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MICRON NETFRAME® LV2000 SERVER

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2GB Ultra-Wide SCSI-3 hard drive
NOS Support (3 incident resolutions/1st year), 7x24

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IS THERE MORE TO JAVA THAN COFFEE JOKES?

Two years ago, the introduction of Java™ software created a whirlwind of excitement and an explosion of coffee-oriented puns. Was it all hype?

At IBM, we think Java is worthy of the stir it created. An idea that brings two benefits to businesses wishing to become e-businesses: one is the promise of standards

and open connectivity, the other is substantially faster application development.

Perhaps the most profound change that the Web has brought to the I/T world is a culture of standards. It's this capability that permits universal connectivity and has allowed 80-million-plus people to access the Web. Java is the first language that allows a single application to run on any platform (write once, run anywhere™).

This can speed the application development process – since you don't have to create a different version of your software for every client, every server and every browser. And since most business environments contain a wide variety of computing platforms, Java is just common sense.

So is the idea of 100% Pure Java™ – a Java that is not corrupted by offshoots and OS dependencies. (We support Sun™ on this issue.)

Is Java perfect? No. Not yet. Like any new technology, it needs refinement. But it's maturing faster than any other language in history and IBM is working to make it real. Recently, we've established Java Solution Studios to work with developers to ensure that the 100% Pure Java applications they create will deliver high performance across a wide variety of operating systems, browsers, tools and applications.

Currently, we have more people working with developers on Java than any other company – creating real-world applications in finance, manufacturing and distribution (to name a few). And we're putting Java to work to solve real business problems.

We're also creating award-winning tools like VisualAge™ software and Lotus Bean Machine.™ These are powerful programming tools that make it easier for independent and in-house developers to build customized e-business solutions (everything from interactive customer service Web sites to collaborative intranets).

To learn more, we invite you to check out the latest IBM developer tools for Java (as well as one or two bad coffee puns) at www.ibm.com/java

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BYTE
COVER STORY
January 1998, vol. 23, no. 1

1998's TOP 25 TECHNOLOGIES

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TALK BACK!!!

BYTE wants your thoughts on the 25 technologies we highlight in this issue. Your individual responses are confidential, but we will publish a report on the overall results. To participate, go to **http://www.marketperspectives.com/tech_invest/survey.cgi.**

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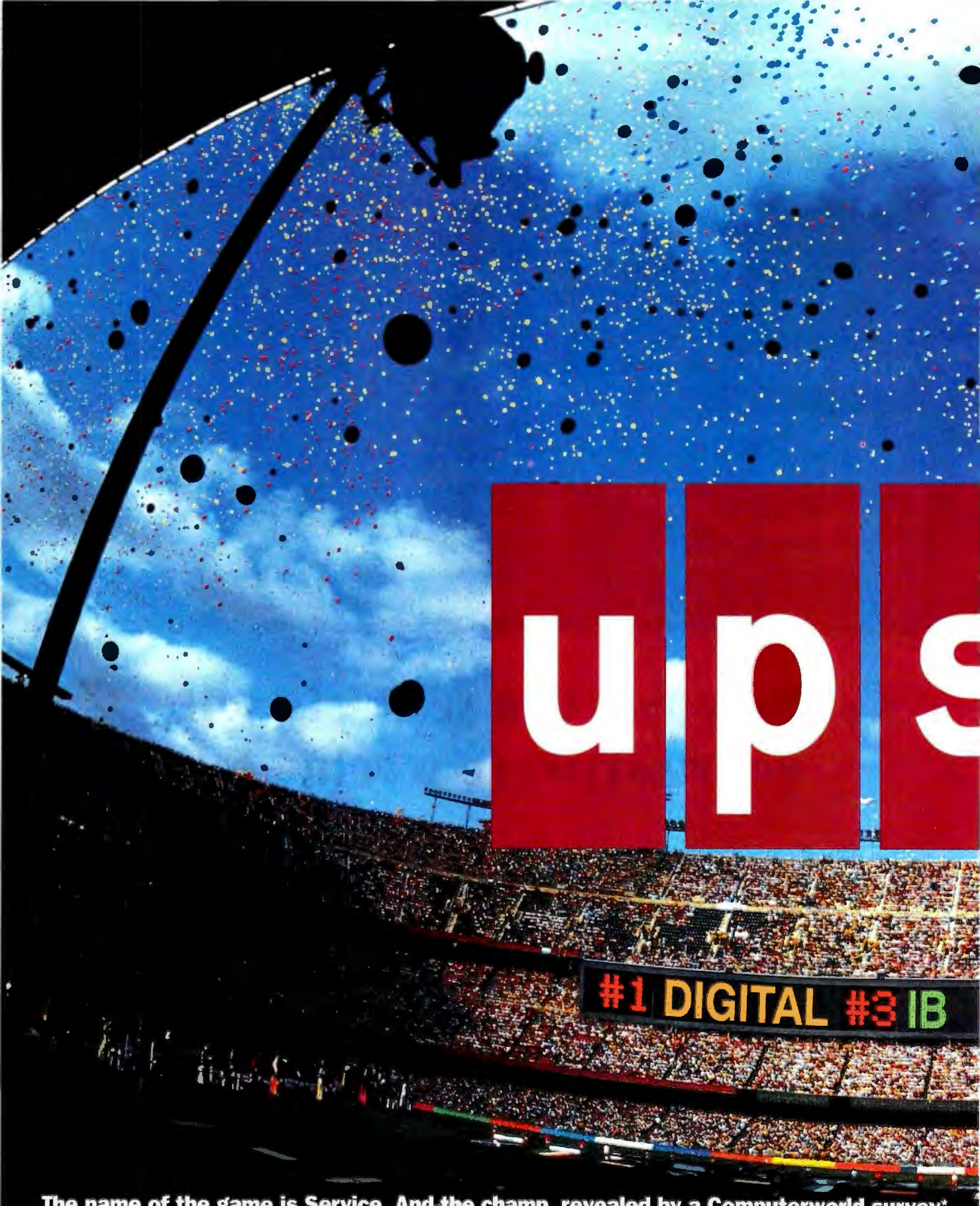

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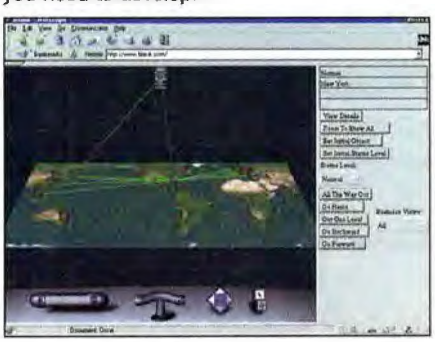

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Auto Discovery	6	9	54	Available Now
Calendar Management	5	8	40	Available Now
Virus Detection	3	7	21	Available Now
Reporting	4	5	20	Available Now
Business Process Views	6	7	42	Available Now
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editorial

Reality Bytes

We give awards to those who should make New Year's resolutions to do better.

It's the end of the year, and everybody's giving out their annual awards. So, what the heck, I'm throwing my hat in. Welcome to the First Annual Reality Bytes Awards.

The business press used to be full of articles about coopitition, a trendy idea that competitors could cooperate to the mutual benefit of themselves and their customers. Well, the trend is over. This year was marked by major nastiness that had everything to do with the quest for total dominance by companies and little to do with concern for their customers' interests. Hence the name of my awards. I'll have to think of a good trophy; a bronzed 8-inch floppy disk might be nice.

The Delayed Gratification Award looked like a lock for Bill Gates with Windows 97, er, 98. But the competition was stiff in this category, and the winner is... Larry Ellison (Yes! He finally beat Bill at something!) for the Oracle NC. In March *1996*, we ran a picture of a prototype Oracle NC that Ellison had flown to Japan to unveil. It looked great, but it was a year and a half before anyone could buy one. Honorable mention to Computer Associates for Jasmine, the object-oriented database that yearns to be.

The George Santayana Award for Historical Farce is no contest. Hands down, this award goes to Steve Jobs for killing the Mac-clone market. Let's see, if we prevent our customers from buying better products at lower prices, they'll flock to us, right? Commercials to the contrary, thinking differently at Apple owes nothing to Albert Einstein.

The AOL Customer Service Award goes to... AOL, which showed the most AOL-like customer service on the Internet by converting to a flat-rate plan without installing the needed infrastructure. To add insult to that injury, AOL slows down your Internet experience further with constant pitches for credit cards, products you don't need, and anything else it can think of.

As usual, Microsoft was a contender in this category, but we couldn't find anyone in customer service at MSN to actually give an award to. Next year, maybe.

Speaking of junk e-mail, **The Golden Spam Award** is already in the inbox at CyberPromotions. King of the broadcast bandits, it proved that you can never have too much bandwidth, but you can certainly do too little of worth with it.

While we're on the Internet, let's give **The Betamax/VHS Award** to modem makers U.S. Robotics and Rockwell and countless others for having two, count 'em two, 56-Kbps-modem technologies. Will there be one standard before we move on to digital subscriber line (DSL) or ISDN or something cooler? What's that? I'm getting two different answers.

The Planned Obsolescence Award goes to Microsoft for making Word 97 incompatible with virtually the entire world's collection of Word documents. What was Microsoft thinking? It's since patched Word 97 up in an effort to silence the howls of disgust from users. But style sheets are still incompatible and can cause machine-locking crashes (readers of this column will recall my previous woes—this turned out to be the source).

The Microchannel Award has finally lost its home at IBM and moved to San Jose. In a fit of hubris, Intel decided that it's the only microprocessor supplier in the world (a monopoly's reach must exceed its grasp, or what's a heaven for?) and locked its product inside a little black box called a single-edge cartridge. It's my way or the I-Way, says Andy Grove. Only time will tell how much damage to the once-unified x86 architecture this will cause.

Was there any good news this year? Sure. Hats off to the Internet Engineering Task Force (IETF) and everyone who kept the Internet running in a year in which it really took off. Unlike Apple, **Novell** conceded it was its own worst enemy and hired new management that's brought some fresh thinking to nearly everyone's network OS supplier. And a special hats off to the tens of thousands of developers who have taken **Java** and **ActiveX** by the horns and begun to do some impressive things, despite the hysteria on both sides of this technology.

You can never have too much bandwidth, but you certainly can do too little with it.

Mark Schlack

Mark Schlack, Editor in Chief
mschlack@bix.com

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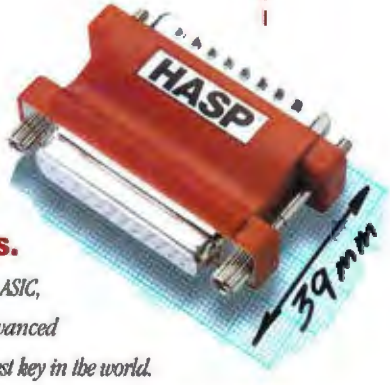

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inbox

Stop at Gateway, Pay Toll

I enjoyed "Fiber in the Sky" (November Cover Story), but I have a question: Has TCP/IP been modified yet? An article by Jube Shiver Jr. in the *Los Angeles Times* on October 3, 1996, contended that "electronic data can take as long as half a second to travel up and down to Earth from geostationary satellites," slowing communications between computers, because "the delay causes TCP to believe there is a backup in the network, which in turn disrupts the electronic acknowledgments" passed between the receiving and sending computers. The article also cites a NASA experiment in which 155-Mbps communications over fiber-optic landlines dropped to "just 10 Mbps when NASA used a satellite communication network," adding that "satellites orbiting at closer distances to Earth can also be adversely affected," contrary to Teledesic's claims. I am a satellite supporter, but this seems like a big hurdle to jump. Have things improved that much since last year?

Dean M. Riley
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The main problem is with TCP's mechanisms for ensuring that the line is alive. There are timers all over TCP—kernel timers that system administrators can modify, such as TCP_KEEPALIVE, and timers in the protocol itself. These timers do assume that the link, although possibly low-bandwidth, isn't highly low-latency.

Calculating the round-trip delay to a geosynchronous earth orbit (GEO) satellite comes out to about 0.24 second (the speed of light up to GEO orbit and back). The rest of the delay, if any, is in terrestrial gateways—the same gateways that any satellite system must go through. So, a low earth orbit (LEO) satellite may be at 0.03-second latency, a GEO at 0.24 second, but both will have some overhead at the gateway.

While Teledesic's representatives like to imply that this latency problem hasn't been solved, the very small aperture terminal (VSAT) vendors such as Hughes have already modified the TCP stacks in their gateways. In essence, they "spoof" the client into thinking the connection is low-latency.

While there is yet no standard for modifying TCP to work over high-latency links, if you bought into a GEO-satellite system today, it would bring with it a solution to the latency problem.
—John Montgomery, West Coast bureau chief

We've Been There Before

Congratulations on the excellent "Fiber in the Sky." The broadband satellites offer a lot of promise. Note, however, that Ka-band concepts were conceived and executed well before NASA's interest in Ka-band. A thorough presentation on a conceptual 30/20-

GHz system appeared in 1969 in *Bell System Technical Journal*. I presented a paper at the June 1977 Radio Science Meeting at Stanford showing the advantages of 40- and 90-GHz satellite links. From a working system viewpoint, the Japanese have been commercial at Ka-band for a decade. They are presently launching a 44-GHz spot beam for Tokyo, for which there is no corresponding NASA program.

The 1997 International Society for Optical Engineering (SPIE) Voice, Video, and Data conference includes a millimeter-wave session. The relative advantages and nuances of 40- and 90-GHz links will be discussed. Papers will appear in *Proceedings of SPIE*, vol. 3232. (See http://www.spie.org for details.)

Paul Christopher
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The New Physics

I enjoyed "Fiber in the Sky," but there was an inaccuracy in the discussion of the speed of light in the text box "Physics Is Everything." It was given as "300,000 kilometers per second or 187,500 miles per second, which is usually rounded to 186,000 miles per second." All these numbers are OK except 187,500. Perhaps what was meant was 186,300 miles per second. To a bit more accuracy, the speed of light in a vacuum is 299,792 kilometers per second or 186,282 miles per second. When traveling through matter, it is less.

Jim Morgan
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Thank you (and other sharp-eyed readers) for pointing out our attempted tampering with the fundamental constants of physics. As an admitted physicist, I should have caught this long before printing.

—Edmund X. DeJesus, senior technical editor

Farming the Web

I read "Farming the Web" (October Core) with interest and believe that the technology our company is developing is relevant to the article.

We have been working for a year on what we call Virtual Database (VDB) technology. We have built the first commercial-strength version of the technology and applied it successfully to recruitment advertising on the Web. We gather listings of jobs from employers' Web sites and normalize them into a SQL-searchable on-line recruitment database. For details, go to http://www.junglee.com/products/whitepaper.html.

Anand Rajaraman
Chief Architect, Junglee Corp.
anand@junglee.com

Too Hot for Socket 7

Bemoan an Intel "bent on dictating not just processor architecture but computer architecture as well" all you want (October Editorial), but Socket 7 has to go. A few years from now, slapping the CPU on the motherboard just will not do. Why not? Heat and cryogenics. At room temperature, the fastest microprocessor today runs at 600 MHz. Maybe we can push it to 2 GHz. But if you want 20 GHz, the CPU and supporting chips must be cooled to liquid-nitrogen temperatures. To do that, you need a self-contained module. This will be the advantage of Slot 1.

John Kominek
jkominek@cs.cmu.edu

You raise a good point. Actually, I believe people have already demonstrated 200-MHz Intel chips running at more than three times that speed in cryogenic environments. Perhaps this is the direction that future chips will take. Even so, I don't see why the technical requirements for a sealed module dictate a commercial policy of closing the architecture. Our concern remains over the possibility of reducing innovation and fragmenting the PC architecture in a senseless bid to move from overwhelming dominance to total monopoly.—Mark Schlack, editor in chief

Object-Database Mythology

The BYTE article "Debunking Object-Database Myths" (October) contains some myths of its own. The comment that "The RDBMS model is based on sets of rows with columns, and it can be seen as 2-D" betrays a lack of understanding of RDBMS theory. The common perception that relations are 2-D is incorrect. A relation is *n*-dimensional, where *n* is the number of attributes of the given relation.

The authors also state that a relational database cannot contain objects. It can. The domain for an attribute does not have to be limited to text or numeric values. It can contain binary large objects (BLObs), blueprints, maps, or any complex business objects. Because a relation is a logical, not physical, structure for data, there is nothing in the relational model to govern how these objects are physically stored. That is up to the vendors. There is nothing about a relational database per se that excludes objects.

Randell Grenier
Waltham, MA

You can think of the attributes as "dimensions" and the rows as "vectors," but I find that leads you to ask what the meaning of a table is in that framework. It also implies that the attributes have to be orthogonal to each other in some sense. I prefer to model a table as a

set of entities of one class or kind. The rows represent members of this set, and I don't look at the columns in those rows when I am at the table level. When I move to the level of each entity, the columns expose some, but not necessarily all, of the attributes of that instance of an entity. Otherwise, altering a table by adding or dropping columns would make it a new kind of entity set.

I do understand the difference between physical and logical data models; that is not the issue. While a column need not be limited to text, temporal, or numeric values, it must have scalar *values. The relational model must be able to use theta operators on the values in a row, and theta operators apply only to scalar values. An object is not scalar; it has behaviors that can expose different parts of its internal structure to different questioners in different contexts. A scalar value is always the same, regardless of the context or questioner.*
—Joe Celko

Open Java

Regarding "Industry Warfare: What's Up with That?" (October Editorial), I think Sun has done a much better job being open about Java than Microsoft has about ActiveX. Java is sufficiently well documented and well designed that several implementations exist. The JDK 1.2 APIs provide simple-to-use, cross-platform access to the functionality sufficient for implementing most business and home applications.

ActiveX is for all practical purposes defined by its single implementation (all versions for other platforms that I know of are based on the same code base used for the Windows implementation), and that relies heavily on the vaguely specified, constantly changing set of APIs that make up Win32. To me, these differences mean that Java is more open and that Sun and other Java companies are more desirable vendors to work with than Microsoft.

Thomas M. Breuel
San Jose, CA

I don't disagree that in year 1 of Java, Sun has done a good job of keeping its proprietary platform open, if you'll forgive that oxymoron. Or that Microsoft hasn't done that over the years. But I don't think the entire IT community—or other Java-based companies—wants to depend on Sun's good will for years to come to guarantee their investment in openness.—Mark Schlack, editor in chief

Toothpicks, Please

I was delighted to see your revelation concerning 4-D images (November Improbable). Your viewing requirement of 4000–4500 seconds without blinking inspired me to consult with a lawyer friend about potential liability issues. My friend assures me that, were I to go blind from lack of

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moisture on my eyes due to not blinking, I could find judgment against you, your magazine, Mr. Papadopoulous, and the state of Idaho. Even though being forever sightless, I would finally have the satisfaction of knowing I had profited from the application of electronics in everyday life.
Chuck Bake
cfbake@pscnet.com

FIXES

The Bug of the Month column in October (on page 23) implied that the Mars Pathfinder's OS, WindRiver's VxWorks, had a mutual-exclusion problem. According to the Jet Propulsion Laboratory, the problem was caused by an application running on the Pathfinder.

In "Fooling Around with the Web" (November Chaos Manor), we confused TweakDUN, from NetPro NorthWest and Patterson Systems Design, with Microsoft's Dial-Up Networking (DUN) 1.2 upgrade. For the record, TweakDUN did not cause the problems Jerry described.

COMING UP IN FEBRUARY

BUILDING NETWORK APPLICATIONS
Java Development
What is a JavaBean, and why is it different from normal Java? BYTE explains what makes Beans special and how they differ from ActiveX controls, and also examines the latest developments in Beans.

MANAGING DATA
The Future of Storage
BYTE explores the near future—spin valve and other giant magnetoresistance materials for hard drives—and far future—holographic storage—of the technologies we'll use to preserve our data.

