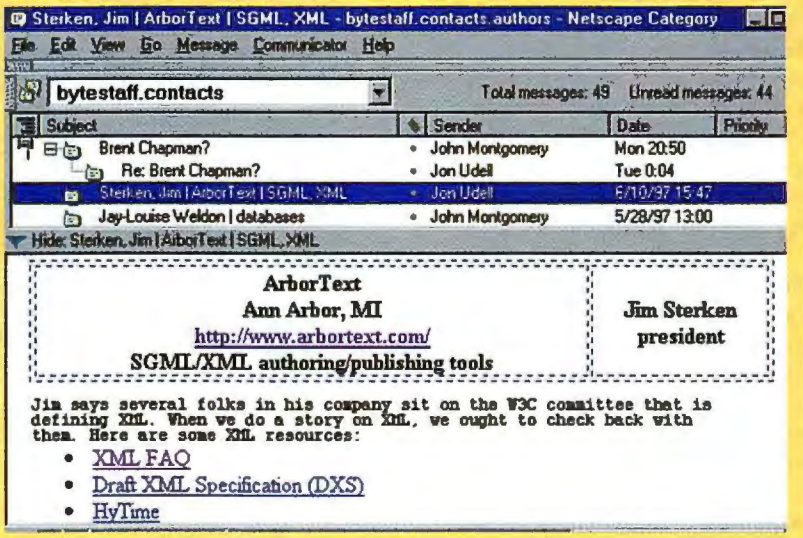
Optional value-added Web integration. Suppose you wanted to construct views of this database by company and keyword, as well as by name. It's straightforward. I've written before about transformers (MHonArc and Hypermail) that convert mail or news archives into Web archives. Given such a Web archive, you need only scan for Subject: headers, parse out the implied fields, sort them, and emit one or more Web pages that serve as indexes on those fields.

NNTP newsgroups are rich file systems. Following the headers, a news message can contain just a simple message body or a set of message parts, each encapsulated between MIME boundary-markers. These attachments can be MIME-encoded binaries, such as images, executable programs, PDF files, and spreadsheets. They can also be HTML files. Listed below are some of the consequences that flow from creative use of the text/HTML MIME type.

No external viewers are needed. If posters convert files to HTML, readers won't have to launch external viewers because newsreaders can now render HTML attachments natively. Some applications already implement "Save as HTML," and many more will.

Content can be full-text-indexed. If you post a Word document as an attachment, I can search for the text that you write only in the primary part of the message. Convert the attachment to HTML, and I can search that, too. That's just what I did

HTML-Enriched NNTP Conferencing



The latest Netscape and Microsoft newsreaders make HTML composition simple enough for casual use. The table formatting shown here was done by Netscape Composer. The hyperlinks were dragged from a browser window and dropped into the message.

THE LEADER IN INNOVATIVE, COST-EFFECTIVE, CHIP DESIGN STRIKES AGAIN

Taking technology to new heights — Realtek's RTL8139 Single-Chip Fast Ethernet Controller

It's no wonder BYTE magazine awarded Realtek its prestigious **"Best Component"** and overall **"Best of Show"** awards at Computex Taipei '97 for the development of the pioneering new RTL8139 Single-Chip Fast Ethernet Controller. This innovative solution integrates the Fast Ethernet Media Access Controller (MAC), physical chip and transceiver ***all in a single chip***—providing unprecedented cost-effectiveness and greatly facilitating the network card design process.

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http://www.realtek.com.tw

Besides its groundbreaking developments in the networking field, Realtek offers a broad range of similar *system-on-a-chip* solutions including graphics and video accelerators, audio, caller ID and speech ICs.

Specializing in complete system development rather than simple chip design, Realtek is constantly reaching new altitudes in low-cost, high-performance IC solutions for the computer and multimedia, communications networks and consumer electronics fields.

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INTEGRATED AUDIO CONTROLLERS WITH 3D SOUND · PCI 64-BIT GRAPHICS/VIDEO ACCELERATORS · MOTHERBOARD CLOCK SYNTHESIZERS · CALLER ID INTERGRATED SYSTEMS · MELODY ICS · SOUND EFFECT ICS · SPEECH ICS · MICROCONTROLLERS

when I received and posted John Davidson's white paper.

Attachments can be live applications. Everyone gets e-mail like this: "Re: Company picnic: Please choose preferred date [7-18/7-25] and activity [volleyball/softball]. Reply to Pat at [phone #/e-mail address]." If we're using HTML-enriched mail tied to a Web-based application, Pat need not collect, tabulate, and disseminate this data. She can package her survey as an HTML message and broadcast it to the staff. An application such as my Polls servlet (see "Java Servlets," June BYTE) doesn't know or care if its HTML client is a Web page or a mail or news message.

Message Threading Creates Document Hierarchy

Suppose that, two months after I enter the John Davidson record in our contacts newsgroup, another BYTE editor interviews John for an article on VPN. Two months after that, a fact-checker calls John to verify some information in the article. The Contacts newsgroup is the obvious place to record these interactions. If the editor and fact-checker add their notes as replies to the original message I posted, they'll create what we normally think of as a conversational thread.

But in this context, the newsreader behaves more like a kind of shared outline processor. When I launch the newsreader, the Contacts newsgroup appears in unexpanded form as a list of names. To explore all our interactions with John Davidson, I can expand that thread.

How well does this work? To be honest, you won't find many examples of this technique in our internal newsgroups today. It's tempting to blame the NNTP tools, which weren't designed for this purpose. You can't, for example, rename or move messages, and if you cancel a message you'll orphan the hierarchy beneath it. What's more, nothing prevents you from posting a top-level message that violates the style (e.g., `NAME | COMPANY | KEYWORD`) that creates the illusion of a database.

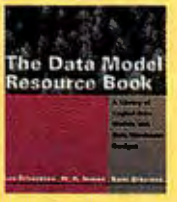
But neither of these limitations is crippling, in my view. The real obstacle, as always with groupware, is cultural. I know people who exploit the rich capabilities of Lotus Notes less effectively than we exploit our relatively primitive NNTP-based tools. Most people, even some who are highly software literate, are not yet attuned to this mode of collaboration. We'll all get there, but it's going to take time.

TOOLWATCH

Win32::Internet
Aldo Calpini (<dada@divinf.it>)
http://www.divinf.it/dada/perl/internet
An essential tool for every NT Perl hacker. Win32::Internet creates a Perl 5 interface to WININET.DLL, the Win32 Internet support library that manages HTTP and FTP connections. It's a great way to make your Win32-based Perl scripts URL-aware.

BOOKNOTE

The Data Model Resource Book
$49.99
by Len Silverston, W.H. Inmon, and Kent Graziano
Wiley Computer Publishing
http://www.wiley.com/compbooks/



If you look at enough information systems, patterns will emerge. These authors have done just that. Here are data-modeling recipes that include all the basic ingredients: people, organizations, products, units of work, and orders.

NNTP Messages Are Link Sources and Link Targets

By *link sources*, I mean that NNTP messages can contain live hyperlinks. Since Navigator 2, we've been able to compose hyperlinks merely by spelling URLs correctly. If I type `http://www.byte.com/` in a message, the news (or mail) client will automatically recognize and activate that link.

This primitive form of hypertext authoring can deliver extraordinary benefits. When Usenet posters refer to Web documents, readers can access them with a single click. Using the HTML composers in the version 4 clients, you can refine the appearance of the hyperlink. If you are writing for an audience of HTML-aware newsreaders, you can wrap an ugly URL, such as http://www.byte.com/art/9706/sec5/art1.htm, in a descriptive phrase such as `my June column`.

By *link targets*, I mean that hyperlinks (on a Web page or in a news message) can lead to news messages. This hardly matters on the Usenet, because messages there don't survive more than a few days.

But on a private NNTP server, it's a different story. You don't ever have to expire messages; they can be as permanent as Web documents typically are. Suddenly it makes sense to create links to these permanent news messages. As I pointed out in "Dual-Mode Conferencing" (December 1996 BYTE), we've long been able to form such links using message IDs. But it was awkward to do so, and the resulting URLs were nasty-looking strings, such as news://staffnews.byte.com/3301F45C.482E@byte.com. I'm delighted to report that, with Communicator's Collabra client, which just shipped, you can achieve this result by dragging a message icon into the message-composition window.

Why is linking to news messages a big deal? It means that the number and quality of documents that you've collected in a newsgroup are not the only measures of its value. Density of interconnection becomes another key measure. References can be a concise and elegant alternative to quoting huge chunks of prior messages.

Even more ambitious, messages with links to messages can summarize discussions and create alternate views of databases. It's true that these meta-messages are still part of the flow of the newsgroup. Like all messages, they'll be seen once and then fade into the archive. But if they're composed in HTML, they can also function as Web pages.

The "discussion highlights" section of our home page, which calls out interesting threads in our public conferences, illustrates this technique. Think of an HTML-based NNTP discussion as a bunch of rough drafts, some of which will merit promotion to the status of finished Web pages.

What's the Catch?

If this NNTP stuff is so handy, why aren't more people using it? Not many folks, other than Internet service providers and network administrators, have ever mastered NNTP servers. The de facto choice, INND, is a mythologically scary beast.

But times change. The latest incarnations of INND from Netscape and Microsoft go a long way toward taming the monster. Most would find it straightforward to deploy these GUI-driven news servers for internal use. Next month I'll show how that's done. B

Jon Udell is BYTE's executive editor for new media. You can reach him by sending e-mail to **jon_u@dev5.byte.com**.

Rick Grehan

Javatalk

Vibe Jive

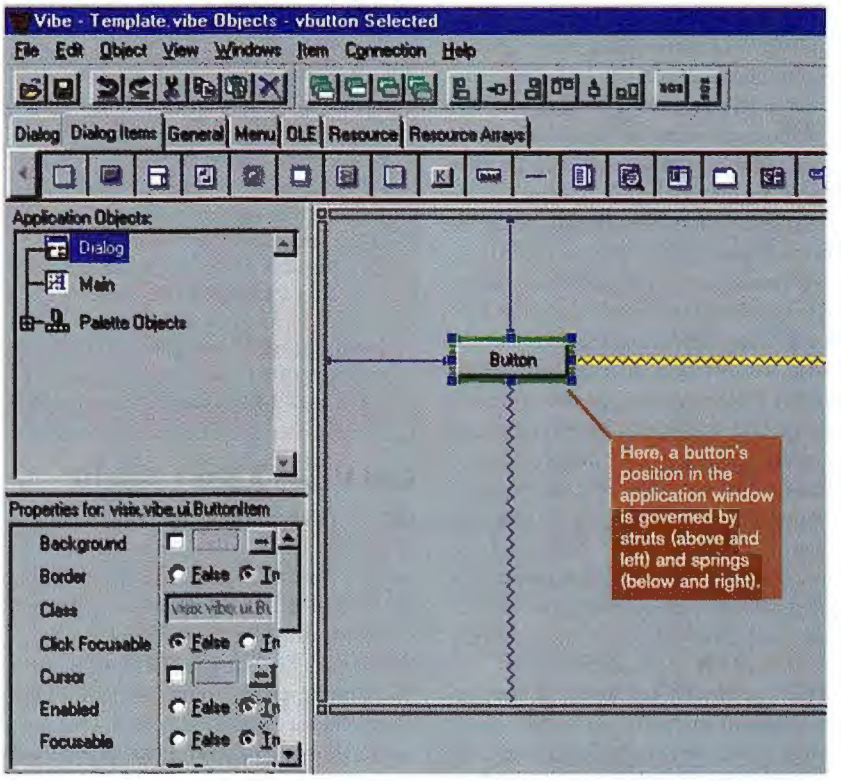
Feeling that cross-platform Vibe is one thing; deploying it is something else.

Sometimes in the Java world, you have to choose between big, slow, and standard versus faster, smaller, and nonstandard. A case in point is Vibe ($49.95), which opts for the latter approach. Vibe comes from Visix, creator of the Galaxy multiplatform development system (see "A Whole Other Galaxy," July 1995 BYTE).

You'd think the Visix technology and Java would be a perfect match: Galaxy's forte is cross-platform GUI development, which is a big part of the Java story. However, several aspects of Vibe might make programmers think twice before using it.

Springs and Struts

The hallmark of Galaxy's GUI development system is its intelligent geometry management, which allows for smarter interfaces and is based on the concepts of *springs* and *struts*. Springs and struts, which in Vibe are a type of "connection," are logical entities that define orientation physics so that on-screen objects reposition themselves appropriately when the screen is resized or when an application designed on one platform is run on another platform.



Vibe brings Galaxy's springs and struts to Java.

During the development of the GUI portion of your application, when you place objects such as buttons or scroll bars on-screen, you can define a connection between the edge of an object and the edge of the frame or between opposite edges of an object. Connections between an object and the frame control the object's position. Connections between opposite edges of an object control the object's size.

Each of Vibe's four connection types—struts, springs, spring/strut, and natural length—has a specific behavior. A strut specifies a fixed value. If you put a strut between opposite edges of, say, a button, the button size remains fixed regardless of what happens on the screen. A spring expands and contracts as the user resizes the window, thus allowing objects to move while maintaining relative positioning. A spring/strut is a spring with a fixed minimum length. The natural-length connection enables an object to resize itself based on its contents. (For example, if you change the font size in a button at run time, the button resizes itself appropriately.)

Visix could have coded the intelligence of its scroll bars and buttons inside huge class files written entirely in Java, but then applications would be big and slow. Instead, Visix moved some of that intelligence into native classes that are actually part of the Vibe virtual machine (VM). Because they're native, they run faster. But they also require a nonstandard VM.

A Profundity of Files

A Vibe application has more than just a set of class files running inside a Java VM (JVM). Vibe has class files, .vibe files, a special Vibe JVM, and a "vibe runner" file. Every Vibe application you build creates an associated .vibe file, which is

roughly analogous to the resource fork of a Mac application. In particular, the .vibe file carries the geometric information associated with the GUI portion of the application—that is, inside the .vibe file is persistent data that describes not only what objects (e.g., buttons and scroll bars) are on-screen, but their position, too.

The .vibe file also contains the complete compiled version of the application. Hence, you can set up a Vibe application so that users can double-click on the .vibe file and launch the application as though it were a stand-alone executable.

This is where the runner file comes in. The Vibe runner, which must be installed on end users' desktops, consists of the Vibe JVM and native class files bundled into a single package. In the above scenario, when the user double-clicks on the .vibe file containing the application, it's actually the Vibe runner file that wakes up and begins execution. Note that the Vibe runner file is most useful for applications deployed through the enterprise. It's less useful for applications run on the Internet, where you can't be sure that a client will have the Vibe runner file.

Visix's use of the runner file offers some benefits. I've seen Java GUI-development systems that attempt to embed information about the visual components of an application directly in the Java source code, surrounded by comments and messages such as, "Don't edit this!" This information is embedded in the file because the integrated development environment (IDE) itself needs that data to create a design-time view of the application's GUI.

Vibe's approach, because it doesn't insert information into your source code, eliminates worries of accidentally editing a forbidden portion of source code. But, with all these special files to keep straight, distributing a Vibe application can be problematic: You can't just bundle an application into a class file and ship that to a client.

Fortunately, Vibe comes with InstallShield, plus InstallShield scripts. These tools will help you by automating the construction of a distributable application bundle.

WHERE TO FIND

ObjectSpace, Inc. Dallas, TX 972-934-2496 http://www .objectspace.com	**Visix Software, Inc.** Reston, VA 703-758-8230 fax: 703-758-0233 http://www.visix.com

Visix Gives Java a Jump-Start

If you're serious about Java, the Java Developer's Kit (JDK) leaves much to be desired, including a need for more containers and generic algorithms to help you more quickly develop and deploy applications. ObjectSpace's Java Generic Library (JGL) is a collection of containers and algorithms that's the Java equivalent to the C++ standard template library (STL). JGL is bundled with Visix's Vibe and is also free for the downloading from http://www.objectspace.com.

JGL consists of over 100 classes and interfaces that define data types and associated algorithms. All the data types in JGL descend from a parent abstract data class that's known as "containers." Five different kinds of "base" containers exist in JGL: maps, queues, sequences, sets, and stacks.

Each type of container has its own characteristics of access and element storage. For example, a queue implements a linked-list structure; a stack implements a first-in/last-out structure, and so on. (I'm using the "base" classes designation loosely. The map class is an abstract class, queue and stack are concrete classes, and sequence and set are interfaces. Think of them as the five main branches of the JGL container-class tree.)

But the container classes are only part of the JGL fabric. Algorithm classes provide the necessary mechanics for operations on containers. JGL includes algorithms for sorting, searching, counting, replacing, applying, and more. In addition, JGL defines a set of iterator classes for each container class so that you can easily program tight loops that process elements within a container.

But the real power of JGL is unleashed when containers, iterators, and algorithms are combined. The combination allows you to turn an algorithm loose on a container with just a few statements. For example, the following code shows how you might sort the first 10 elements of an array container:

```
ArrayIterator first =
   array.begin();
ArrayIterator last =
   array.begin();
last.advance(10);
Sorting.sort(first,last);
```

The `first` iterator is set to the front of the array. Then the `last` iterator is created and moved to just past the tenth element. Finally, the `sort` method is called to sort the subset of the array. Note that, with little modification, you could easily sort subsets *within* the array, as well as the entire array itself.

Bad Vibes About Safety

On the darker side, some of Vibe's admitted security holes are a wee bit disturbing. I am aware of two of them. First, the Vibe JVM does not perform all the verifications done by a standard JVM when a Java class file is loaded. The JVM specification describes four passes that take place when a class file is loaded. One pass verifies (among other things) that no local variables are accessed prior to being stored with valid values. The Vibe JVM doesn't do this check; it must depend on the compiler to do it.

If the compiler hasn't done this check, then the Vibe JVM is susceptible to whatever maladies might occur if the program attempts to manipulate an unorthodox value. (I should point out that the Vibe compiler does do these checks. Still, that's little help if someone tries to bring in an application from the outside.)

Second, the Vibe JVM does not include a security manager that restricts access to the network or file system. That means that if you have installed the Vibe JVM in your browser, a Vibe application (applet, really) downloaded over the network has full access to your machine. The Vibe documentation is succinct about this: "Basically, a Vibe application can do anything on your computer which a native application can do." Ouch.

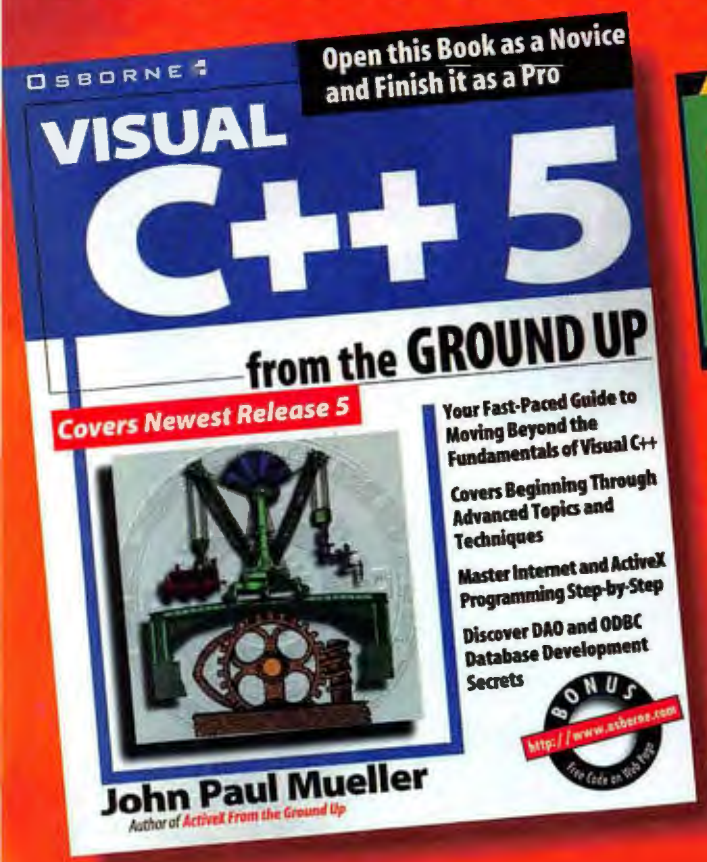
Good Vibes

Vibe's springs-and-struts paradigm is a welcome mechanism for managing the GUI portion of an application. The .vibe file, while somewhat nonstandard, is certainly a step in the right direction for handling the sticky problem of where to put resource information.

However, too much of Vibe is nonstandard. The .vibe file is nonstandard. The Vibe JVM is nonstandard. The runner file is nonstandard. The reasons for all these nonstandard entities are easy to see, but Vibe sacrifices portability to bring them about. Perhaps these problems will be addressed in future releases. B

Rick Grehan is a senior editor at Computer Design *magazine and coauthor of* The Client/Server Toolkit *(NobleNet, 1996). You can contact him by sending e-mail to* **rickg@pennwell.com.**

Construction Zone Ahead



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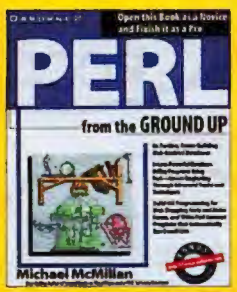

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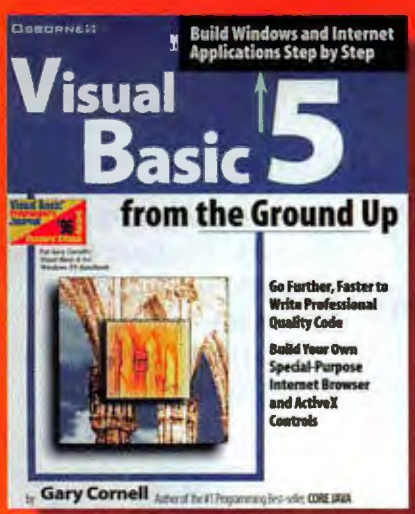

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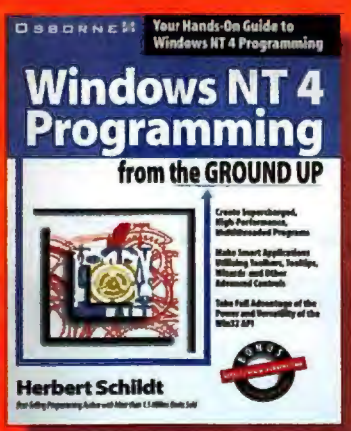

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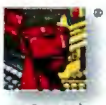

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A fiber-optic interface standard and programmable motors help build precise motion-control systems quicker. By Alan Joch

Plug and Play for Manufacturers

In cavernous aircraft hangars across the country, industrial versions of R2D2 quietly motor around the fuselage sections of next-generation military and commercial aircraft. The robots pause frequently to shine lasers that take 3-D measurements to assure that they place the sections precisely. Dozens of motors and precision actuators buzz as the robots perform the calculations and smoothly lift the outer skins into place. To resellers and systems integrators that create motion-control systems, robots such as these are poetry in motion. Unfortunately, for decades, proprietary motion-control hardware has made interoperability among system components almost impossible in systems such as this.

Fortunately, this is changing for integrators that build packaging and printing machines, material-handling systems, and robots. Change comes courtesy of standard-issue Windows PCs, C/C++ development tools, and a maturing standard—serial real-time communications system (SERCOS)—that first caught on in Europe and in the last two years has begun to establish itself in North America.

SERCOS's raison d'être is to establish communications between controllers and the digital-motor drives that perform complex multiaxis movements. SERCOS defines a standard way for integrators to plug as many as 254 programmable drives into a 4-Mbps fiber-optic ring that becomes the medium for controls and drives to pass data serially to each other. Unlike analog interfaces, SERCOS allows for two-way communication between controls and programmable drives. Basically, it's a Plug and Play bus for manufacturing systems.

"SERCOS helps us speed integration," says Ed Chalupa, president of Advanced Integration Technology (AIT), the Plano, Texas, systems integrator that built the aerospace robotic units. Chalupa adds that his company's manufacturing systems have to be constructed at his customer's site—without benefit of debugging in an AIT quality-assurance lab. SERCOS eliminates bugs that were common in the wiring between the controller and the programmable motors, he says.

SERCOS alone wouldn't open architectures for motion-control systems. Openness results from teaming the SERCOS standard with PCs and standard development tools. PCs are more

"We do the final installation, wiring, and programming in the field. SERCOS reduced bugs from wiring errors to zero."

—Ed Chalupa

economical than programmable logic controllers (PLCs), the likely alternative. Standard development tools let integrators draw on the same programming expertise from project to project. Together, these standard resources help alleviate the frustrations of resellers and integrators about proprietary systems, says Charles F. Carter Jr., vice president of technology for the Association for Manufacturing Technology.

However, SERCOS is still evolving, and some integration issues remain unresolved. Add to that the competitive pressures of the marketplace, which induce component vendors to interpret the standard in different ways to give their products a performance edge. The result is that SERCOS is what John Odenthal, vice president of systems integrator Motion Design, calls "an integrator's nightmare—a nonstandard standard." Yet Odenthal says the benefits of SERCOS outweigh its annoyances, if you know how to work around the rough spots. Here's how to avoid integration problems.