NETWORK INTEGRATION
Internet 2
The government and educational institutions are behind the next high-speed version of the Internet. Will it ever get off the ground, or will political wrangling kill it forever?

LAB REPORTS
Hard Drive Blowout
NSTL puts 4.5-GB-and-up SCSI and EIDE hard drives through a battery of performance tests to see which company has the drive to succeed.

Publish & Subscribe
The BYTE Lab tests leading-edge software for publishing Web content and applications the smart way: TIBCO's TIB/Rendezvous, Talarian's SmartSockets, and Open Horizon's Ambrosia.

REVIEWS
Work Flow for the Web
A hands-on comparison of Web-based collaboration tools, including Lotus TeamRoom, Instinctive eRoom, and more.

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Java Poison or Just PR?

The lawyers are busy, and developers concerned, as Sun and Microsoft fight over Java compatibility in court.

Has Microsoft poured a poisoned cup of Java? Or has Sun unfairly singled out one competing vendor when it accuses Microsoft of deliberately misleading programmers and failing to deliver a compatible implementation of Java technology in its products?

These questions and others were thrust into the spotlight when Sun filed its lawsuit charging that Microsoft breached its contractual obligation to deliver a compatible implementation of Java technology. Microsoft's countersuit charges that Sun failed to deliver technology that passes Sun's own compatibility test suites, hasn't delivered a public set of test suites, and doesn't treat Microsoft the same as other Java licensees. As the lawsuits wend their way through the U.S. legal system, some programmers worry that Java and its promise of "Write Once, Run Anywhere" is splintering even more into vendor-specific versions.

Sun charges that with the release of Microsoft's Internet Explorer 4.0 and version 2.0 of the Software Development Kit for Java (SDKJ), Microsoft modified key class libraries of Java. The result, Sun says, could be that developers would unwittingly write programs they think are cross-platform but actually work properly only with Microsoft's latest Java-enabled programs (e.g., IE4). Sun also accuses Microsoft of not supporting standard core Java features such as the Java Native Interface (JNI), an API that lets the Java run-time interpreter invoke native code. Instead, Microsoft ships its own Raw Native Interface, which the company claims offers better performance. Microsoft says doing so is within its rights of the agreement, as is adding methods or fields to Java classes.

Microsoft's latest SDKJ does have

The Code Shows: Added Methods Can Result in Errors

Microsoft Documentation

Enhanced Locale Support

The Microsoft VM includes the following enhancements to the internationalization.

- Locale support for all locales supported by Win32. This forty locales to the locales supported by JDK 1.1, inclu writing (for example, Locale.JAPANESE_VERTICAL).
- A new method, getLCID, to get the locale identifier.
- A new method, getCodePage, to get the code page as

Microsoft's documentation for its SDK for Java has information on new methods and locales that are enhancements to the JDK 1.1 standard. Programs written using these methods would run correctly only on Java platforms that implement these enhancements, such as Internet Explorer 4.0.

getDefaultLocaleList

```
public Locale[] getDefaultLocaleList();
```

Gets a list of all predefined **Locale** constants.

Return Value:

Returns list of predefined **Locale** constants.

One of the new public methods introduced to the java.util.Locale class, getDefaultLocaleList(), is also documented, but not in a way that clearly indicates this is a Microsoft enhancement.

BYTE-generated Applet

```
import java.util.Locale;
import java.applet.Applet;
import java.awt.*;

public class MyTest extends Applet {
  Locale us;
  Locale newUs;
  public void init() {
    us = Locale.US;
    int lcid = us.getLCID();
    newUs = Locale.getLocaleFromLCID(lcid);
  }
  public void paint (Graphics g) {
    g.drawString (newUs.toString(), 20, 20);
  }
}
```

Executing this applet that uses Microsoft-specific methods results in an error message with a non-Microsoft browser.

Resulting Error Message

Java Console

```
# Applet exception: error: java.lang.UnsatisfiedLinkError: getClassContext
java.lang.UnsatisfiedLinkError: getClassContext
    at java.util.ResourceBundle.getLoader(Compiled Code)
    at java.util.ResourceBundle.getBundle(Compiled Code)
    at java.util.Locale.getLCID(Compiled Code)
    at MyTest.init(MyTest.java)
    at netscape.applet.EmbeddedAppletFrame.run(Compiled Code)
    at java.lang.Thread.run(Compiled Code)
```

new classes, methods, variables, and other components that are not part of the JDK 1.1 reference platform. Sun officials say the more troublesome of the additions are the new public methods added into key Java libraries, such as getWin32Index added to java.awt.SystemColor, or the five new methods added to java.util.Locale. "Developers can unwittingly use these additions, not realizing that their code will then be nonportable," says Carla Schroer, engineering manager responsible for Java compatibility at Sun's JavaSoft division.

Microsoft officials react to such charges with dismay. "Sun's lawsuit is pure PR," says Joe Herman, product manager of Internet Platforms at Microsoft. "Numerous articles and reviews have said Internet Explorer [4.0] is the most compatible, fastest-performing browser available."

Microsoft might be justified in feeling unfairly singled out. Netscape Communications has also added public methods to key Java class libraries and has also failed to offer JNI support (though Netscape officials say that JNI support is coming). Microsoft officials object to the original lawsuit's charge that the company has failed to support remote method invocation (RMI), although Microsoft had posted RMI to its Web site. "These all boil down to non-issues," says Herman. "Netscape added methods, and Netscape doesn't implement JNI either. So what is the issue here? It's one-sided. Sun is looking for a scapegoat." Sun officials disagree. "There are 117 Java technology licensees today," says Sun's Schroer. "If everyone went and added whatever they wanted into Java packages, it would be total chaos."

Who is right? That's for the courts to declare, but both vendors appear to have valid claims. You can write an applet that is Microsoft-specific using the new SDKJ (see the example at left), but Microsoft is hardly unique in that regard: At press time, Netscape had information on its Web site about how to write programs using some of its modified Java APIs. (Netscape recently removed the Java logo from Communicator 4.04.)

The suits could have a positive effect: increased publicity for Java, the importance of cross-platform compatibility, and the "Write Once, Run Anywhere" concept. In the meantime, programmers who want to write portable code should take care to avoid vendor-specific code.

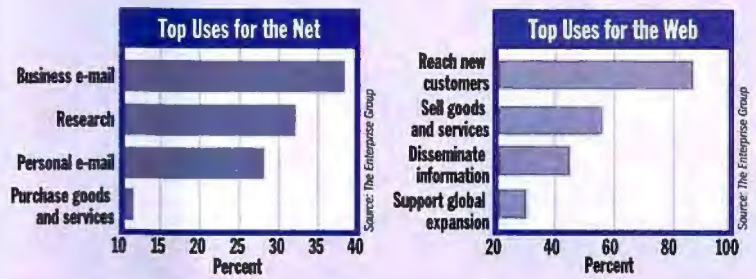
– Dave Andrews

Geek Mystique

Net Use Increases in Small and Midsize Businesses

The number of small and midsize businesses using the Internet has almost doubled in one year, according to a recent survey. In 1996, 25.8 percent of such businesses used the Net, a figure that grew to 43.1 percent in 1997, according to the sixth annual survey conducted by Arthur Andersen's Enterprise Group and National Small Business United. Additionally, the number of such businesses that have home pages on the Web grew from 7.6 percent to 12.6 percent in the same period. Top use for the Net: e-mail. For the Web: reaching new customers.

– Dave Andrews



Big LCDs Plentiful, but Still Pricey

The biggest trend in displays isn't in the size you see—it's in the size you don't. Virtually every major monitor manufacturer is introducing LCDs with panels that match a CRT in viewable area and overall performance but cut out the weight, depth, and general hunger for desktop real estate that larger CRTs demand. True, the LCDs still command a hefty price premium versus a comparable CRT. However, as models proliferate and prices continue to drop, this year should mark the beginning of a slow but sure market growth for flat panel displays on the desktop.

"There are lots of applications that lend themselves to LCD panels because of the low power consumption, excellent resolution, and small overall footprint," says Lee Schugar, industry analyst with the Technology Directions Program at Gartner Group/Dataquest (San Jose, CA). "People involved in desktop publishing, medical fields, financial, military, and many other areas will begin to buy more of these new models coming onto the scene."

NEC, Panasonic, Samsung, Mitsubishi, Nokia, Viewsonic, and Nimantics are just a few of the vendors selling thin displays. For example, the Nokia 300XA is a 13.3-inch edge-to-edge display that is only 2.4 inches thick and weighs just 10 pounds, and will probably sell for $2249, including a built-in amplifier and speakers. IBM's new family of LCDs ranges in size from 14.5 to 16.1 inches; prices range from $2795 to $4595.

Several other displays, ranging in size from 13 to 15 inches, will be on the market. Given their edge-to-edge viewing area, these thin LCDs approach a 17-inch CRT in terms of actual screen space, and 16-inch panels approach the viewing area of a 19-inch desktop CRT monitor. At the high end, 17- to 19-inch LCD panels that

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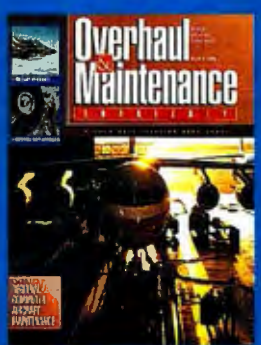

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AVIATION WEEK GROUP

Samsung's new LCD will sell for less than $3000.

sell for up to $9000 will be available—expensive but still worth it for those who want the lower emissions or thin profile. "You need the cost to be about two times or so of a CRT to make a dent in the CRT market," says analyst Schugar. Prices are currently closer to 5X right now, and Schugar predicts LCD prices won't hit the 3X price range compared to monitors with similar viewing area before the third quarter of 1998. That, he says, is an optimistic forecast.

For now, most vendors are not expecting to sell LCDs in high volume. Most analysts predict it will still be years before flat panels become more widely used with desktop computers, except for niche markets or those people with plenty of disposable income. "The bottom line is they are still too expensive to take much more than maybe 5 percent of the market by the year 2000," says Ed Buckingham, an analyst with International Data Corporation (Framingham, MA).

To reduce LCD prices, some manufacturers are using passive-matrix technology, which is less expensive, or shaving features. One example: Sharp recently announced a 12.1-inch passive-matrix LCD that's capable of full-motion video thanks to its high contrast and fast response time (fast for a supertwist nematic display).

Another example: NEC's new 14.4-inch MultiSync LCD 400V (about $1998) has almost all the features of the company's older 14.4-inch LCD (which costs $2699). The 400V saves cost by eliminating NEC's Extraview technology that allows viewing from angles of up to almost 180 degrees. Analyst Schugar says that if consumer demand increases for LCDs, manufacturing output will increase and prices will drop more rapidly than currently projected.

–Jon Pepper

Nokia's 300XA weighs just 10 pounds.

Future Watch

Intel Gets Into the Alpha Biz

1 That's the number of years Intel claims it will take to make Digital's main semiconductor facility profitable, once Intel assumes control. In an attempt to settle a patent dispute over technology used in the Pentium processor, Intel recently agreed to buy Digital's semiconductor operations for $700 million, plus other considerations such as chip licensing fees and Intel processor discounts to Digital. Intel gets a chip facility for less than the estimated price tag of $2 billion needed to build a new facility. Digital sheds its unprofitable facility while retaining ownership of the Alpha processor itself.

10 is the number of years (according to reliable sources) that Intel is obligated to continue producing the Alpha once it takes over the plant (the deal is still subject to approval by the U.S. government).

1 is the number of operating systems (Digital Unix) Digital says it will help port to Intel's forthcoming Merced processor, expected to ship in 1999.

25 That's how many years Digital officials said Alpha would be part of the company's strategy back when it introduced the chip in 1992.

Remote Access Supports Analog/ Digital Mix

Effective remote access today requires support for a diverse mix of analog and digital technologies. The latest generation of remote access servers provides this capability and more; most can support analog, 56K, and ISDN over a single set of phone lines using modems that automatically identify the type of incoming call and handle it appropriately. This allows you to choose the remote access method that best suits each situation, knowing that you're prepared to field calls of any type.

A wide range of remote access options is available, depending on your requirements and budget. Products that offer more room to grow generally cost more, but they often return the investment later when you need to upgrade. Ariel's Rascal RS 1000 (see the table on page 27) typifies the more economical solution. The Rascal RS 1000 ($11,500) has 24 ports on two PC cards that plug into an NT server the customer buys separately. At the other end of the spectrum, 3Com's Total Control Enterprise Network Hub costs about $41,500 for a 24-port version, but it offers better management and more expandability. (A 24-port modem card expected later this year will allow the TC Hub to support approximately 300 ports per chassis.) The hub's Total Control Manager, a graphical utility, lets an administrator configure settings for individual modems. Products such as the Livingston Portmaster 3 ($17,300 for 24 ports, expandable to 48 ports) and the Ascend Max 2024 ($15,420 for 24 ports, available in 12- or 24-port ver-

sions) fall within these price ranges.

One ongoing trend with these remote access servers is increased demand for 56-Kbps communications. Vendors of remote access servers are promoting their support for 56-Kbps connections over analog phone lines, especially to Internet service providers who want to reduce the wait for their customers. In fact, Livingston recently announced that it will merge with Lucent Technologies, promulgator of the K56flex technology. As is often the case in the analog modem world as new standards emerge, however, vendors are releasing prestandard products

Ascend's Max supports analog and digital connections to an ISP or office.

now, with promises to upgrade at a later date. Two 56K modem solutions, x2 and K56flex, are available today, and they aren't compatible with each other. Few (if any) network access servers support both. To further complicate matters, the International Telecommunications Union (ITU) is expected to finalize a new standard within the next year that will replace both, rendering any non-upgradable products obsolete.

Several entirely new technologies, such as digital subscriber line (DSL), are also on the horizon. Most remote access servers are software-upgradable and promise to support the final ITU 56K standard, but technologies such as DSL will probably require upgrades to server hardware. Modular products are the most likely to support these cutting-edge technologies as they become available.

All of these solutions assume that you're starting fresh. If you already have a remote access server in place, and it uses separate modems or a modem pool, you can upgrade just the modems. A modem bank such as the 3Com MP/8 I-modem or MP/16 I-modem will allow you to upgrade only your modems to the latest technology with less cost and administration hassles than replacing the entire installation. **–Keith Levkoff**

Keith Levkoff is a senior product analyst at Progressive Strategies (New York City), a technology assessment and market research firm.

Bug of the Month

Your Call Did Not Go Through...

Here's a cautionary tale of how things can break when an area code changes. Almost every major metropolitan area in the United States has already diced, or will soon dice, its area codes into smaller geographic zones with new area codes. Generally when this happens, if you dial someone who used to be in your area code but is now in the new area code, you dial only 10 digits (area code + seven digits) instead of dialing 11 digits (1 + area code + seven digits). The phone companies don't require the "1," even though you are dialing a different area code, so that customers don't think they're being charged for a long-distance call.

This may not seem like a big deal, but these changes will be a headache for most computer users. For example, the phone dialer and modem control in Windows 95 automatically dial a 1 before dialing a number with an area code. Microsoft is aware of the problem (Seattle's 206 area code was split and a 10-digit plan instituted in November). Several Win 95 work-arounds have been posted, but these must be performed each time you dial a number. In Windows 98, you will be able to set dialing properties, and a new tab called Area Code Rules lets you program your system to handle 10-digit dialing.

The biggest flaw with most 10-digit dialing plans is that they are unnecessary, according to Bell Atlantic officials. Dropping the "1," government officials say, indicates to people that they aren't paying for a toll call. But officials at telcos say bureaucrats don't understand the capabilities of telephone backbones. "[The Department of Public Utilities'] idea is that dialing a 1 is a toll indicator, a flag telling you that you're paying long-distance rates," says Tom Desisto, executive director of state relations at Bell Atlantic. "But we [Bell Atlantic] have the technology to charge people the correct rates no matter how they dial a number."

It remains to be seen what the impact of 10-digit dialing will be, But it could also cause some companies enormous headaches in reprogramming databases, akin to Year 2000 legacy problems. **– Jason Krause**

jason.krause@byte.com

Analog/Digital Remote Servers at a Glance

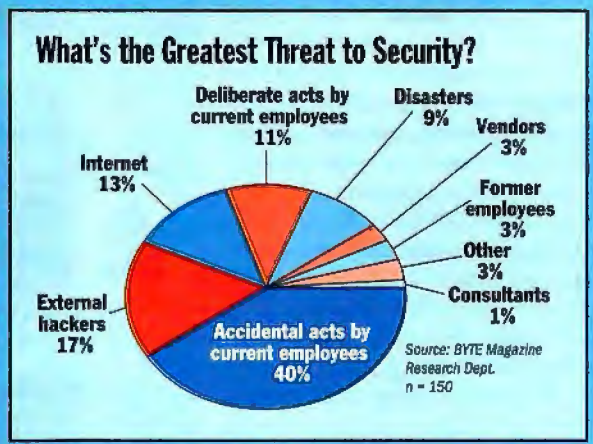
	Form Factor	Maximum number of ports	Price for 24 ports[1]	Supports analog, 56K, and ISDN	Type of 56K technology
3Com Total Control Enterprise Network Hub 800 NET 3COM; http://www.3com.com	Chassis with cards	48	$41,500	Yes	x2
Livingston PortMaster3 Integrated Access Server 800-458-9966; http://www.livingston.com	Chassis with cards	48	$17,300	Yes	K56flex
Ascend Max 2024 800 ASCEND4; http://www.ascend.com	Chassis with cards	24	$15,420	Yes	K56flex
Ariel Rascal RS1000 609-860-2900; http://www.ariel.com	Separate card (host PC provided by user)	24	$11,500	Yes	K56flex

[1]manufacturer's list price for a typical configuration

Survey

The Enemy Within

When it comes to network security breaches, threats from external sources—such as hackers, the Internet, disasters, vendors, and former employees—aren't even the half of it. Results from a recent survey of 150 BYTE readers, conducted by the BYTE research department, indicate that current employees are the greatest threat to an organization's security. According to readers responding to the survey, many breaches occurred because employees failed to follow proper security procedures, or management had failed to tell employees about changes in security procedures.



Apple Macs Get Faster and More Affordable

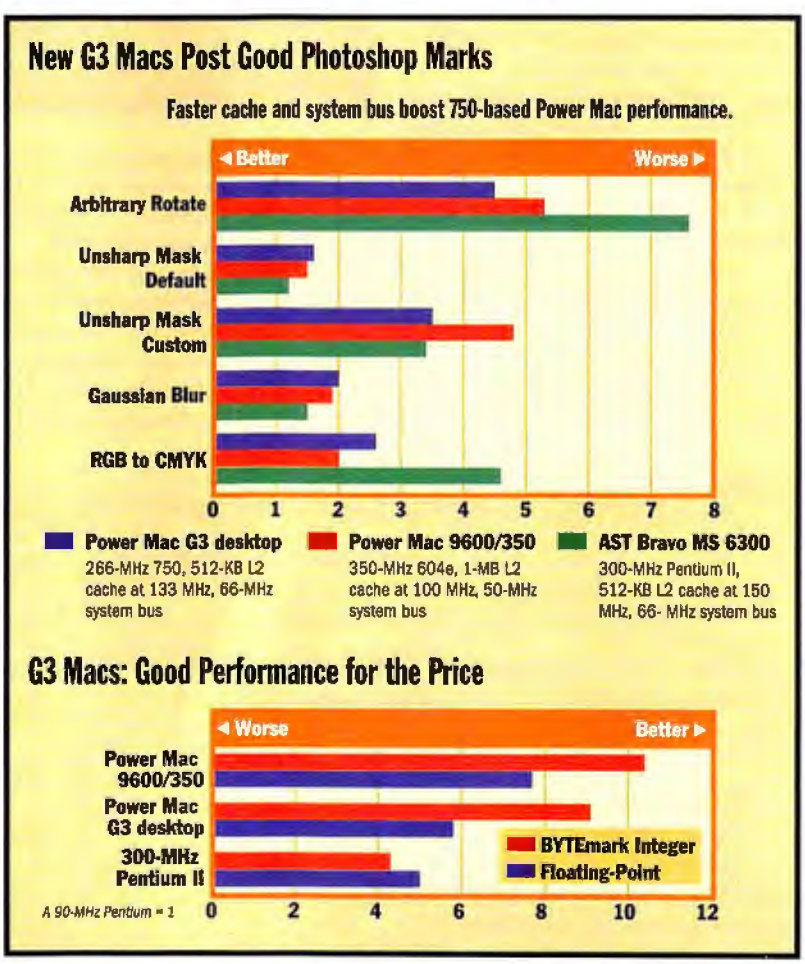
Thanks to a faster system bus and Level 2 (L2) cache, plus the new next-generation PowerPC 750 CPU, Apple's latest Power Macs deliver excellent performance at an affordable price.