Why SERCOS Now?

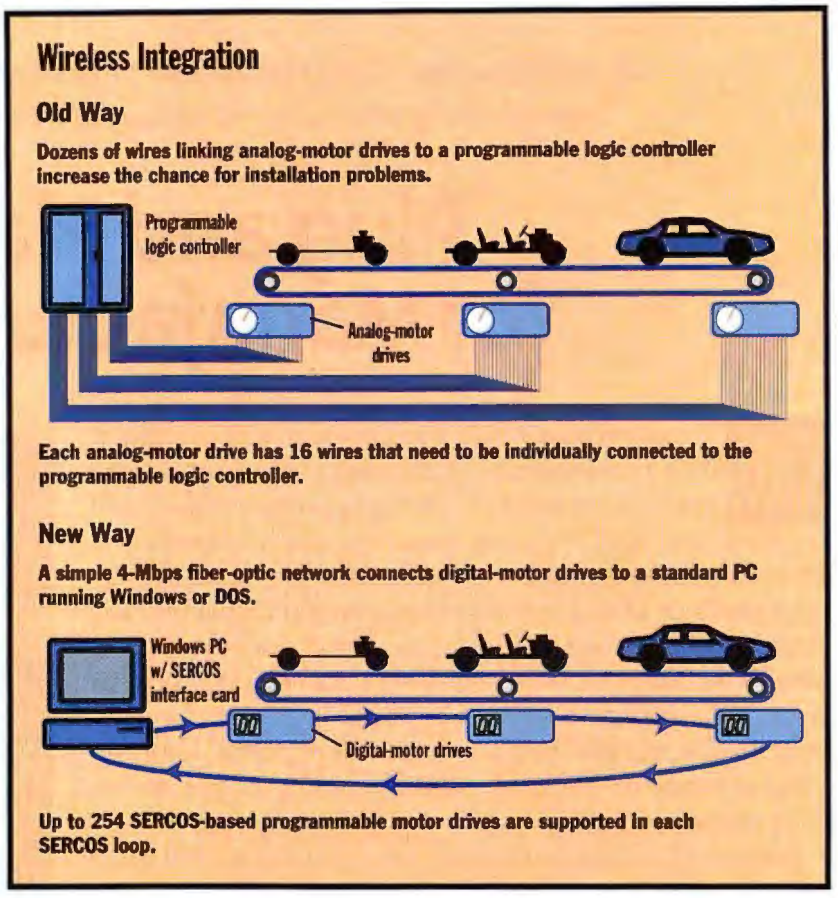
Although SERCOS may be unfamiliar to many resellers, it's not new. Its development began in the 1980s, spurred by German manufacturers that wanted a nonproprietary interface for machine-tool systems. Why is SERCOS suddenly important? Two reasons: big endorsements and digital programmable drives.

The biggest endorsement came in 1995, when GM told suppliers to its Powertrain and European manufacturing divisions that all future equipment must support SERCOS.

Another recent catalyst for a better and faster interface, beyond interoperability, is the motion-control industry's move from analog to digital components, particularly digital programmable drives.

Digital drives are faster and more precise than analog drives. It's not unusual for them to go from 0 to 3000 rpm in 20 milliseconds or come to a stop within 1/8000 of a revolution, says Jeff Pinegar, spokesperson for Automation Intelligence, a Duluth, Georgia, systems integrator that was one of the first U.S. companies to work with the standard in 1992.

Also, analog drives are electrically noisy. Because the motors are almost constantly starting and stopping, they become essentially a series of antennas for electrical interference. Electrical noise is not a problem with SERCOS's fiber optics.



Integrators building large systems may complete hundreds of connections. SERCOS replaces them with one fiber-optic ring.

Obviously, SERCOS isn't the only interface choice for motion-control systems. Many vendors have proprietary solutions. There are also other alternatives, from Fieldbus to ProfiBus, CANbus, Inter-Bus-S, and DeviceNet, that are often best suited to low-level components, such as motor starters, rather than for more sophisticated multiaxis motion-control components.

Fieldbus, for example, establishes a communications link for I/O data to travel to a number of field devices. Some integrators say that they use DeviceNet and SERCOS side by side, the former for I/O control, the latter for motion control. However, Pinegar says his company often uses SERCOS for both I/O and motion control, eliminating the need for a separate $1000–$2000 I/O card.

Most integrators give SERCOS high marks for lessening wiring woes (see the figure above). A typical analog-motor drive might have 16 wires coming out of it that lead to a motion controller. A large automated packaging system might have 15 drives, which means an integrator for such a system would have to complete 240 electrical connections. SERCOS reduces this to one fiber-optic ring.

Easy connections mean a faster setup time. "In the past, we would put a card in the PC doing motion control and have two or three 100-pin ribbon cables fan out to 100 terminal blocks," Pinegar says. "With SERCOS, the network goes out from one transmitter to each drive in one clean fiber-optic ring. In terms of systems integration, this simplified wiring is a tremendous advantage." For Chalupa, simplified wiring is important because the systems AIT builds for the aircraft industry are so large. "We do the final installation, wiring, and programming in the field. SERCOS reduced bugs from wiring errors to zero," Chalupa says.

Who's Behind It?

Thanks to GM's endorsement and the rise of digital drives, the number of products

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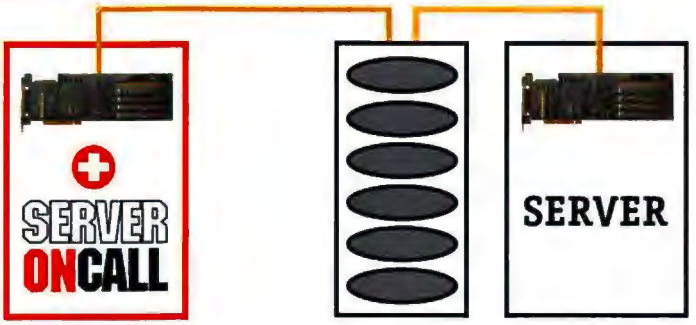

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that support the standard has finally made it a universal interface. Who's supporting SERCOS?

According to SERCOS N.A., a trade association, the protocol's capability to ease systems-integration tasks especially benefits machine builders. "Networking drives and controls through the SERCOS interface is a straightforward matter of systems integration," says Tom Lauterback, the association's managing director. "With the ability to manipulate every variable in a drive system, SERCOS-compliant digital drives have brought drive setup and optimization to a new level. Today, such tasks are being performed in graphical environments such as Windows," he adds.

Lauterback estimates that more than 27 companies offer SERCOS products and systems-integration services. This includes leading suppliers of motion-control cards and equipment, such as Indramat, Motion Engineering, and Pacific Scientific.

But Wait: There's Less!

SERCOS has advantages, but resellers aren't oblivious to its shortcomings, which range from slow speed for some applications to poor documentation that leads to inconsistency in how the standard is implemented.

Over the past 11 years, SERCOS's creators have tried to address speed concerns. The original specification, which called for a 2-Mbps data transfer rate, has been boosted to 4 Mbps. New SERCOS ASICs are capable of 10-Mbps rates. But until 10 Mbps is widely available in programmable drives and SERCOS cards, some integrators will hunger for more speed. "We'd like SERCOS to be faster," Pinegar says. "The more drives you add, the slower the network becomes."

Part of the speed problem comes from the fact that, although the standard calls for a maximum of 254 programmable-drive connections in each fiber-optic ring, the actual drive limit may be less depending on the communications cycle time, how much data is being passed, and the speed requirements of the application. Consequently, applications that require both high speeds and a large volume of data may need multiple SERCOS rings.

Officials at SERCOS N.A. advise integrators to be sure that they factor in the time required to exchange all command data across the SERCOS ring. Integrators must take cycle times and data volume into account, not just the bus-transmission rate, to decide if the system they are building is fast enough for a given application. Exact timing in the software interrupt routine is more important than speed, they say, because even the fastest software routine isn't useful if timing isn't consistent.

SERCOS was designed with synchronous operation in mind so that transmission-signal jitter is minimized. It was also designed so that actual values are detected and commanded values acted on by all drives simultaneously. Because drives work synchronously, "beat" frequencies or harmonics appearing in the motion-control system are eliminated. Feedback acquisition and commanded value executions are performed in every drive at the same instant, making an effective snapshot for control purposes, according to SERCOS N.A.

The second drawback—lack of interoperability among SERCOS-compliant hardware—stems from two reasons: an attempt by the standard's designers to write flexibility into the protocol and documentation that generally receives poor grades from integrators who have tried to comprehend it. Many integrators say the best information comes from programmable-drive vendors rather than from official SERCOS publications.

Pinegar says interoperability among large programmable-drive vendors is common; problems usually crop up among smaller vendors or those new to the market.

Community Needed

The real problem, say resellers, is that no central repository exists to help integrators exchange solutions. "We need more support for the user community," Chalupa says. Anomalies are "an annoyance" rather than an insurmountable technical problem, adds Odenthal. He would like to see SERCOS documentation available via the Internet, so changes to the standard could be updated regularly and there could be a forum for resellers.

Chalupa also confesses to mild irritation over the fact that the type of fiber specified for SERCOS is a nonstandard diameter. Also, the fiber must have a screw-on connector rather than the more conventional bayonet clasp. "All the drive manufacturers sell the fiber, but we like to buy it from a local source in case we break fiber in the field," he explains.

In the end, however, motion-control integrators say SERCOS is becoming a regular part of their work. Digital technology means motion-control systems can be more precise and easier to build, and SERCOS represents progress away from the frustrating days of proprietary prisons. If dynamic, real-time forums spring up to let integrators share design experiences, SERCOS may become an open standard in the truest sense. B

Alan Joch is a freelance writer and former BYTE senior editor who covers emerging technologies. You can reach him at **ajoch@monad.net.**

Help for the SERCOS-Challenged

If you want to know more about SERCOS, you're not alone. Its creators are credited with producing a generally effective protocol but receive criticism for user-community support. Here's help. For a good technical overview of the standard, including an explanation of design strategies, contact SERCOS N.A. The association also sells a drive/control developer's kit, which includes a listing of sources of information and support, for $50. The group also compiles information about SERCOS-compatible products available in North America.

You can obtain the formal specification from ANSI. Request IEC 1491, "System Interface." Also, take the advice of integrators and resellers who are SERCOS pioneers. Don't rely just on official documentation to answer all your technical questions. Bolster that information with technical bulletins from programmable-drive vendors, such as Indramat, Lutze, Motion Engineering, and Pacific Scientific.

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New reseller programs put R/3 into the hands of smaller companies. By Jason Krause

Thinking Small(er) with SAP

With only 20 resellers in the U.S., and an image as a Fortune 500–class business product, R/3 might seem like something that's out of your league. Think again. SAP is introducing new programs for rolling R/3 into smaller corporations, and this is creating new opportunities for certified resellers to hook up with other resellers to gain expertise in hardware, databases, and networking.

SAP's R/3 is a do-everything product, integrating back-office functions, such as financials and human resources, with front-office functions, such as sales and marketing. Yet, outside the Fortune 1000, R/3 is a well-kept secret. Since many resellers perceive it as a big-ticket product that only large consulting firms and SAP itself could hope to successfully implement and sell, they overlook the opportunity it presents. However, with SAP opening new reseller channels, that's about to change.

The R/3 System

R/3 is an application suite that manages and integrates the spectrum of business needs for a company by linking such disparate functions as financials, sales and distribution, logistics, and manufacturing. To do this, R/3 uses a typical client/server, three-tiered architecture consisting of a database, an application layer, and a presentation layer. The latest release, 3.1, is Web-enabled, adding what SAP calls an Internet Transaction Server to the architecture.

To work with R/3, you need to understand what SAP calls the Business Framework. This includes two main technologies: Business APIs (BAPIs) and Application Linking and Embedding (ALE). Also part of the Business Framework are the SAP Business Objects, an effort to structure R/3 in an object-oriented way, and the Open Information Warehouse (OIW), a collection of R/3's data-warehousing features.

BAPIs use Microsoft's COM to create an object-oriented interface to the business-application logic within R/3. They allow R/3 to pull identifiable content from non-SAP applications into R/3, extending the functionality of the product to other, unrelated corporate systems. "A BAPI is business content," explains Peter Graf, technical marketing manager with SAP. "BAPIs change slower than content, which means you can achieve inde-

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"SAP realized that large enterprise projects accounted for only 50 percent to 60 percent of our business."

—Bryan Plug

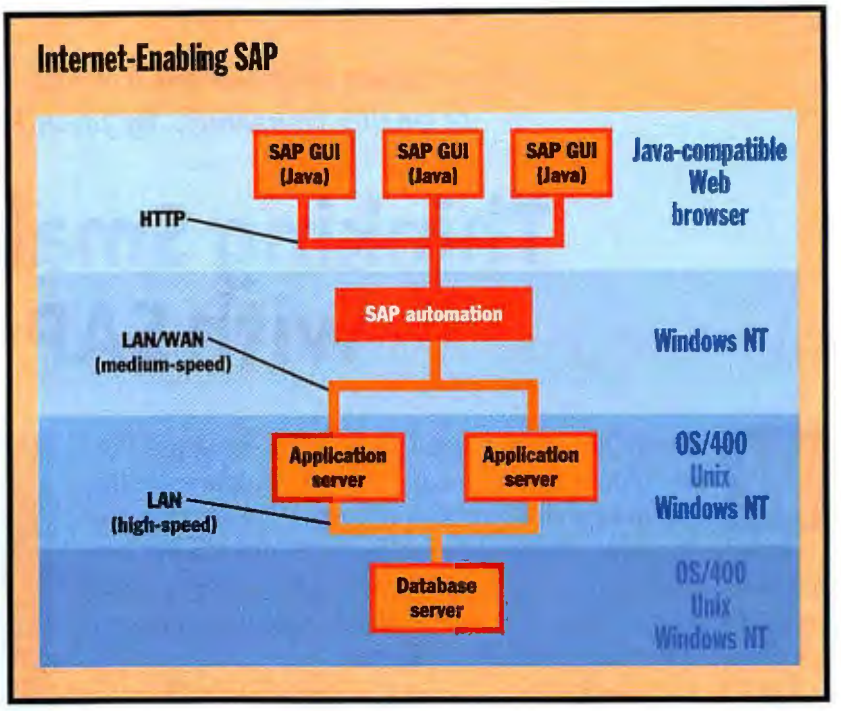
pendence from technical issues and just worry about keeping your content up to date."

R/3 introduced ALE with version 3.0. This feature loosely synchronizes physically separate R/3 systems as well as R/2 and non-SAP systems.

The Business Objects feature, SAP's approach to the object-oriented movement of data, uses Microsoft's COM/DCOM to allow business objects to coexist in loosely coupled, multiplatform, multistandard environments. A Business Object consists of a core business-logic layer, or business-object kernel; a second layer for rules and constraints, which ensures data integrity; and a third layer, which consists of methods, attributes, and event controls. The fourth level is the access layer, where object-oriented standards, such as COM/DCOM and CORBA, reside.

The OIW is a data-warehouse solution within the R/3 system. It's an extensible on-line analytical processing (OLAP) server with information models for business management that are derived from the R/3 system. The Business Explorer is an integrated analysis tool, based on Excel and Internet technology, with ready-to-go reporting libraries for corporate data analysis.

Also important to R/3 are Internet links for conducting Web transactions and running business functions through the Internet. New Internet features include bank data transfer, order entry, order-status requests, human-resources (HR) employee self-service applications, and graphical on-line product catalogs. With a transaction server, this architecture



After insertion of an NT automation server between the SAP application server and the Java-enabled client, R/3 is Web-enabled.

makes it possible to guarantee that when someone clicks on a Web application, that transaction will be carried out. The SAP Internet Transaction server, which runs on Windows NT, is an addition to the R/3 architecture and does not change it in any fundamental way.

Because R/3 ties into a company's Web site, it eliminates the need to invest in new Web-enabling technology. "We're staying competitive because we can show our products on our Web site and tie our business into the site without changing our business model in any way," says Jean Fulchino, MIS director of Polyfibron Technologies, a printing firm in Billerica, Massachusetts.

The New R/3

This year, SAP plans to introduce R/3 4.0. With this release, SAP adds new features that take an object-oriented approach to business applications, which will provide more functionality.

continued

R/3 ASAP

R/3 has been criticized for poor time to implementation. A response to this is the Accelerated SAP (ASAP) system, a streamlined, consistent approach to implementation.

The ASAP program organizes and plans the implementation of R/3 using a six-point system that begins with the gathering and assessing of resources and ends with the final "go live" and support phase. This program keeps the learning curve down and puts the right people in place ahead of time, ensuring that everyone involved is on the same page.

For the CBS market, the process is abbreviated. The CBS version combines some steps to provide a shorter, less-labor-intensive preliminary process for firms that must conserve worker-hours spent on the job. The CBS implementation program assumes customers are too busy for a full system analysis.

But this does not mean that the CBS version is incomplete. ASAP can speed implementation, but no one should expect it to come without effort. "We include a questionnaire in the planning process," says Kay Anderson, SAP's director of field services. "With it we discovered that people were not defining their project requirements before they began. Without that, the whole project is shot."

One of the benefits of this program is that it not only plots a course before implementation, but it leaves customers with documentation of how their system works after they've gone live with the product. SAP's Bryan Plug believes six months is the average time to implementation, but he's seen one executed in 67 days. Jean Fulchino saw her company's implementation come off effectively. "I think some teams don't have the knowledge of how a business works," she explains. "We've managed the implementation well because we understand our own business needs."

This program is not a universal fix for implementation. It doesn't address reengineering issues, so companies coming from legacy systems need to address issues that this plan doesn't cover.

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BEST OF EDITORS' CHOICE BYTE COMPUTEX Taipei '97

With release 4.0, HR functions will be a separate component. But these functions won't be isolated from other business functions; R/3 Human Resources will be easy to integrate into R/3 Financials and Logistics applications because the HR applications are part of BAPI. This approach makes back-office HR information available to the front office for better management of HR. The new HR functions include a number of country-specific versions, as well as modules for employee self-service through Internet or intranet applications.

With the new release, what SAP calls an Availability-to-Promise, or ATP, server for order-processing transactions will be available. The R/3 customer can access this server, which runs on a single general-purpose database, across corporate networks or the Internet to perform multilevel product-availability checks.

Another innovation with release 4.0 is the Engineering Workbench, a dedicated platform for managing real-time changes that users make to the R/3 business process. The Workbench is Internet-enabled and instantly incorporates the latest templates for business applications into the R/3 system.

R/3 4.0 also extends its international business features by providing an intelligent function that will convert financial information to and from the European Monetary Union currency.

SAP plans for R/3 to be written in pure Java in the future. The GUI for release 3.1 is already written in Java. "We reimplemented the GUI as an applet," says Graf. "When you use our GUI, there's zero maintenance needed at the client level." The Java-enabled GUI also makes it easy to push R/3 content out to the Web.

SAP for Smaller Companies

R/3 got its reputation as a big company's product because SAP sold it that way. SAP's new, separate channel for smaller customers means R/3 no longer needs to be characterized as a big corporation's tool. Small firms are now a target for R/3, which is a boon not only for them, but also for the resellers and integrators that SAP is using to sell to this market.

In August 1996, SAP created the Certified Business Solutions (CBS) program. CBS is a network of independent providers focused on customers with an annual revenue of $200 million or less.

"SAP realized that large enterprise projects accounted for only 50 percent to 60 percent of our business," says Bryan Plug, executive vice president of SAP America. "The other 40 percent were what now falls into the CBS program."

A CBS customer's R/3 solution is typically viewed as being in a different league from that of a small to midrange or start-up company. SAP, however, is making a concerted effort to sell the product to these organizations. Simple awareness of the CBS reseller channel is a problem for many resellers. "I hear, 'Jeez, I thought we were too small for SAP' from a lot of companies," says Gil Missana, an SAP reseller with Missana & Associates of Westbrook, Illinois. "The challenge is not awareness of R/3, but to help people appreciate the new strategy for delivery."

R/3 didn't need to change, but SAP's implementation practices did. "We learned what mattered was that the product must fit Best Business practices and be scalable and easy to use, acquire, and maintain," explains Plug. "This means we tie up the smallest possible number of people, because these companies simply don't have manpower to spare for implementation when people are needed at work."

SAP also learned that system needs may be the same for smaller companies, but implementation needs are more exacting when there are fewer resources. Michael Malone, executive vice president of sales and marketing with CTS, a reseller company based in Atlanta, says, "Compa-

SAP Gets Small

Implementing R/3 is not a simple task. Often, smaller firms are more nimble at implementing R/3 than large companies with huge legacy mainframes and infrastructures.

NetManage, a fast-growing Silicon Valley–based network-application-development company, has about 500 employees and $105 million in annual revenue. The company came from a PC LAN–based invoicing and accounting system that could readily be dropped in favor of R/3. The cost was acceptable, and the firm gained a more flexible and scalable infrastructure from the migration. "R/3 was a perfect fit for us," says Sheryl Haller, business applications manager for NetManage. "It has the configuration capabilities built right in that made it work for us."

R/3 is a big product, and it requires customization—sometimes extensive customization. To get around that, R/3 employs 20 industry-specific modules. The module for the software industry, for example, meets demands for the complex tracking of licenses, serial numbers, configurations, and software ownership.

Do these modules really save time? "SAP integration makes sense, especially in the software industry," says Haller. "We have nothing to ship except code, so e-commerce is obviously the solution for us." To program R/3 to carry out these functions would demand much scripting and worker-hours, but industry-specific modules can save this expense. "We don't waste too much time scripting," says Haller.

"R/3 was a perfect fit for us. It has the configuration capabilities built right in that made it work for us."—Sheryl Haller

Some may fear that R/3 is simply too big to fit the needs of mid-size or specialized companies. "With R/3 we could select only the modules we needed, and we also got a system that can keep up with us as we grow," Haller explains. "We have the same issues as large corporations," she adds. "We all have to track sales, keep a general ledger, and track spending. We just do it at a lower volume."

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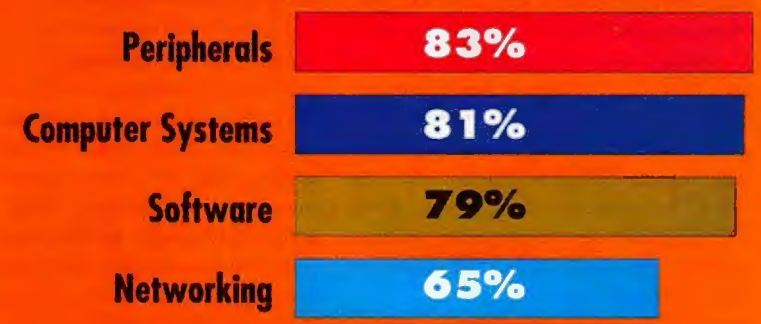

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nies set expectations, but without block-and-tackle documentation, customers wait too long and then fall prey to time constraints."

CBS Is Small

SAP's CBS reseller channel is pretty tight: SAP plans for about 20 resellers in North America, and 16 of those slots are already filled. SAP investigates the organization, staff, product-management experience, information-technology (IT) experience, and capital of a reseller firm before making a company a certified reseller.

But unless you're one of four companies ready to take the mantle of Certified Business Partner from SAP, discussing this channel seems pointless. SAP has looked at over 50 resellers just to select the ones who are certified resellers today.

Fortunately, R/3 is such an expansive technology that the opportunities for people who can sell peripheral products and services, such as hardware resellers and IT companies, are endless. "Our resellers are typically not hardware resellers, networking experts, NT experts, or database experts," says Plug. CBS reseller companies are experts in R/3 implementation, but they depend on others for the extensive peripheral services and hardware needed for a complete execution.

Integrators and resellers need an assortment of platform and environment skills. Seventy-five percent of R/3 systems currently in use run on Windows NT, but knowledge of Unix for LAN and WAN environments is frequently needed. Oracle databases predominate, and extensive knowledge of it is necessary for the implementation of R/3.

CTS sells IBM RS/6000 servers and its expertise in Oracle database products to R/3 customers. CTS works with larger consulting firms, such as Andersen and Cooper, who build the SAP environment, while CTS builds the server and database architecture. "A lot of resellers miscalculate the size of the box needed," says Malone. "R/3 eats up small boxes, and we need to feed it more hardware for an upgrade."

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Third-Party Solutions for R/3

SAP is fastidious about certification and its R/3 product. But with a technology as expansive as R/3, there's always room for peripheral products to supplement the core package.

TSI International Software's Mercator for R/3, for example, eliminates the need to write custom ABAP codes for data-conversion tasks. Mercator provides a graphical environment for creating ALE interfaces for drag-and-drop conversion to and from R/3 formats. The program cuts the time and skill level needed to integrate information, and it supports information definitions that R/3 doesn't support, including COBOL copybooks and relational databases.