The PowerPC 750 was formerly code-named "G3" (for third-generation processor), and Apple's new line of computers, the Power Mac G3, carries that name. The Power Mac G3 family consists of two desktop configurations that resemble the Power Mac 7500/7600 and a minitower. The minitower resembles the Power Mac 8500 in capabilities, but it sports a Power Mac 9600-style, easy-to-service chassis.

The systems come with 32 MB of industry-standard SDRAM, three PCI slots, internal and external SCSI interfaces, a built-in 10Base-T Ethernet interface, and ATI 3D Rage II+ accelerated graphics hardware with 2 MB of SGRAM. Storage peripherals include a 24x ATAPI CD-ROM drive, and a choice of a 4- or 6-GB IDE drive. The hard drive platters rotate at 5400 rpm to improve access time. An internal Iomega Zip drive is available as an option.

The PowerPC 750 is a highly enhanced version of the PowerPC 603e's microarchitecture. It delivers 604e-calibre performance in a low-cost design (see "First Look at PowerPC G3" in the April 1997 BYTE for more information).

In Apple's desktop system, the processor runs at either 233 or 266 MHz, while in the minitower it runs at 266 MHz. These systems have a 512-KB L2 cache connected to the 750's 64-bit backside bus, and the cache operates at half the processor speed (117 or 133 MHz). Significantly, a new main logic board design uses revamped memory-controller and PCI-bridge ASICs that let the system bus operate at 66 MHz, which



boosts system throughput. The main logic board also allows tailored hardware enhancements through a "personality" module.

On the desktop system, the personality module provides 16-bit stereo sound I/O and a communications slot for a modem card; on the minitower the module provides video capture and video output capabilities in addition to the sound I/O and modem slot.

BYTEmark tests we ran on a preliminary 266-MHz desktop G3 system show the PowerPC 750's potential. As the chart indicates, the Power Mac G3 didn't beat a Power Mac 9600 equipped with a 350-MHz PowerPC 604e, but it came close in terms of raw integer performance. The G3 also decisively beat a 300-MHz Pentium II in the BYTEmark tests.

The Photoshop 4.0 tests provide a better picture of each system's application performance. The synthetic BYTEmarks measure only raw CPU performance, whereas the Photoshop tests do a better job of exercising the CPU, secondary cache bus, and system bus without emphasizing hard drive and video card performance.

We tested two different Power Macs—the Power Mac 9600 and the G3-based system—and a 300-MHz Pentium II-based PC from AST running Windows NT 4. All three systems had 64 MB of RAM to minimize the effect of the different hard drives' performance. The Photoshop tests were conducted with the same display resolution and color depth (1024 by 768, 24-bit color). To minimize the influence of different video cards in each system, we counted only the time required to complete each operation rather than also counting additional time required for the screen to redraw.

The Photoshop tests indicate that the G3's faster system bus (66 MHz) and L2 cache (133 MHz) help the 266-MHz Power Mac G3 beat the Power Mac 9600 by a nose on several tests. Even though the 9600's 604e CPU was running at 350 MHz, its in-line L2 cache bus was running at 100 MHz, and its system bus at just 50 MHz.

When you look at the bottom line, the Power Mac G3 is a winner in price as well: A 233-MHz desktop Power Mac G3 costs $1999, a 266-MHz desktop Power Mac G3 with a Zip drive costs $2399, and the 266- MHz minitower model with a Zip drive costs $2999.

–Tom Thompson

Datapro Report

Smartcards Hit the Street

When two large banks and two large payment companies team up to sponsor a smartcard program, it must be more than just a passing fad. Citibank, Chase Manhattan Bank, Visa, and MasterCard are jointly sponsoring the New York Smart Card Program, which targets the upper West Side area of New York City.

Smartcards are used throughout Europe, and the technology is gaining momentum in the U.S. as well. (For more information, see "The Smartcard Invasion," page 76.) Consumer knowledge of smartcards has increased in the U.S., in part due to their use at the 1996 summer Olympics in Atlanta. But a stumbling block in smartcard use has been lack of merchant involvement. By signing up more than 600 merchants in a specific area to participate in a smartcard program, sponsors of the New York program are addressing this issue.

Two types of cards were issued: Citibank customers received the Visa stored-value card; Chase customers were given the Mondex electronic-cash product. People can load up their smartcards with as much as $500 or as little as one penny. Customers of other banks can also participate, but at press time, you had to have a bank account (i.e., you couldn't load "money" into a smartcard using straight cash). Participating vendors include restaurants, retail stores, and even some merchants that previously accepted cash only, such as dry cleaners.

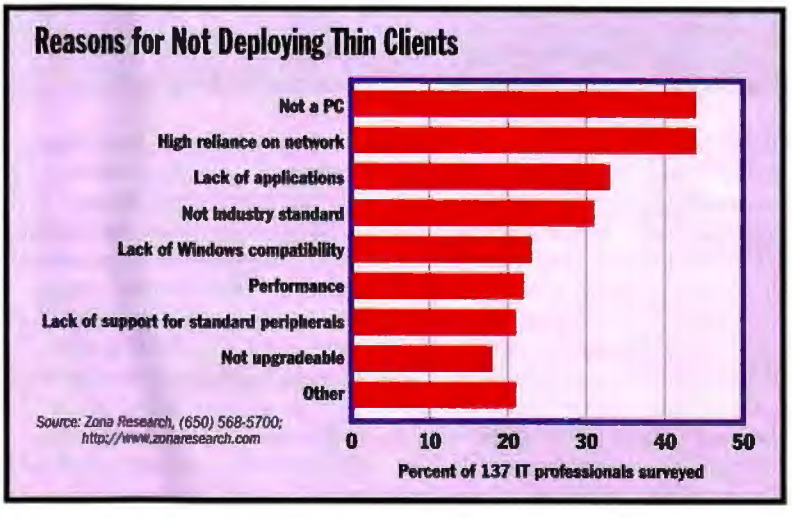
–Jannette M. Alston

For more information on reports from Datapro, a business unit of the Gartner Group, contact 609-764-0100; fax 609-764-2814; or http://www.datapro.com.

Adoption of NCs on Thin Ice

Concerns over bandwidth, lack of applications, and the basic fact that network computers (NCs) are not PCs may stymie corporate acceptance of thin clients. In a recent survey of 137 senior-level IT decision makers at large, medium, and small U.S. enterprises, just 15 percent of respondents said they plan to deploy thin-client architectures in the next three years.

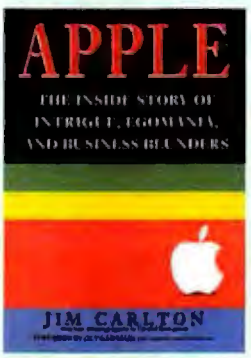
The survey also shows that those who plan to deploy thin-client architectures cite total cost of ownership and ease of administration as the leading factors



Book Reviews

Apple Lives Despite Management Incompetence

If Jim Carlton set out to definitively list the myriad ways by which the leaders of Apple Computer totally blew their chances to rule the personal computer industry, then present him his laurels: He has done so in a manner that no one will ever challenge. A solid decade's worth of world-class incompetence is unforgivingly documented in these pages, from the catastrophic failure to license the marvelous Macintosh operating system (even after no less a personage than Bill Gates wrote then-CEO John Sculley an actual business plan for accomplishing this—in 1985!) to more mundane train wrecks like the doomed Pink project, the horrendous Mac Portable, and the continuing executive incapacity to gauge demand on any given model of Macintosh (invariably, they under-manufactured Macs that people clamored for and stuffed the pipeline with turkeys). In an astonishing feat of reportage, Carlton routinely gets the inside story behind literally dozens of corporate embarrassments, providing not only particulars but smoking guns of culpability.



In the process, we get to know some intriguing characters, particularly those who led this once charmed company from Cupertino Camelot to the brink of bankruptcy. Previous accounts had already fleshed out the imperious John Sculley, but only Carlton was able to get a full accounting of the reclusive, depressed Michael Spindler, under whose reign Apple really tanked. (Spindler, it is reported here, was prone to "stress attacks" during which he would literally hide under his desk.) Carlton is also relentless in documenting the endgame under which Apple's leaders even screwed up the seemingly no-brainer task of selling the company off—even seasoned followers of the antics in Cupertino will be amazed at how close the firm was to selling out to IBM or AT&T.

So why, in light of the splendid reporting, is this inside story of Apple such a humdrum tome? Mainly because it consistently fails to go beyond the reporting. Carlton, a *Wall Street Journal* correspondent tackling his first book project, is wonderful at giving us trees, but he doesn't really have a bead on the forest. Instead of providing us perspective on how any of this fits into a view he might have of the soul of Silicon Valley, or how Apple fits into the world at large, Carlton simply provides one painfully detailed horror story after the next, in dry prose loaded with facts and bereft of charm. As someone who covered Apple on a monthly basis during most of the last 15 years, I can attest that I am more interested than most in learning of System 7's tardiness, or the lousy air-conditioning in some of the meeting rooms where discussions were held for the ill-fated IBM merger. I was even willing to hear of the personality quirks of executives like Jean-Louis Gassee. But as Carlton kept dumping his notebooks onto the page, the failed projects kept piling up, and the list of characters began to resemble the telephone book (Fred Forsythe... Ian Diery... Ed Stead... Roger Heinen... Dave Nagel.... Zzzzzzzzz). Eventually, even I wound up crying for mercy.

A less crucial but nonetheless annoying flaw is Carlton's clumsy insertion of himself as a character in the saga, trumpeting occasions when he interviewed Apple executives in the line of duty, or even asked questions at press conferences. However, he is less than candid regarding the one time that his reportorial efforts actually *did* become part of the story—when in early 1996 the *Wall Street Journal* prominently—and incorrectly—reported that Sun Microsystems was almost certainly going to buy Apple. As a participant in this premature obituary—it was even accompanied by a touching Walt Mossberg (another WSJ writer) eulogy for Apple—Carlton should have been more frank about *his* own business blunder.

On the other hand, you can't blame the author for the final problem with *Apple*: The book's revelations have been rendered somewhat less relevant by Steve Jobs's triumphant reemergence as the company's would-be messiah. Though Carlton supplies a hastily written epilogue sketching recent events, it doesn't quite compensate for the damage this development does to what passes for a dramatic arc in the book: how great failures brought Apple to ground. Suddenly, Apple has a new story under way, one which promises, if not necessarily a happier ending, certainly a more compelling one than the dim fade-out with Gil Amelio, the guy Jobs muscled out. Once again, Carlton has declared that's the game over before the warbling of the fat lady.

Steven Levy *is a columnist for* Newsweek *and author of* Hackers *and* Insanely Great: The Life and Times of Macintosh, The Computer That Changed Everything.

Apple: The Inside Story of Intrigue, Egomania, and Business Blunders by Jim Carlton; Times Books; 464 pages; hardcover; ISBN, 0-8129-2851-2; $27.50

affecting their purchase decisions. Clerical personnel, receptionists, administrative assistants, low-level managers, and supervisors are most likely to be the users of thin clients, according to the survey, which was conducted by Zona Research (Redwood City, CA), which provides Internet-related market research and advice.

The number 1 reason cited by those not planning to deploy thin clients (which include Windows-based terminals, NetPCs, Java-based network computers, Windows CE devices, and information appliances) is that the devices are not PCs (see the chart for more information).

"With so much hype surrounding thin clients, there may be a backlash against them," says Peter van de Graaf, director of product management for Lotus Components, a unit of IBM that was expected to release its first Java-based suite of productivity applications (code-named Kona) in November. "This backlash may be because people haven't seen enough full-featured Java applications yet."

Greg Blatnik, vice president at Zona Research, agrees the lack of Office-type applications may be the cause of some thin-client skepticism by managers, but he notes that of those in the survey planning to deploy thin clients, more than 70 percent want them to be able to access Windows applications running on the server. Says Blatnik: "That indicates that the goal of coming up with a non-Windows product that kicks Microsoft off the desktop is a futile effort."

–Dave Andrews

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Blasts from the Past

5 Years ago in BYTE

Compaq's LTE Lite 4/25C ran on a 25-MHz 486SL, weighed 6.5 pounds, had an 8.5-inch display, 209-MB hard drive, and a price of about $4000. Gateway's Hand-Book, a subnotebook, had a 7.6-inch screen, weighed under 3 pounds, and cost $1295. We reviewed Windows accelerator cards from the likes of ATI Technologies, Diamond, and others.

10 Years ago in BYTE

Michael Barnsley and Alan Sloan's article revealed how fractals can be used to compress data. We reviewed SQL databases. Toshiba's T3100/20 used an 8-MHz 80286, weighed 15 pounds, had a 720-KB floppy disk drive, 20-MB hard drive, and cost about $4699 (it also required you to connect to AC power to run).

15 Years ago in BYTE

Compaq's latest portable was an IBM PC-compatible that weighed 28 pounds. A basic system with 128-KB memory and a new 320-KB floppy disk drive cost $2995.

20 Years ago in BYTE

Lots of personal computers, including Processor Technology's SOL computer that we reviewed in this issue, were still of the build-your-own variety. But in this issue, Apple ran an ad for its new Apple II computer, which cost $1298. The ad stressed that unlike other microcomputers of the day, the Apple II was a "ready to use computer, not a kit."

Where's NetWare Headed?

Eric Schmidt, CEO and chairman of the board, discusses the technology directions he's setting for Novell.

BYTE: *What's your greatest technology challenge at Novell?*
Schmidt: We need to get to the TCP/IP platform as fast as we can. Historically, IPX took off because it was the fastest solution by at least a factor of 5, and it was very easy to plug and play. Novell has to replicate both of those functions in the TCP/IP world.

BYTE: *Will IPX [Novell's proprietary LAN protocol] go away?*
Schmidt: [NetWare will] really be transport-independent. We have such a large installed base that we'll ship IPX in a legacy mode forever. The issue really is how do you get all of your innovation, all of your new stuff on top of IP... and it'll be truly native IP, not encapsulated.

Our second main technology direction is our directory service, NDS [Novell Directory Services]. It's much more scalable than any of its competitors, and it needs to become even more scalable and to be cross-platform. We're introducing... a version of NDS called NDS on NT. We intend to adopt ADSI, Microsoft's internal interface to Active Directory. Part of our strategy is to interoperate with everybody else.

BYTE: *Microsoft has adopted a "surround NetWare" strategy. Are you going to take the reverse tack—surround NT?*
Schmidt: Yes, that's exactly what we're going to do. Somebody sent me a motto: "We don't make NT, we fix it."... I actually think the future of Novell is not so much as a platform company but rather with the services that are enabled on top of NT and NetWare... If we can offer services that run on every platform and solve some problems like network management, software distribution, or network integration, or auditing—that category of problem—then we become a very strategic vendor for those companies.

BYTE: *Won't people be interested in servers that are extendable, that they can modify, or that can be modified by other applications? Where does NetWare fit into that world?*
Schmidt: There's every reason to believe that the NetWare model can be the leader in the server-side market. The reason is that we have more control over performance and latency than the other guys do because we do not have a general-purpose kernel. We can present the very best Java engine because we can embed the Java engine in the kernel and the Unix and NT people cannot.

We're in the saddle point as a company. The NLM [NetWare loadable module] architecture is not very strong anymore. Java is going to take off. The question is: what year and how fast? We have a kernel that's part of Moab, the next version of NetWare. It has controllable preemption and non-preemption. You can really control protocol latency. And it is transport-independent and has full symmetric processing and full virtual memory. It has very little assembler code and is written in C. It has a new file system, and a Java virtual machine inside it. Other guys have to do round-robin scheduling for Java. We have a real-time OS for protocols.

BYTE: *You're placing a lot of emphasis on Java as your development solution.*
Schmidt: We're betting the company on it.

Four loaded-high notebooks use the new mobile Pentium chip to offer 233-MHz performance at killer prices. ***By Tom Yager***

Four Tillamooks Face Off

The cycle of processor upgrades isn't confined to the desktop world. Notebooks with the mobile Pentium processor with MMX ("Tillamook") run at 233 MHz, the new standard. Four of these machines appeared at my lab in time for the big face-off: Compaq's Armada 7770, NEC's Versa 6230, Toshiba's 750CDT, and Hewlett-Packard's OmniBook 3000.

Toshiba Tecra 750CDT

Toshiba's Tecra 750CDT is a fully loaded notebook with some impressive features, including a color video camera, S-video output, dual Universal Serial Bus (USB) ports, a 4.7-GB hard drive, and an S3 Virge/MX video adapter with 4 MB of RAM. With those specs, you would expect solid design and performance. But that wasn't the case in my tests.

I ran the Intel Media Benchmark 1.0 and found that the Toshiba's video speed lags far behind the other systems in this review. In fact, my 166-MHz Micron Transport XKE outperformed the 233-MHz Tecra 750CDT in the media benchmark except in the floating point-intensive 3-D test. Though it has extra video RAM, it may be of limited use. For resolutions above 1024 by 768, the 750CDT's noninterlaced refresh rate is 60 Hz.

The 750CDT's inconsistent design bodes both well and poorly for travelers. The LCD panel casing is wonderfully rigid; Toshiba uses hinged port covers, even at the back of the machine. However, I found it too easy to brake the hinge when putting the notebook into its carrying case.

It's difficult to extract the CD-ROM drive from its swappable bay, but you may not need to since the floppy comes with a self-powered external enclosure. Conversely, I found it too easy to release the battery. Unlock its compartment and the battery falls (not slides) out of the bottom of the machine.

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

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

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

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

The 750CDT's performance places it at the bottom of this pack. Add to that its design shortcomings and its $5099 price and it's easy to see why its nifty video camera wasn't enough to win me over.

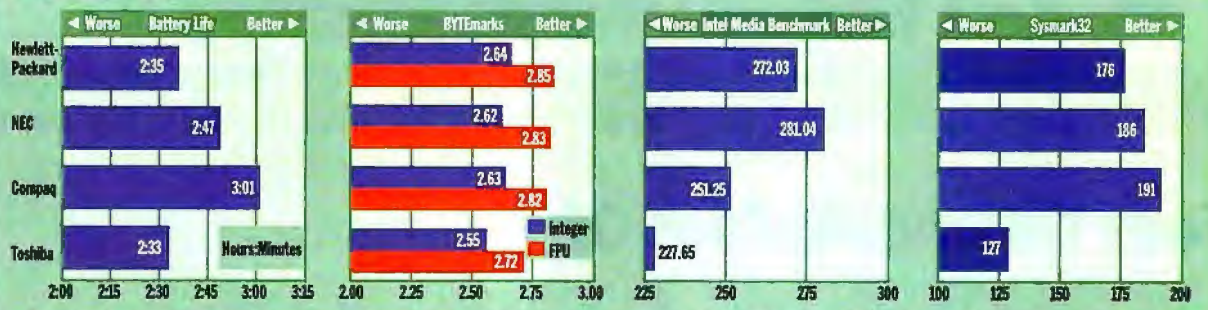
NEC Versa 6230

NEC's Versa 6230 has most of the basics down, but in the fit-and-finish category it comes up shy of its competitors. Its keyboard is likeable, with sufficiently deep

PHOTOGRAPHY: JIM COON © 1998

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

Performance Results



Compaq's Armada 7770 leads the way, by a few minutes, in battery-life performance. Hewlett-Packard's OmniBook 3000 has the highest overall BYTEmark scores. NEC's Versa 6230 scored the highest Intel Media Benchmark numbers. Compaq's Armada 7770 edged out HP's OmniBook 3000 and NEC's Versa 6230 for best Sysmark32 performance.

travel, good feedback, and quiet clicks.