Computer Associates' ARCserve Backup Agent for SAP R/3 backs up data while R/3 applications are open and in use. This means that the system can be backed up without a system crash and ensures that users' mission-critical data is protected from human error. The product gives administrators the option of managing backup tasks from either SAP's BACKINT interface or ARCserve's GUI.

Customization

Many people chafe at the notion of buying into a monolithic solution like R/3 because it would seem to rigidly impose a single business model on companies with distinct personalities. But this simply isn't the case.

"It's flexible enough that we can run things the way we did before," says Polyfibron's Fulchino, who's currently in the process of migrating to R/3. "There are minor changes that we put up with: We had to adjust some methods because of the size of the number field in some applications." Polyfibron has two people on staff who can script in ABAP/4, SAP's scripting language. To customize R/3 applications, a company should have staffers familiar with ABAP/4, but all R/3 applications are somewhat customizable without scripting to fit a company's general business needs.

Sheryl Haller, business applications manager for NetManage, a Silicon Valley–based development company, agrees that R/3 is flexible. "The software is designed generally enough that it's not a hindrance. We'll use it as long as it meets our requirements." (See the text box "SAP Gets Small" on page 92N.)

In addition, R/3 applications are easily recognizable by standard Windows interfaces and the integration of Microsoft Office programs, which can be used for presenting R/3 files. "I think the real strength of the system is the use of Windows programs for presentation," Fulchino says. "They're familiar to just about anyone with a computer at their desk."

How long does all this take? SAP aims for general implementations to take five to six months. "Some companies have encountered delays because they don't have sufficient knowledge of how their business works in the first place," explains Fulchino.

Of course, the time to implementation is affected by the approach a company takes. Most companies prefer a gradual one, implementing one or more R/3 modules in the department or departments that need it most, and adding on as necessary. The "big bang" approach may be lucrative for companies that are impatient to update their systems, but it sharply increases the learning curve for the whole company. "We changed over our financial department first," says Fulchino. "I think changing gradually makes a smooth transition possible."

The opportunities for a reseller in R/3 implementation are currently growing. As SAP's market share grows, and as the company cultivates its new sales avenues, more resellers, integrators, and consultants will be able to cash in on its product family.

But no one should leap blindly to this product line. SAP is picky about who it selects for certification, and R/3 itself is such an all-encompassing technology that no one can half-heartedly adopt it. This is true for integrators and customers alike. As Jean Fulchino summarizes the implementation of R/3, "it's an investment, not an acquisition." B

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HUI7ESPC

These 17 Pentium II systems deliver surprising power and promise to the desktop.
By Michelle Campanale

Power Platforms: 233- and 266-MHz Pentium IIs Compared

Vision, forethought, and potential are three important and desirable qualities. We like to see them in our politicians, leaders, city planners, network administrators—and our computers' CPUs. Intel's new Pentium II (PII) processor, which powers the 17 233- and 266-MHz PCs we reviewed in this roundup, has all these characteristics.

Indeed, the true merit of the current-generation PII and its supporting architecture lies in its latent possibilities—not so much what it can do, but what it will do when it can reap the benefits of expandability, added Multimedia Extensions (MMX) instructions, and speeded-up segment-register writes, which allow the PII to run older, 16-bit software faster than the Pentium Pro.

New Architecture

First, the PII represents a whole new architecture that carries a much greater possibility for future expansion than do its Pentium predecessors that use Socket 7/8 (the zero insertion force [ZIF]–type socket where the processor sits). For example, the Pentium's limited upgradability is due to the lack of on-chip circuitry and other chip components that are necessary for you to be able to upgrade to a faster CPU.

The PII's Single Edge Contact (SEC) cartridge, which is about the size of a Nintendo cartridge, sits in Slot 1 on the motherboard and is designed to make upgrades easy. The tool-free SEC cartridge pops out from Slot 1 after you unscrew the retainer, heat sink, and CPU fan.

With the PII design, gone are the days when you had to pry out the processor with a rake and risk bending pins while changing chips. Within the SEC cartridge is a circuit board that contains the processor, some core logic, and system and bus caches—all the components needed to handle future high-frequency versions of the PII (although SRAM chips for the L2 cache are not in the same package as the CPU die).

Dual-Bus Support

Like the Pentium Pro, the PII uses the Dual Independent Bus (DIB) architecture. This accelerates the flow of information within the system, boosting overall performance to three times than of a single-bus-architecture processor. The DIB architecture allows today's 66-MHz system-memory bus to move to higher speeds in the future.

Two buses make up the DIB: the L2 cache bus and the processor-to-main-memory system bus. The PII processor can use both buses simultaneously, which increases the chances that it will achieve its peak execution time of three instructions per clock cycle.

BYTE BEST
PENTIUM II PCS

DTK APRI-74M/K266 and IBM PC 300XL

Long known for its low-cost PCs and system BIOSes, DTK wins our Pentium II overall choice, with its superfast APRI-74M/K266, a 266-MHz PC. The IBM PC 300XL's $2500 price makes it the best value of the bunch; it's $1000 less than the DTK APRI-74M/K266.

MMX Technology

Like the Pentium with MMX, the PII processor includes accelerated MMX, which enables it to execute two MMX instructions at a time. Added to the PII are 57 new MMX instructions specifically designed to process video, audio, and graphical data more efficiently. The use of single instruction/multiple data (SIMD) technology enables one instruction to perform identically on multiple pieces of data and allows the chip to reduce the compute-intensive loops common with video, audio, graphics, and animation.

Intel expects MMX to play a significant role in videoconferencing, among other applications. It also expects upcoming MMX drivers to improve printing.

Setting the Specs

Future possibilities aside, the current emphasis of PCs with the PII processor and the 440FX (Intel's new PII chip set) is performance. In this roundup we focus on a range of systems, from high-powered 266-MHz PCs to surprisingly competitive 233-MHz machines.

Although the PII market extends beyond mainstream business, we chose to focus on Windows NT PCs ranging in price from about $2200 to $4100. Each was equipped with a single-processor configuration and 64 MB of RAM. A maximum 512 KB of secondary processor cache, a 32-KB L1 cache (16 KB for instructions, 16 KB for data), and a minimum 3.8-GB hard drive were also included. In addition, a CD-ROM drive, a

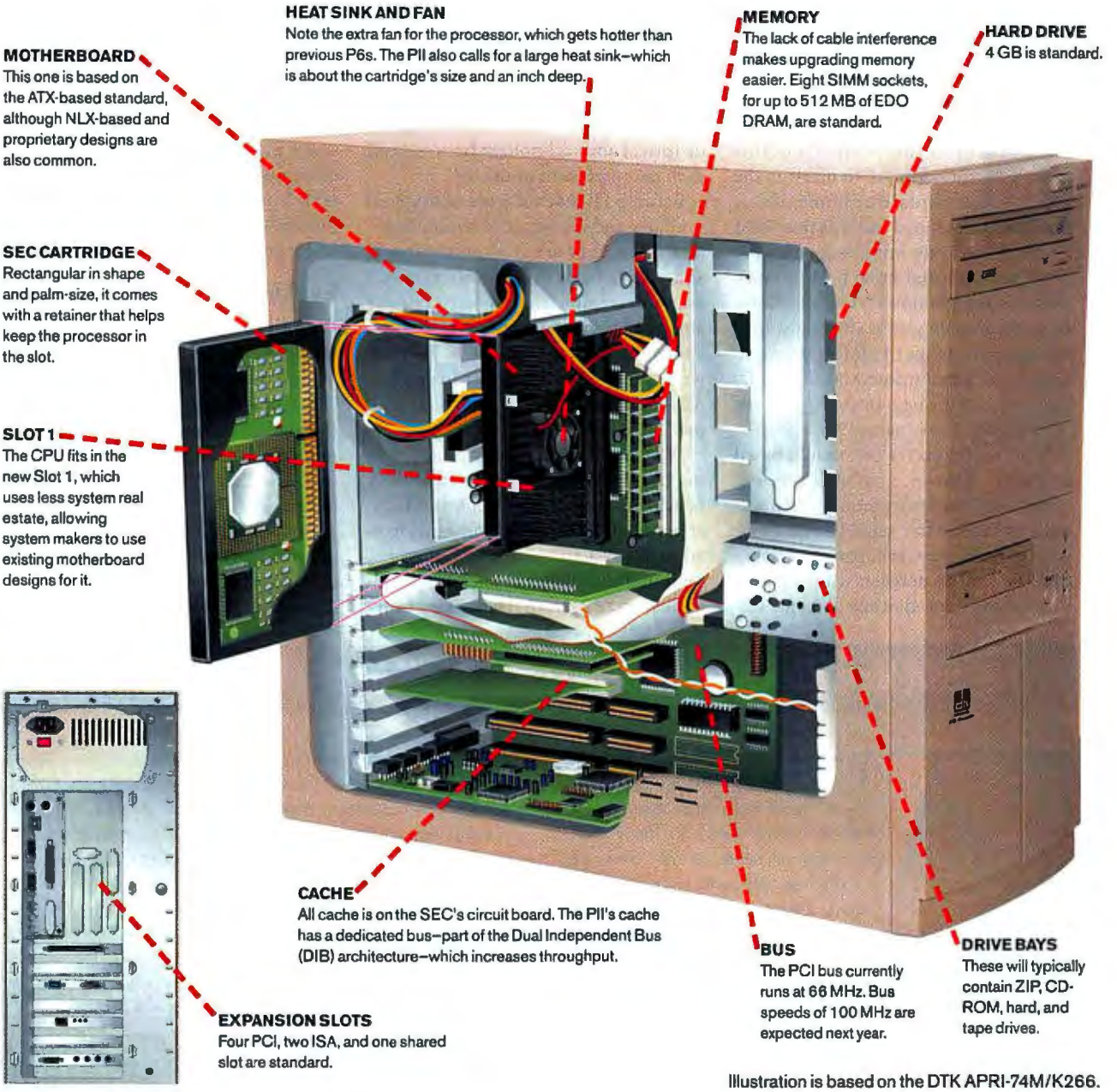

Illustration is based on the DTK APRI-74M/K266.

3½-inch floppy drive, and VGA with 4 MB of video memory were part of the system specifications.

The PII is optimized for 32-bit code. As BYTE readers increasingly demand coverage that reflects what they most often use, we selected Windows NT Workstation 4.0 as our OS for this roundup.

What's Next?

Expected to ship this month, Intel's 440LX chip set will include add-ons to better exploit the PII's abilities. The 440LX will be compatible with the Advanced Graphics Port (AGP), which gives graphics chips dedicated access to main memory. Error-correction-code (ECC) RAM will also be supported, making the PII with the 440LX chip set ideal for high-end desktops and servers. The 440LX will include support for synchronous DRAM (SDRAM), which can boost overall system performance by allocating memory for each bit of data that passes through the PCI bus. You can also expect to see Ultra DMA hard disk support.

The current iteration of the PII with the 440FX chip set supports two-processor symmetric multiprocessing (SMP). Support for four-way SMP won't be available until 1998. In addition, the internal bus speed is 66 MHz; support for a 100-MHz bus is not expected until 1998.

By the time you read this, 440FX PIIs are expected to plunge in price as the first PIIs with the 440LX chip set roll out, so seek current pricing when making your buying decisions. Pricing aside, the PII's high-performance test results and expandability make the jump to Intel's new platform worth the while of many business and home users looking for entry-level PCs.

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BEST OVERALL PENTIUM II PCS

Any of the 17 PII PCs in this roundup will fit nicely in the workplace or home office. Equipped with 32 MB of RAM and powered by the breakneck-speed PII, these systems offer great performance with current Windows NT applications. And, because they're MMX-ready, they can take advantage of MMX-optimized applications and future MMX-friendly OSes, such as the next major upgrade of Windows 95 (code-named Memphis).

We rated these PII workstations based on their performance, usability, features, technology, implementation, and price, all on a scale of five stars. Performance is weighted highest, at 67 percent. Usability is rated at 17 percent, while the features set is factored in at 8 percent. Value (price) and technology (innovation) each take 4 percent of the pie.

Because PII machines are configured similarly and constructed around identical CPUs, they are commodity items, and price becomes a determining factor. So, to determine the low-cost winner among all the systems tested, we derived a separate scoring formula. All systems were weighted with price at 50 percent, performance at 30 percent, usability at 10 percent, and features at 10 percent.

We derived overall performance rating by averaging the results from our benchmark tests. User's guides and other pertinent features regarding the operation of a system, such as ease of access, setup and installation issues, and upgradability, were used to derive a usability score. Finally, the features score is based on components that differentiate the systems from each other. Add-ons, such as ZIP drives, high-capacity hard drives, and 62-bit graphics cards, are examples.

Best Overall

With its strong performance, efficient motherboard and chassis designs, and a good price, the 266-MHz DTK APRI-74M/K266 is hard to overlook. It showed the highest and most consistent performance scores in all the tests we threw at it: C++, Access, Fourier, IMark, and BYTEmark.

Performance isn't the only thing that matters, of course. The APRI-74M also scored well in both the usability and features categories. For example, it comes

The First Brand-Name AMD K6 System

The 233-MHz Digital Equipment Venturis FX represents the first machine from a top-tier system vendor to be powered by the AMD K6 processor. At $2504, it's a cost-effective system, considering that it comes with a 4-GB Ultra DMA hard drive and 64 MB of SDRAM. Although Digital's Venturis line comes preinstalled with Windows 95, we tested the system using Windows NT 4.0 Workstation, just as we did for the 17 Pentium II PCs in our roundup.

But don't expect performance that beats that of PII machines. We exercised the Venturis by duplicating most of NSTL's benchmark tests, including the floating-point-intensive Fourier test, C++ language test, IMark graphics test, and BYTEmark CPU test. We compared its performance to that of two of the top-performing 233-MHz systems in our roundup, Micron's Client Pro XLU and Unicent's Titania II 233 XLA. We also compared its scores to those of our two winners—both 266-MHz systems—the DTK APRI-74M/266 and IBM's PC 300XL.

The 233-MHz PII machines had a slight performance advantage over the K6-equipped Venturis. And it's no surprise that the 266-MHz PII systems were significantly more robust than the K6 system (see the figure).

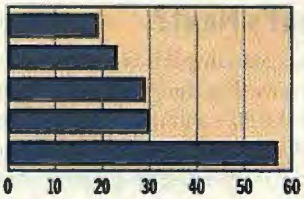
Still, this system could be a good choice if you don't want to wait (for the PII with 440LX chip set) to reap the benefits of Ultra DMA and SDRAM. The Venturis FX, which shipped in July, targets the business market. It's equipped with AMD's 233-MHz K6 processor and uses Intel's 430 TX PCI chip set. A 4-GB Ultra DMA hard drive, a 12X CD-ROM drive, and a 4-MB Matrox Millennium II graphics card round out this well-balanced system. Its 66-MHz PCI bus supports three DIMM sockets and up to 256 KB of SDRAM. A full 64 KB of L1 cache is included on the chip (32 KB for data, 32 KB for instructions), and 256 KB of pipeline-burst L2 cache is soldered onto the motherboard.

Digital's famous motherboard design, based on the NLX standard, allows you to slide the unit directly out through the top of the system. Unnotch the three nonremovable screws on the cover, and you can access its internal components instantly. The K6 processor offers full MMX-instruction-set compatibility. Like the Pentium and Pentium MMX chips, it uses the low-cost ZIF processor Socket 7.

With the right manufacturer support, BIOS, and voltage-regulation module, it is theoretically possible to swap a Pentium or Pentium MMX chip for an AMD K6. Digital says it might offer an upgrade kit in the future. Along with this MMX compatibility and a larger L1 cache than the Pentium II's, AMD claims its K6 chip's core logic has fewer mispredictions than the Pentium II. According to AMD, 8000 stored entries overshadow the Pentium II's 200 or so built-in branch predictions used for running execution units. In short, executions are processed efficiently. AMD plans to ship an AGP chip set by this fall, and several graphics-chip vendors plan to support AGP on Socket 7 by the end of the year.

Although it's not a workstation optimized for intensive 3-D gaming or calculating scientific equations, the Venturis will do well for its intended market: the enterprise level. And businesses will appreciate its advanced features set and low price.

Performance



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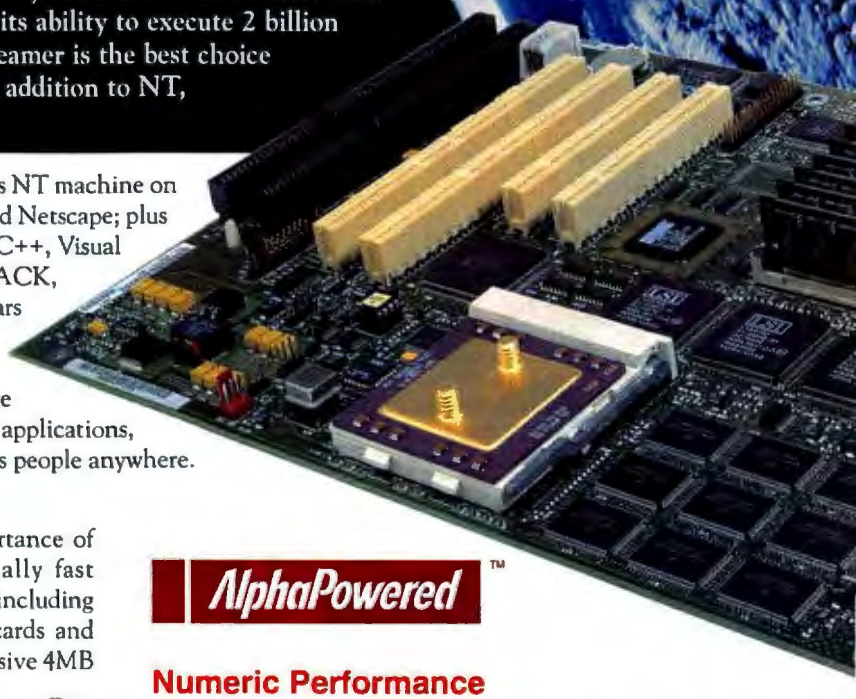

Your applications can now run on "the fastest Windows NT machine on the planet." These include Microsoft Office, Oracle and Netscape; plus engineering and graphics software such as Fortran, C/C++, Visual Basic, Pro/Engineer, Microstation, ANSYS, LAPACK, Gaussian, Softimage and Lightwave. Over the last 15 years we have designed systems for thousands of satisfied customers including many prestigious institutions like NASA and Fidelity Investments. Our technicians are expert at configuring all Alpha operating systems and applications, and you will not find more technically competent sales people anywhere.

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PC Computing - July, 1997

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LAB RATING RESULTS

BEST OVERALL

DTK APRI-74M/K266

The DTK APRI-74M/K266 is the clear winner among the Pentium II crop, outperforming the other systems in our benchmark tests by a big margin. Plus, its usability and features were also solid.

	PRICE	TECHNOLOGY	IMPLEMENTATION	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
DTK APRI-74M/K266	**$3500**	★★★★	★★★★★	★★★★★	★★★★★	★★★	★★★★★
Dell Dimension XPS H266	$3179	★★★★	★★★★★	★★★★	★★★★	★★★★★	★★★★★
IBM PC 300XL	$2500	★★★★	★★★★★	★★★★	★★★★★	★★★★	★★★★★
Digital Celebris GL-2 6266	$4149	★★★★	★★★★	★★★★	★★★★★	★★★★	★★★★
Polywell Poly 7266TD	$2495	★★★★	★★★★★	★★★★	★★★★	★★★★	★★★★
Compaq Deskpro 6000	$3199	★★★★	★★★★	★★★★	★★★★	★★★★	★★★★
HP Vectra VL6/266	$3350	★★★★	★★★★	★★★	★★★	★★★	★★★

LOW COST AND BEST VALUE

IBM PC 300XL

If price is a concern, we recommend the IBM PC 300XL, our Pentium II low-cost winner. It was helped by excellent usability and features scores and a rock-bottom price of $2500.

	PRICE	PRICE RATING	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
IBM PC 300XL	**$2500**	★★★★★	★★★	★★★★★	★★★★	★★★★★
Polywell Poly 7266TD	$2495	★★★★★	★★★	★★★★	★★★★	★★★★★
Dell Dimension XPS H266	$3179	★★★	★★★★	★★★	★★★★★	★★★★
Xi 266 PII Mtower SP	$2499	★★★★★	★★★★	★★★	★★	★★★★
Unicent Titania II 233 XLA	$2399	★★★★★	★★	★★★	★★★	★★★
DTK APRI-74M/K266	$3500	★★	★★★★★	★★★★	★★★	★★★
Micron Millennia XRU	$2839	★★★★	★★	★★★	★★★★	★★★

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

equipped with a 16X SCSI CD-ROM, Seagate's Cheetah Ultra-Wide SCSI 4.55-GB hard drive, and the Matrox Millenium II graphics card with 8 MB of EDO DRAM. To boot, it comes equipped with a Creative Labs AWE 64 sound adapter and a built-in network interface. Its well-organized design allows easy accessibility to internal parts and contributes to its usability.

Best Value

In picking a low-cost winner, we skewed our rating system to emphasize price, which accounted for 50 percent of the overall score. Thirty percent of the overall score was based on performance, with 10 percent determining usability. Features made up the remaining 10 percent.

The IBM PC 300XL is our choice for best low-cost PII machine. This 266-MHz system turned in top scores in our benchmark tests. It shined in the usability and features areas. A Matrox Millennium II graphics card with 32 MB of video memory and a 2.5-MB IDE hard drive round out this low-cost leader. Its well-written user's manuals, easily accessible drive bays, and a cover lock all added value to the package.

Runners-Up

The Dell 266-MHz Dimension XPS H266 represents our overall second-place pick. It turned in a perfect usability score and a solid composite performance score, which was third best. Its strong features set includes a ZIP drive, a Matrox Millennium II graphics card with 8 MB of dedicated Window RAM (WRAM), and a 24X CD-ROM drive.

Behind by a hair in the low-cost race was the 266-MHz Polywell Poly 7266TD, a system that combines strong usability and features scores with middle-of-the-road performance. This machine includes an S3 ViRGE 3D/GX graphics accelerator with 4 MB of DRAM, a Maxtor 5.1-GB enhanced IDE hard disk, and a 16X CD-ROM drive.

DETAILS

Motherboard Access

The engineers at Digital made getting at the Celebris GL-2's motherboard simple. As a result, swapping out the board or replacing the memory isn't a tough chore. Because of this unit's organized design, none of the internal components, such as the drive bays, cables, and power supply, block access to the motherboard. Tool-free access to the motherboard makes it extremely easy to deal with; you just pull two clips, and the whole board slides out from the top of the system. We found access to many other systems' motherboards tricky due to their cluttered interiors, which makes adding memory or switching a jumper setting a nightmare.

ZIP Drives

With the PII comes a generational leap in system configurations. Case in point: The Dell Dimension XPS H266 and the Micron Millennia XRU have Iomega ZIP drives.

TECH FOCUS

SEC CARTRIDGES

Investigating the SEC

The SEC cartridge sits in Slot 1 on the motherboard, a design feature that saves system real estate and power. If you break open the SEC cartridge (which, incidentally, renders it useless), you'll see the circuit board. This contains the CPU, cache chips, and some of the core logic (for more information, see "The Pentium II Revealed" on page 51).

The CPU is manufactured on a 0.35-micron process and contains 7.5 million transistors. It uses both buses simultaneously, thanks to the superpipelined microarchitecture. The pipeline of the P6 family contains 12 stages and uses dynamic execution, with two-level adaptive training and branch-prediction mechanisms. These combined processing techniques speed up software performance by up to three instructions per clock cycle.

All cache is located on the SEC cartridge's circuit board. Next to the CPU chip is 512 KB of level 2 pipeline burst; placement here helps the PII achieve its improved performance. A full 32 KB of level-1 cache (16 KB to handle data and 16 KB to handle instructions) is integrated into the CPU chip itself.

Other advantages of the SEC cartridge involve lowered production costs. Intel can employ current manufacturing techniques and still obtain very high frequencies; the company can then pass the resulting cost savings along to the consumer.

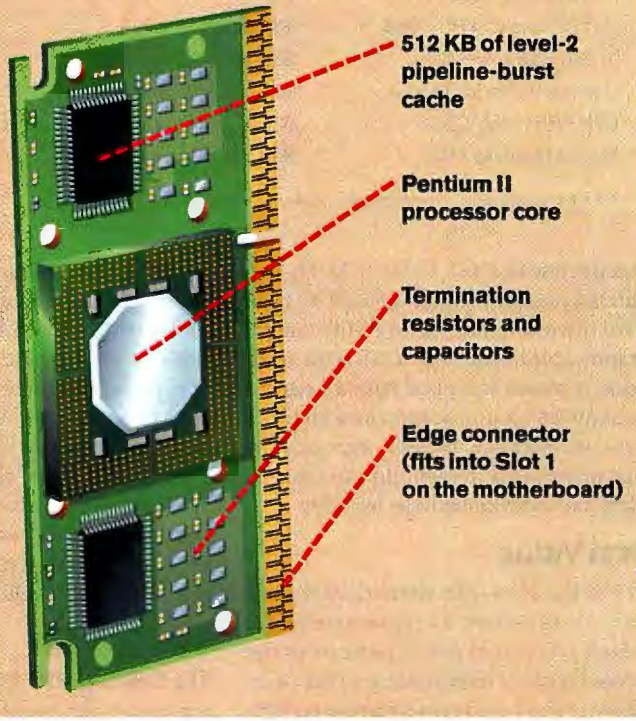


ILLUSTRATION: SANDERS/TIKKANEN DESIGN & ILLUSTRATION © 1997

Our benchmark tests represent overall system performance under a demanding OS (Windows NT 4.0) and intensive applications. The range of performance tests reflects real-world applications that typical BYTE readers use: Microsoft Access (database test) and C++ 4.3 (language test), plus the Fourier test (WAV file analysis), IMark (graphics test), and our low-level BYTEmark CPU test. None of our benchmark tests, however, included applications recompiled for MMX technology—a feature that the PII can certainly take advantage of.