The Versa's device bay holds a floppy drive, a CD-ROM drive, a battery, a hard drive, a Zip drive, or a 120-MB optical drive. However, the battery and its dedicated bay are the worst design I've seen in a notebook. The flimsy, unhinged cover comes off after you release a simple latch. The awkwardly shaped battery snaps into the bay through a row of sharp, skinny pins. There are no guide rails to keep you from bending the pins. This would be a fair design for an industrial device that needs its battery changed yearly. One hurried in-flight swap, however, might be enough to ruin this machine.

The Versa 6230 performed respectably. It solidly led the field in Intel's Media Benchmark and scored consistently high in the BYTEmark tests. At $4999, there is enough right about the Versa 6230 to make me wish NEC had built it better.

Compaq Armada 7770

Although this notebook shares price range ($4999) and 233-MHz CPU with HP's and NEC's, the Compaq Armada 7770 isn't quite in their league. The LCD panel is a 12.1-inch, 800 by 600 TFT. The case's lid is smaller than the base, giving the Armada 7770 an underbite when it is closed. Indicator LEDs are few.

Compaq breaks with modern notebook design by moving the keyboard toward the front of the chassis. To use it on your lap or on an airplane seat tray, you'll have to place your hands in a most unnatural position to type.

There is no room for a touchpad, so Compaq supplies a pointing stick. The pointing stick's buttons are as stiff as the keyboard. They have too much travel, their feedback feels weak, and they're too close to the stick. They're also only about half an inch below the spacebar.

The Armada's swappable bay accommodates a floppy drive, CD-ROM drive, or battery. Unfortunately, the CD-ROM doesn't mount flush with the rest of the case. It takes too much effort to dislodge it from its bay. The battery and the 3-GB hard drive slide out easily, however.

In performance, the Armada turned in solid CPU numbers (roughly even with the HP and NEC units reviewed), but its S3 Aurora 64V+ display controller lagged badly in Intel's Media Benchmark. Considering this, the lack of a 13.3-inch display, a poor keyboard design, and an overall lack of attention to factors that matter to traveling computer users, only a radical price drop would move me to take the Compaq Armada 7770 seriously in such a crowded field.

HP OmniBook 3000

Hewlett-Packard's OmniBook 3000 proves you don't have to trade weight for features. It's only 1¾ inches tall when closed, yet the unit weighs just 6.8 pounds with battery. And it performed well in both CPU and graphics benchmarks.

One of my few complaints is the blinking in the display. An arrow flashes constantly to show you which battery is in use. Another blinking indicator shows you AC power is connected. It cries wolf so often it's hard to tell when you really need to check something out.

Virtually everything else about this notebook is right on target. It performs well both in media and CPU tests, and its battery life (2:35 at maximum drain) is at least average. The keyboard is a little stiff, but the touchpad is responsive and the buttons are well placed. The floppy, CD-ROM, and battery slide easily in and out of the swappable bay. The battery has charge-level LEDs that you can activate whether the battery is installed or not.

Of the units tested, the HP OmniBook 3000 makes the best showing. Though it lacks video output (which its Neomagic display controller supports), it is otherwise a good design in a sturdy, lightweight package. The NEC Versa has worthwhile features the OmniBook lacks (including a better keyboard), but serious design issues prevent me from recommending it. The Toshiba is simply overpriced and underpowered, while the Compaq Armada 7770's smaller display and poor multimedia performance knock it out of the running. B

*Tom Yager (**tyager@maxx.net**) is a technical analyst and writer based in north Texas.*

PRODUCT INFORMATION

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NEC Versa 6230
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http://www.nec-computers.com
Enter HotBYTEs 1038.

Compaq Armada 7770
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Hewlett-Packard OmniBook 3000
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Sybase's PowerSite offers an easy way to mix Java and ActiveX apps on the most popular Web servers. By Steve Gillmor

PowerSite Straddles the Object World

As the Web matures, a new class of enterprise tools is mixing and matching the best of Microsoft's Active platform and technologies based on Sun's Java and JavaBeans. Sybase's PowerSite Enterprise 1.0 blends these open and proprietary Internet standards to produce, deploy, and manage dynamic Web sites on the leading Web-server platforms from Microsoft and Netscape.

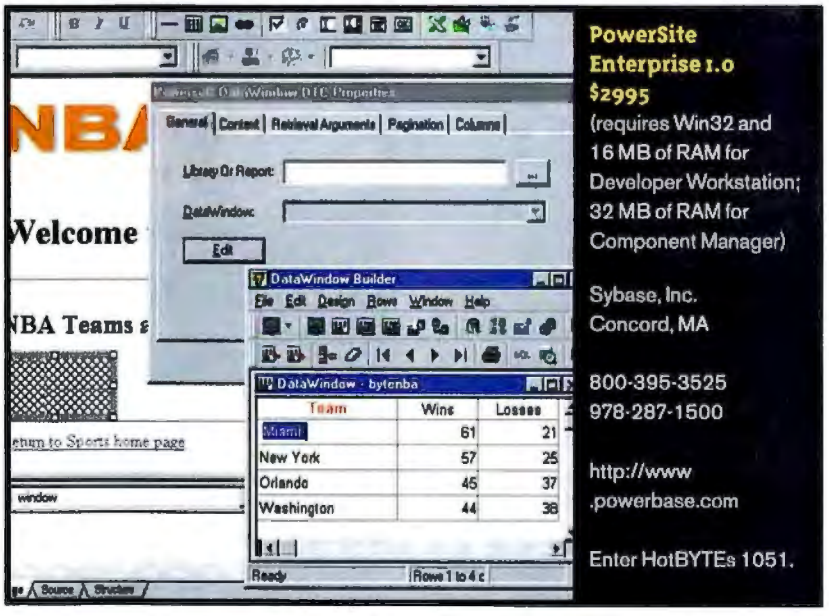
PowerSite ships with everything you need for rapid, team-based, scalable Web application development: Internet Explorer (IE) 4.0 for integrated Web browsing, PowerDynamo 2.0 Application Server for testing and debugging on local or remote machines, DataWindow Builder 6.0. for building and maintaining reusable database queries, PowerX for automatically generating ActiveX and design-time controls, and Sybase SQL Anywhere Server 5.5 Development Version for hosting PowerSite's Component Manager.

PowerSite's JavaScript-based object model adds an abstraction layer to absorb the common elements of today's leading Web application-server engines, including Microsoft Active Server Pages (ASP), Netscape LiveWire, and PowerSoft PowerDynamo. Developers can write once and deploy to many different servers without modification, leveraging more advanced application-server engines, such as ASP, while adding JavaScript to enhance less powerful midtier servers.

During Web deployment, vendor-specific HTML- and PowerSite-generated function libraries interact to produce essentially the same functionality on each target server. For example, the ASP deployment controller generates your site to NT's Internet Information Server (IIS), changing file extensions to ASP where appropriate. However, you must still manually create any virtual mappings and ODBC entries that your site needs.

PowerSite's extensible deployment controller and design-time ActiveX control support let Sybase and other third-party developers build support for servers from KIVA, ChiliSoft, and IBM/Lotus Domino into upcoming versions. The product's team-development and security features are useful for delegating tasks to designers, programmers, and artists over the Internet or through an intranet.

PowerSite's strong implementation and even-handed support for ActiveX and Java will help developers take advantage of each component model's strengths. With PowerSite, Sybase is taking a page from Microsoft's "Embrace and Extend" strategy and making it its own. B



The DataWindow design-time control generates HTML and server-side scripts for application server/database interaction.

RATINGS

TECHNOLOGY	★★★★★
IMPLEMENTATION	★★★★

Steve Gillmor is a consultant for Southern Digital, Inc. (Charleston, SC). You can reach him at **sgillmor@southerndigital.com**.

TECH FOCUS

Analyzing Web Sites

PowerSite's Web-import function evaluates a Web site on import, parsing each page syntactically, tracing the Web, and posting each page as an HTML node on a tree. PowerSite first captures predefined relationships between HTML containers and elements; it then processes vendor-specific tags, such as server-side scripting and design-time controls, and adds special HTML metatags to categorize and store pages in the Component Manager. To deploy, PowerSite reconstitutes or translates the Web site to its original format.

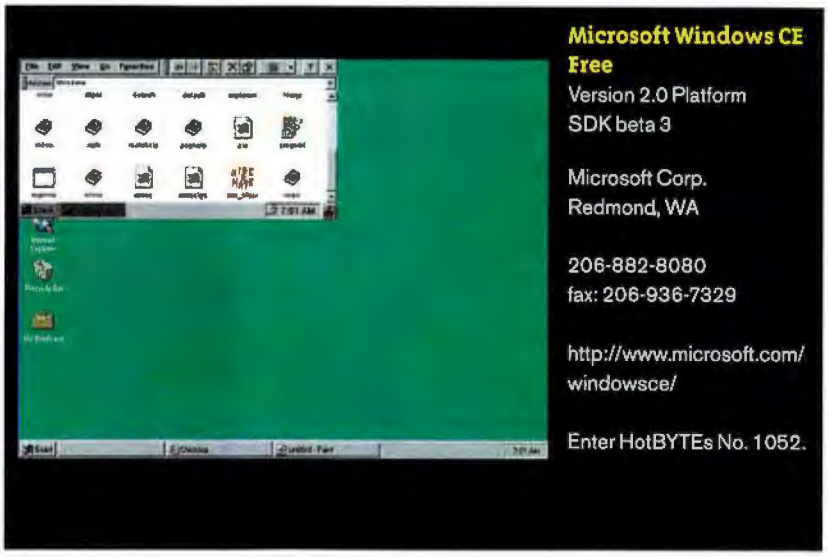
The Windows CE 2.0 SDK is Microsoft's best effort yet to create a Windows-everywhere world. ***By Peter Wayner***

Windows CE Goes Global

When Windows CE hand-held PCs (HPCs) first came out, users had to settle for software supplied by the manufacturer. No software development tools were available to anyone except Microsoft's partners. In the meantime, PalmPilot users quickly developed thousands of applications with Metrowerks' compiler.

Microsoft is playing catch-up and, as usual, is leveraging its strengths. Version 2.0 of the Windows CE Software Development Kit (SDK) integrates with Microsoft's popular Visual C++ environment, so Windows programmers will feel right at home.

All this is part of Microsoft's limited version of the Java "write once, run anywhere" credo. Applications designed for Windows 95 should be portable (after some reworking) to CE, a strict subset of the standard Windows API. Almost all the calls in the Windows CE API are the same as the basic Win32 interfaces. The only additions are routines for power control, stylus control, and communications.



The Windows CE 2.0 SDK's Mercury emulator simulates the most popular type of hand-held PC screen (320 by 240 pixels).

Ideally, you would create a copy of your source code, look for Win32 routines that didn't make the trip, and replace them with the simpler routines. It is rarely so easy. Memory and screen space are in short supply. Complicated GUIs need a redesign to fit on the screen. And if you like to use assembly code for speed, think again. Windows CE runs on chips from Mips, Hitachi, and Philips, so you must code for each.

Still, the SDK makes porting as easy as can be expected. The best approach is to start from scratch, plugging in code as you need it. The main job is designing an interface that works on small black-and-white screens. (CE 2.0 also supports color screens such as the one on Sharp's new Mobilon HPC.)

There are two emulators for the Gryphon and Mercury configurations. Mercury (see the screen) is the 320- by 240-pixel display on most CE machines. Gryphon adopts the vertical alignment of the PalmPilot or Apple Newton. Once the code is running, you can simulate it in a window, where the process becomes like developing code for a PC. The Visual C++ debugger, like the integrated development environment (IDE), is well integrated into the CE environment.

RATINGS	
TECHNOLOGY	★ ★ ★ ★
IMPLEMENTATION	★ ★ ★

Documentation is extensive but not as helpful as it could be, and I struggled to get everything up and running. But overall, this new Windows CE SDK is a credible vehicle for spreading Windows to places it's never been before. B

*Peter Wayner (**http://www.access.digex.net/~pcw/pcwpage.html**) is a consulting editor who lives in Baltimore.*

TECH FOCUS

Windows CE and WebTV

WebTV started out as a set-top box maker with its own proprietary software for displaying Web pages on a TV screen. Then Microsoft bought WebTV and announced it would port Windows CE to the WebTV box. However, the latest WebTV hardware, WebTV Plus, has no CE-style interface, nor is there a Start button in the lower-left corner. WebTV still concentrates on "enhancing the TV experience" and is not aimed at users who want to add their own software.

A future version of WebTV will use Windows CE to make it easier for users to add software from other vendors. CE will open up the insides to developers, and the current WebTV OS will run on top of it.

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

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DHTML's data-binding capability delivers fast, dynamic data over the Web. By Rick Dobson

Dynamic HTML Explained, Part III

This final Dynamic HTML (DHTML) installment examines data binding. This technology stores a local copy of a recordset in a data source object. This design innovation lets developers convert a Web page's HTML into a template for presenting data. Isolating the data from the structure of Web pages makes it easier to perform maintenance on information shared by many Web pages.

The workstation-based data cache speeds data viewing by eliminating a browser's need to return to a Web server for each new record. Because the data is available locally, Web pages can contain integrated logic to sort and filter them. Because data downloads asynchronously, recordsets start to render faster than with an exclusively server-based approach.

This article presents two basic display techniques to prepare you for exploring the full scope of data-binding technology. You will also learn about the Tabular Data Control (TDC), a simple data source object, and attributes that bind HTML elements to the TDC's data cache. The article ends with an overview of these objects. Microsoft has a site (http://www.microsoft.com/gallery/files/datasrc/) with a gallery of free data source objects.

Presenting a Table

The repeated table design displays a local data cache with the TABLE tag and its associated HTML elements. The TABLE tag is the only element that displays data in a tabular format (all other HTML elements display data one record at a time). The repeated table design derives its name from representing a whole table by repeating a single record template (held in a local data cache) once for each record.

Any HTML element requires a source for data to display. Use the TDC when you require the simplest and easiest-to-use data source object.

The "Repeated Table Code Gallery" shows how to use the TDC in a repeated table design to present a table on a Web page. The OBJECT block toward the page's beginning references the TDC. It is essential that you assign an ID attribute to the OBJECT tag to refer to and manipulate the TDC's data cache.

Two data-binding attributes are essential for linking HTML elements to the local data cache. The DATASRC attribute points to the data source object. Data-binding syntax requires you to insert a # before the data source object's ID. This attribute ties the entire local recordset to the Web page, but it does not indicate which field ties to a particular element. The DATAFLD attribute performs that function. The gallery illustrates how to place a DATAFLD attribute in a DIV element to display an individual recordset field. When working with the TABLE block, you do not need to assign the DATASRC attribute to each column element, because the columns inherit the DATASRC setting for the TABLE tag.

The code gallery lets site visitors page through successive blocks of records. It initializes this capability by setting the TABLE tag's DATAPAGESIZE attribute to 5. This permits just the first five records in the recordset to display when the page loads. Excluding the DATAPAGESIZE attribute causes the whole table to appear.

continued

Repeated Table Code Gallery

A repeated table design represents a table with 82 rows in just 19 lines of code.

```
<HTML><HEAD><TITLE>Rick's Pubs</TITLE>
<OBJECT ID=tdcRDPubs
CLASSID="clsid:333C7BC4-460F-11D0-BC04-0080C7055A83">
  <PARAM NAME="DataURL" VALUE="RDPubs.txt">
  <PARAM NAME="UseHeader" VALUE="True">
</OBJECT><SCRIPT LANGUAGE="JavaScript">
function previousPage(){
 tblRDPubs.previousPage();}
</SCRIPT></HEAD><BODY>
<TABLE ID=tblRDPubs DATASRC=#tdcRDPubs DATAPAGESIZE=5
BORDER="3" CELLPADDING="3"><THEAD STYLE="font-
weight:bold"><TD>Topic</TD><TD>
Publication</TD><TD>Month</TD><TD>Year</TD></THEAD><TBODY>
<TR><TD><DIV DATAFLD="Topic"></TD><TD><DIV
datafld="Publication"></TD>
<TD><DIV DATAFLD="Month"></TD><TD><DIV
datafld="Year"></TD></TR>
</TBODY></TABLE><BR><BR>
<BUTTON onclick="previousPage()"
STYLE="position:relative;height:30;width:100">
Previous Page</BUTTON><BUTTON onclick="tblRDPubs.nextPage()"
STYLE="position:relative;height:30;width:100">Next Page
</BUTTON></BODY></HTML>
```

When you specify a DATAPAGESIZE attribute, it is necessary to include logic for paging back and forth in the recordset. The code gallery indicates two ways to do this. First, you can reference a function in a SCRIPT block. The Previous Page button uses this technique. Second, you can include code as the argument for a button's onclick event setting. The Next Page button illustrates how to use this approach.

Presenting a Form

One of the most common ways to present records is with forms. The data-binding technology supports this display format by letting developers link INPUT text boxes to the locally cached recordset. You must supply your own record navigation code. The "Form Code Gallery" offers a model that you can adapt as your needs dictate.

The code gallery for displaying a form is an excerpt from a Web page that illustrates two separate aspects of DHTML. First, it links the INPUT text box controls to recordset fields. Second, it applies dynamic-positioning settings to locate and size the text boxes as well as the record navigation buttons.

The BODY block of the page contains three pairs of SPAN and INPUT text box elements. Absolute positioning locates the SPAN elements relative to their BODY container. The INPUT text box controls include both DATASRC and DATAFLD attributes. These are two essential attributes for HTML elements bound to data fields.

The two INPUT button controls tie back to VBScript event procedures in the SCRIPT block at the top of the code gallery. Using VBScript confirms the language versatility of DHTML (all preceding examples in the series used JavaScript). The functions apply either MoveNext or MovePrevious methods to the recordset objects of the data source object (not shown in the excerpt). The function logic also traps attempts to move out of the recordset.

Data Source Objects

Data source objects are the drivers that make data binding work. These objects perform three critical functions. First, they provide data asynchronously so that page rendering begins more quickly than if it were all constructed on a server. Second, they permit manipulation, such as sorting and filtering, on the client workstation. Third, they can allow direct updating of server-side databases from a form in a browser. This eliminates elaborate server-side processing that parses and acts on data sent from a browser.

I used the TDC in both examples in this article. It is appropriate when you have a data set of comma-delimited values and off-line browsing suits your needs. The Remote Data Service (RDS) is another data source object that provides update, insert, and delete capabilities. This data source object supports OLE DB and ODBC data sources. It requires you to specify an extract with a SQL statement. The RDS requires both server and client components to function. You must perform a separate installation to load the server-side component. Both the TDC and RDS are ActiveX controls, and they ship with Internet Explorer 4.