Performance Tests

In the Fourier test, we ran simultaneous copies of the floating-point-intensive Fourier transform program. This program analyzes the spectral content of a WAV file; its results are largely dependent on raw floating-point power.

The second processor test measures how fast a system can build (i.e., compile and link) a large amount of source code by running two simultaneous instances of version 4.3 of Visual C++. This benchmark produces results that also depend on hard disk I/O performance, because the tested systems must access their hard disks often for both reading and writing when running the test.

The Access test is the lone application-based benchmark in this suite. Using Microsoft's Visual Test 4.0 compiler, it measured how well these PII systems could generate multiple business-database transactions. It executes two iterations of test runs.

The IMark video tests were conducted at 640- by 480-pixel resolution with 256 colors, using each vendor's preinstalled graphics driver.

The single-threaded BYTEmark test exercises the capabilities of a system's CPU, FPU, and memory system.

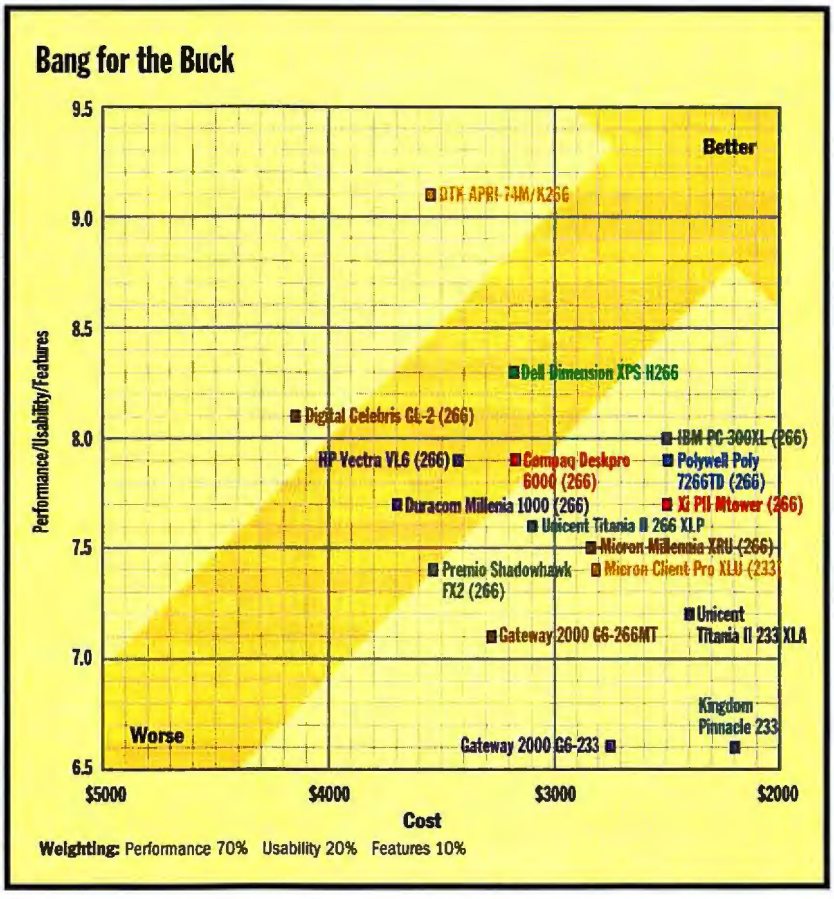
Usability and Features

We examined each of the 17 reviewed machines for usability by focusing on system design and documentation. System design is important; therefore, we rate how easy it is to remove and reinstall the cover, for example. Ease of upgradability (for adding RAM and mass-storage devices) adds points to the usability score. We look for accessible memory slots and drive bays that offer room for cabling. Systems are penalized for having I/O connectors that are blocked by an expansion slot.

We give top honors to systems with vendor-specific manuals that are comprehensive, include easy-to-use diagrams, and offer up-to-date technical information. Manuals with a glossary and an index get better scores. Those that lack specifications for the motherboard, hard disk, and graphics subsystem get rated lower.

Each vendor completes a lengthy questionnaire that we send to provide a detailed description of each system's features and support options. We weight each feature and calculate an overall features score. Features related to performance include the size and write policy of the secondary cache. The use of hard disk controllers, network adapters, and graphics adapters on the motherboard frees up expansion slots. The amount of video memory supplied with the system is critical in determining the maximum display resolution. We weight the highest noninterlaced display resolution supported by each system, along with the maximum number of colors at that resolution.

Finally, it's important to note that warranty and support policies are what frequently separate major system vendors from second- and third-tier vendors.



Evaluations in this report represent the judgment of BYTE editors, based on tests conducted by NSTL, Inc., as documented in a recent issue of NSTL's monthly PC Digest. *To purchase a copy of the full report, contact NSTL at 625 Ridge Pike, Conshohocken, PA 19428; (610) 941-9600; fax (610) 941-9950; on the Internet, editors@nstl.com. For a subscription, call (800) 257-9402. BYTE magazine and NSTL are both operating units of The McGraw-Hill Companies, Inc.*

PENTIUM II SYSTEMS FEATURES

	Compaq Computer Corp. Deskpro 6000 6266/4200	Dell Computer Corp. Dimension XPS H266	Digital Equipment Corp. Celebris GL-2 6266	DTK Computer, Inc. APRI-74M/K266	Duracom Computer Systems Millenia 1000	Gateway 2000 G6-266MT	Gateway 2000 G6-233	Hewlett-Packard Co. HP Vectra VL6/266
Price as tested (MSRP)	$3199	$3179	$4149	$3500	$3699	$3279	$2748	$3350
Overall rating	★★★★	★★★★★	★★★★	★★★★★	★★★	★★	★★	★★★
MICROPROCESSOR								
CPU speed (MHz)	266	266	266	266	266	266	233	266
BIOS vendor and version	Intel/AMI 1.00.03.DTO	Dell/AMI A01	Digital/ Phoenix 4.01/1	AMI 1	Intel/AMI 1.00.03.DTO	AMI 1.00.01 VT0T	AMI 1.00.01 VT0T	HP/ Phoenix HD.07.00
DMI-compliant	✔	✔	✔		✔	✔	✔	✔
Setup	ROM	ROM	Disk	ROM, disk	ROM	ROM	ROM	ROM
BIOS shadowing	ROM, video	ROM, video	ROM, video	ROM, video				ROM, video
EQUIPMENT INFORMATION								
Sound adapter/chip	Compaq Business Pro Audio/ ESS 1868	Yamaha OPLSA-3	ESS 1887	Creative Labs AWE 64	Yamaha OPL3SA-3 YMS715	Ensoniq PCI Audio	Ensoniq PCI Audio	Aztech MMPro 16V-A PnP
CD-ROM/speed	Compaq OEM/ 8X	Toshiba XM-6002B/24X	Mitsumi/16X	Toshiba XM-3801B/16X	Sony CDV-511/ 16X	Mitsumi FX-240S/16X	Mitsumi FX-240S/16X	Panasonic/ 24X
Fax/modem	None	U.S. Robotics/ 3M Sportster				U.S. Robotics/ 3M Telepath x2	U.S. Robotics/ 3M Telepath x2	
Motherboard	Compaq OEM	Intel	Digital Equipment 54-25290-01	DTK PRM-0074I	Intel Portland	Intel Portland	Intel Portland	Hewlett-Packard
Keyboard/chassis lock	No/✔	No/No	✔/✔	No/No	No/No	No/No	No/No	No/✔
Set password(s) available	Keyboard, preboot	Preboot	Preboot	Preboot	Preboot	N/A	N/A	Preboot
Password-disable jumper		✔	✔	✔	Yes			✔
Hard drive vendor and model	Compaq OEM	IBM	Quantum	Seagate ST-34601W	Western Digital AC3400	Quantum Fireball ST6.4AT	Quantum Fireball ST6.4AT	Western Digital AC 34000
Hard drive controller vendor and model	ATA	Intel	Adaptec AHA-2940VW	Adaptec AHA-2940UW	Intel	Promise Ultra 33	Promise Ultra 33	Intel 440 FX
Hard drive interface type	Ultra SCSI	EIDE	SCSI-II	Ultra-Wide SCSI	EIDE	EIDE	EIDE	EIDE
Hard drive capacity (GB)	4.2	6.4	4.5	4.55	4	6.4	6.4	4
Hard drive seek time (ms)	9.5	9.5	12	7.5	11.5	10	10	11.5
Primary system architecture	PCI	ISA	ISA	ISA	ISA	PCI	PCI	ISA
Shared slots	1	1	2	1	1	1	1	2
Toolless cover removal	✔	✔	✔	✔		✔	✔	✔
VIDEO								
Video on system board			✔					
Video accelerator	Matrox MGA Millennium	Matrox Millennium II	Matrox MGA Millennium	Matrox Millennium II	Matrox MGA 2064-W	STB ViRGE GX	STB ViRGE GX	Matrox Millennium II
Video adapter (external bus type)	64-bit PCI	64-bit PCI	32-bit PCI	32-bit PCI	64-bit PCI	64-bit PCI	64-bit PCI	64-bit PCI
Video memory and type	8/WRAM	8/WRAM	8/VRAM	8/DRAM	8/WRAM	4/EDO DRAM	4/EDO DRAM	16/VRAM
Maximum resolution w/o upgrade	1280×1024	1280×1024	1280×1024	1280×1024	1280×1024	1280×1024	1280×1024	1600×1200
I/O PORTS								
Total number of serial ports	2	1	2	2	2	2	2	2
Parallel port type	Enhanced	Selectable	Selectable	Selectable	Selectable	Enhanced	Enhanced	Selectable
SCSI-2 ports	0	0	1	1	0	0	0	0
EIDE ports	0	2	2	2	2	2	2	4
MEMORY								
Max. RAM on motherboard (MB)	256	256	256	512	256	256	256	192
Memory (EDO) architecture	Fast paged	Cached, fast paged	Cached, paged, fast paged	Fast paged	Fast paged	Cached, interleaved	Cached, interleaved	Cached
ECC RAM on motherboard		✔	✔	✔	✔			
CUSTOMER SUPPORT								
Warranty length (years)/coverage	3/P, R; 1/L, R	3/P, L, F, R	3/P, L, R	2/P, L, F, R	3/P, L, R	3/P, R; 1/L, R	3/P, R; 1/L, R	3/P, L, F, R
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On-line address	http://www.compaq.com	http://www.dell.com	http://www.windows.digital.com	http://www.dtkcomputer.com	http://www.duracom.com	http://www.gateway.com	http://www.gateway.com	http://www.hp.com
Inquiry number	**1041**	**1042**	**1043**	**1044**	**1045**	**1046**	**1047**	**1048**

B = BYTE Best

✔=yes; N/A=not applicable; INP=information not provided.

Warranty: P=parts; L=labor; F=freight to repair center; R=return to customer.

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

IBM PC Co. IBM PC 300XL	Kingdom Computers Pinnacle 233	Micron Electronics, Inc. Millennia XRU	Micron Electronics, Inc. Client Pro XLU	Polywell Computers, Inc. Poly 7266TD	Premio Computer, Inc. Shadowhawk FX2	Unicent Technologies Titana II 266 XLP	Unicent Technologies Titana II 233 XLA	Xi Computer Corp. Xi 266 PII Mtower SP
$2500	$2197	$2839	$2814	$2495	$3539	$3099	$2399	$2499
★★★★★	★★	★★★	★★★	★★★★	★★★	★★★	★★★	★★★
266	233	266	233	266	266	266	233	266
IBM	AMI 1	AMI 19	AMI 1.00.02 .DTO5	AMI 3	Award 1	AMI	AMI	AMI G71595
✔		✔	✔	✔		✔	✔	✔
ROM disk	ROM	ROM	ROM	ROM	ROM	Disk	Disk	ROM
ROM, video	ROM, video	None	None	ROM, video	ROM, video	Video	Video	ROM, video
IBM Crystal C54236	Ensoniq Audio PCI ES1370	Yamaha OPL3SA	Yamaha OPL3SA	Crystal 3D-16	Creative Labs Sound Blaster 16/ Vibras 16C	Yamaha OPL3SA	Yamaha OPL3SA	Creative Labs AWE 64
Sony 8/16X	Goldstar CRD-8160B/16X	Hitachi CDR-8130/24X	Hitachi CDR-8130/24X	Toshiba 6002B/ 16X	Mitsumi FX-820S/ 8X	Toshiba/ 24X	Toshiba/ 24X	Panasonic CR-58 S-B/24X
		U.S. Robotics/ 3M 1787/PC	U.S. Robotics/ 3M 1787/PC	GVC 336i		Phoebe 33.6 voice/fax	Phoebe 33.6 voice/fax	
IBM XL	Gem-Light GMB-P61AK-VO	Intel Anchorage AN430TX ATX	Intel Portland	Tyan 51682D	Premio 212A	Intel PD440FX	Intel PD440FX	Supermicro P6SKE
✔/✔	✔/No	No/No	No/No	No/No	No/No	No/No	No/No	No/No
Keyboard, preboot	Preboot	Preboot	Keyboard, preboot	Preboot	Preboot	Keyboard, preboot	Keyboard, preboot	Preboot
✔			✔	✔	✔			✔
IBM 2.5 GB	Seagate Medalist Pro 6450	Maxtor 85210A8	Maxtor	Maxtor 85120A	Quantum Atlas II	Quantum Fireball ST QM 34320	Quantum Fireball ST QM 34320	Maxtor 86480A
Intel 440FX	Seagate ST 36450A	PiiX4	N/A	Intel 440FX	Adaptec AHA-2940VW	Intel	Intel	Intel SB82371SB
EIDE	EIDE	EIDE	EIDE	EIDE	SCSI-2	EIDE	EIDE	EIDE
2.5	6.1	5.1	4	5.1	4.5	6.5	4.3	6.1
INP	9.5	11	11	7.5	8	10	10	9
ISA	ISA	PCI	ISA	ISA	ISA	PCI	PCI	PCI
2	0	1	1	1	1	1	1	1
✔		✔	✔	✔		✔	✔	
		✔	✔					
Matrox Millennium II	Hercules Dynamite	Diamond 3D 2000	Diamond 3D 2000 Pro	S3 ViRGE 3D/GX	Matrox MGA-2164	Matrox Millennium Mystique 220	Matrox Millennium Mystique 220	Matrox Millennium II
32-bit PCI	128-bit PCI	64-bit PCI	64-bit PCI	32-bit PCI	32-bit PCI	64-bit PCI	64-bit PCI	32-bit PCI
32/VRAM	4/MDRAM	4/DRAM	4/DRAM	4/DRAM	4/WRAM	8/WRAM	8/SGRAM	8/WRAM
1280×1024	1280×1024	1280×1024	1280×1024	1280×1024	1280×1024	1280×1024	1280×1024	1600×1200
2	2	2	2	2	2	2	2	2
Selectable	Selectable	Selectable	Selectable	Selectable	Selectable	Selectable	Selectable	Selectable
0	0	0	0	0	1	0	0	0
4	2	2	2	2	2	2	2	2
384	512	256	256	1024	512	256	256	768
Cached, fast paged, interleaved, paged	Paged, fast paged	Fast paged	Fast paged	Paged, interleaved	Fast paged	Fast paged	Fast paged	Cached
✔	✔	✔		✔	✔	✔	✔	✔
3/P; 1/P, L	3/P, L, F, R	5/P, L	5/P, L	5/P, L, R; 3/P	3/P, L, R	5/P, R; 3/L, R; 1/L, R	5/P, R; 3/P, L; 1/F, R	3/P, L; 1/F, R
919-559-5221	717-662-7515	208-893-3343	208-893-3343	415-583-7222	818-333-5121	216-344-2600	216-344-2600	714-498-0858
800-426-2968	800-385-3436	888-209-8039	INP	800-999-1278	800-677-6477	800-628-4888	800-628-4888	800-432-0486
http://www.us.pc.ibm.com	http://www.kingdomcomputers.com	http://www.micronpc.com	http://www.micronpc.com	http://www.polywell.com	http://www.premiopc.com	http://www.unicent.com	http://www.unicent.com	http://www.xicomputer.com
	1050	1051	1052	1053	1054	1055	1056	1057

Videoconferencing software is the next best thing to being there.
By David Seachrist

See and Be Seen Over IP

There's no denying the allure of videoconferencing over IP networks. Whether you're using the global Internet or the corporate intranet, videoconferencing means that you can use the nuances of body language and facial expressions to get your point across or to better understand what faraway colleagues need from you without even getting up from your desk.

As the two Windows 95 videoconferencing programs we examined demonstrate, instant and inexpensive multimedia communication over the Internet or the corporate intranet is possible, but two obstacles must be overcome: the bandwidth barrier and the usability barrier. Despite barely adequate performance over 28.8-Kbps links, videoconferencing uses a lot of bandwidth. And despite adequate usability with properly configured systems, because IP videoconferencing relies on a medley of hardware, software, and networking technologies, it has a ways to go before it is as easy as picking up a telephone.

The International Telecommunications Union (ITU) H.323 specification is a vendor-independent standard that defines how audiovisual conferencing application data can be transmitted over an open network using standard transport protocols like TCP/IP. Two of the earliest products that adhere to or are on the verge of adhering to this standard for audiovisual conferencing are White Pine Software's CU-SeeMe version 3.0 and Microsoft's NetMeeting version 2.0. Collaborative tools, which make videoconferencing with these new clients even more useful, include electronic whiteboards to provide blank drawing space that can be used by all participants; shared applications to allow all participants to view the same application window while one participant at a time manipulates it; file transfer; and chat.

Standards-based IP collaborative software is still fairly new technology, and it requires a platform of a well-equipped PC configured for IP connectivity. But there are many other players besides White Pine and Microsoft in or near this market, with more videoconferencing products that were still in the pipeline when we compared CU-SeeMe and NetMeeting (see the table on page 108).

BYTE BEST
IP VIDEOCONFERENCING

Picking a winner this early on is like trying to pick the winner of a marathon based on who's in the lead after the first 100 yards. **Microsoft's NetMeeting** and **White Pine's CU-SeeMe** are both strong contenders, but it's still too early and too close to call one the best.

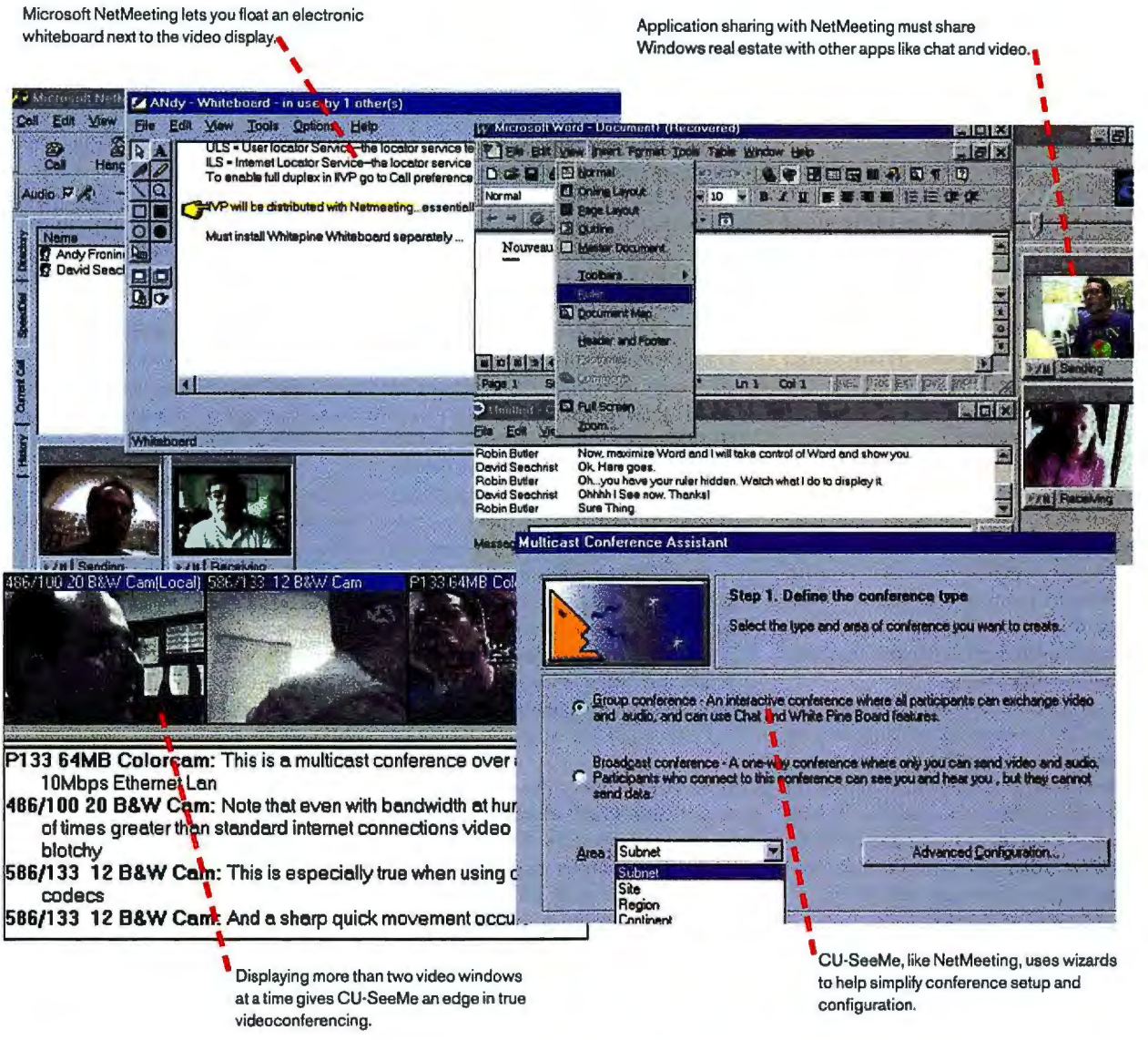
Getting It Together

Interoperability is the name of the game, especially when you're playing with IP. No matter how good a proprietary videoconferencing solution is, if it can't play nicely with the other videoconferencing solutions, it's not going to be as useful to you. Despite the early implementers' claims of adherence to H.323, I couldn't interoperate CU-SeeMe with NetMeeting because CU-SeeMe's H.323 client-to-client interoperability capability would not be available until long after I finished testing. This capability will be enabled through White Pine's MeetingPoint videoconferencing server product (see an upcoming BYTE for an Eval). NetMeeting happily interacted with other video clients, but CU-SeeMe requires MeetingPoint to support multipoint, multiwindow videoconferencing with other H.323-compliant clients. White Pine reported that CU-SeeMe clients will get direct compatibility without the server in an upcoming release due early next year.

Another stumbling block for many users will be taming the configuration beast. You'll need to put together video inputs, audio inputs and outputs, and proper IP networking software and configuration, as well as the videoconferencing software itself. Even when it all comes in a single package, it doesn't always work right out of the box. CU-SeeMe and NetMeeting both include installation wizards, and both support any video-capture board that supports the Video for Windows standard, but software setup may still require fine tuning, particularly when dealing with firewalls and managing bandwidth consumption on internal LAN connections.

So Many Standards

Interoperability issues go beyond compatibility among clients: Videoconferencing is a complex application that has to interoperate with other network pieces, too. The H.323 standard for multipoint audiovisual communication complicates matters for firewalls because it



The images are small, but with access to chat windows and shared applications, IP videoconferencing can jump-start productivity.

uses two separate Transmission Control Protocol (TCP) connections as well as User Datagram Protocol (UDP) datagrams to set up and maintain a single connection. (TCP is a virtual circuit transport protocol; UDP is a connectionless transport protocol.) T.120, the standard for multipoint document conferencing and data sharing, requires only a single TCP circuit, unlike H.323, so data conferences do not pose the same problems to a firewall as do audio and video communications. (For more on standards, see the Tech Focus, page 106.) Both NetMeeting and CU-SeeMe can be configured to work through firewalls, but doing so is not trivial. Unless the firewall explicitly allows H.323 videoconferencing, the administrator must manually open the TCP and UDP ports used for conferencing.