Data binding may offer the single most productive use for DHTML. This feature expedites and enhances data display, manipulation, and updating over the Web. I have touched on only a small subset of data-binding technology. Use the Internet Client Software Development Kit (SDK) as an additional resource for a good general overview of the basics of this exciting technology that delivers business applications via the Web (check out http://www.microsoft.com/msdn/sdk/inetsdk/help/default.htm). ■

*Rick Dobson, Ph.D., (**RickD@cabinc.win.net**) is president of CAB, Inc., a database and Internet development consultancy. Visit his firm's Web site at* **http://www.cabinc.win.net.**

Form Code Gallery

A form to display data without using a TABLE tag to position elements on the page.

```
<SCRIPT LANGUAGE="VBScript">
function forward_onclick()
 If tdcRDPubs.recordset.AbsolutePosition <>
tdcRDPubs.recordset.RecordCount then
    tdcRDPubs.recordset.MoveNext
 else
    msgbox "This is the last record"
 end if
end function
function backward_onclick()
 if tdcRDPubs.recordset.AbsolutePosition > 1 then
    tdcRDPubs.recordset.MovePrevious
 else
    msgbox "This is the first record"
 end if
end function
</SCRIPT></HEAD><BODY>
<SPAN Style="font-
size:20;position:Absolute;top:50;left:5">Topic: </SPAN>
<INPUT  TYPE=TEXT DATASRC="#tdcRDPubs" DATAFLD="Topic"
STYLE="position:Absolute;top:50;left:105;height:30;
width:350">
<SPAN Style="font-
size:20;position:Absolute;top:80;left:5">Publication:
</SPAN>
<INPUT  TYPE=TEXT DATASRC="#tdcRDPubs" DATAFLD="Publication"
STYLE="position:Absolute;top:80;left:105;height:30;
width:350">
<SPAN Style="font-
size:20;position:Absolute;top:110;left:5">Year: </SPAN>
<INPUT  TYPE=TEXT DATASRC="#tdcRDPubs" DATAFLD="Year"
STYLE="position:Absolute;top:110;left:105;height:30">
<INPUT ID=forward TYPE=button Value= "Next">
<INPUT ID=backward TYPE=button Value= "Previous">
</BODY></HTML>
```

Apple's next-generation OS is stable, but it relies too much on Unix to get certain features to work. By Tom Thompson

A First Look at Rhapsody

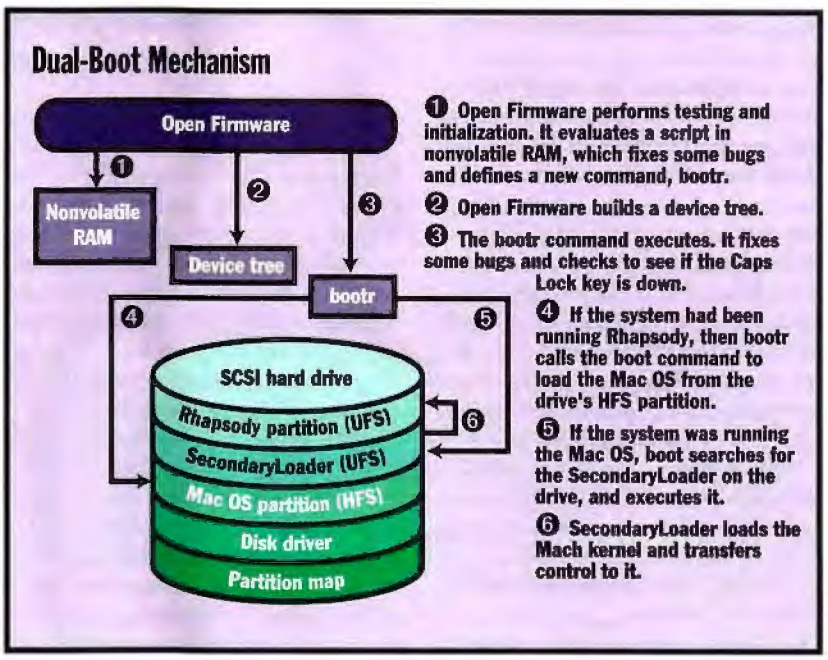
No banners flew or bands played when Apple released the Developer version of Rhapsody, its next-generation operating system, last year. That's because it was a limited release to 10,000 developers, and not to the public. As one of those 10,000, I received a copy. It comes on a single bootable CD, while a second CD contains third-party sample applications and some object-based frameworks for database development. Before giving my impressions, let's review what Rhapsody is.

Quick Tour

Rhapsody provides modern OS features such as preemptive multitasking, threading, and memory protection. Apple positions Rhapsody as an OS for servers, work-flow applications, and high-end desktop work. It's basically a port of OpenStep. OpenStep itself is a port of the original object-oriented NextStep OS to both Unix and Windows. The name change was made because NextStep class libraries employed the Mach kernel to supply low-level services, while the OpenStep libraries are an application framework that rely on the host OS for low-level services. While Rhapsody uses the OpenStep libraries, it is an OS that uses the Mach 2.5 kernel for system services. Doing the many code ports confers two important advantages to Rhapsody. First, it reduces time to market because the ports eliminated most of OpenStep's hardware- and OS-specific dependencies. Second, it means Rhapsody is built with field-tested, time-proven code (NextStep was introduced in 1988), which improves its reliability. The OpenStep class libraries themselves got a new moniker: the Yellow Box. This distinguishes their threaded, object-based nature from the nonreentrant Mac OS compatibility environment, called the Blue Box. These libraries also sport some new features not found in OpenStep, such as Java support, and Mac-like UI elements. However, it is still an application framework.

Enhancements have been made to Rhapsody's Mach 2.5 kernel so that it supports NFS. It also supports SCSI disks, and removable devices such as CD-ROM and Jaz drives. While the kernel has multiprocessing capabilities, the feature uses processor-specific code. Therefore, this release doesn't offer support for symmetric multiprocessing (SMP). Later Rhapsody releases will offer SMP, and they'll use the Mach 3.0 kernel.

Running on top of the kernel are the Yellow Box libraries and BSD 4.4 Unix. Java support comes through a virtual machine (VM) based on Sun's JDK 1.1.3. The interfaces are revised so that Yellow Box APIs can be called from Java. Theoretically, you could write a Java program using the Yellow Box APIs once and it would execute anywhere: on a Power Mac or a PC running Rhapsody, on several flavors of Unix, and on any x86-based machine running Windows. Java code would execute on the Java VM, while the Yellow Box API calls would execute in native code. Since applications make extensive use of GUI API calls, this makes it possible to write a Java application whose image could execute virtually anywhere, and with reasonable performance.



Rhapsody adds a Forth command to the Open Firmware boot process that lets you select which OS to use.

Tricks and Traps

For the PowerPC-based version of Rhapsody, you need 32 MB of RAM minimum (64 MB recommended), and a 1-GB hard

drive. To meet the delivery date, Apple wrote a subset of Mac hardware drivers, so only Power Mac models 9500, 9600, 8500, and 8600 are supported. (For the brave, this release happens to work with Power Mac models 7200, 7300, 7500, and 7600, but they aren't officially supported.) Rhapsody works only with ATI and IXMicro video boards, and only TCP/IP on Ethernet is available for networking—no AppleTalk or PPP. Rhapsody uses the Unix File System (UFS) on the hard drive, while it uses NFS for remote drives. The Blue Box is absent, as are Mac OS technologies such as QuickTime, QuickTime VR, and AppleScript. This is definitely a release only for those interested in writing to the Yellow Box APIs. The Blue Box will make its debut in the Premier release of Rhapsody, scheduled to ship the first quarter of this year.

On a large hard drive, you can create two partitions, one for the Mac OS and another for Rhapsody, to make a dual-boot configuration. You toggle between the two OSes by holding down the Caps Lock key during the boot process. (See "Dual-Boot Mechanism" on the previous page for how this is done.) On the Mac OS side, a Rhapsody control panel lets you set the hard drive's SCSI ID and certain boot parameters. To enter Rhapsody, you hold down the Caps Lock key until the Rhapsody control panel loads. The Mac restarts, and Rhapsody boots. Under Rhapsody, you log out with the Caps Lock key down to flip back to the Mac OS.

On developer releases, you expect a few rough edges, and Rhapsody has some with the system configuration. Setting up the boot drive in the Rhapsody control panel requires you to enter the Unix name of the root device (e.g., `rootdev=sd0`). The documentation is vague on how to do this, particularly for an external SCSI chain with several devices. The best bet: Leave the boot process in the verbose mode (put `-v` in the kernel arguments [args] pane in the Rhapsody control panel). This lets you watch Unix commands execute in a console window during the boot process. Jot down the Unix device name Mach assigns to the SCSI drive in question. Press the Command and Power keys to interrupt the boot, and type `r` when Unix prompts you. Enter this name in the kernel args pane when you flip back into the Mac OS. When you've got everything set right, remove the verbose command, and Rhapsody boots, displaying a sliding progress bar just like the Mac OS.

The Rhapsody Developer release is a mixture of Mac and NextStep elements.

The Workspace Manager process acts like the Mac OS Finder and hides Rhapsody's Unix entrails, to a degree. The lone menu bar, the sample application windows, and the Desktop look amazingly Mac-like. However, when you run HostManager and SimpleNetworkStarter to configure the computer's network settings, NextStep rears its head. The appearance of the menus and windows in these programs is quite different, as the screenshot above shows. These applications do let you point and click to assign your computer an IP address and set router information. Establishing domain name services or printer services, unfortunately, requires resorting to a text editor and Unix scripts for setup, so Rhapsody's network services aren't quite ready for prime time. With the correct network settings, I was able to use Unix telnet and ftp programs to grab files from Web sites. As of yet, there's no drag-and-dropping of remote files as in AppleTalk.

Tip: If you munge a network setting and experience problems booting, use the magic Command-Power key sequence to interrupt the system, restart, and hold down the S key during the boot (or add `-s` to the kernel args pane in the Rhapsody control panel). This gets you into the single-user mode, where you can try to correct things—providing you know your way around Unix.

Future Platform

Rhapsody comes with a bunch of development tools: GNU C; a linker; a make utility; and Interface Builder, the OpenStep point-and-click software for rapidly laying out an application's interface. There's also Project Builder, which manages the source, object, and header files for programming projects and resembles the Metrowerks CodeWarrior integrated development environment. About 25 sample applications—with source code—can help jump-start your coding efforts. Sun's Java compiler and class libraries are also included. The code for a sample text editor, written entirely in Java with calls to the Yellow Box APIs, is provided for Java aficionados.

From a Mac user's perspective, Rhapsody still relies too much on Unix to set up fundamental services. The Jekyll-and-Hyde mixture of NextStep applications and non-HFS file system creates confusion as well. In its favor, Rhapsody did not crash once during my testing. If the engineers can implement user-friendly system configuration tools, and get the Blue Box, QuickTime, and AppleScript working, then Rhapsody stands to deliver a powerful server-class OS that everyone can use. Stay tuned. B

*Tom Thompson (**tom_thompson@byte.com**) is a BYTE senior technical editor at large.*

The TCP/IP version of a messaging protocol enables client/server communication over the Internet. By Paul Clip

IIOP: The Next HTTP?

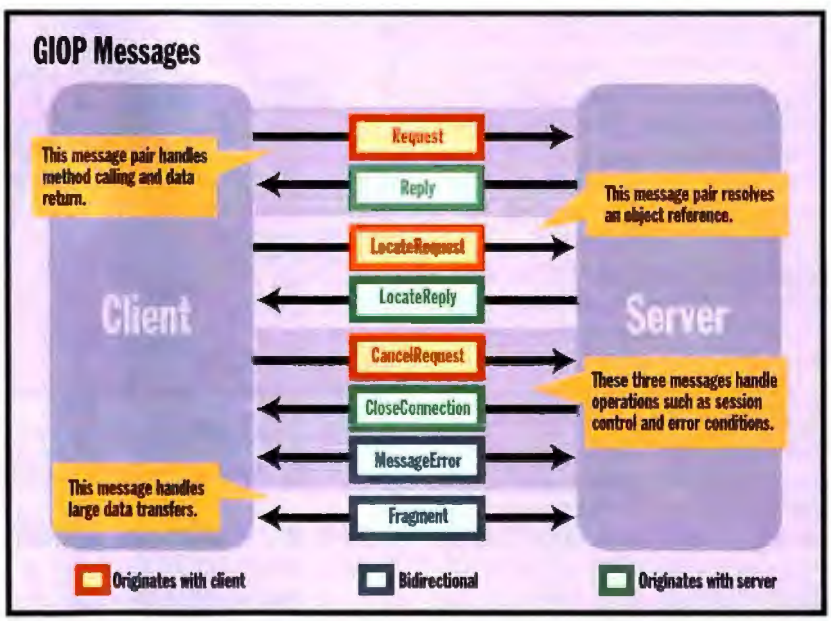
In October 1996, Netscape cofounder Mark Andreessen wrote that the Internet Inter-ORB Protocol (IIOP), which is part of the Common Object Request Broker Architecture (CORBA), would become as important and universal as HTTP. Over a year later, IIOP is spoken by, among others, millions of copies of Netscape Communicator. Yet IIOP is still a poorly understood protocol.

The latest CORBA specification (version 2.1, available at http://www.omg.org/corba/corbiiop.htm) describes IIOP as the TCP/IP implementation of GIOP, the General Inter-ORB Protocol. GIOP defines a network protocol-independent set of messages, formats, and data encoding that all object request brokers (ORBs) must follow when communicating with each other.

The goals of GIOP were simplicity, scalability, and generality. Simplicity ensures GIOP's ease of use and an easy implementation job for ORB vendors, keeping their costs low. Scalability means supporting ORBs and networks of ORBs, up to the size of the Internet. Designing GIOP message formats for use with any connection-oriented transport protocol meets the goal of generality. Finally, by using TCP/IP as a network transport mechanism, GIOP can achieve the widest possible availability.

Common Data Representation

To exchange information between systems, GIOP specifies a method for encoding the data types of CORBA's interface definition language (IDL) into a low-level representation that all parties understand. The common data representation (CDR) defines representations for primitive types (for example, ints, longs, and doubles) and constructed ones (structs, unions, arrays, and strings). The CDR also encodes pseudo-objects that are neither basic nor constructed types, such as invocation context information and exceptions. Object references are particularly important pseudo-objects since they represent the objects upon which methods are invoked. Within a single ORB, an object reference could simply be a pointer to an object. But when that reference must be sent to another ORB, it is encoded as an interoperable object reference (IOR) profile, a data structure containing not only an opaque reference to the object itself (an object key) but also transport protocol-dependent information describing how to contact that object. We shall see later in this article how IIOP IOR profiles are defined.



Through only eight messages, GIOP provides a simple yet scalable client/server communication mechanism.

GIOP Messages

To maintain its simplicity, GIOP defines only eight messages. The figure "GIOP Messages" depicts these messages and the originators of each. Three originate from clients (systems initiating connections) and three from servers (systems accepting connections). The last two messages, *MessageError* and *Fragment*, are bidirectional. GIOP messages are generally composed of three parts: a GIOP header, a message-specific header, and a message body.

Request is the basic CORBA method-invocation message. It includes information concerning the target object, the method to invoke (and any parameters), whether the client expects a reply, and a request ID. This ID is client-generated and enables both parties to uniquely identify a request.

Reply is the server's response to a request. It contains the request ID, the reply status, and the reply body. If the reply status indicates that no exception occurred,

then the body holds any return values associated with the method invoked. If an exception did occur, it is encoded in the message's body. The third status, "Location Forward," indicates that the requested object has moved to another ORB. The body contains its new location. The client ORB should then transparently retransmit the initial request to this new location.

LocateRequest enables clients to determine whether an object reference is known, whether the server in question can process a request to this object, and if not, the server to which requests for this object are made. The information obtained by LocateRequest is also provided by Request, but in the case of a Location Forward situation, it enables clients to avoid a potentially lengthy transmission of parameters associated with a particular request.

LocateReply is the server's response to a LocateRequest. It contains the LocateRequest's request ID and a location status indicating whether the object is known, located at the server, or located elsewhere. In the latter case, LocateReply also includes the object's new location.

CancelRequest's only parameter is a request ID. Clients use this message to notify servers that they no longer expect a reply from a pending request or LocateRequest.

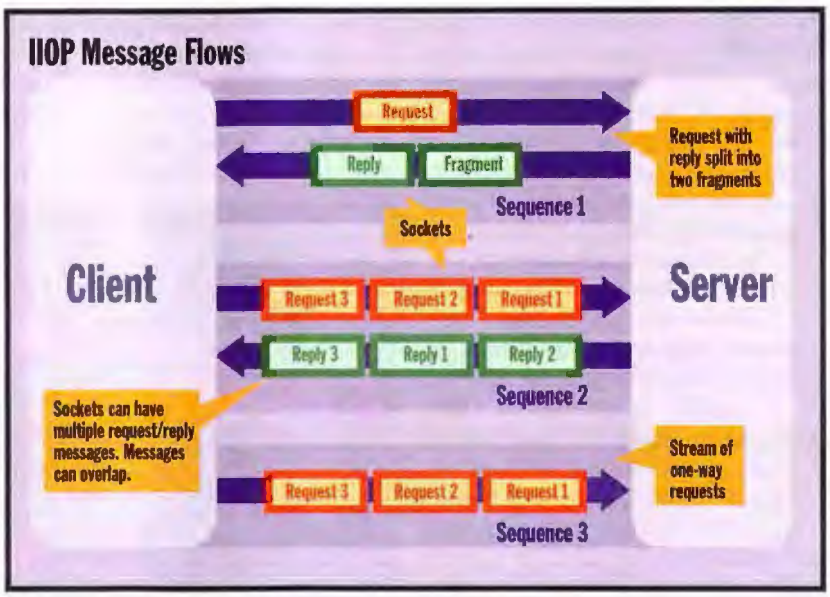
Servers issue a *CloseConnection* message to notify clients that a connection is closing. Any pending requests are lost and must therefore be resent on another connection. For the sake of robustness, a client may close a connection without prior notice, servers being expected to handle this event gracefully. CloseConnection enables ORBs to reclaim and reuse idle connections.

MessageError is sent in response to any unknown or improperly formatted message. *Fragment* enables ORBs to split messages into sections and send each as a separate GIOP message. If a request's or a reply's GIOP header indicates more fragments of a message are to follow, these will be sent as fragment messages.

IIOP

IIOP is little more than GIOP with TCP/IP as its transport and network layers. The assumptions the Object Management Group (OMG) made regarding the characteristics of any transport layer for GIOP map particularly well to TCP/IP: a reliable, connection-oriented protocol that can be viewed as a byte stream and robust error handling in case of connection failures.

While GIOP defines the form and content of messages, IIOP encodes the information necessary for invoking methods on objects in IIOP IOR profiles. IOR profiles are composed of a version number, the host and port of the ORB to which messages should be sent, an object key, and a series of components containing information used when invoking methods on the object (e.g., the originating ORB's type and security parameters).



The Internet Inter-ORB Protocol (IIOP) encodes information to invoke ORB methods through a TCP/IP connection.

The strict distinction between clients and servers (to avoid race conditions, neither may send messages that should originate from the other) is just one aspect of the ways IIOP uses its underlying transport layer. The figure "IIOP Message Flows" shows the different ways in which clients and servers communicate.

In sequence 1 of the figure, a client's request is answered by a server's reply, in this case split in two fragments. Note that each "stream" represents a single (bidirectional) socket connection. Since requests are uniquely identified, multiple messages may share a connection, and asynchronous requests/replies may even overlap, as shown in sequence 2. This allows a more efficient sharing of resources. Some ORBs (notably Expersoft's) give you a choice between a dedicated and a multiplexed connection, so that a large message can be sent via a dedicated socket to avoid slowing down other, smaller, messages.

Finally, in sequence 3, the client can send a series of one-way requests, expecting no replies from the server. For example, a client may wish to periodically "ping" a server to tell it "I'm alive."

IIOP's Future

IIOP does not, and might never have, HTTP's ubiquity. Nevertheless, as CORBA's popularity grows, IIOP will increasingly be found outside the ORB. In June 1997, JavaSoft announced it would run a subset of its remote method invocation (RMI) for Java on top of IIOP and would work with the OMG to expand IIOP to support all of RMI's capabilities. This will allow Java programs to easily invoke methods on ORBs using RMI.

A recent proposal (see http://www.sun.com/solaris/neo/wp-naming-svc/) by IBM, SunSoft, Netscape, Oracle, and Visigenic formalizes a URL form for CORBAservices Naming Service. For example, the Naming Service name iiop://host:port/path/to/object would be suitable for embedding within an HTML page. Who knows? Maybe Andreessen's prediction will come true after all. B

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The latest Rx000-series processor reaffirms Silicon Graphics' commitment to RISC. ***By Tom R. Halfhill***

RISC Fights Back with the Mips R12000

It hasn't been a stellar year for RISC. The biggest desktop RISC vendor, Apple, has its own troubles. In the workstation and server markets, Intel's x86 and Microsoft's Windows NT are making significant inroads against RISC and Unix. Microsoft halted development of NT on the PowerPC and the Mips Rx000–series microprocessors. And Silicon Graphics, Inc. (SGI)—Mips Technologies' parent company—has agreed to make x86-based workstations that run NT.

Where does that leave Mips? Still in the ball game, if the new R12000 processor is successful. Derived from the R10000, announced in 1994 (see "T5: Brute Force," November 1994 BYTE), the R12000 is an evolutionary design that improves upon the R10000 in several ways.

The R12000 isn't a radical redesign of the Rx000 microarchitecture, as was the R10000. Instead, Mips decided to tweak a proven core. The R12000 was taped out in early September and should begin volume production in the first half of 1998—assuming there aren't any last-minute snags in the silicon. It will be manufactured by Mips's foundry partners, NEC Electronics and Toshiba. Workstations and servers should follow in the second half of 1998.

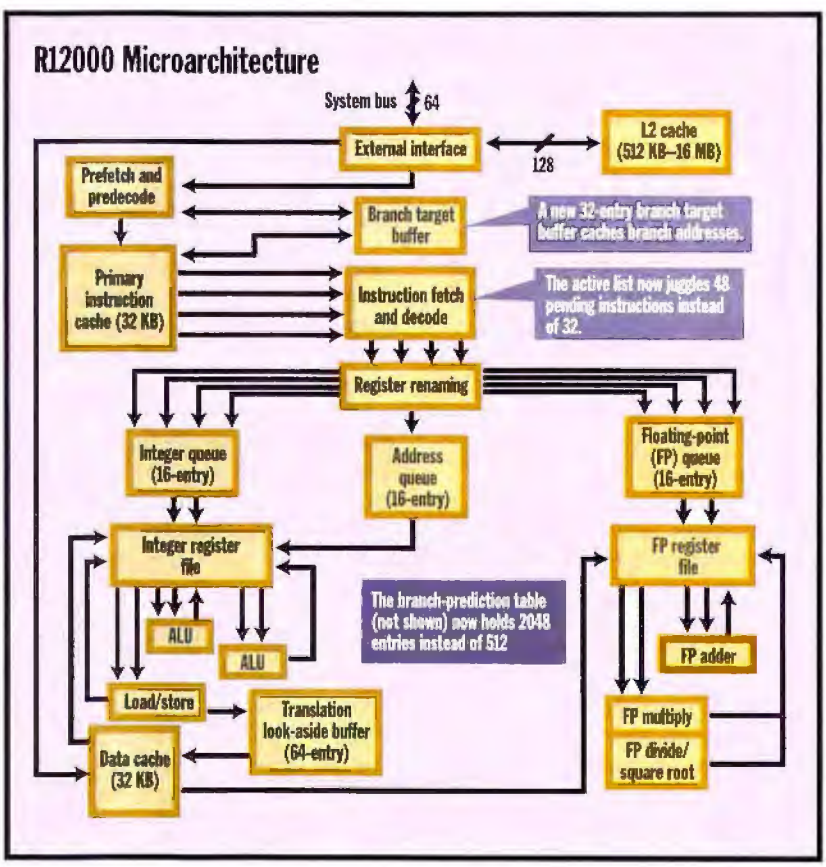
Smaller, Faster, Better

The R12000 will debut at 300 MHz on a 0.25-micron, four-layer-metal CMOS process. The R10000 currently peaks at 200 MHz on a 0.35-micron, four-layer process. Actually, NEC and Toshiba can produce five metal layers with their 0.25-micron processes, but Mips engineers limited themselves to four layers to accelerate the production schedule. They could press the optional fifth layer into service if they encounter problems with the initial samples.

At four layers, the R12000's die area is 204 square millimeters—roughly one-third smaller than the R10000, even though the new chip has about 100,000 more transistors (6.9 million total).

Sometime in 1999 or 2000, the next-generation 0.18-micron processes should become available, along with at least six layers of metal interconnects. Those advances will greatly shrink the R12000 and permit even higher clock speeds (over 400 MHz), lower operating voltages, and reduced power consumption.

At 0.25 micron, with a 2.5-V core and 1.5-V I/O, the first production version of the R12000 should dissipate about 20 W. It will first appear in a 600-pin ceramic land grid array (CLGA) package, but it will soon afterward adopt the more popular ball grid array (BGA). It's pin-compatible with the R10000.



The R12000's microarchitecture is quite similar to the R10000's, with tweaks for higher performance.

Like Father, Like Son

The R12000 retains the basic 64-bit core of the R10000, which was the first single-chip superscalar processor from Mips. It can execute up to five instruc-

tions per cycle and retire up to four per cycle using its two integer units, two FPUs, and load/store unit, as shown in the figure "R12000 Microarchitecture" on page 49. The processor's minimum pipeline depth is five stages.

The R12000 can execute instructions out of order, dynamically predict branches, and speculatively execute instructions up to four branches deep. It has 64 integer registers and 64 FP registers (each 64 bits wide), which the CPU dynamically renames to represent the architectural set of 32 integer and 32 FP registers. It adheres to the 64-bit Mips 4 architecture, and Mips says that binaries optimized for the R10000 should run even better on the R12000 without recompiling.

Even the Level 1 (L1) caches remain unchanged, bucking the trend toward more on-chip memory. However, the caches are respectfully large to begin with: 32 KB each for instructions and data, twice as much as on a Pentium II.

One of the most significant changes in the R12000 is that it can juggle 50 percent more pending instructions than an R10000 while reordering the instruction stream. In effect, this opens a larger window onto the executing program and gives the R12000 more flexibility to rearrange the instructions in the most efficient order to keep its execution units busy.

Here's how it works. The CPU maintains a list of occupied registers, called the *active list*. Registers on the active list can have two states: active (currently in use by an executing instruction) or completed (the final result of an executed instruction). When a completed result retires, the register is free to handle a new instruction, so the CPU removes it from the active list. The more instructions the CPU can maintain on the active list, the larger the chunk of code it can reorder to optimize the instruction stream. The R10000 maintains an active list of 32 instructions; the R12000 increases that number to 48.

Mips also added a branch target buffer (BTB) and quadrupled the size of the branch-prediction table. The BTB is a 32-entry, two-way set-associative cache that holds the target addresses of branches. Most of the time, the R12000 finds the target address it needs in this cache instead of fetching from the L1 cache.

The branch-prediction table now holds 2048 entries instead of 512. Each entry is a 2-bit value that predicts the outcome of a branch instruction. Two bits allow four possibilities: strongly taken, weakly taken, weakly not taken, and strongly not taken. The CPU dynamically adjusts those predictions by watching the outcomes of previous branches.

Likewise, Mips doubled the size of the way-prediction table for the Level 2 (L2) cache; it now holds 16,384 entries. This table allows the CPU to fetch things more quickly from the cache. Because the cache is two-way set-associative, the CPU loads two lines of instructions and data during each fetch, one after the other. The way-prediction table helps the CPU decide which line to load first.

All these changes should improve performance when running large programs, especially databases. Mips points out that processors like the R12000 are typically found in servers and workstations, not in desktop PCs, so they should be optimized for different tasks. For instance, the expanded way-prediction table works best with an L2 cache of 4 MB—eight to 16 times larger than the L2 caches typically found in desktop PCs.

That's also why the R12000 (like the R10000) supplements the 64-bit-wide system bus with a 128-bit-wide backside bus for the L2 cache. That's twice as wide as the backside bus on a Pentium Pro or a Pentium II. Also, the signaling required for the backside bus (address tags, error correction, and so on) travels on separate wires instead of being multiplexed with the data. The result is higher throughput. The trade-off is a package with 600 pins—too many for the R12000 to be an economical mass-market processor.

One important difference between the backside bus on the R10000 and that on the R12000 is that the new processor can't drive its bus at the core frequency. Clock divisors range from 1.5 to 3.5 in 0.5 increments, so the R12000's backside bus cannot run faster than 200 MHz if the core runs at 300 MHz. Intel's 0.25-micron Pentium II (aka Deschutes) will have the ability to drive its backside bus at core speeds of 333 MHz or more when it appears in midyear. But the R12000's bus is twice as wide, so even at 200 MHz it will have more peak bandwidth (3.2 GBps) than a Deschutes at 333 MHz (2.6 GBps).

R12000: What's New

- 64-bit core is substantially the same as the R10000's; it's compatible with the Mips 4 architecture.
- 300-MHz core frequency; the dedicated L2 cache bus can run at 200 MHz.
- Estimated performance is about 50 percent greater than the R10000's at 200 MHz.
- Handles up to 48 pending instructions, versus 32 on the R10000.
- New 32-entry branch target buffer for caching branch addresses.
- Branch-prediction table is quadrupled in size (2048 entries).
- L2 cache way-prediction table is doubled in size (16,384 entries).
- 0.25-micron, four-layer-metal CMOS, 600-pin CLGA package, pin-compatible with the R10000.
- 6.9 million transistors on a 204-square-millimeter die.
- Tape-out in early September 1997; volume production in the first half of 1998.

Alive and Kickin'

Together with an improved die layout and optimized signal paths, all these tweaks should boost the R12000's performance about 50 percent beyond the R10000's. Although Mips has successfully tested Unix on simulations of the R12000, the engineers were still awaiting the first silicon samples when this article went to press, so actual benchmarks are not yet available.

Will the R12000 be good enough to fend off Intel for another CPU generation? With its superior bus bandwidth, wider parallelism, and stronger emphasis on FP performance, the R12000 should be better suited for high-end graphics workstations and servers. B

WHERE TO FIND

NEC Electronics Santa Clara, CA 408-588-6000 fax: 408-588-6130 http://www.nec.com/necel/	fax: 650-960-0197 http://www.sgi.com/MIPS/
Silicon Graphics/Mips Group Mountain View, CA 650-933-3900	Toshiba Irvine, CA 714-455-2000 fax: 714-859-3963 http://www.toshiba.com/taec/

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A new communications infrastructure moves critical decision data through intranets at near real time. By Dale Skeen

Enabling the Real-Time Enterprise

In today's extremely competitive business climate, increasing the speed and accuracy of business activity translates into a significant competitive advantage. In financial institutions, for example, faster settlement times reduce carrying costs and financial risk.

To do this, corporations can no longer use existing methods where decisions are tied to a database's batch-cycle times or where responses are based on stale information. Instead, they must transform themselves into real-time enterprises, where they quickly gather and immediately respond to changes in information.

A real-time enterprise requires new applications and application services designed to immediately process changes in information. These services are termed business event–driven, where a business event is any significant change in business data or conditions. Such services require new technologies and capabilities, such as event communications services (ECSes) that can provide asynchronous, near-real-time communication of business events to all interested parties. ECSes foster the development of event-enabled applications and databases, real-time decision support services, and business automation.

In this article, I will describe the ECS. It forms the basic infrastructure that other event services rely on. A subsequent article will discuss the other services.

Event Communications

The world is becoming event-enabled. For example, database systems support triggers, mechanisms that report changes to database records. Most packaged applications now offer external interfaces that communicate changes to business data. Common Object Request Broker Architecture (CORBA) and Distributed Component Object Model (DCOM) explicitly support business events.

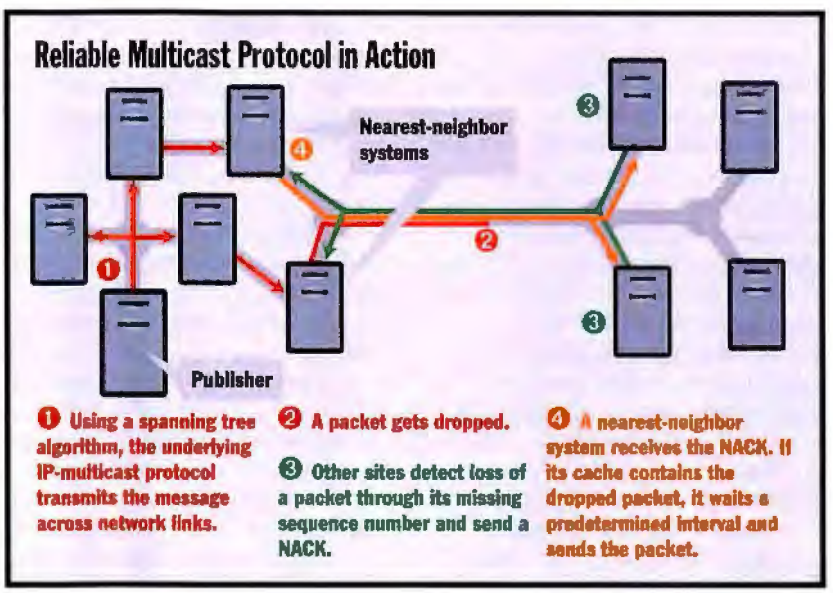
Once generated, the ECS manages the events. It uses a publish and subscribe (P&S) mechanism, where an application publishes events and consumers subscribe to events of interest. The ECS ensures that each published event reaches each subscriber, asynchronously and with minimal delay.

While ECSes have existed for several years, a new generation, such as Velociti, offers better performance and scalability. Based on Internet and distributed object standards (e.g., CORBA and IIOP), they can implement near-real-time event transmission throughout a large enterprise. These new ECSes use three mechanisms to achieve these capabilities. First, they use scalable and reliable multicast protocols built on the Internet-standard IP-multicast protocol. Second, they use a federated architecture—similar to the Web's—where many servers are deployed and the load is seamlessly partitioned among them. Finally, caching functions help balance the network load.

Scalable, Reliable Multicast

Multicast protocols are an efficient method for disseminating real-time information. In contrast to unicast protocols such as TCP that send a message to every event consumer, multicast protocols send a message once, regardless of the number of consumers. For example, using a multicast protocol, an event publisher performs one send to transmit a message to 1000 subscribers. A unicast protocol must send 1000 messages.

An IP-based standard for multicast was defined in the late 1980s (RFC 1112) and today is supported in hardware in most commercial routers. By itself, however, this standard can't tackle business-critical event communication because it is not



Periodic status messages let every participant assess the latency or distance to each other.

"reliable": It does not automatically detect and retransmit lost messages. Business-critical event communications require a more reliable protocol layered on top of IP-multicast.

Achieving reliability in a scalable manner is a difficult challenge. Consider the "obvious" approach of sending acknowledgment (ACK) responses for each successfully received message. For 1000 subscribers, this results in 1000 ACKs for each multicast message. The resulting traffic would flood the network, creating what is known as the ACK implosion.

A better approach returns responses only when errors occur. These negative acknowledgments (NACKs) leverage on the reliability of today's networks, but it can still result in an implosion problem if large numbers of recipients happen to lose the same message. Scalable, reliable multicast protocols must therefore solve the ACK/NACK implosion problem.

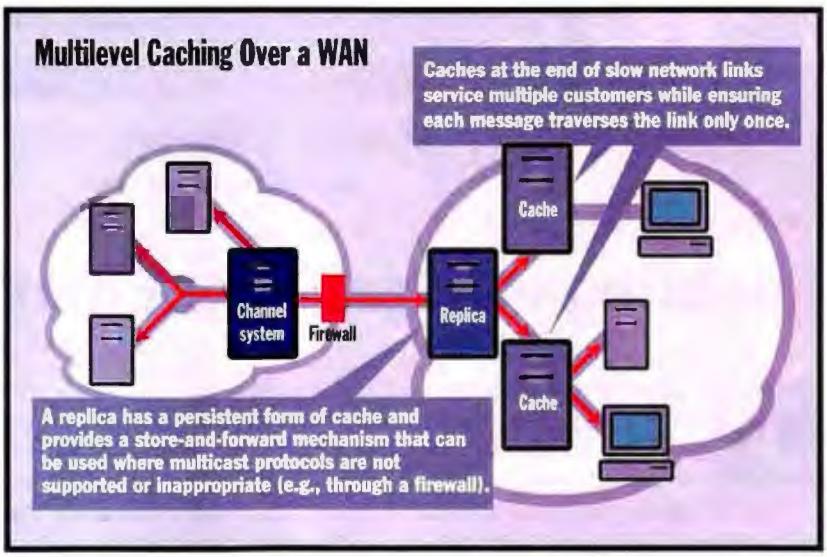
In the early 1990s, researchers JoMei Chang (cofounder and CEO of Vitria Technology) and Nick Maxemchuk invented the first reliable multicast protocol to solve the ACK/NACK implosion problem. This pioneered the field of reliable multicast for the next 15 years. Velociti, a product of Vitria, implements a reliable multicast protocol (VRMP) that achieves scalability and reliability through four key mechanisms.

First, participants cache received messages for some small period of time. The interval varies among participants. Second, participants dynamically estimate the distance, measured as communications latency, to other participants through the use of periodic status messages.

Third, on detecting a lost message—an observed gap in the packet sequence numbers—participants use a NACK-based protocol with random delays and exponential back-off. Instead of immediately sending a NACK, the recipient chooses a random delay proportional to the sender's distance and then waits to multicast the NACK. If during the wait, the recipient hears the same NACK from another recipient, it doubles the wait time. If the recipient receives the missing message during the wait, it cancels the NACK request.

Finally, VRMP uses what's called distance-based repair. On receiving a NACK, a participant checks whether its cache contains the message. If it does, it waits for a random interval proportional to the recipient's estimated distance. If during the wait the participant hears a "retransmission" response for the same NACK, it does nothing. Otherwise, it remulticasts the message at the end of the delay, as shown in the figure "Reliable Multicast Protocol in Action."

Why does VRMP work so well? It uses standard IP-multicast, requiring no special assistance from network routers or special network services. In practice, VRMP adjusts quickly and automatically to network topology changes. It uses statistical protocols with exponential back-off, similar to robust Ethernet CSMA/CD protocols, to solve the NACK implosion problem. Finally, network errors can cause duplicate NACK responses or slow the resending of lost messages, but they don't impair the protocol's reliability.



Caches and replicas help tune event communications to diverse subscriber networks.

Federation, Caching, and Replicas

Multicast protocols provide scalability in terms of the number of information consumers. A federated architecture provides scalability through a number of independent information streams, known as channels. Velociti implements a Web-like notion of federated architecture, which lets the channels be located on any available Velociti server. This lets the communications load be partitioned across any number of servers and expanded as needed. Web-like naming ensures that all consumers, subject to security authorization, can access channels globally on any server. The result is unlimited scalability with no architectural constraints.

Each additional Velociti server can support newly created channels or caches or replicas of existing channels. (A replica is a persistent form of cache and provides a fault-tolerant "store-and-forward" capability.) Caches and replicas allow optimized message flows across a wide variety of WAN topologies, as shown in the figure "Multilevel Caching Over a WAN." Replicas can support the recovery requirements of intermittent consumers or long-duration consumer failures.