Performance Problems

Latency, the delay in receiving a signal after it has been sent, can really hammer bandwidth-hungry apps like live video: A transient delay of more than a fraction of a second can seriously disrupt reception. Microsoft NetMeeting has an automatic tuning mechanism that makes audio quality easy to adjust to compensate for bandwidth variations. CU-SeeMe uses forward error correction to compensate for packet loss on the Internet, and it uses interleaving to cut down on the actual data losses when packets are dropped.

Because audio and video streams are so bandwidth-intensive, videoconferencing products must compress data on one end, send it over the network, and decompress it on the other end. This process of compression and decompression reduces the quality of the original, manifesting itself in many ways: as dropouts, static-plagued audio, or blotchy, pixelated video. Codecs are the software that compress and decompress this data, and selecting one codec over another involves issues that include quality versus performance trade-offs, the amount of bandwidth that is available, and the need for interoperability.

These products also use different audio

codecs to allocate a certain amount of the data stream for audio transmissions, for different bandwidths. This helps keep audio quality up to snuff without adversely affecting video quality.

Anyone who has used a cheap speakerphone knows that only one party can speak at a time, and when someone at one end of the connection is speaking, the people at the other end can only listen; this is half-duplex communication. Hands-free, full-duplex conferencing, provided by both CU-SeeMe and NetMeeting, allows different participants to hear and talk at the same time, though at the cost of additional bandwidth.

An approach to managing the bandwidth beast is to use so-called "gatekeeper" products, which let system administrators monitor video and audio streams. Unlike gateways that route H.323 traffic, gatekeepers monitor and limit network bandwidth and let administrators restrict the bandwidth used by streaming video and audio applications.

Many other variables can affect performance during videoconferencing sessions. For example, connecting the camera to a video-capture board is much more efficient with system resources than linking through the parallel port. I found that mixing LAN and dial-up links in the same conference bogged down the test system.

Desperately Seeking Someone

Users can register their contact information with a location server, like the one from Four11, or with Microsoft's own Internet Locator Server (ILS). A directory based on Lightweight Directory Access Protocol (LDAP), ILS will eventually be integrated into Microsoft's Active Directory Services. Client software notifies the server of things like IP address changes each time the user connects. You can connect directly to videoconference participants as long as you have an IP address for them; using a directory service is not always necessary and can be time-consuming. Some of the directories must deliver their entire database every time you make a query, though eventually they will support more efficient search methods.

How to Decide?

We tested these products for ease of learning, ease of use, sound quality, and range of features. Video quality was measured subjectively by our NSTL testers, and the results were included as part of each program's ease of learning and use scores. The tests designed to rate ease of learning and ease of use assumed the products would be used to run a meeting between geographically dispersed participants.

White Pine CU-SeeMe

CU-SeeMe is the grandaddy of video over IP. White Pine was first to market with IP-based group videoconferencing, though the version we tested required White Pine's upcoming MeetingPoint server-

TECH FOCUS PROTOCOLS

Conferencing Standards

The International Telecommunications Union (ITU) standards body maintains these four important specification families for conferencing technologies:

ITU H.320 was adopted in 1990 and refers to a suite of specifications setting standards for multipoint audio/videoconferencing over digital switched networks. H.320 sets standards for conferencing over ISDN links only, laying a foundation for room-based conference systems that will be most useful to organizations that can afford the high-priced facilities. ITU T.120 is part of this suite.

ITU T.120 specifies protocols for use by multipoint document conferencing and data-sharing applications, and it includes functions such as image sharing and exchange, electronic whiteboard conferencing, and file transfer. Some of these protocols, most importantly those defining how conferencing applications interact and what they do, have already been ratified. Other protocols in the suite, in particular those defining conferencing control and reservations services, have not yet been finalized.

The ITU H.323 standard suite addresses multipoint audiovisual communications. As an extension of H.320, it specifies services over ISDN and plain old telephone service (POTS) direct links as well as over IP internetworks and Ethernet LANs.

The ITU H.324 standard suite addresses sharing audio, video, and data using point-to-point analog modem connections over POTS; this specification is analogous to the H.320 suite for conferencing over ISDN and switched data circuits.

A good source of information about ITU standards is at http://www.itu.ch, the ITU site. For information about interoperability among products supporting these standards, check out http://www.imtc.org, the International Multimedia Teleconferencing Consortium Web site.

IP VIDEOCONFERENCING

BEST OVERALL

Microsoft's NetMeeting and White Pine's CU-SeeMe

This time around, it's a toss-up between NetMeeting and CU-SeeMe. But if you can wait a few months, you'll have many more products to choose from.

	TECHNOLOGY	IMPLEMENTATION	EASE OF USE	OVERALL RATING
Microsoft NetMeeting 2.0	★★★★	★★★	★★★	★★★
White Pine CU-SeeMe 3.0	★★★★	★★★	★★★	★★★

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

based reflector software to interoperate with other vendors' clients. The only program we've tested that displays video of more than two participants simultaneously, CU-SeeMe allows up to 12 video windows in a virtual conference room. You can have additional floating windows on top of that, although that many open video windows would tear through lots of system resources.

CU-SeeMe controls allow individuals to limit send and receive rates, but this must be done on a client-by-client basis. MeetingPoint will let clients with lower bandwidth participate in conferences with clients that have much higher bandwidth, permitting everyone to get the best possible quality based on their own bandwidth. CU-SeeMe's Rolodex-style contact interface is a straightforward directory mechanism, though its display of splashy animation prior to each connection makes it cumbersome during routine use. Directory service is provided through Four11, and White Pine adds support for the Versit vCard standard for transferring electronic business card information. The Four11 service and vCard make for more helpful directory entries. Direct support for X.500 directories through LDAP is planned for the next release.

Integrated chat, also available with NetMeeting, helps a lot during those times when low bandwidth or a spotty network connection limits transmission of usable audio or video. Chat is well-integrated into the CU-SeeMe interface. This mode includes support for macros to create keyboard shortcuts for longer character strings, filters to screen out the ranting of specific participants, and a private facility to set up one-on-one conversations—a capability that extends to private audio conversations, too. CU-SeeMe uses T.120 to transport data for whiteboarding and file transfer, as does NetMeeting.

Microsoft NetMeeting

With Microsoft NetMeeting, no matter how many participants there are in a meeting, only two video windows can be displayed at the same time. Audio and video are point-to-point, unless you're using an H.323 conferencing server; application sharing, whiteboard, and chat are all multipoint without an extra server; for audio and video, you can switch among members of a conference without a server. Thus, participants must request the use of the video window when they want to

IP CONFERENCING FEATURES

	Microsoft NetMeeting	White Pine CU-SeeMe
PROGRAM PARAMETERS		
Multipoint whiteboard	✔	✔
Simultaneous multipoint video and audio		✔
Telephone access via H.323 gateway	✔	
Supports H.323 multipoint control units	✔	
Supports video reflector server software		✔
Internally supports IP multicasting of video		✔
ADDRESS BOOK/DIRECTORY SERVICE		
Attach graphics files (photos) and URLs to address card		✔
Optional auto answer	✔	✔
Call management (call waiting and blocking)		✔
Call history	✔	
Includes directory service client software	✔	✔
Supports LDAP directory servers	✔	
VIDEOCONFERENCING		
Adjust size of video during call	✔	✔
Freeze frame	✔	✔
Freeze frame with notification	✔	
Full-duplex and half-duplex audio	✔	✔
Adjust quality of transmission during call	✔	✔
Audio and video tuning controls	✔	✔
WHITEBOARD		
Separate private and public whiteboards		✔
Copy/cut/paste and clear	✔	✔
Zoom or magnification tool	✔	✔
Import graphics files		✔
Import graphics via clipboard	✔	✔
Import word processing files		IC
Import spreadsheet files		IC
Export graphics files		✔
APPLICATION AND DATA SHARING		
Request/relinquish control of shared applications	✔	
Share DOS applications	✔	
Share Windows applications	✔	
Share selected Windows applications	✔	
FILE TRANSFER		
Attach file to message	✔	
Option to compress/decompress files during send/receive		✔
CHAT		
Multipoint chat	✔	✔
Filter chat messages		✔
Include launchable URLs in chat text		✔
Option to list time/date message was sent	✔	
Send Public and private chat messages during a conference	✔	✔
SECURITY		
Password-protected conferences	✔	✔
Screen incoming calls	✔	✔
Limit access to tools available to conference participants	✔	
INTEROPERABILITY		
Supports H.323	✔	MP
Supports H.323 gateways	✔	✔
Supports H.324	VG	VG
Supports T.120	except T.126	✔
Supports H.320 through gateway	✔	✔
Windows 95 and Windows NT clients	✔	✔
Macintosh client software		✔
Server software available	✔	✔

✔=yes

IC=Utility allows printing from other applications to program-compatible image files.

MP=Meeting Point conference server software costs between $1995 and $10,000, depending on number of simultaneous users.

VG=Via gateway

Working the Web

It's still the early days of IP videoconferencing, and video isn't the only way to conference over the Internet. The table below points to some of the established players providing videoconferencing, as well as audio and document conferencing, over IP.

Though H.323-compliant videoconferencing products were scarce when we tested Microsoft's NetMeeting and White Pine's CU-SeeMe, by the end of the year there should be a much better selection of products from companies offering video telephones and H.324 videoconferencing. For example, Vocaltec's Internet Phone with Video will support H.323 conferencing this year, as will VDONet's VDOPhone Professional. PictureTel also announced an H.323 suite that includes an H.323/H.320 gateway to connect users of both standards in the same conference.

Another choice is to consider conferencing products that offer voice, electronic whiteboard, and application-sharing functions without the video. Netscape Communicator's Conference module provides such features. T.120-only conferencing, like that offered by DataBeam's FarSite 3.0, cuts out both audio and video, which means less overhead and more modest system requirements, while still permitting standards-based virtual conferencing over the Internet.

PRODUCT NAME	VENDOR	URL	STANDARDS SUPPORTED	PRODUCT TYPE
AudioVision	Smith-Micro Software	http://www.smithmicro.com	H.324, H.323 (as of June), NetMeeting-compatible	video telephone
EasyAxess	AcerWare, a unit of Acer	http://www.acerware.com	H.324, T.120	video telephone
Internet Phone with Video	Vocaltec Communications Ltd.	http://www.vocaltec.com	H.323 in fall '97	video telephone
VDOPhone Professional	VDONet	http://www.vdo.net	H.324-compliant, H.323 support announced	video telephone
LiveLAN 3.0	PictureTel	http://www.picturetel.com	H.323, T.120; software-only product available later this year	videoconferencing
FarSite 3.0	DataBeam	http://www.databeam.com	T.120	document conferencing
Netscape Conference	Netscape Communications	http://www.netscape.com	H.323, T.120	audio/ data conferencing

be seen by the other participants.

NetMeeting's whiteboard won't yet interoperate with CU-SeeMe's White PineBoard because White Pine uses the T.126 protocol for whiteboarding while Microsoft devised its own standard. The NetMeeting whiteboard application runs on top of the T.120 services. A Microsoft spokesperson said the company developed the proprietary protocol before the T.126 standard was set. Although a T.120 connection can be made, the two applications cannot share any whiteboard data.

Microsoft NetMeeting uses the T.128 application-sharing protocol to allow one user to share access to the document through the conference. NetMeeting's application sharing allows only one person at a time to have control over the document, but anyone participating who gets control of it can make changes to it.

Microsoft NetMeeting combines ease of use with lots of functions. Its unique ability to allow remote-control collaboration and video, audio, and chat channels make it well suited for technical-support applications.

PRODUCT INFORMATION

CU-SeeMe 3.0
$99 list; $69 via Web site (Windows 95, NT 4.0; Mac version in beta)
White Pine Software
Nashua, NH
603-886-9050
fax: 603-886-9051
http://www.cu-seeme.com
Enter 1022 on Inquiry Card.

NetMeeting 2.0
free download via Web site (requires 32-bit Windows)
Microsoft
Redmond, WA
206-882-8080
http://www.microsoft.com
Enter 1023 on Inquiry Card.

Something for Everyone

Videoconferencing and data conferencing are developing technologies. Neither White Pine nor Microsoft has fully addressed all the needs of a routine project-status meeting between multiple, geographically dispersed participants, running over the Internet. But both products offer something the other lacks. Microsoft NetMeeting's remote-control application sharing suggests implementing it as a tool for remotely providing technical support—a help desk staff can take control of a user's computer. Unlike dedicated remote-control products of the past, the real-time communications mode can allow the user to explain the problem as the help desk staffer is working on the problem. Still, sound and video quality are essential in this scenario, too, raising the bandwidth and quality issues.

Alternatively, the popularity of chat rooms on on-line services suggests that a product like CU-SeeMe that offers multipoint video, audio, and chat will benefit from the user base of the chat culture. CU-SeeMe is designed to accommodate all three media in an interface that is familiar to users of chat sessions. If you're looking for broadcast-quality interaction over the Net, it doesn't exist yet. But if you've ever wanted to hear and see the colleague you've traded e-mail with, or the person you've talked with in a chat room, CU-SeeMe is just what you need. B

David Seachrist (**dseachrist@prodigy.com**) *has tested software at NSTL for 10 years.*

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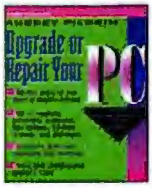

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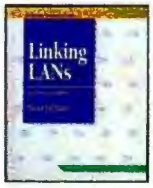

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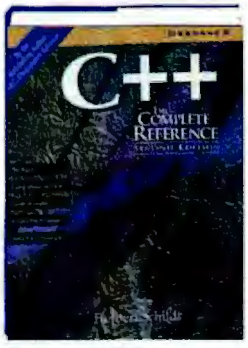

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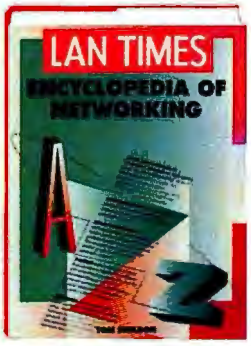

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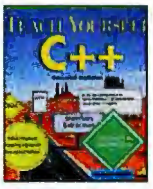

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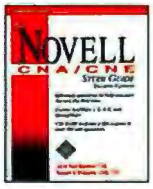

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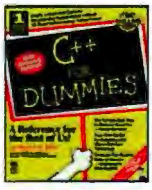

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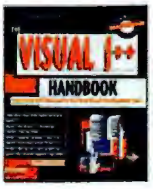

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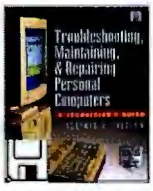

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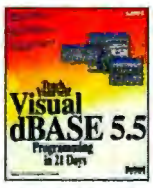

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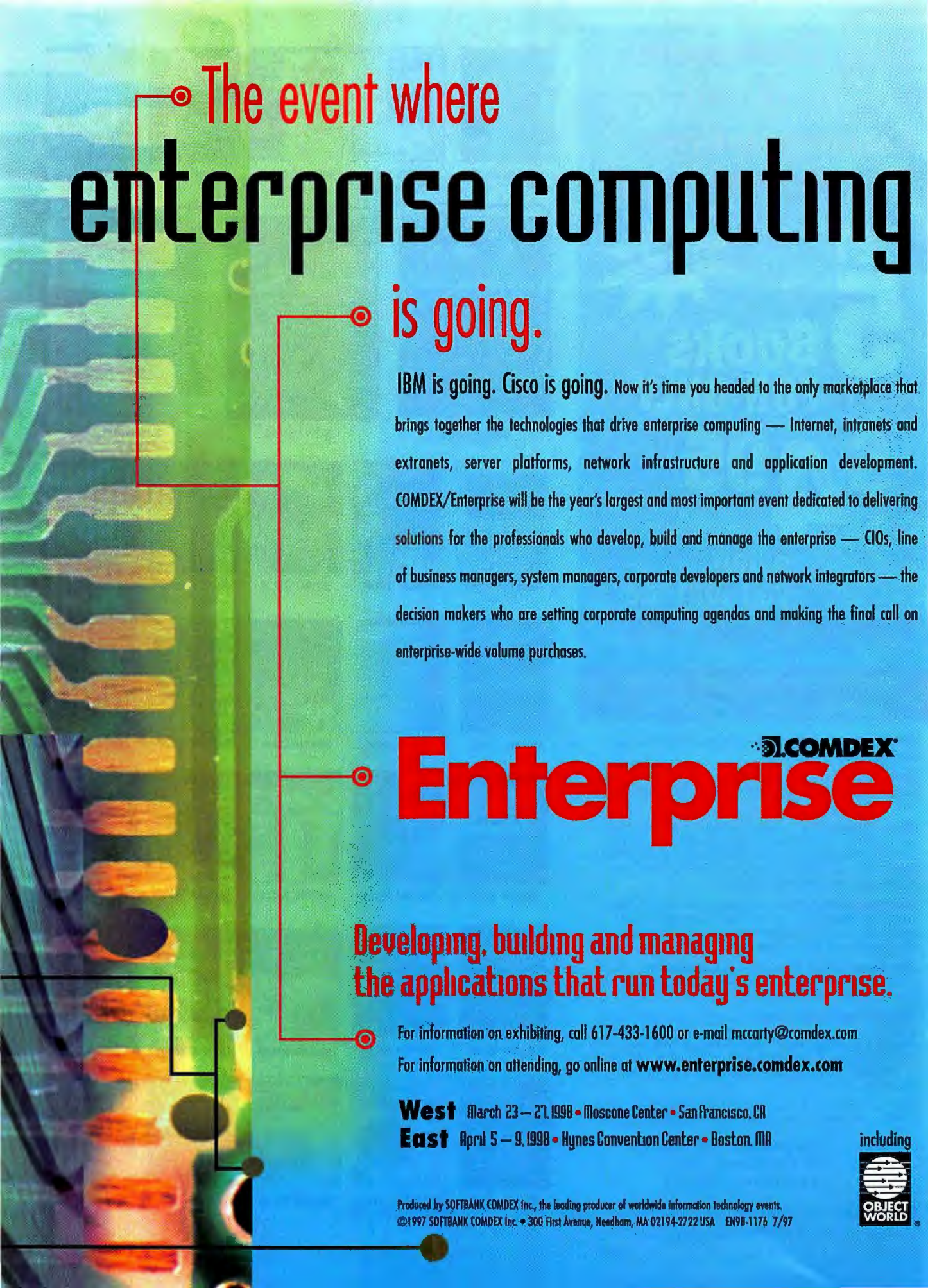
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Finally, 1992 (and newer) technology combines OO and relational data management for distributing complex data. By Robert J. Muller

Oracle8: Worth the Wait?

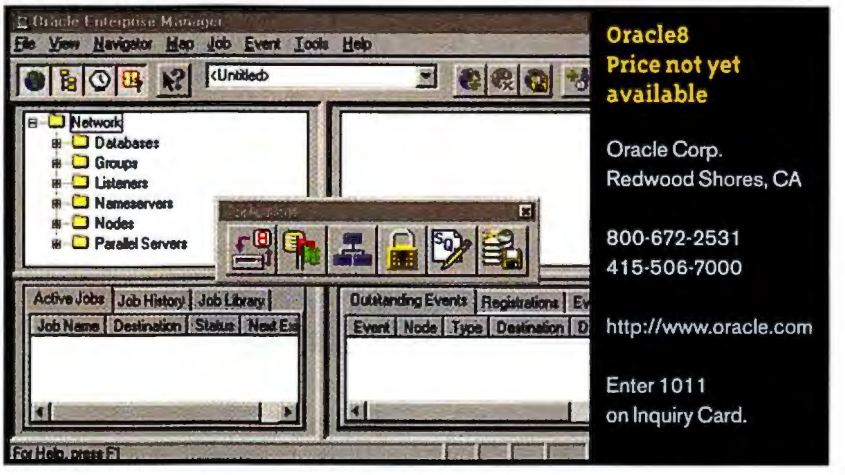
You've run your business with Oracle for years, but your requirements are changing and Oracle is hard pressed to meet your needs. You're suddenly getting more users, huge tables, and hardware upgrades that significantly stress your current software configuration.

Now your business managers want to put your organization on the Web. They want to eventually offer on-line catalogs or, worse, large multimedia-content databases and interactive applications that require serving up complex data that's way beyond your current server's capabilities. What are you going to do?

The long-awaited new version of the Oracle relational database management system (RDBMS), Oracle8, is finally available in an extended beta release, and it delivers strong performance gains for large database configurations as well as a strong object-relational typing system that gives you the ability to handle new kinds of data.

If you need to allow many simultaneous users to log on to a database, or if you need to back up and restore huge databases, or if you want to store and retrieve data that just doesn't fit well into standard relational tables, Oracle8 offers some real solutions.

RATINGS	
TECHNOLOGY	★ ★ ★
IMPLEMENTATION	★ ★



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Redwood Shores, CA

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Enter 1011
on Inquiry Card.

You can do anything you want to an Oracle server on your network with the Enterprise Server Manager administration tool.

Before getting into what this new package does, it's important first to point out what it is not—Oracle8 isn't what we normally refer to as an object-oriented database management system (OODBMS). Those systems offer full data encapsulation, inheritance, full integration with OO programming languages, and all the other defining characteristics of OO software; Oracle8 does not. [*Editor's note: Several OODBMSes will be examined in the Software Lab Report scheduled to appear in the October BYTE.*]

Instead, Oracle8 is an object-relational system; it adds a layer of data abstraction on top of the standard relational methods of representing data and programming, and it also provides the ability to extend the storage mechanisms to cope with complex data types. The object-relational data abstraction that Oracle8 provides gives you the ability to add new data types to standard SQL (see the Tech Focus on page 112) and to store and retrieve arrays of values and nested tables (e.g., column values that are themselves tables) and methods (i.e., stored subprograms that you associate with the new object types). However, there's no inheritance system for the types you add, nor can you hide the data columns in your object types.

Finally, the object-relational system provides you with a way to make your complex objects look like relational tables; Oracle calls this the object view. While these features do not give you true OO database-programming capabilities, they nonetheless extend the already-strong Oracle RDBMS into the object world in a tremendously useful way.

The strength of Oracle has always been in its strong server capabilities: security, integrity, concurrency, and high-volume transaction processing. Oracle's high performance, reliability, and wide availability on many different operating platforms have catapulted the product into the forefront of the database market. Oracle8 extends these strengths with additional client/server capabilities and adds the object-relational extensibility that the new application world needs.

Object Lessons

If you've been holding off looking at Oracle8 because you're afraid of the learning curve, it's now time to take the plunge; Oracle8 really isn't all that much different from Oracle7.3. For a database administrator (DBA) experienced with Oracle7, learning the new features won't take long. If you're currently programming database applications in C++, you will

benefit from the new type features, and it likely won't take you long to get used to them or to the new OCI API (the Oracle Call Interface, a set of functions that allow a program to send SQL to Oracle8 and get data back). In fact, the beta process has greatly improved the structure and capabilities of the OCI API as compared to the earliest versions.

Nonetheless, I'm not about to describe OCI programming as easy, so it's good that there's an alternative programming interface: Pro*C/C++. This precompiler technology gives you somewhat easier access to Oracle8's major enhancements to SQL, including an extensive new system of object types, tables, and views; large object (LOB) and image data types; collections of objects (VARRAYs, or variable-length arrays, of data and nested tables); and table partitions.

Object types let you declare new SQL types, which you can then use to define tables, columns in tables, or attributes of other types. See the Tech Focus below for some details of object types. In addition to representing complex types, you have the ability to link objects through references (REFs) and store those pointers and dereference them on demand. Object views let you construct objects from old-style relational tables for programming purposes, integrating such tables with the full object-relational programming facilities in Pro*C/C++ and the OCI API.

LOBs are special data types in the Oracle RDBMS server engine. Unlike with the old LONG data types, you can declare as many LOB columns as you need in your tables. There are four LOB types: BFILE, BLOB, CLOB, and NCLOB (see the text box "Four Varieties of LOB" on page 113).

In addition to these flavors, there's a built-in image type, implemented as a Network Computer Architecture (NCA) data cartridge, that uses BLOB and BFILE types and a set of object types to represent image objects. LOB types provide a much more powerful means of representing complex data than the old LONG and LONG RAW data types did. They also relax the single-BLOB limitation that the use of LONG data imposed.

The disadvantage of these types, as always, is that they are not objects, just raw data. It's up to your program to interpret the results. At least for the image types that the image-data cartridge supports (BMP, CALS, GIF, JPEG, Kodak Photo CD, PCX, PICT, Sun raster, Targa, and TIFF), you get some SQL extensions that let you do more programming, such as changing formats, copying, scaling, and other image-related operations, in the database. These types show what the NCA and Sedona environments can do; unfortunately, these aren't

TECH FOCUS | OBJECT TYPES

Roll Your Own Data Types

Oracle8 extends the SQL data-type system with a TYPE object that comes complete with its own CREATE, ALTER, and DROP statements. Types include both attributes (i.e., data) and methods (i.e., stored subprograms that operate on the data). The data attributes can be standard SQL types, such as VARCHAR2 or NUMBER, previously declared object types, or collections of nested tables. Here's a simple example:

```
CREATE OR REPLACE TYPE Address (
  Street     VARCHAR2(100),
  City       VARCHAR2(100),
  State      CHAR(2),
  Country    VARCHAR(50),
  PostalCode VARCHAR2(25),
  Location   REF GPSLocation,
  MEMBER FUNCTION Label RETURN VARCHAR2,
  MEMBER FUNCTION Location RETURN GPSLocation
  MEMBER FUNCTION Location RETURN Building);
```

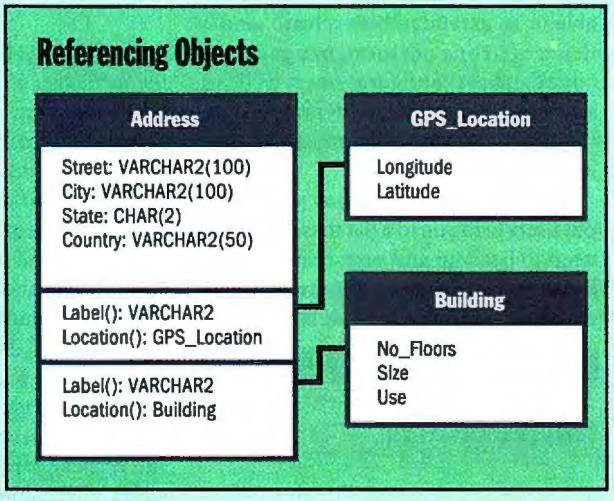
The separate CREATE TYPE BODY statement has the PL/SQL implementations of the member methods. The figure "Referencing Objects" at right shows this type using the object-oriented Universal Modeling Language (UML) design notation. The best way to use these types is to create a table as the type

```
CREATE TABLE Addresses OF Address;
```

This object table lets you create objects with the INSERT statement using the built-in constructor method for the type, which you can also use when creating objects embedded in tables or other objects:

```
INSERT INTO Addresses
      VALUES (Address('1600 Pennsylvania Avenue',
            'Washington', 'DC', 'USA', '12345'));
```

The trick to embedding objects, though, is that you can't use pointers to such objects because they don't have object IDs; only standalone objects have them. A much better approach than embedding objects is to create references to objects (REF types, pointers to objects of a type) that are stored separately. That lets you refer to and dereference pointers to such objects in your programs, which is generally what you want to do in an OO program. You should realize, of course, that most of what you are likely to want to do with this kind of object through SQL is best done through a PL/SQL or C++ program that enables you to call the methods and get complex results into variables that you can do something with, not with SQL*Plus or other simple query tools.



You can design complex object types that include methods (i.e., behavior) and references to other object types.

available yet for your own data cartridges. (As this review went to press, there was much confusion over Sedona because of remarks made by Larry Ellison, CEO of Oracle Corp., saying that the product had been placed on hold, and denials of this by other sources at Oracle.)

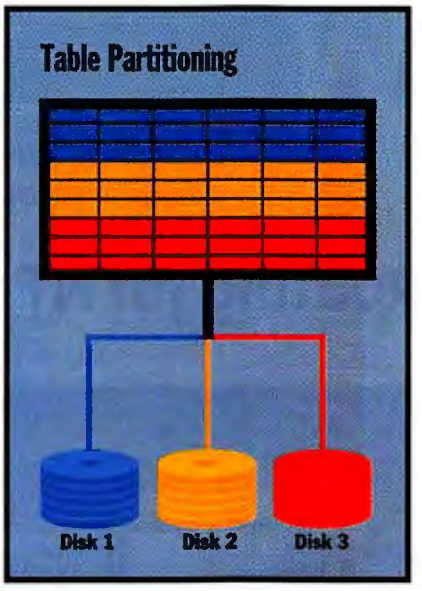
The collection of objects lets you represent either variable-length arrays of data or tables nested within other tables, extending the original relational first-normal-form model, which required a single value of a column for each row. Now each value can be an array of values or even a complete table.

Table partitions add the ability to store tables (and indexes, too) in more than one data segment. This allows you to store a table on different disks or in different locations that are under your control by allocating multiple tablespaces and assigning rows to the different partitions according to their data content, as the figure "Table Partitioning" above illustrates. You can use table partitioning to replace complicated disk-striping performance optimizations to speed up access or to allow for taking part of a table off-line for maintenance or backup without interfering with the rest of it. This is a major improvement for huge tables, which are increasingly becoming a requirement for many large databases.

Another use for partitioning is to simplify and speed parallel processing. In particular, if you're using data manipulation language (DML) operations in parallel, your tables must be partitioned so that each operation is confined to a single partition. (Often, much of this type of processing involves large batch jobs.)

What about Pro*C/C++ programming? This is the alternative to messy programming with OCI, the precompiler that takes an embedded SQL program and turns it into C++ source. I wish I could report that the enhancements that have been made to Pro*C/C++ make programming with objects easy, but they do not. First, you have to use a completely separate utility, the Object Type Translator, to produce header and `typefile` files for your object types. Unfortunately, this produces C++ `structs`, not classes, which means that object-oriented C++ programmers won't be happy with the results.

There's more: Pro*C/C++ uses an object cache to create these `struct` objects in memory, and you must use explicit embedded SQL commands to allocate and deallocate memory rather than the standard



Oracle8 lets you partition large tables row-wise across multiple disks.

C++ free-store facility. The advantage of going through all this is that you can extract object data using SQL. One disadvantage for those used to OODBMS behavior is that you need to use explicit UPDATE statements to move changes from the object cache back to the database. It doesn't happen automatically when you commit your transaction.

On the downside, however, Oracle8's SQL, called SQL*Plus, conforms to the Entry level of the SQL 1992 (SQL2) standard. This sounds great—until you realize that the Entry level is pretty close to the SQL 1989 standard and does not include most of the neat features of the 1992 standard, such as the extended FROM clause syntax for inner and outer joins, the orthogonal use of SELECT queries in lots of interesting places, the TIMESTAMP and INTERVAL data types, and the character-set features, which are much cleaner and easier to use than Oracle's National Language Support.

Also, the development tools (Designer/2000, Developer/2000, Pro*C, and JSQL for Java) still lag behind the server technology and don't yet take advantage of the new object features. The graphical tools for the DBA's use, such as Oracle Enterprise Manager (shown in the screen on page 111), haven't changed much and still are not particularly easy for a DBA to use. However, the DBA now has the ability to administer passwords through this as well as through Oracle8 directly using SQL*Plus, which is a new capability.

Finally, until Oracle releases its Sedona project, you won't be able to add your own data cartridges to the system to construct your own data types. Only the Oracle-built cartridges will be available until Sedona comes out.

The new backup and recovery managers will make life a lot easier for the ever-suffering DBA and system administrator by fully automating the backup process and by providing better incremental backups than Oracle7. Because I did not benchmark the product, however, I was unable to verify many of the claims of improved architecture, memory use, performance, and scalability. But the beta version that I used was refreshingly bug-free and performed well on a Pentium-133 NT-Workstation system.

Overall, I was impressed by the engineering in Oracle8, if not entirely happy with the product's design and integration. If you need complex objects and you're willing to write complex C, C++, or COBOL programs to use them, this is a great tool. Otherwise, you might want to wait for upgrades to Oracle's application-development tools that take advantage of Oracle8. But if you're an Oracle7 user and you need the advanced performance features of Oracle8 for very large applications, you should start exploring Oracle8 now to see if it meets your needs. B

Four Varieties of LOB

BFILE: A binary file outside the database that contains some kind of binary object.

BLOB: An unstructured, in-database binary LOB.

CLOB: A large object consisting of many single-byte characters, such as ASCII or EBCDIC.

NCLOB: A large, fixed-width object consisting of many multiple-byte characters, such as Unicode. (Oracle8 does not support variable-width character sets.)

Robert J. Muller is a partner at Poesys Associates, an OO and client/server development consulting firm in San Francisco, California. He is the author of the Oracle8 SuperBible *(Waite Group, 1998) and* The Oracle Developer/2000 Handbook *(Oracle Press, 1997). You can reach him at* **muller@acm.org**.

Microsoft turns Windows into a multipurpose network device with its NT RRAS. By Morgan Stern

Software-Only Routing for NT

Microsoft's quest for enterprise OS domination with Windows NT Server takes an important new direction with the release of the Routing and Remote Access Service (RRAS), formerly codenamed "Steelhead." Positioned as an inexpensive alternative to satellite-office hardware-based routers and remote-access devices, RRAS turns NT 4.0 Server into a dial-up server or Internet router.

Actually three pieces in one, RRAS includes an enhanced version of the familiar Remote Access Service (RAS), a demand-dial routing service, and a completely revamped set of multiprotocol routing tools. RRAS also adds server-to-server Point to Point Tunneling Protocol (PPTP) capability to the client-to-server links introduced in NT 4.0 to simplify the creation of multisite virtual private networks (VPNs). The enhanced version of the already-popular RAS includes a redesigned administration tool and RADIUS authentication, which authenticates dial-in users through either the NT security database or a RADIUS server (see the Tech Focus below).

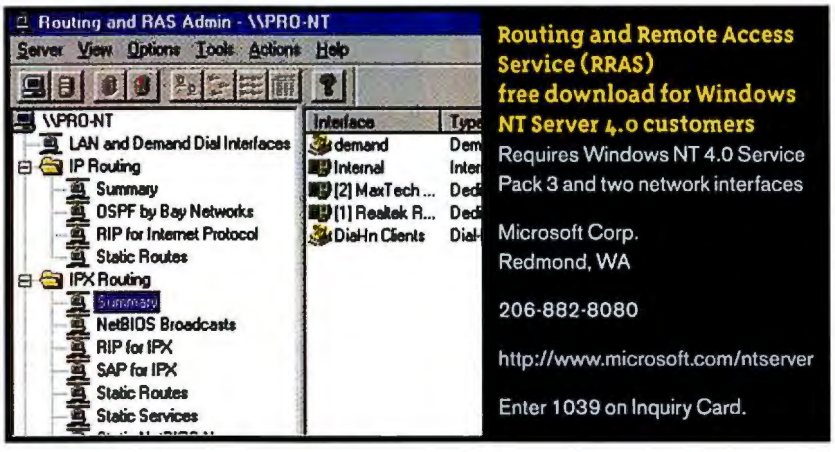
Demand-dial routing lets RRAS establish dial-up network connections on demand. Users and administrators looking to reduce the cost of dial-up Internet and network-to-network connections will find this service useful. The multiprotocol router piece extends NT 4.0's routing functions, adding support for IP RIP versions 1 and 2, OSPF, IPX RIP, and a DHCP relay agent. AppleTalk routing, while supported by the Services for Macintosh component of NT Server, can't be managed through the GUI.

You can install one, two, or all three of the services, although the installation program removes any old versions of the components being updated, such as an existing RAS service. (Keep a recent tape backup handy in case of problems.) The RRAS Admin utility is an Explorer look-alike service-configuration tool that's based on Microsoft Management Console (MMC); you can also enter configuration commands at a command line or in router-configuration scripts.

Although I found installation simple, configuring a multiprotocol routing service to work in an existing network means understanding how the protocols work and how the existing network is configured. So, don't expect to be operational in a half hour if you've never worked with routing protocols before.

RRAS offers basic packet filtering for the IP and IPX protocols, with the ability to filter by source and destination network, protocol, and port number. But filtering alone isn't really a suitable alternative to a stand-alone firewall.

RRAS simply doesn't have the horsepower to replace large backbone routers or switches, but it's not meant to. Microsoft offers RRAS as an inexpensive alternative to small-office dial-up routers or for use with the Microsoft Proxy Server for enterprise-network border routing and access services. For the price, it's hard to beat. B



RRAS keeps remote-access services and multiple routing protocols in order with the Microsoft Management Console interface.

RATINGS	
TECHNOLOGY	★ ★ ★ ★
IMPLEMENTATION	★ ★ ★ ★

TECH FOCUS

The RADIUS Authentication Protocol

Remote Authentication Dial-In User Service, or RADIUS, provides centralized authentication services for dial-in users. When a remote user dials in to a network, his or her user name and password are transmitted to a RADIUS server, which stores a master list of users, passwords, and services available to each user. A RADIUS server can handle multiple dial-in devices, providing a central point for user-account maintenance and session accounting.

Morgan Stern is a network consultant and the coauthor of NT Enterprise Network Design *(Sybex, 1997). You can reach him by sending e-mail to* **morganst@world.std.com**.

The Winterm 2930 uses a touchscreen and a radio link to free Windows users from their desktop PCs. By Barry Nance

Wireless Wonder

Long before Oracle and Sun launched their network computer initiative, Wyse Technology was making Windows terminal devices that embody the spirit of the network computer. Wyse's latest product is a lightweight (3.4 pounds) radio-linked terminal on which mobile Windows users can interact with applications. The software runs on a central multiuser NT Server-based network equipped with Citrix WinFrame and a 2.4-GHz spread-spectrum, frequency-hopping radio transceiver (such as a Proxim RangeLAN2 Access Point unit). Each sleek Winterm 2930 connects its user, via the Intelligent Console Architecture (ICA) and radio link, to WinFrame on the NT Server computer.

The Winterm 2930 sports a PS/2-style keyboard port, and Wyse says it will release an integrated-keyboard version later this year. (Though I must say that while testing the unit, I became quite accustomed to its virtual, on-screen keyboard.) The 8.5-inch 640 × 480 dual-scan LCD, capable of either 16 or 256 colors, is clear and sharp. In my tests, the lithium ion battery required recharging after slightly more than five hours of heavy, continuous use, and after about seven hours of moderate use. (Wyse claims you'll get five to eight hours on a single charge.) The delay intervals for sleep mode (instant wake-up) and hibernation (a 10-second wake-up after 60 minutes of sleep) are configurable.

Winterm 2930
$3399

Wyse Technology
San Jose, CA

800-438-9973
408-473-1200
fax: 408-922-5729

http://www.wyse.com

Enter 1012 on Inquiry Card.

Wyse's Winterm 2930 captures the essence of a network computer and a hand-held PC in a 3.4-pound package.

TECH FOCUS

Remote Control Linkage

Citrix WinFrame diverts Windows screen updates, keyboard events, and mouse events to and from the Winterm 2930. The Winterm unit handles screen updates as if it were a Windows device driver. On the server, WinFrame intercepts calls to the Windows Graphical Device Interface (GDI) and redirects them to the client through the Intelligent Console Architecture (ICA, a protocol developed by Citrix that lets NT distribute graphics processing to networked clients). Flash-upgradable ROM-based code in the Winterm understands ICA and handles the redirected GDI calls.

Wyse put some special touches in the Winterm 2930 to make it easy to use. For example, to click an on-screen button, you simply touch it with the stylus. Wyse also allocated two left-side icons as hot keys so you can assign keyboard macros.

I exercised the Winterm 2930 in the barcode-based local public library. I used a three-column Microsoft Access database that had Catalog ID, Book Category, and Author Name columns. In addition, I used a battery-powered barcode scanner I had lying around to inventory a few shelves of books. The Winterm 2930 let me operate a small Visual Basic application, which I ran on a Windows NT Server PC I left powered on in my car outside the library. The Winterm 2930's coverage range let me roam throughout the library without losing the connection to the server. Wyse accurately says the unit works within 500 feet of the server in an office environment and 1000 feet in open spaces.

RATINGS	
TECHNOLOGY	★ ★ ★ ★
IMPLEMENTATION	★ ★ ★ ★

You won't use this device in an aircraft at 30,000 feet. But for mobile networking on a shop floor, or in an office, the Winterm 2930 makes a superb thin client, figuratively and literally. B

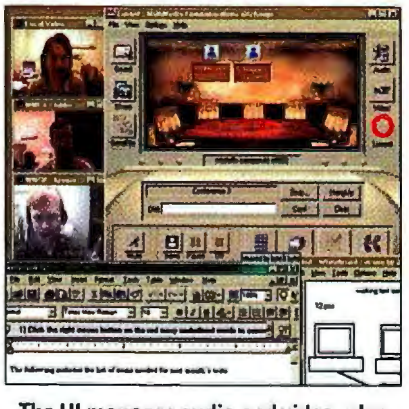
Barry Nance is a computer analyst, consultant, and author of numerous books on networking. You can reach him at **barryn@bix.com.**

Lucent's MMCX Server now supports PC endpoints and the latest ITU standards. By Michelle Campanale

Mixed-Media Maven

The latest release of Lucent's MMCX (Multimedia Communications Exchange) Server extends multiparty conferencing to mixed-media sessions on PCs, Unix workstations, or any standards-compliant device connected to a LAN or WAN. The MMCX Server can link with a PBX (i.e., a circuit-switched telephony network) for TCP/IP internetworking with phones and multimedia PCs.

Available since July, the second release of the server and client software now supports Intel-compatible PC endpoints running either Windows 95 or NT. Although it's a pricey package (starter kits begin at $36,650), MMCX Server now offers support for any kind of mixed media and handles mixed-media sessions the same way it handles conference calls. Also new to this version is support for H.323, the Internet/LAN ITU standard for voice and video data over IP. In addition, the MMCX Server now supports T.120-based data sharing (for shared applications and whiteboarding) and mobility, so users can access any MMCX endpoint by using a single log-in name.



The UI manages audio and video, plus whiteboard and document sharing.

By year's end, Lucent plans to add support for MASI (which allows the Definity PBX to act like a features server sitting on a LAN); H.320, an early ISDN standard that's circuit-switch-based for voice and video over 128-Kbps lines; and H.263 video capabilities.

MMCX Server
$36,650 (starter package)

Lucent Technologies
Murray Hill, NJ

888-458-2368

http://www.lucent.com

Enter 977 on Inquiry Card.

MMCX Server supports one Ethernet NIC, one ISDN PRI, and four end-user versions of the GUI software.

I tested an early version of Lucent's newest MMCX Server release. After linking to a Definity PBX and a 24-B-channel ISDN Primary Rate Interface (PRI), I plugged the server into three Windows 95 machines. These three clients each contained 32 MB of memory, a Windows-compliant video-capture card, and a full-duplex sound card, in accordance with Lucent's specifications.

I initiated a conference call among the three client PCs on the LAN as well as a phone that was plugged into our PBX. Then, using Lucent's client-side user interface, it was easy to initiate the system's H.261-compression-based videoconferencing, share whiteboard and Word documents, and transfer and forward calls.

Based on a 166-MHz Pentium processor, MMCX Server comes with 48 MB of DRAM, a 2-GB SCSI-2 hard drive, a 1.44-MB floppy drive, and a WILDcard (WAN to LAN device card) that provides interfacing among LAN, Ethernet, and ATM network interface cards (NICs) and E1/T1 circuit-switched networks. IS managers who have an immediate need for a multimedia conferencing package should take a look at Lucent's MMCX Server. With no direct competition, it represents a robust solution that's easily integrated into existing PC LANs. B

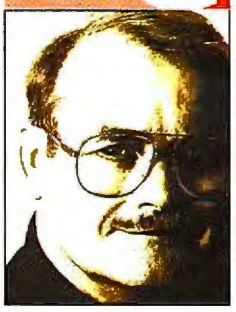
RATINGS	
TECHNOLOGY	★ ★ ★ ★ ★
IMPLEMENTATION	★ ★ ★ ★

Michelle Campanale is a BYTE technical editor based in San Mateo, California. You can reach her at **michelle@bix.com.**

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor

Jerry Pournelle

Chaos Manor



New Synergies for Computing

The combination of writable CD-ROMs and new image technologies may usher in a new age for computer users.

I was at an opera association lunch the other day when I found I was seated at the table next to Mr. Blackwell, who annually compiles the Worst-Dressed List. Figuring that any publicity is better than none, I quickly took my "We BE Geeks" pocket protector out of my shirt pocket, where it probably wouldn't be noticed, and put it in my outside jacket pocket. I don't know if he saw it.

While that incident wasn't important, another was. I had my Olympus D-300L digital camera with me and took pictures of the stars, including Richard Bernstein, our home-developed Figaro, and Inva Mula, the Albanian Susanna. Everyone was fascinated. Most had never seen a digital camera before. When I showed them the pictures I had just taken, they thought it was wonderful, and I suspect I sold several of those cameras with that demonstration.

That was probably a mistake.

The D-300L is wonderful technology, and I don't mind recommending it to BYTE readers. However, the software that comes with it is miserable at best, and I suspect it will prove impossible for consumer-market buyers. It's not so much that Adobe PhotoDeluxe isn't pretty good once you get it installed; it's that installation is between extremely difficult and impossible.

Here, I have to make a confession. Usually I do everything myself, but my son Alex and our intern Eric were fascinated by the D-300L when we got it a couple of months ago, and it came at a time when I had books due. Alas, I let them do the software installation, and they took care of downloading the pictures. The result was my enthusiastic report about the D-300L. While I don't withdraw a word of that, I do have to give fair warning: the software is both ill-conceived in design and horrible in execution.

First, installation: you must install Adobe PhotoDeluxe from a CD-ROM before you install the Olympus Digital Vision software from floppy disks. You do both in the blind faith that your system will find the camera; there's no way to tell the software what port your camera is on.

When you run Adobe PhotoDeluxe, it isn't at all clear that this isn't really an Olympus program; what happens is that Digital Vision installs as a plug-in to PhotoDeluxe. It's easy enough to find the big Digital Camera icon, but when you click on that, you get a menu of plug-in options. You then have to figure out which plug-in goes with the D-300L; that happens to be TWAIN 32, there being no mention of the D-300L whatever in the menu you're offered.

The D-300L is wonderful technology, and I don't mind recommending it to BYTE readers.

If you select the wrong one, the program goes off to never-never land, and you have to do Ctrl-Alt-Del to shut down PhotoDeluxe. If you choose the right one but the serial port isn't properly selected, if you're lucky, you'll get a message that says your camera isn't connected or not turned on and please try again. Only after that do you get a menu that lets you configure the system to select the serial port.

If you get that far, Bob's your uncle. Sort of. That is, there's an "automatic" configuration button that probably will do the job. If it won't, you can manually select the port and serial rate, and while you may have to do Ctrl-Alt-Del to turn off that task, eventually you'll be connected to your camera. The software now gets thumbnail sketches of all the photos on the camera and lets you select one—one—and download it. It then shuts down the plug-in, having given you just enough time to delete that photo from the camera. You'll want to do this, because after you save your photo, you have to go through all that, including downloading all the thumbnails, each time you want another picture. The more pictures in the camera, the longer that takes.

In other words, you can't just tell the system to download and save all the pictures on the camera and put them in a holding folder for dealing with later. You have to deal with them one at a time. This is fun at first, but it soon becomes tedious.

It gets worse. I never did get this stuff to install on my new Compaq Armada laptop, because I never got to the configuration menu; and if PhotoDeluxe once tries to find your camera and can't, it doesn't even bring up the Olympus screen again until you reinstall.

Finally, if you want to uninstall PhotoDeluxe, the best of British luck to you. It doesn't uninstall everything and leaves behind both font and DLL files that you can delete only by shutting down to DOS and deleting them from there. For the final insult, if you uninstall PhotoDeluxe and then try to reinstall, when it gets to those undeletable files, it doesn't tell you they are undeletable. It merely says they are read only; but you'd better not tell it to overwrite them because it

can't, and when it fails to overwrite, the silly installation program blows up.

There are a few morals to this story. First, my apology for not doing all this nonsense myself before reporting about the camera. Second, even after I learned just how stupid this software is, I probably wouldn't have noticed if I hadn't been thinking about how the opera stars will react when they encounter this madness. We computer enthusiasts will put up with a lot; too much, I think.

Bottom line: the D-300L is a technical marvel, but I sure don't recommend you buy one for an unsophisticated friend.

Flash: I have e-mail saying there is available at the Olympus Web site a routine that will let you batch-file transfer your pictures to your hard drive in one unattended operation. It's not easy to find—you have to go to http://www.olympusamerica.com/digital/download/download.html, and there's no direct link from the Olympus home page.

Once you get the software, it does install properly, although the instructions talk about "inserting your CD," and there's some oddball confusion about dates; but it does let you download all the pictures in one batch. So far as I can tell, if you do batch the downloads, you can grab the pictures only in JPEG format; if you want the full resolution, you still have to get them one by one. Bottom line now: you can get this for Aunt Minnie if you're willing to spend some time showing her how to get and use the upgrade software. But stay tuned.

I've been wondering about speed: why do we need more?

EVERYONE IS ADVERTISING FASTER SYSTEMS. I've been wondering about speed: why do we need more? I suppose it depends on what we're doing. I have lately been using the U.S. Robotics 56-Kbps external modem for my Internet connections through Earthlink, and I have to say it's easy to get used to the resulting 48- to 52-Kbps effective speeds and to feel deprived at a mere 28.8 Kbps. The U.S. Robotics 56-Kbps system really works. So does Diamond's Rockwell chip-set 56-Kbps modem, but of course the Diamond and U.S. Robotics modems are not compatible; that is, each will send to another system just like it, but not to each other. At the moment, I can access more U.S. Robotics systems than the other kind, and since I've always been partial to them anyway, that's what I'm using.