Toward a Real-Time Enterprise

A new set of ECSes is taking event communications to new levels of performance and scalability. Federated architectures let information channels be partitioned across many servers with no architectural constraints. Reliable multicast protocols such as VRMP let each information channel scale to an unlimited number of subscribers. Because you can flexibly configure caches and replicas to use unicast or multicast protocols, event communications can be tuned to varied heterogeneous network configurations and diverse subscriber environments. The resulting rich flow of events, with minimum latency, lets today's enterprise make decisions in real time. B

Dr. Dale Skeen (**skeen@vitria.com**) *is CTO and cofounder of Vitria Technology, Inc.*

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Forecasting the future is a dirty job, but someone has to do it. Probably you, for example. Are you going to recommend Windows NT 5.0 on the desktop next year? Are digital versatile disc (DVD) drives in your future? You can absorb only so much technology in your limited time and finite budget. Our aim in this issue is to alert you to the technologies that you need to monitor to stay ahead of the curve.

So we're out here on a long limb, suggesting that there are at least 25 technologies that you ignore at your own peril in 1998. Some you already know about; some you probably don't. In the next 25 pages, you'll get succinct descriptions of each technology, the pros and cons, when they're likely to hit, and how much disruption they will cause. If we're even half on the mark, you'll be getting a preview of our Editors' Choice Awards of 1998 a full 11 months early as you read this issue.

More Than a Face-Lift

By now, you may be thinking that 25 significant technologies will peg your changeometer needle all the way into the red and that focus is called for. If so, start with basic platforms, where serious churn will occur in 1998. A prime example: Both of Microsoft's major OSes will undergo big changes, in at least a few ways.

Both Windows 98 and NT 5.0 will contain Microsoft's best effort to date at taming the beast of PC unreliability. If limited self-administration and self-healing don't do enough for you, consider multiuser Windows. For some, that will be the way to achieve a more centralized, manageable environment.

Both OSes will gain a common way of addressing hardware. Put simply, if the Windows Driver Model gets quick and capable support from device makers, it will be a lot easier to switch from Windows 98 to NT 5.x or 6.0.

Next year will be a major year for what's fast becoming the main alternative to Windows, Java. The entire environment will begin to look a lot more prime time with a new version of the Java Development Kit (JDK).

The coming year is likely to be make or break for Apple, as it unveils Rhapsody, its multithreaded, multitasking OS. Rhapsody will also get some attention as a cross-platform environment. While it's not quite as universal as Java, it does offer developers a way to cross-develop for PowerPC, Intel, and Alpha, because its development environment will also run on NT. Judging by its predecessor, NextStep, Rhapsody will be a strong object-oriented development environment that deserves a look-see, at least for companies with a significant Mac population. We've already seen, however, that some in the Mac community are coalescing around Be instead of waiting.

Better Mousetraps

We'd like to say that turmoil at the OS level will be offset by stability at the chip level. However, that's only

STANDING ON A MOVING PLATFORM

Dramatic changes in OSes will dominate 1998. By Mark Schlack

partially true. Intel appears set to continue its "Motherboard of the Quarter" program.

Faster bus architectures and memory will debut next year. Finally, these components will catch up to the speed of today's blazing processors. One year from now, the computer you buy will be completely different at almost every component and subsystem level from today's system.

The most action in computers could well be in the various flavors of network computers (NCs). Will the diskless, Java-based NC prove to be cheap, available, and really simpler to manage on existing networks? Will the NetPC stick around? After more than a year of serious hype, this technology is much more talked about than used.

Some of the most dramatic opportunities for improvement in 1998 lie in the network infrastructure.

Check it out:

- large-scale directory services for any major environment
- cheaper, more mature Gigabit Ethernet
- intelligent switches that unclog the router bottleneck
- more ways to leverage your data network for voice traffic
- enhanced security from digital IDs and smartcards

Much of what they need to do that already exists. Build your extranet on the Internet by leveraging virtual private network (VPN) technology—it's likely to mature to be secure enough and easy enough for most uses without the cost of private networks. Many of you will take advantage of that better security, combined with the productivity of component-based development (whether it's JavaBeans or ActiveX controls) to develop and deploy on-line commerce applications. You'll be helped in that effort by new electronic-cash technologies, Internet transaction-monitoring middleware, and even a new Dynamic HTML (DHTML). All this will bring order to the relative chaos of Web development today.

So dig in, roll up your sleeves, and exalt in the fact that you'll have no lack of new technology to put to work next year. And by the way—while you're trying to get through 1998 with your sanity intact, let's not forget that 2000 is only 24 months away. Fortunately, there will be no shortage of tools for the job. B

TALK BACK!!!

BYTE wants your thoughts on the 25 technologies we highlight in this issue. Your individual responses are confidential, but we will publish a report on the overall results. To participate, go to **http://www.marketperspectives.com/tech_invest/survey.cgi.**

The Next Windows

The desktops of 100 million people are about to change. What's going to happen?

By John Montgomery

For tens of millions of users, Windows is *the* OS. It's the only one they'll use, and they use it day in and day out. Therefore, it's big news when Microsoft announces major revisions to both its mainstream desktop OS (Windows 95) and its workstation/server OS (Windows NT). And unless the U.S. Department of Justice (DOJ) can stop it, 1998 will be the year remembered for OS desktop/Web integration.

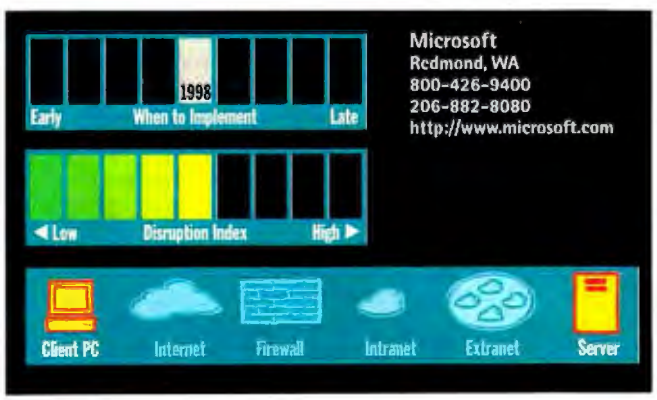
Both Windows 98 and NT will support some extreme Internet integration. Foremost among that integration is the merging of the desktop user interface and the Web browser so that browsing your computer and browsing the Web have a similar feel. A key technology behind this integration is Active Desktop (and Active Channel), a technology that permits users to put Web elements, including HTML, Java applets, and ActiveX controls, onto their desktops.

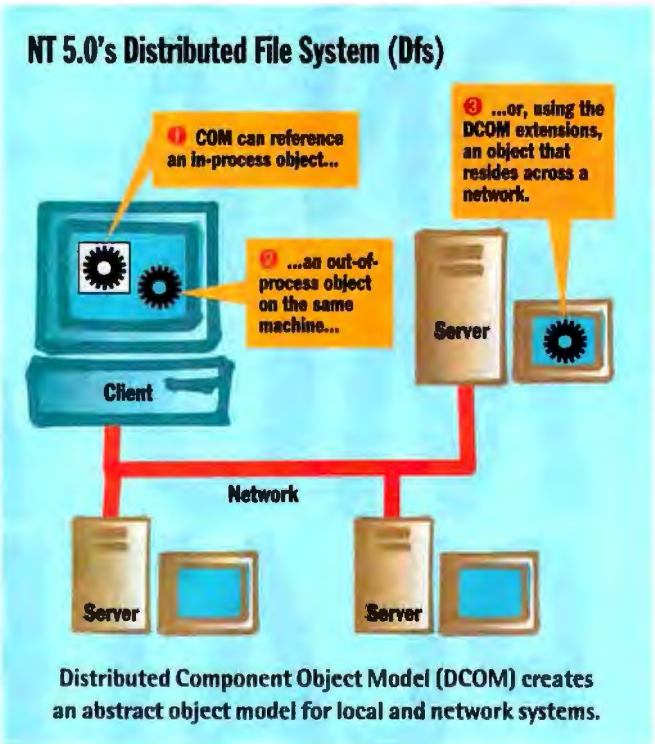
The DOJ's October 20, 1997, declaration that Microsoft's bundling of Internet Explorer 4.0 with Windows is illegal has cast a shadow over Windows 98. But unless the DOJ's action is supported by a federal judge, you can expect Microsoft to complete the integration of its desktop OS into the Web, and vice versa, by the end of 1998.

AT A GLANCE: Windows 98 and Windows NT 5.0 will integrate desktop and Web functions, unless the U.S. Department of Justice can interfere.

WHO SUPPORTS IT: Microsoft, numerous ISVs, numerous users.

For its part, Windows 98 is intended to be compatible with Windows 95 but faster and easier to manage. A new Disk Defragmentation Wizard enables users to optimize their hard disks for the applications they use the most. Windows 98 will also include a system file checker that tracks system changes and helps restore the system if necessary.





Distributed Component Object Model (DCOM) creates an abstract object model for local and network systems.

As for Windows NT 5.0, it promises enhanced scalability at both ends of the spectrum. NT 5.0 will bring better support for laptops through improved Plug and Play, better power management, and an encrypting file system to prevent prying eyes from getting information off a lost laptop. On the desktop, the inclusion of file allocation table (FAT) 32 and a direct Windows 95–to–Windows NT upgrade will make migration to NT simpler. In addition, NT 5.0 will be more at home on the network, with technologies such as the Distributed File System (Dfs), Kerberos security, a smartcard infrastructure, and Active Directory. At the high end, support for 64-bit very-large-memory systems and the I_2O I/O architecture push NT's scalability way up.

But the biggest question on users' minds about Windows in 1998—aside from when Microsoft will actually ship the next versions—is, "Which Windows should I run?" Microsoft has been very clear about this: It strongly urges business users without a need for Win16 compatibility to use NT. Home users, especially game players, should stick to Windows 98. But a unified driver model (WDM) and new versions of Microsoft's gaming APIs show strongly that Microsoft believes the future of Windows is NT and that, at some point, the Windows 95/Windows 98 line will expire. B

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CPU Interface Wars

The struggle to define the next x86 interface is shaping up as the mother of all motherboard battles.

By Tom R. Halfhill

The future direction of the x86-compatible PC platform will probably be decided in 1998. Or should we say future *directions*? At issue is whether the PC platform will remain a cohesive standard or split into semicompatible fragments that could force users and vendors to choose sides.

On one side is industry giant Intel, which makes about 90 percent of the x86 microprocessors in today's PCs. On the other side are Advanced Micro Devices, Cyrix, and Centaur Technology, three smaller companies who fight over the remaining 10 percent. Dissatisfied with table scraps, they want to grab more market share and challenge Intel's technology lead.

To keep them at bay, Intel is developing even better processors—and is changing the ground rules. Today, all four companies make CPU chips that fit a standard CPU interface called Socket 7. But Intel's P6-class processors—the Pentium Pro and the Pentium II—use a different bus protocol that delivers higher performance. It's also heavily patented and difficult to clone. It comes with a slew of new physical interfaces that are incompatible with Socket 7: Socket 8 (Pentium Pro), Slot 1 (mainstream Pentium II), Slot 2 (high-end Pentium II), and a miniature Slot 1 for future Pentium II notebook computers.

AT A GLANCE: Intel's proprietary CPU interfaces could trigger a legal showdown with competitors, squeeze the competitors out of business, or force them to develop their own alternative interface.

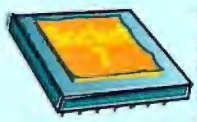
WHO SUPPORTS IT: Intel versus AMD, Cyrix, and Centaur Technology.

In response, the other x86 vendors will boost Socket 7's bus frequency from today's 66 MHz to a new high of 100 MHz. The 50 percent faster bus will appear in new CPUs, system chip sets, and motherboards in early 1998. That will match Intel's 100-MHz P6 bus, which is due in the same period when Intel releases the 440BX chip set.

Intel's P6 interface still has the advantage of a separate bus for the off-chip Level 2 (L2) cache. To counter that advantage, AMD and Centaur have announced that their new CPUs in late 1998 will integrate a 256-KB L2 cache directly on the chip. And those CPUs will fit Socket 7. Watch for Cyrix to announce a similar stopgap solution.

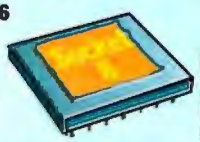
But in the long run, Intel's chipmaking rivals must either clone the proprietary P6 bus or invent a completely new interface. AMD is taking the second course. Its next-generation K7 chip (due in 1999) will join an x86 core to the bus interface of Digital's Alpha 21264. The K7 will fit a new slot that's physically—but not electrically—compatible with Intel's Slot 1. Future Alpha processors and system chip sets will also be compatible with this slot. A key event to watch for in 1998 will be whether Cyrix and Centaur go along with AMD's plan. B

Sockets and Slots



- Intel Pentium
- Intel Pentium-MMX
- AMD K6
- Cyrix 6x86
- Cyrix 6x86MX
- Centaur WinChip C6

The industry standard for x86 chips. No backside bus for L2 cache. Accelerates to 100 MHz in early 1998.



- Intel Pentium Pro

Intel P6 proprietary bus protocol. Has backside bus for L2 cache that runs as fast as 200 MHz.

- Intel Pentium II (mainstream)

Same bus protocol as Socket 8. Backside bus for L2 cache. Accelerates to 100 MHz in 1998.

- Intel Pentium II (high-end)

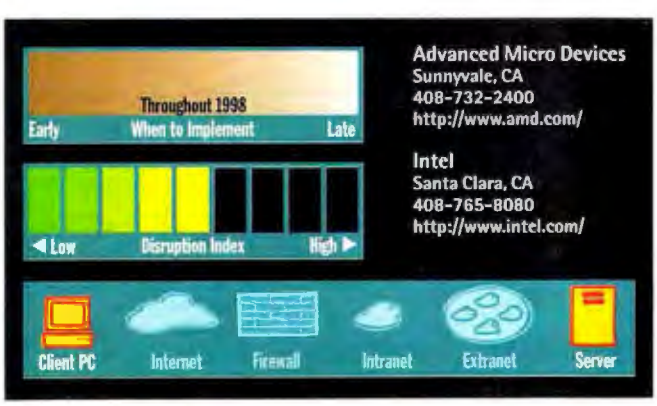
Same bus protocol as Socket 8. Backside bus for L2 cache. Makes debut at 100 MHz in 1998.

- Intel Pentium II (mobile)

Same bus protocol as Socket 8. Backside bus for L2 cache. Slated for 1998.

- AMD K7

Physically identical to Slot 1, but electrically compatible with Alpha 21264 bus. Scheduled to arrive in 1999.



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Java Evolves

With solid standards and tools, Java is becoming important in enterprise and embedded development.

By David S. Linthicum

No other technology has taken our Web-driven world by storm the way Java has. A simple, general-purpose, object-oriented, application-development language, Java provides the appropriate architecture and enabling technology for bringing true dynamic applications to the Web browser. In addition, through its portable Java virtual machine (JVM), Java finally solves the cross-platform problem. It provides a true "write once, run anywhere" architecture that most developers are finding too good to pass up.

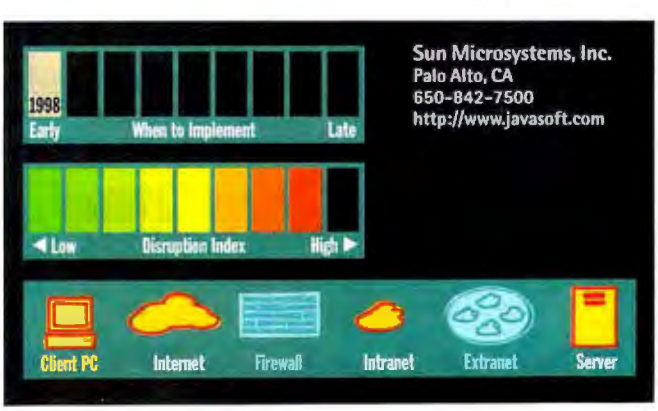
Now only two years old, Java is ready to grow in new directions. Among other things, Java will become standardized and is poised to create enterprise-ready applications and reveal a new awareness of embedded systems.

One of the initial complaints of early Java developers was the lack of features and functions built into the Java Development Kit (JDK). Tool vendors, such as Borland, Microsoft, and Symantec, were more than willing to fill in the gaps, but they did so using proprietary, tool-dependent hooks.

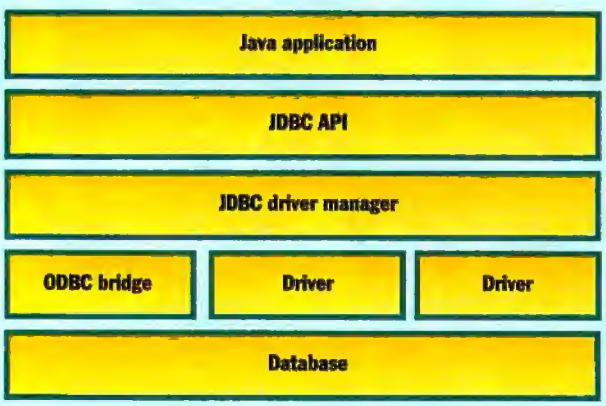
Since the release of JDK 1.1 in early 1997, Java now provides most of the basic features and functions that developers seek in a development language. One is the ability to link Java objects to relational databases using the Java Database Connectivity (JDBC) interface. Another is the ability to link Java applets, either intra- or inter-machine, using Java's remote method invocation (RMI). Java also has security, multimedia, and management APIs, to name a few.

AT A GLANCE: Java is a platform-agnostic development and application-execution environment currently supported on nearly every OS.

WHO SUPPORTS IT: Everyone is publicly backing Java—even Microsoft (despite the lawsuit). However, JavaSoft, a division of Sun, owns this technology.



Java Database Connectivity Architecture



JDBC enables Java developers to access databases in a standard way.

But the mother of all Java APIs is JavaBeans, which defines a set of portable APIs and lets developers build and integrate software components into Java-enabled applications. What's more, it incorporates existing component standards, such as ActiveX, the late OpenDoc, and Netscape's LiveConnect.

All these APIs would be of little use unless coupled with a strong set of tools. While most of the popular tools went in proprietary directions in 1997, they're moving toward standard Java APIs in 1998. Borland's new JBuilder, for example, is the first to leverage the power of both JDBC and JavaBeans. Other heavy hitters, such as Symantec's Visual Café Pro, IBM's VisualAge for Java, and MoJo Pro from PreNumbra, are being revised to support most of the new API set as well.

Sun has applied to ISO/IEC JTC1 for recognition as a Publicly Available Specification (PAS) submitter. The new PAS process was designed to submit Java as a new ISO Standard language.

Thus, it's foreseeable that we could have a standard Java, which will protect the language from those who would leverage it for their own proprietary purposes. Moreover, developers will be more confident that the code they create is portable to other tools that support the standard.

Another clear direction for Java to be headed in is embedded systems. In response to this need, JavaSoft has created EmbeddedJava, a new Java application environment that provides a core and standard extension APIs. EmbeddedJava is for environments with few resources (e.g., memory and storage). Thus, it supports only a subset of Java features but provides upward compatibility to traditional Java development. B

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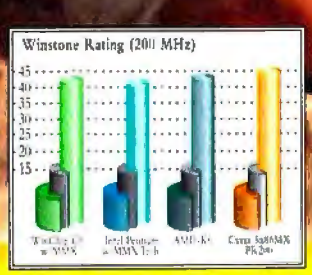
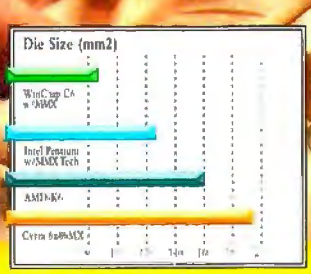
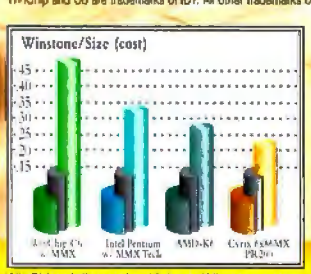


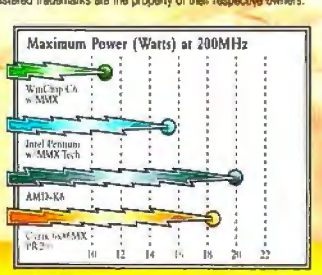
For Windows business applications, WinChip offers comparable performance to Intel Pentium with MMX Technology, AMD-K6 and Cyrix 6x86MX™.