When I began writing with computers, it would take many seconds to save a text file to disk. Now it's nearly instantaneous, and I'd hate to go back. On the other hand, some operations, such as saving even very large text files, are very fast on my slowest systems, and I doubt I would notice improvements.

One place I would like more speed is in transfer operations. Universal serial bus (USB) promises to speed up operations such as downloading photos from a digital camera. It's also supposed to make Plug and Play much easier, so there won't be problems like not being able to find the D-300L. I suspect that will be true only for newer systems, though, and I'll still get my monthly ration of horror stories.

We all want more speed for graphics. We have several new high-end systems at Chaos Manor, and artist associate David Em has been putting them through their paces with enormous graphics files. The result so far is that the Compaq Workstation 5000 with dual 200-MHz Pentium Pro processors is very fast, the Carrera Computers Cobra EV56 with a 500-MHz Digital Equipment Alpha is even faster, and the Intergraph Dual Pentium II 266 system is awesome.

Any one of these would be impressive. However, it also shows the ratcheting-expectations effect: once you have used the Intergraph system with Softimage, and watched shadows move in real time as you move the lights around the screen, you wonder how you ever lived without that speed. David has a full report in the Web Exclusive section.

Bottom line: you can now have on your desktop image-processing capabilities that no one had a few years ago.

There's more. Play, the people who brought you the Snappy image-capture device, have been showing Trinity, a real-time, broadcast-quality, full-motion image processor that will let you merge image input sources. You can animate 3-D objects with programs such as Softimage 3D Extreme or 3D Studio Max and then mix in live actors. If your dinosaur object has

shiny eyes, you'll see the actor's image reflected in them. Real time. In addition to real-time reflections, Trinity does wipes and fades and all kinds of mixes that you associate with studio equipment.

With the $5000 Trinity box and a decent Pentium system, you can have your own TV studio and produce professional-quality video. Add the new digital camcorders and writable digital videodiscs (DVDs), and the result will be a spate of innovative TV documentaries, dramas, and oddball entertainments. Most of those will be silly or useless, but not all. I expect some real revolutions in television entertainment over the next few years, and the cost to get in on it is about the same as a year's tuition at a major university. Graphic arts is one of the fastest-growing fronts in the computer revolution.

Affordable digital camcorders, Play's Trinity, and DVDs form one synergy. Others are beginning to emerge.

THE IDEA OF THE PAPERLESS OFFICE HAS been around since the earliest days of microcomputers. The goal, we are told, is that some day all documents will be electronic and filed in databases, retrievable by subject, keywords, or black magic, and we won't need paper files at all.

We haven't got there yet. Visioneer's PaperPort ix did move us a bit closer. For those who tuned in late, this is a small gadget that sleeps on a serial port. (There's also the PaperPort Vx, which is built into a keyboard; that works, too.) When you feed it a sheet of paper, it wakes up and reads it. Then it stores that as a bit-map image. It can also feed it to an optical character reader to turn it into a machine-readable, editable, electronic document. This works pretty smoothly, and a number of businesses use the PaperPort, which is small enough to carry in a briefcase and can be used on trips.

There are several problems. First, the PaperPort, while small, still requires a power source, and it was black and white only. Second, even in this era of cheap disk drives, storing all the documents in an office can use up a lot of storage and create a nightmare of files and folders.

Solutions to both problems are at hand. Visioneer recently introduced a color version, the PaperPort Strobe. This one hangs off the parallel port (with a pass-through to the printer). It can do both black-and-white and color documents, but also photographs and business cards.

continued

I'll get back to photographs in a moment, because there's another important synergy there.

Adaptec, with Easy CD Creator Deluxe 3.0, has made the write-once CD-ROM drive a practical device that's easy to use. It will read regular CD-ROMs and write on $4 blanks. Mass storage ceases to be a problem. Scan your documents, put them through an optical character reader—Caere's OmniPage Pro for Visioneer PaperPort is a good one that works with the Visioneer scanner—or don't, as you choose. Store them on a CD-ROM blank. Periodically compile your archives to another CD-ROM that you store off-site.

For that matter, at 600 MB on a $4 blank, I can afford to make monthly or even weekly backups of everything in the office. I'll store a copy at Niven's place, so even if my house burns down, I can recover what I'm working on and everything else.

The final synergy involves the Visioneer PaperPort Strobe, writable CD-ROMs, and Kai's Photo Soap from MetaCreations (née HSC, née MetaTools).

Kai's Photo Soap is a $50 program that takes photo images and lets you clean them up, increase the contrast, touch up colors, and generally do anything you can do with Adobe PhotoDeluxe and a lot of what you can do only with Photoshop. There's some mild morphing or "goo" capability (increase the smile on the Mona Lisa or make your boss into an egghead).

The program accepts most graphics input formats and outputs nearly everything but GIF. If you want GIF, you'll have to get something else—PhotoDeluxe, one of the Corel image manipulators, or Debabelizer—because MetaCreations declined to pay the GIF-format licensing fees for a $50 program.

With a Visioneer PaperPort and Photo Soap, you can scan in all those old photographs, including the boxes of them Grandma has stored away, sharpen the contrast if they've faded, arrange them in electronic albums, and store them on cheap CD-ROM blanks. When Visioneer came here to show me the PaperPort Strobe, I fed it my photograph of Jeremy Bentham (see the August Web Exclusive section). It worked just fine, and the Visioneer people kept a copy as well. I've been playing with it with the goo features of Photo Soap.

No one knows how long CD-ROM files will be stable, but it's certainly many

decades, so once you have scanned your pictures, you'll have really permanent family archive albums. You can also send copies to anyone with a PC and CD-ROM drive, which nowadays is probably everyone you want to send copies to. You could also print them on the Alps MD-2010 Photo-Realistic Color Printer I've mentioned before.

The key to this is ease of use: anyone can scan photos with the PaperPort, anyone can clean up those photos with Photo Soap, and with the new Adaptec software and interface, anyone can store both pictures and documents on CD-ROM. Unlike PhotoDeluxe and the D-300L, they did this right for the consumer market.

Eventually there will be standards and easy-to-use digital CDs, and we'll move all our paperless-office and photo-file archives to that medium; but that's going to be a while. CD-ROMs will be with us for years to come.

With Easy CD Creator Deluxe 3.0, it's as easy (but nowhere near as fast) to write files onto a CD-ROM blank as it is to write to an Iomega Zip drive or a floppy disk. Just put your blank disk into the drive (a Philips CDD 2600 with 2× write and 6× read capabilities in my case), invoke Adaptec's easily installed software, and follow the instructions. You can write files or whole directories, from local drives or across the network.

None of this is fast, and my first write seemed to take forever. I had selected a large directory, Q&A, which contains many subdirectories (everything I wrote on Q&A Write, which is effectively everything I wrote for about 10 years), with the notion of making an archive. The program went into "test" mode and trundled for a long time without doing anything. Eventually I interrupted it and wrote something shorter, noticing as I did that the formerly blank CD now had a serial number. I selected a shorter directory and wrote that. This went quickly, so I returned to the Q&A file. That worked fine, and to test it, I ran the Q&A program from the CD-ROM and used it to examine a dozen or so files.

This was a good test because Q&A uses a complex file-storage format, and if there's anything corrupt in the formatting notes, you'll find out when you read in the program. I had no problems at all; thus, in less than an hour, I made an archive of everything I wrote from 1983 to 1993. It comes to about 14 MB.

THE ADAPTEC SOFTWARE WILL ALSO LET you write audio CDs with a CD Recordable (CD-R) drive. Alex calls this the "Arrrh!" feature, as in "pirate's special," because you can play all or part of your audio CD in one drive and record onto another. You can even assemble albums of different stars performing the same work. You can also play old 33- or 45- or even 78-rpm records, pipe the resulting audio into the Adaptec software, automatically clean up hisses and pops and scratchy noises, and make a CD. I have some very old Paul Robeson 78-rpm records and a badly scratched 33-rpm record of Highlander songs I intend to salvage this way. I love that.

In less than an hour, I made an archive of everything I wrote from 1983 to 1993.

Fair warning: as I write this, I've found some glitches in the writable CD system, particularly if your regular CD-ROM is IDE and you then add a SCSI writable. Most of those problems are sloppy application software. Example: I installed the external Philips CD-R drive on Cyrus, the Cyrix 6x86 P-166. Cyrus has an internal Matsushita IDE CD-ROM drive. New World Computing's Chaos Overlords was the first CD I found in the Games book (I use Case Logic CD "books" to store CD-ROMs), so I tested compatibilities with it.

The Philips CD-R drive displaced the Matsushita IDE CD-ROM drive, taking over the G slot and moving the IDE drive to H. This was more or less as expected; at least the Philips CD-R drive didn't displace the Fujitsu DynaMO or the Iomega Zip, which both live on the Cyrix SCSI string. I was once told that the SCSI ID device number is important in determining drive-letter assignments, but it's not.

Then I put Chaos Overlords into the IDE H drive. It auto-started and offered to play the game. I clicked on play. The system trundled and then demanded that I insert the CD-ROM—from which it had just read the EXE file in the first place. Nothing I could do would change this.

I used Device Manager to assign the IDE CD-ROM to R, so it would stay there regardless of whether the Philips drive was present. Reset the system, booted up with

the Philips drive in the string but turned off. That left me with drive letters G and H free, the IDE CD-ROM at R, and Chaos Overlords played just fine. Reboot, with the Philips CD-R drive turned on. Philips seized G as expected. Chaos Overlords in R would auto-play and demand the CD-ROM.

Could this, I wondered, be a problem because I have both IDE and SCSI CD-ROM drives? I tried it on Pentafluge, which is a pure SCSI system with a Sony internal SCSI CD-ROM drive. Exactly the same results obtained. Then I tried the experiment with MicroProse Software's This Means War, and that played perfectly; and I realized what was happening. Chaos Overlords looks for its CD-ROM in the lowest-lettered CD-ROM drive, and if it doesn't find it there, it looks no further. This Means War keeps searching.

At the moment, the drive-displacement problem isn't fixable: your writable CD drive is probably going to take over a lower drive letter than your regular CD-ROM drive, and software such as Chaos Overlords will be too stupid to survive that. It's particularly dumb when it auto-plays but then can't find the CD-ROM to finish loading. Fortunately, some software is better designed. Incidentally, if auto-play drives you nuts, you can turn it off: click your way through Control Panel, System, Device Manager, CD-ROM, your particular CD-ROM, Settings, and then check the "auto-inform" box. Then restart. Naturally none of this is in the Windows Help system.

Of course, you can make the writable CD drive your only CD-ROM drive. They are, after all, falling in price, they read all CD-ROMs, and you can connect them to your speaker system; why not? The only drawback here is that the fastest writable CD drives I know read at 6×, and while that's fast enough for most things, some games already demand a faster drive. (The "rewritable" CD-ROM drives called CD-RW have all the above problems, are even slower, can't make audio disks, and aren't totally compatible with other drives; if you replace your usual CD-ROM drive, you're better off using CD-R in my opinion.)

The other remedy is to use an external writable drive and leave it turned off; turn it on and reboot to write CDs.

This is likely to be a temporary problem only: I don't think it will be all that long before they make 10× and faster CD-ROM drives that can also write. The writing speed will be slower than the read speed, but it is now.

One thing that may not be fixed soon is the ability of DVD drives to read "gold" writable CD blanks. As of now, DVD drives can read ordinary CD-ROMs just fine, so you could replace your CD-ROM drive with a (read only) DVD drive; but that drive won't read CDs you have written yourself. Most everyone says this is fixable and will be fixed, but there are a few skeptics who think it will never happen. That ought to be clearer by the time you read this. Given the low cost of writable CD media and the falling cost of the CD-R drives, it may not matter. There's no single standard for DVD formats, and writable DVD drives are expensive anyway; it will be a few years before those are popular on desktops.

DVD has a lot of neat features. DVD movies look spectacularly great on a TV screen, when they're encoded intelligently. (Many of the early DVD titles look like a bad VHS copy from a UHF station up the coast 200 miles.) They're all right on your monitor, but the translation from NTSC to VGA is only good, not great. Games and other DVD visual stuff written to be shown on a computer screen are also wonderful; the visuals are stunning.

DVD movies look spectacularly great on a TV screen, when they're encoded intelligently.

Most of us will have a DVD in our future. However, whatever happens with DVD, I'm sure that at least one of my networked computers is going to have a writable CD-ROM drive as well. The combination of ease of use and cheap media is just too useful. I said long ago that CD-ROM would change the world. It did, and in conjunction with cheap scanners, it's about to do it again.

THE BOOK OF THE MONTH IS BY CLIVE MAXfield and Alvin Brown, *BEBOP Bytes Back, An Unconventional Guide to Computers* (Doone Publications, ISBN 0-9651934-0-3). While this looks like a book with a CD-ROM, it's actually an entire course in practical computer application, but presented in an irreverent and amusing way. You "build" your computer on-screen, endow it with many properties, and set it tasks, all the while learning about what goes on inside a computer. Build text editors, hardware simulators, logic engines, and anything else a computer can do. If you work through this book, you will understand your computer a lot better.

The game of the month is Strategic Simulations' Age of Rifles with the follow-on Campaign Disk. British-Indian Colonial Wars, the Austro-Prussian War, the Franco-Prussian War, and many battles of the American Civil War; they're all here and all very playable, hours of game fun and military history.

I'm out of space, and the place is still stacked to the ceiling with good stuff. I'll get to more of it next month. Stay well. B

PRODUCT INFORMATION

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PaperPort Strobe Windows 95, $299; Mac, $329
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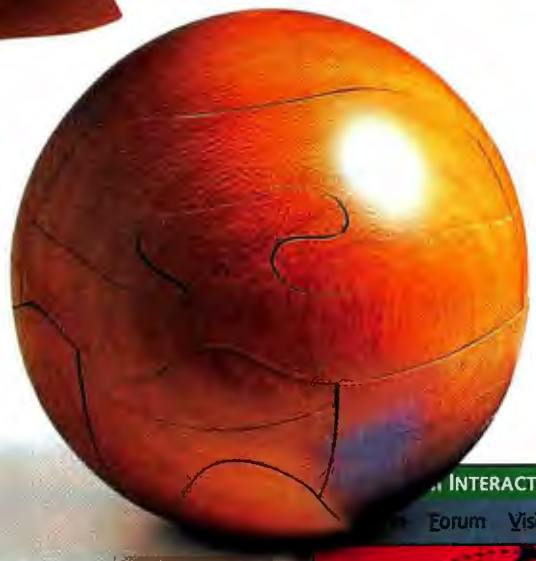

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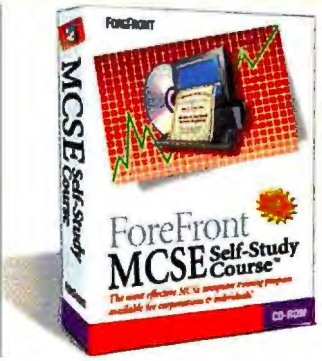

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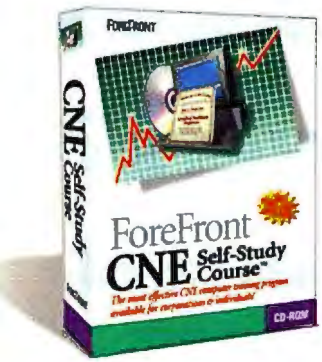

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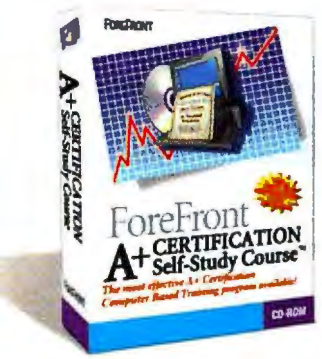

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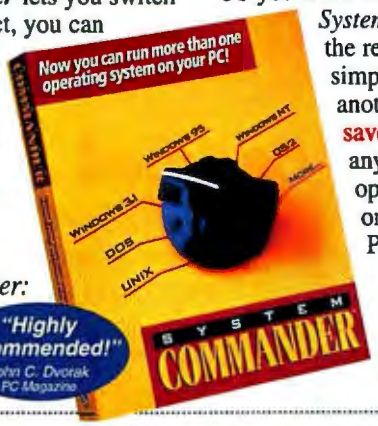

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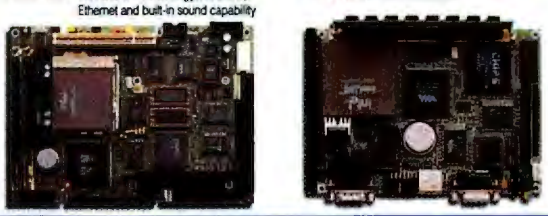

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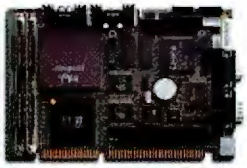

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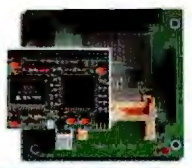

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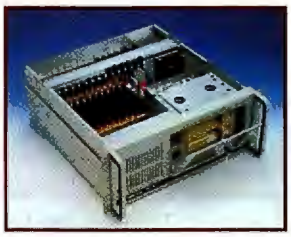

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EDITORIAL INDEX

For more information on any of the companies covered in articles, columns, or news stories in this issue, enter the appropriate inquiry number on the response card. Each page number refers to the first page of the article or section in which the company name appears.

IS pages appear only in the International edition. NA pages appear only in the North America edition. E and K pages appear only in the Reseller edition.

What's New

Hardware

We look at Gateway's newest desktop-replacement notebook, new digital paint brushes from Painter, and an 800-MHz-ready Alpha workstation.

PREVIEW

Solo 9100
$4799–$5999

Enter 979 on Inquiry Card.

Gateway 2000
Sioux City, SD
800-846-2000
605-232-2000
http://www.gateway.com

One Laptop, with the Works

Gateway is touting the Solo 9100 as a desktop replacement, and with 4 MB of EDO video memory, two USB ports, NTSC/PAL video input and output, a fast IR port, and up to 192 MB of EDO RAM, this system has more features than many desktop systems. A 13.3-inch XGA TFT display and a weight of 8.6 pounds make this laptop system too cumbersome for use in an economy-class airplane seat, but it's ideal for taking multimedia demonstrations on the road.

The unit measures 12.3 by 9.6 by 2.2 inches. It includes an external VGA port, a serial port, a parallel port, a PS/2 port, two deep-socketed CardBus slots, a joystick/MIDI port, and a 240-pin PCI connector for docking with the Gateway Solo station or minidocking station. The lithium-ion battery gives up to 5 hours of battery life; actual time will vary with use. It has a full-size 88-key Windows 95 keyboard, which has a very slight throw but is easy to use, even for touch-typists. It also has some new design enhancements for durable use and added functionality. The door that covers the parallel port, serial port, and PCI docking connector locks down when open to prevent breakage. Also, rather than force users to choose between a CD-ROM drive or a disk drive, the 9100's drives are stacked in a single, removable, modular unit. The system comes with either a 150- or 166-MHz Pentium with MMX, a 256-KB pipelined burst cache, integrated 16-bit stereo Sound Blaster Pro–compatible Altec Lansing dynamic-equalization speakers, and the Intel 430TX chip set. The 9100LS, with a 2-GB hard drive and 24 MB of SDRAM, costs $4799; the 9100XL, with a 3-GB hard drive and 64 MB of SDRAM, costs $5999. **—Jason Krause**

PHOTOGRAPH: MICHAEL MAYO © 1997

Security

Security for the Small Office

REDCREEK'S RAVLIN LINE OF STAND-alone security products provide standards-based encryption and authentication for mobile employees and small offices. The Ravlin 4 ($1300) unit has an encryption throughput of 4 Mbps and creates VPNs over private and public networks through DES encryption. The Ravlin 10 ($3500) also uses DES with two 10Base-T Ethernet ports for secure network connections. The Ravlin Remote Access is a version of the Ravlin 10 with the same standard features, but with software that lets remote users log in securely. All three products are designed for Windows 95 and NT installation.

Contact: RedCreek Communications, Newark, CA, 510-745-3900; http://www.redcreek.com.
Enter 980 on Inquiry Card.

Storage

RAID for the Small Office or Home

RAIDPLUS ($179–$499) IS A SCSI host bus-adapter card for small office and home environments. RAIDPlus can support up to eight drives per adapter for mirroring and/or striping capabilities. RAIDPlus is designed for users who want the performance gains that are associated with RAID hardware (mainly for graphics or CAD applications) or for small offices that need reliable backup, which is still typically a high-end solution with hardware of this kind.

Contact: Mylex Corp., Fremont, CA, 510-796-6100; http://www.mylex.com.
Enter 983 on Inquiry Card.

Faster Access to Data

THE SIDEWINDER 50 ($4000) IS A HIGH-end tape backup for midrange servers using Sony's new Advanced Intelligent Tape standard, which supports memory chips embedded in storage cassettes. With a 16-Kb programmable memory chip built

into the data cartridge, the Sidewinder 50 speeds up file access by storing reference information on the chip that is normally stored on tape, reducing seek time. The Sidewinder 50 has a self-cleaning head, Advanced Metal Evaporated medium, and a capacity of 50 GB with data compression or 25 GB native.

Contact: Seagate Technology, Scotts Valley, CA, 408-438-6550; http://www.seagate.com.
Enter 984 on Inquiry Card.

Printers

Create Bigger, Bolder Prints

DIGITAL PHOTOGRAPHERS AND GRAPHIC artists can produce full-bleed color prints and presentation material at 1440 dpi with the Epson Stylus Color 3000 ($1995). The printer can handle paper ranging from 4 by 4 inches to 17 by 22 inches and has a built-in tractor feed and banner

paper holder. It uses Epson's Micro Piezo technology, which accurately and consistently places dots on the page with electromechanical pressure. This process is less heat-intensive than previous technologies, letting the Stylus Color 3000 use faster-drying ink.
Contact: Epson America, Torrance, CA, 800-463-7766; http://www.epson.com.
Enter 985 on Inquiry Card.

One-Stop Digital-Camera Printing

YOU CAN PRINT COLOR PHOTOS DIRECTLY from digital cameras with the RXP-10 digital color printer ($499) without processing photos on a PC. The printer has controls for sharpness and softness, allowing you limited control over photo quality. This eliminates some of the need to use PC-based photo-imaging software for editing and tweaking before printing. Cameras can access the unit through a serial cable, and it prints directly from a digital camera as well as from Windows or a Mac. The RXP-10 prints at 640- by 480-dpi resolution with a digital-camera input or 700- by 480-dpi resolution with a PC connection.
Contact: Ricoh, Sparks, NV, 800-225-1899; http://www.ricohcpg.com.
Enter 986 on Inquiry Card.

Networking

Easy Internet Access

THE MATROX ISWITCH ($999) HAS EIGHT switched 10Base-T Ethernet ports, two enhanced serial ports for modem connections, and wire switching for instant Internet access for small office environments. The iSwitch supports any type of modem, including 56 Kbps and ISDN. With two serial ports and eight Ethernet ports, you can significantly reduce charges to ISP accounts, as well as build a small, high-speed LAN. The iSwitch protects against outside hackers mapping your IP addresses and comes with firewall protection.
Contact: Matrox, Dorval, Quebec, Canada, 800-837-3611 or 514-969-6080; http://www.matrox.com.
Enter 987 on Inquiry Card.

Scanners

A Smaller Desktop Color Scanner

THE VISIONEER PAPERPORT STROBE (Windows, $299; Mac, $329) is an update of the PaperPort desktop scanner, with a new imaging technology and color scanning. The Strobe measures 11 by 2 by 2.5 inches. It scans photos and color or black-and-white documents or business cards, which you can save in various formats. With the bundled TextBridge and PaperPort Links software, you can drag and drop documents or photos into Windows applications.
Contact: Visioneer, Fremont, CA, 510-608-0300; http://www.visioneer.com.
Enter 994 on Inquiry Card.

Systems

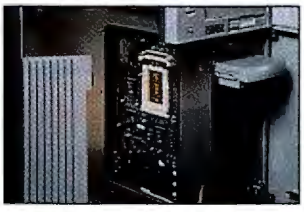
Walking and Talking with Your Computer

THE INTERACTIVE SOLUTIONS MENTIS ($3699) computer measures 5⅛ by 7⅛ by 1⅛ inches. It features a 75- to 166-MHz Pentium processor, a 2.5-GB IDE hard drive, a removable 6× CD-ROM drive, a Sound Blaster Pro audio card, and an MPEG decoder card. You can wear it on the hip with an LCD mounted waist high or with an optional head-mounted monitor. The manufacturer claims the lithium-ion battery lasts 6 to 8 hours. You can use a keyboard, but it is optimized for voice-recognition applications. The programs this product runs are interactive tutorials and diagnostic programs called Real-Time Mentoring, designed for technicians to take into the field and use to make repairs.

Contact: Interactive Solutions, Sarasota, FL, 888-463-0474 or 941-753-5000; http://www.info-isi.com.
Enter 991 on Inquiry Card.

Beat PC Obsolescence

THE NEXAR XPA (STARTS AT $1100), OR Cross Processor Architecture, is a family of mini-tower PCs that feature an easily removable and upgradable motherboard for simplified processor changeovers. The mini-tower chassis is designed for easy access, with a motherboard that slides out. The Nexar motherboard is modular, with the processor, chip set, and memory sockets on one half and I/O controller internals and expansion slots, which are not as susceptible to obsolescence as processors, on the other half. To upgrade, simply slide out the old motherboard and snap a new one in. Nexar has Pentium, Pentium Pro, dual Pentium Pro, and Pentium II boards available.



Contact: Nexar Technologies, Westborough, MA, 888-639-2772 or 508-836-8700; http://www.nexarpc.com.
Enter 993 on Inquiry Card.

Are You Ready for 800 MHz?

THE RUFFIAN IS ENGINEERED FOR POWER-hungry users. It is optimized for 3-D animation and CAD programs. It has plenty of room on the motherboard for new add-in cards. It features six PCI slots, on-board Ultra Wide SCSI, and 10-/100-Mbps Ethernet. The Ruffian RPX Workstation/Server ($5995) supports Alpha processors at speeds of up to 600 MHz currently, and future CPUs up to 800 MHz. The Ruffian runs Windows NT and has 128-bit memory access, 64 MB of memory, and six DIMM sockets, for up to 768 MB of memory boost.
Contact: DeskStation Technology, Lenexa, KS, 800-793-3375 or 913-599-1900; http://www.deskstation.com.
Enter 992 on Inquiry Card.

Add-ins

High-Performance Graphics

THE REVOLUTION 3D ($349 TO $449) IS a graphics card with a new accelerator chip. It supports advanced OpenGL and Direct3D features. An 8-KB on-chip texture cache allows for faster rendering, and an externally mounted 220-MHz DAC provides cleaner video signals to the monitor. A floating-point setup engine coupled with a 128-bit 3-D drawing engine provides enhanced graphics performance.
Contact: Number Nine Visual Technology, Lexington, MA, 617-674-0009; http://www.nine.com.
Enter 990 on Inquiry Card.

Peripherals

24× CD-ROM Drive

THE NEW PANASONIC CD-ROM DRIVES offer a transfer rate of 24× in a standard-size 5¼-inch unit that fits

in a PC drive bay. The drives range in price from $199 to $209 and offer a seek time of 85 ms. At a speed of 24×, the transfer rate equals 4104 KBps. The drives feature CD audio output through a headphone jack and power-save features for controlled power consumption. CD-ROM, CD-Audio, Photo CD, CD-R, and CD-RW are supported, as well as Video CD and CD-I. An MPEG board is needed to support the last two formats.

Contact: Panasonic,
Secaucus, NJ,
800-742-8086;
http://www.panasonic.com.
Enter 988 on Inquiry Card.

A Powerful Pen Tablet

THE STYLISTIC 1200 ($3300) IS A SYSTEM in a pen tablet. It comes with a 120-MHz Pentium processor and has a 1.4-GB hard drive, a USB, and a 128-bit video controller built into a pen tablet. With 16 MB of EDO RAM, expandable to 48 MB, the Stylistic 1200 is a portable system in a hand-held unit without cumbersome keyboards or input devices. It runs Windows NT, Windows 95, or Windows 3.11, and is ready for PC Card add-in WAN radio devices, enabling you to work remotely.

Contact: Fujitsu Personal Systems,
Santa Clara, CA,
800-831-3183;
http://www.fpsi.fujitsu.com.
Enter 989 on Inquiry Card.

Digital Camera

The New Storage Medium: Floppy Disks

WHILE THE DEBATE RAGES OVER THE BEST digital-camera storage medium, Sony turns to an old friend, the 3½-inch 2HD floppy drive. The Mavica ($400–$700) stores images on disks in JPEG format and formats disks in DOS, making them operable with Windows or Mac applications. The camera uses rechargeable lithium-ion batteries, and the LCD screen tells you how much battery life is left in minutes. Disks store 40 images in standard mode and 20 at high resolution. It has a 2.5-inch LCD with a 30-fps video display and built-in flash. The camera has a photo-editing application. There are two models. The higher-end model has a 10-to-1 zoom lens.

Contact: Sony Electronics,
Park Ridge, NJ,
201-930-1000;
http://www.sony.com/mavica.
Enter 981 on Inquiry Card.

Camera, Audio Recorder, and Messaging Center

THE COOLPIX 300 ($699) IS A NEW HYBRID camera, audio recorder, and message-pad product that Nikon is calling a personal imaging assistant. The camera has an output resolution of 640 by 480 pixels, allows continuous shooting at 1 fps, and stores photos as standard JPEG images. The unit includes 4 MB of internal flash memory, which can store 132 images in standard mode or 66 at high resolution, or 17 minutes of audio in the ADPCM format. The built-in touch-screen/2.5-inch color LCD allows you to review images instantly without having to upload them to a PC, as well as write messages with a stylus. You can store these messages separately from the photos or merge them into a photo for documentation.

Contact: Nikon,
Melville, NY,
800-526-4566;
http://www.nikonusa.com.
Enter 982 on Inquiry Card.

SOFTWARE Video

The Future of Videoconferencing

WHITE PINE'S MEETINGPOINT ($1995–$10,000) conference-server software supports the International Telecommunications Union's H.323 standard for conferencing over packet networks. MeetingPoint makes true group conferencing and multipoint collaboration manageable. Any standards-based client, such as Microsoft's NetMeeting, Intel's Internet Videophone, or White Pines' CU-SeeMe, can participate in full multipoint group conferences. Users can participate in conferences regardless of the hardware and software that they use. With MeetingPoint, you can control bandwidth usage in group conferences, minimizing the impact on a network with multicasting and other bandwidth-optimizing technologies.

Contact: White Pine,
Nashua, NH,
603-886-9050;
info@wpine.com;
http://www.wpine.com.
Enter 995 on Inquiry Card.

Programming

Build Applications for Hand-Held Devices

WINDOWS CE AND NEWTON APPLICATION developers have a new development platform, Wright Strategies' FormLogic 3.0. FormLogic ($195 per seat) consists of application model and management tools designed to accommodate the limited computing power and networking capabilities of Newton OS and Windows CE. You use the FormLogic Builder to build applications with standard languages such as Visual Basic and C++ in a visual environment. Developers can create and input images for touch-screens on the Newton MessagePad 130 and 2000 interfaces. Another product, the FormLogic Application Server ($1000 per port), facilitates the integration of hand-held applications with LANs, dial-up communications, TCP/IP, and Cellular Digital Packet Data networks.

Contact: Wright Strategies,
La Jolla, CA,
619-551-6808;
http://www.wrightstrat.com.
Enter 999 on Inquiry Card.

Write and Rewrite Application Rules

PRESENTER/J ($495), A PURE JAVA GUI toolkit, and Advisor/J ($6000 per developer), a Pure Java rules engine, combine to create an open-component framework for building Java applications. Advisor/J is a set of Java class libraries that runs on any Java virtual machine and Web browser that simplifies embedding business rules into an applet, client, or server application. Developers not only add logic and rules to software with this product, but they can also rewrite rules without recompiling applications. Presenter/J is a GUI builder with a set of interface components for Java applications.

Contact: Neuron Data,
Mountain View, CA,
415-528-3450;
http://www.neurondata.com.
Enter 998 on Inquiry Card.

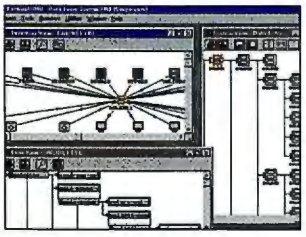
Visual Java for Visual Basic Developers

TWO NEW EDITIONS OF SUPERCEDE, THE Java/ActiveX edition ($199) and the Database edition ($499), make it easier to change applications written in other languages into Java. The Java/ActiveX edition allows you to develop pure Java applets, translate existing Visual Basic projects into Java, and also build Windows-based Internet applications that use Java and ActiveX controls. The new Database edition uses a

drag-and-drop interface to implement Java Database Connectivity for database development.
Contact: Asymetrix, Bellevue, WA, 206-462-0501; http://www.asymetrix.com.
Enter 1000 on Inquiry Card.

Beat the Clock

MICRO FOCUS'S SOFTFACTORY/2000 application suite employs "windowing," a technique that leaves two-digit date fields in place but adds logic that allows programs to differentiate between centuries. Windowing minimizes risk by reducing the overall effort and offers flexible and incremental implementation. Owners of COBOL-based legacy systems use SoftFactory/2000 to identify and reinterpret the logic that dictates how years are read by a system. For $35,000, the Revolve/2000 application assesses and identifies year-



field problems, and the SmartFind module that creates the new logic costs 9 cents for each line of code written. For large legacy systems, this could mean millions of lines of code. To conduct system testing, the Workbench/2000 costs $5000.
Contact: Micro Focus, Palo Alto, CA, 800-872-6265; http://www.microfocus.com.
Enter 1001 on Inquiry Card.

Painter 5 (Mac/Win 95)
$449

Enter 1019 on Inquiry Card.

MetaCreations Corp.
Carpinteria, CA
800-846-0111
408-430-4100
fax: 408-438-9670
http://www.metacreations.com

New Brushes Make You a Better Painter

Fractal Design's Painter has always been a favorite among artists for its brushes that closely simulate natural media. Version 5's new brushes, filters, and other features should broaden its appeal to new audiences without diminishing its status among artists.

One of the most appealing additions is "photo brushes" that you use to touch up scanned photos. These photo brushes let you eliminate scratches or recolor and tint photos. Painter 5 has other new brushes, too. The cloning brushes do more than stamp out images cookie-cutter style; they can also make a photo seem like a painting. The layer brushes are akin to painting on glass overlays. And the gooey brushes do exactly that—turn images into liquid pools that you can pull, push, and pinch.

Some of the cooler and more useful floaters, which are filters that can dynamically apply special effects to a given layer in your image, include liquid metal, which gives the effect of dripping, metallic paint, and glass distortion and kaleidoscope lenses that alter the look of the layer underneath, much as viewing an image under glass would.

Other additions include an improved interface with tear-off tool palettes, the ability to create eye-catching Internet effects fairly easily, and Kodak's Color Management, for consistency in production. Also worth noting are some excellent masking features and the ability to easily share files between Photoshop 4 and Painter (Painter can read and write Photoshop files). Given all these changes, Painter 5 remains a prime paint tool and has evolved into a program that graphic designers and business users involved with professional image editing should consider for their software shelf. **—Jon Pepper**

Peripherals

A Face Your Computer Will Love

VISIONICS' FACEIT PC 3.0 ($99) USES A videoconferencing camera that's mounted on a Pentium-powered PC to control access to your system. FaceIt PC 3.0 automatically detects the presence of a face in video and matches it to a database of authorized users' faces. If someone is not an authorized user, he or she is denied access, the software saves a thumbnail of the person's face and the time they were viewed by the camera, and gives them the option to leave a standard MIME e-mail message with the thumbnail for the system's owner. Authorized faces are saved as standard JPEG files.
Contact: Visionics Corp., Metuchen, NJ, 908-744-1585; http://www.faceit.com.
Enter 1002 on Inquiry Card.

Applications

Is True Interoperability Here?

ANYSOFT'S ANY97 ($69) PROMISES AN open cross-platform application environment for PC users to open any Windows application, including Internet, legacy, and PC. This application-independent tool supports user components installed on a system as part of applications from Microsoft, Lotus, Corel, and other publishers, and activates them using a simple UI. With a single GUI, you can access information from heterogeneous platforms and applications. Currently, Any97 supports only OLE components, but it's slated to support ActiveX and Java in the future.
Contact: Anysoft, Cambridge, MA, 617-868-3397; http://www.anysoft.com.
Enter 1006 on Inquiry Card.

Business

Automated Internet Data Entry

COLLECT DATA FROM INTERNET OR INTRANET resources with Cardiff Software's TELEform ($4995). TELEform creates HTML forms that can be accessed, filled out, and submitted by anyone with a Web browser and transmitted to an Internet server using stan-

dard protocols such as MAPI and POP3. The forms are converted into the appropriate database language and sent to a database for processing. TELEform supports HTML 2.0 and requires access to a Web server for posting forms created with it.
Contact: Cardiff Software, San Marcos, CA, 760-752-5200; http://www.cardiffsw.com.
Enter 996 on Inquiry Card.

New Work-Flow Functionality

NovaWeb is a suite of Java-based document management business applications that document and manage work flow. Two new releases, NovaWeb/Approve ($750) and NovaWeb/View ($50), supplement this suite. NovaWeb/Approve gives employees the ability to review and approve documents via the work flow. With an open-standards approach, it can run through any Java-enabled browser; with an HTML editor, users can create and modify documents. NovaWeb/View is a search-and-view function that gives workers access to documents without the ability to annotate or change text.
Contact: NovaSoft Systems, Burlington, MA, 617-221-0300; http://www.novasoft.com.
Enter 997 on Inquiry Card.

Software Update

Ray Dream Studio release 5, from Fractal Designs, updates the popular 3-D illustration program with new tools for more realistic 3-D rendering. The application includes new object-creation tools, new animation tools (including physically based behaviors such as collision detection and gravity), new rendering effects such as visible lights and depth of field, and a new tool for a hand-drawn look called Natural Media. Ray Dream Studio supports Apple's QuickDraw3D and Microsoft's Direct3D software and hardware accelerators for better on-screen previews. You can export files directly in VMRL for on-line presentation. The program supports drawing programs such as CorelDraw and Adobe Illustrator and lets users import 3DMF or DXF file formats from other 3-D design programs.
Contact: MetaCreations, Scotts Valley, CA, 800-297-2665; http://www.fractal.com.
Enter 1008 on Inquiry Card.

Release 8 of **Lotus cc:Mail**, the popular e-mail system, provides Internet e-mail integration with support for Internet standards, including POP3, IMAP4, LDAP, and MIME. The bundled Lotus Mail 4.5 is a native POP3 connector that lets users access mailboxes from any POP3 client, including Web browsers. Release 8 provides an upgrade path and backward compatibility for cc:Mail release 6 users. This version also includes an enhanced version of cc:Mail for the Web that lets users access a LAN mailbox using a standard browser. This version also includes an SMTP/MIME gateway (which was previously sold separately), a new Windows NT router to support multiple inbound and outbound communications sessions, and a NetWare directory-synchronization utility. The estimated retail price is $55 a seat for volume purchases, including cc:Mail server, cc:Mail SMTP, and cc:Mail Router.
Contact: Lotus Development Corp., Cambridge, MA, 617-577-8500; http://www.Lotus.com.
Enter 1009 on Inquiry Card.

Virus Scan 3.0 ($49) promises improved virus-detection rates with a new Hunter engine that can detect a variety of viruses, including Microsoft Word and Excel macros, boot-sector infectors, multipartite viruses, encrypted viruses, and new viruses written in Microsoft Visual Basic. Hunter includes 3000 new virus detectors and algorithms for the detection of polymorphic viruses. VirusScan Deluxe 3.0 ($69) includes Quick Backup desktop backup software and access to McAfee's Internet backup service for data-storage protection, a supplement to SecureCast, the on-line update service.
Contact: McAfee, Santa Clara, CA, 408-988-3832; http://www.mcafee.com.
Enter 1010 on Inquiry Card.

Backup

Sync Up Your Network

SureSync ($795 per server, $69 per user) is synchronization and disaster-recovery software for managing remote PCs on LANs and WANs. It organizes and manages synchronization between disparate PCs and disparate backup disk drives. With SureSync, you can provide rules and requirements for synchronizing files by selecting unidirectional or bidirectional synchronization, as well as organize directories and files individually. It supports DCOM for secure communication and recognizes when files have been stored multiple times.
Contact: Software Pursuits, Alameda, CA, 510-747-6900; http://www.spursuits.com.
Enter 1005 on Inquiry Card.

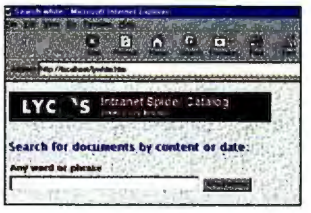
The Web

Build a Bug-Free Web Site

Big Picture Multimedia's Mortar 2.0 aims to be an all-encompassing tool for Web developers. It integrates Java 1.1, Dynamic HTML, and FTP and HTTP clients for automating changes to a Web site. Also, it has a URL-verification tool, for checking all external links, and a site mapper with graphical notations marking any errors within a site to help eliminate bugs before you go live. The program runs on Windows 95 and NT. It costs $499.
Contact: Big Picture Multimedia, Calgary, Alberta, Canada, 888-424-4742; http://www.bigpic.com.
Enter 1003 on Inquiry Card.

Untangle Your Intranet

Inmagic and Lycos's Internet spidering technology is the basis for this intranet-indexing software. Spiders gather and index on-line documents, and this Windows NT spider ($995) automatically builds a catalog database that personnel can search using a standard Web browser. The Lycos Intranet Spider eliminates trial-and-error searching by enabling users to preview



multiple search results and has document management control for redistributing information in the intranet environment.
Contact: Inmagic, Woburn, MA, 617-938-4442; http://www.inmagic.com.
Enter 1004 on Inquiry Card.

Networking

Personalized Windows NT

NuView ManageX 2.0 ($299) extends Microsoft's Management Console for Windows NT with personalized remote-control functions. The NuView Management Console lets managers customize NT and BackOffice functions such as database, security, and operations management according to their everyday needs. There are seven snap-in modules, such as a Reboot/Shutdown module, which reboots systems remotely, and an Event Log module, which prioritizes, filters, and consolidates log messages and can automate functions on remote systems. NuView has SNMP support to handle event messages from consoles such as Tivoli TME.
Contact: NuView, Houston, TX, 281-497-0683; http://www.nuview.com.
Enter 1007 on Inquiry Card.

improbable

Advances and Retreats in Computing

We test a new program that wipes out your info-overload concerns.

The End of Info-Glut

Besieged with mail, faxes, voice mail, e-mail, FedEx, UPS, Western Union, pages, phone calls, and just plain yelling, today's managers are caught in an "Executive Dilemma." As a Reuters wire-service report recently put it, "They believe they cannot operate efficiently without high levels of information. But this heavy load of often-irrelevant data affects their efficiency and clogs the corporate machine." Stilted, but true.

However, help has arrived. We recently tested a program called "Stochastic Cleaner." Stochastic Cleaner claims to "clean your hard disk of all the clutter that you probably don't need," and that's exactly what it does (more about the word "probably" in a minute).

Stochastic Cleaner was developed by WormWare Productions, of Cupertino, California. Three months ago, on a lark, we bought a copy for $4.95 at CompUSA and installed it on our Mac's 10-GB drive. We had no real plans to use it; we purchase and install anything we find in CompUSA for $4.95, on principled whim. Eight weeks later, in one of those coincidences that make you wonder, a review copy of Stochastic Cleaner arrived in the mail. Having forgotten about the earlier copy, we installed and actually ran the new one. Were we impressed: Stochastic Cleaner removed every piece of $4.95 software on that disk—more than 9 GB's worth.

The only $4.95 software programs it did not remove were the other programs manufactured by WormWare Productions (about 600 MB's worth, altogether), including the earlier copy of Stochastic Cleaner.

One terrific thing about this program is that every time you run it, it leaves an extra copy of itself on your disk. That's mighty handy in case you ever need to know how many times you've run it, and it also makes you feel like you've gotten a terrific bargain. In effect, the $4.95 buys you a lot more than just the traditional "single-copy license." We run Stochastic Cleaner every morning. It's a great way to start the day—you feel that you've just gotten a great piece of software for almost free.

Now about that key word "probably." Stochastic Cleaner has no way to really, absolutely, guaranteed-for-sure know what files you will never need, but it makes reasonable guesses. In all the time that we've been using Stochastic Cleaner, we can honestly say that we haven't found a single file that it lost.

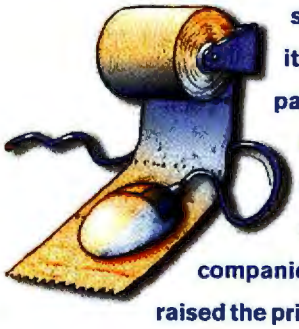
We can recommend this product without hesitation. It's one of those rare ones that does just what its manufacturer claims. Stochastic Cleaner wipes your cares away.

Marc Abrahams is the editor of the Annals of Improbable Research. *You can contact him by sending e-mail to* **marca@improb.com.**

NANO-QUALITY NOTES

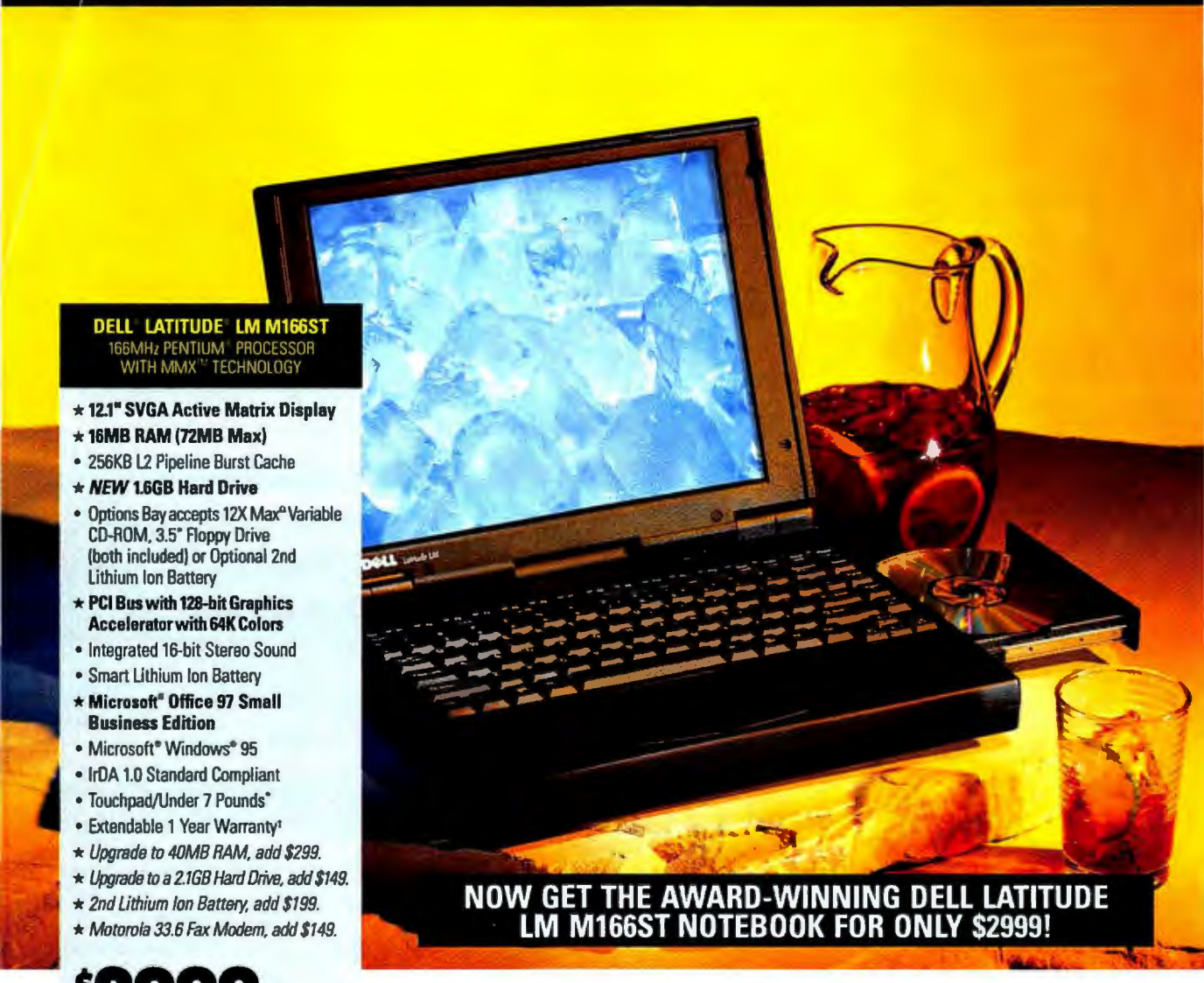
As promised, we have begun publishing our new journal, "Nano-Quality." It's off to a rousing start. CEOs from more than 1200 corporations have written in, asking how they can go about starting Nano-Quality programs within their own companies. To them we can only say this: If you feel the need to ask, then you most likely already have a Nano-Quality program at your company.

Mouse Paper Chase



Following the release of our Mouse Report, the commodities markets have run wild. Our five-year study demonstrated that the best item to use as a computer mouse pad is actually a pad of paper, not the plastic or rubber slabs that are traditionally used. As a result of the report, several major paper companies have in the last two months raised the prices for mouse-quality paper. We will continue to report the details of this exciting story.

QUENCH YOUR THIRST FOR POWER WITHOUT DRAINING YOUR WALLET.



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