Smaller die area means lower production cost, lower power consumption and heat dissipation.



WinChip delivers the highest Winstone rating per square millimeter of die area among Pentium-class microprocessors.



WinChip runs cooler and thus more reliably than others, extending battery life for mobile users.

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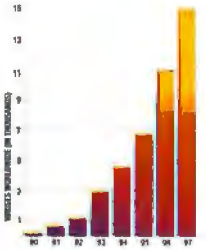

The worldwide computer virus count currently tops 15,000, but the virus threat gets worse every year. Hundreds of new viruses are created every month.

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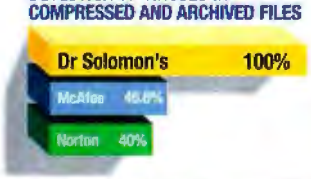

SOURCE — Secure Computing, January 1997
Dr Solomon's is far more advanced in detecting viruses lurking within zipped and compressed files including Internet downloads covering the widest variety of file compression formats.

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SOURCE — Secure Computing, January 1997
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SOURCE — University of Hamburg, February 1997
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Centralized Management for Desktops

Centralized management lowers costs and simplifies maintenance of desktop computers.

By Mike Hurwicz

Organizations are increasingly waking up to the costs of managing desktop computers. For instance, the Gartner Group (Framingham, MA) estimates that the total cost of ownership (TCO) for a networked Windows 95 PC is $9784 a year. TCO includes hardware and support costs. Much of that expense comes from users changing configurations, installing applications, and plugging in cards, making every machine unique and greatly complicating troubleshooting and upgrading tasks. Users might even do things such as download programs that are infected with viruses, creating unnecessary and expensive crises for the whole organization.

AT A GLANCE: Centralized management for desktops is lowering total cost of ownership by as much as 25 percent. Low-cost, sealed, thin-profile desktop machines could bring minor additional savings.

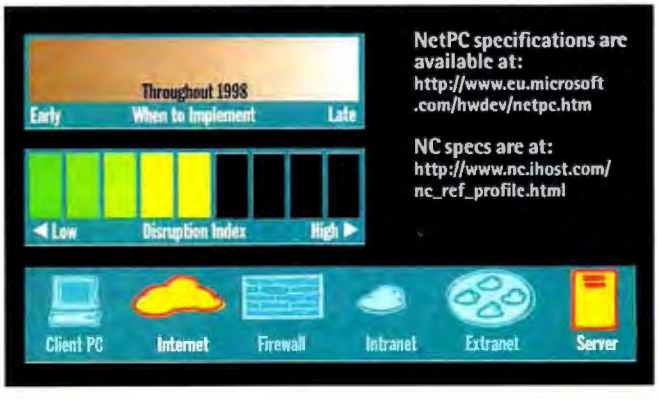
WHO SUPPORTS IT: Major proponents of centralized management include Microsoft, Intel, Sun, HP, and IBM. Manufacturers of NetPCs include Compaq (Deskpro 4000n NetPC), Packard Bell NEC (NetPC), and HP (netVectra). NC manufacturers include Sun Microsystems (JavaStation) and IBM (Network Station).

Centralized desktop management strategies will become increasingly widespread in 1998 because of their potential for lowering TCO and protecting the corporate network. These strategies include automatic configuration, remote diagnostics, remote booting, and LAN wake-up (power-on). Company policies might also prohibit users from changing their setups or installing their own software, then denying them central support if they do. Centralized, automated management of desktops can reduce TCO by as much as 25 percent, according to estimates by the Gartner Group.

NetPC vs. Network Computer

	NetPC	NC
Savings in total cost of ownership	26 percent	39 percent *
Must support local hard disk?	Yes	No
Network speed requirements	Modest	High-speed
Local operation possible?	Yes	No
Primary target application type	Windows	Java

* Compared to a typical Windows 95 workstation. The cost of migrating from Windows to Java is not included in this estimate.
(Source: Gartner Group)



NetPC specifications are available at: http://www.eu.microsoft.com/hwdev/netpc.htm

NC specs are at: http://www.nc.ihost.com/nc_ref_profile.html

In 2Q 1998, Microsoft expects to release Windows 98, which will be the first operating system to embed Zero Administration for Windows (ZAW), a Microsoft initiative promoting centralized, automated management for desktops. ZAW is out in kit form for Windows 95. ZAW can restrict users from installing unauthorized software and accessing network resources; it can also lock down machines entirely.

Sealed, low-cost, thin-profile desktop computers, such as those being built according to the Intel/Microsoft-sponsored NetPC specification, provide minor additional benefits, adding perhaps another 3 percent to the savings that are possible with centralized management. However, NetPCs are not designed to function if the network is down, since their local hard disk is only for caching. Nor can people install software locally, since there are no local storage devices such as floppy disk drives or CD-ROM drives.

Because of these limitations, even proponents like Compaq say the NetPC will garner no more than 10 to 15 percent of the market. Neutral sources such as market research firm International Data Corporation (Framingham, MA) predict market share of only 1 to 2 percent, even by 2001.

Even at these low rates of adoption, the NetPC might accomplish its primary task: countering the publicity blitz associated with the network computer (NC) promoted by Sun, Oracle, and others. The network computer is itself now expected to garner no more than 2 percent of the market by the year 2000, according to the Gartner Group. B

Stop the Insanity

Digital IDs address a multitude of access, authentication, and encryption issues.

By Jon Udell

When I came to work this morning, I used a card key to unlock the main door, then the door to BYTE's offices, and finally the door to the computer room. My card key identifies me, among the 80 cardholders in this building, as one of only a few with access to all three of these domains.

Then I began typing in passwords: to my machine, the LAN, mail and conferencing systems, Web applications. This is nuts.

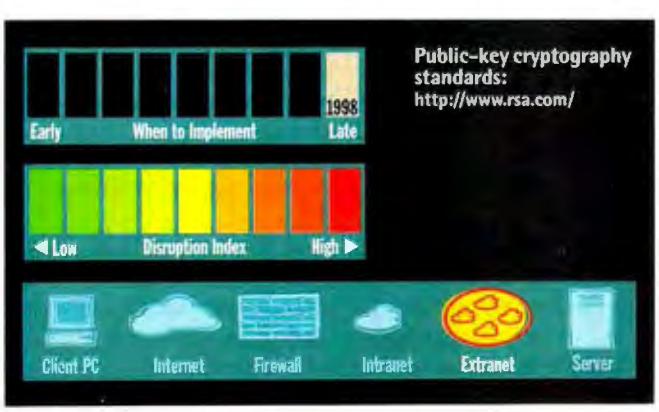
To stop the insanity, a broad industry coalition is forming around digital ID technologies. These include:

Certificate Authorities. CAs mint new digital IDs, bind them to people, verify bindings on demand, and revoke IDs if necessary. A major 1998 decision: Outsource to a third-party CA, or run your own internal CA services? To outsource, check commercial CAs such as VeriSign and Thawte. You can customize their "private-label" certificate services for your business. To roll your own, Hewlett-Packard's Praesidium line and Xcert Software (Sentry CA) can provide infrastructure.

AT A GLANCE: **Digital IDs will eventually replace almost all uses of passwords and cookies with a more secure, more convenient way to control access to private applications and information.**

WHO SUPPORTS IT: **Core technology: RSA Data Security. Toolkits: Sun, Microsoft. CA service: VeriSign, Thawte, AT&T. Infrastructure: HP/Nortel, Microsoft, Netscape. Apps: Netscape, Microsoft.**

Crypto Infrastructure. Today, crypto applications mostly bundle their own crypto support. But the infrastructure belongs in the OS: That's where Microsoft is putting it. MS CryptoAPI comes with Microsoft Internet Explorer (MSIE). In Windows 98 and NT 5.0, it will be bundled with the OS. Sun's Java Cryptography Extension (JCE) will provide key management, digital signatures, encryption, and other services for the Java platform.



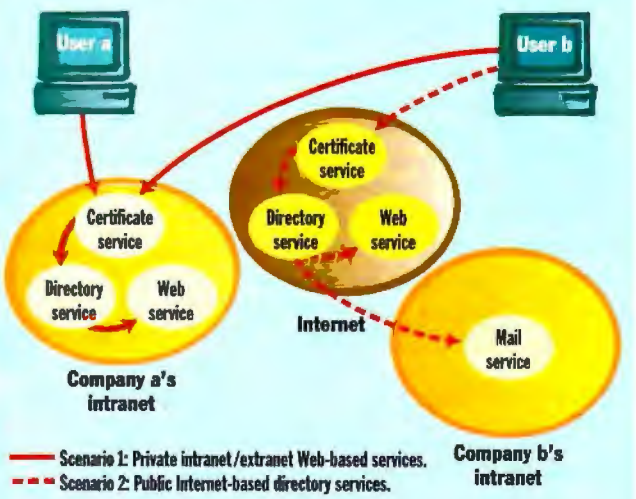
Digital IDs must work closely with directory systems, too. Netscape's SuiteSpot 3.0 led the way, enabling users of mail, news, and Web clients to identify themselves and then gain permissions based on an LDAP directory lookup. Microsoft's Active Directory will provide a generalized way to map digital IDs to users.

Crypto-Aware Applications. With Netscape's Communicator or MSIE 4, you can already use a digital ID to gain access to a protected Web application, sign an e-mail or conference message, or encrypt an e-mail message. With the Communicator newsreader, you can also use a digital ID to gain access to a secure newsgroup. Few users today exploit these features; as 1998 progresses, more users will.

As mainstream applications such as Communicator and MSIE 4 educate users about digital IDs, more commercial and corporate developers will begin to deploy their own digital-ID-enabled applications. CryptoAPI and JCE will be powerful enablers.

Smartcards and Readers. Once you use a digital ID on your office machine, you wonder: "How do I use this same ID on my laptop or home machine?" The answer now is: "With great difficulty." By 1998's end, card readers (attached to serial-port, PC Card, universal serial bus [USB], or other interfaces) will begin to make using digital IDs as simple as the card key I opened the door with this morning. B

Two Digital ID Scenarios



Digital ID infrastructure can be located inside your company (scenario 1) or outside (scenario 2).

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MultiWin Gets Its Audition

NetPC was just the overture; Citrix's MultiWin will be the tune Windows administrators want to hum.

By Dick Pountain

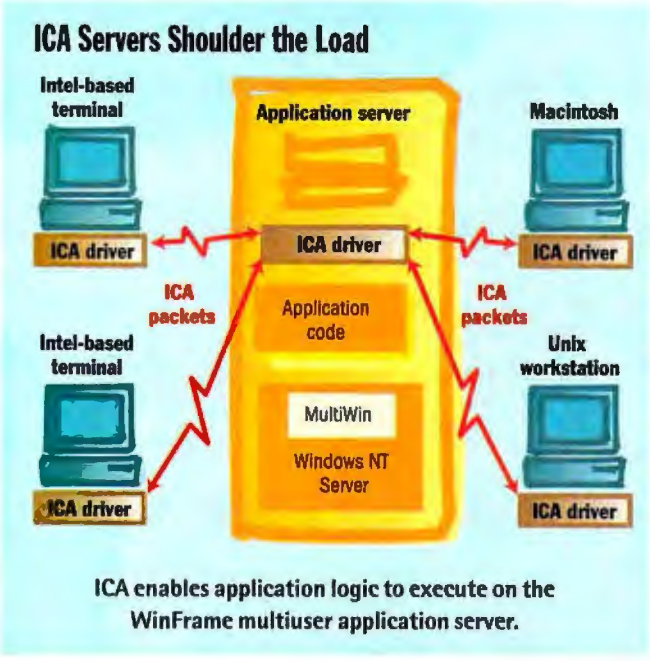
The high cost of maintaining Windows PCs has become a strategic issue as Sun and its allies challenge Microsoft's domination of the desktop with their centrally maintained network computer (NC) concept. Microsoft countered with the hastily concocted NetPC standard. But behind the scenes it's readying Citrix's MultiWin technology as a not-so-secret weapon in the cost-of-ownership wars.

MultiWin boosts NT so that many users can run applications such as Word and Excel simultaneously on the same server, driving them remotely from user interfaces running on inexpensive terminals. Unlike NCs, these client terminals don't need to download any OS or application code, so they can be very "thin" indeed. Citrix claims a minimum hardware requirement of an Intel 286 processor or equivalent and 640 KB of RAM, far skinnier than any NC or X Window System terminal. An independent report found that 30 MultiWin clients can run Excel simultaneously on a twin-Pentium server without taking a big performance hit.

AT A GLANCE: MultiWin technology turns Windows NT Server into a multiuser OS: It lets you run desktop applications on a server while controlling them from inexpensive terminals.

WHO SUPPORTS IT: Bell Mobility, British Telecom, Chase Research, Compaq, Dell, Dr. Solomon's Software, Eicon, Equinox, Hyperion Software, IBM, Insignia, Intergraph, Microsoft, Multitech, Novell, Sequent, Shiva, Tektronix, Ventana, Wyse.

Like X, MultiWin works by packing up the Graphical Device Interface (GDI) commands that ordinarily control an application's local display and sending them across a communications link to the client for execution (see the figure above). The client doesn't have to be a PC; it can be a Mac or a Unix workstation running suitable client software. Citrix has invented an efficient protocol, called Intelligent Console Architecture (ICA), to send the display commands.

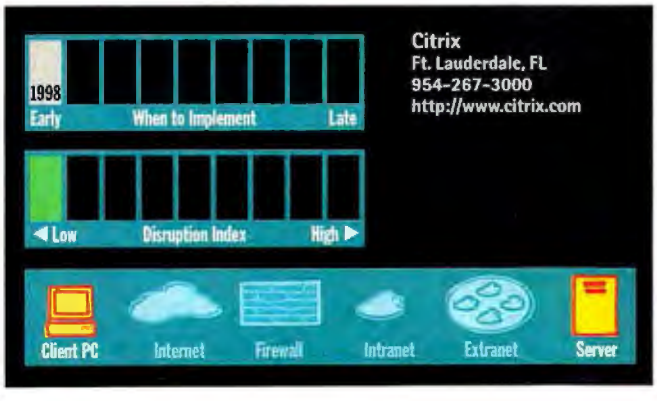


ICA enables application logic to execute on the WinFrame multiuser application server.

Unlike the bit-mapped screen images that a conventional remote-control program would send, ICA messages are very compact, needing as little as 20 Kbps of bandwidth to interactively control a typical Microsoft Office application. Thus, humble transports, such as 10-Mbps Ethernet, ISDN, and even 28.8-Kbps modem links, are adequate—they act as thin wires for thin clients. ICA can run over all the popular network protocols, including TCP/IP, IPX/SPX, NetBEUI, and PPP.

Citrix developed the MultiWin technology for its own WinFrame application server, which already has 500,000 users worldwide. Microsoft purchased a license for MultiWin and rolled it into Windows NT 5.0, under the code name Hydra. Microsoft is substituting its own T.Share protocol (which is used in NetMeeting) in place of ICA, but Citrix will offer suitable adapter software to its own user base.

MultiWin/Hydra will enable roving laptop users to dial in to mission-critical applications running on their home server and allow task-based users of green-screen mainframe terminals to painlessly upgrade to Windows applications. Expect the technology to also turn up in special-purpose terminals, from street kiosks to pocketable PDAs. Desktop Windows terminals are expected to cost around $500; the server and client software cost is currently $200 to $400 per seat. B



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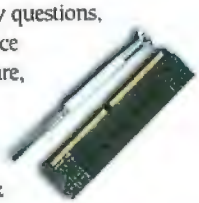

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Apple Plays a Rhapsody

The initial release offers OpenStep classes, Java support, and multiplatform versions.

By Tom Thompson

In October 1997, Apple Computer shipped the developer release of Rhapsody, its next-generation OS, to 10,000 developers. Rhapsody will prove to be a modern OS that provides attractive features that are bound to please users. Its Mach 2.5 kernel includes memory protection, threading, and preemptive multitasking. This first release runs on Macintosh systems based on the PowerPC 604 and 604e processors. But Rhapsody isn't a one-processor pony: A version for x86 PCs shipped several weeks later. This version supports the Pentium and Pentium II processors.

Developers will also find goodies for them in Rhapsody. A Unix BSD 4.4 shell provides ready access to scripting features, plus a set of bundled development tools. You can build applications out of a set of object-class libraries dubbed the "Yellow Box." These libraries are based on Next's OpenStep, which has powerful GUI support and has been extensively field-tested for over a decade. In fact, much of Rhapsody has its basis in work that was done at Next.

Note that Rhapsody is an OS in itself. The Yellow Box libraries are an application framework that can run under Windows NT and 95, as well as certain flavors of Unix without Rhapsody.

Rhapsody does not ignore the Java boomers. You can call the Yellow Box APIs directly from Java. On a Power Mac, Rhapsody supports Java using a Java virtual machine (VM) based on Sun Microsystems' JDK 1.1.3. The Windows-based Yellow Box libraries use the Windows Java VM, so in theory you can write a Java application that relies on the Yellow Box APIs and count on it to run on the Mac, Windows, and Unix.

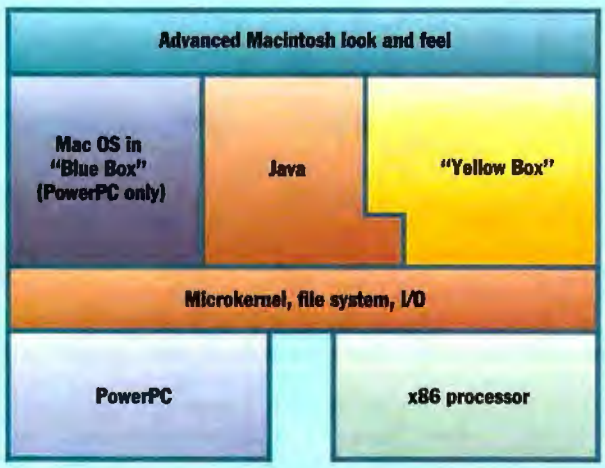
AT A GLANCE:

Apple's next-generation OS is based on Next's OpenStep and can run on x86-based PCs and Unix.

WHO SUPPORTS IT:

Apple Computer and every Macintosh user.

Rhapsody OS Architecture



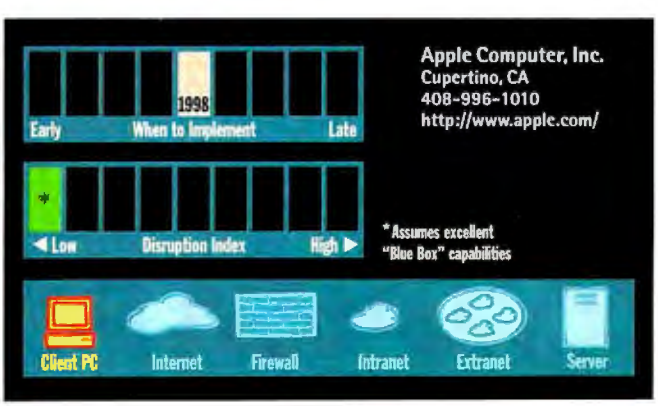
Rhapsody provides extensive Java support and a set of class libraries (the Yellow Box) that run on any platform.

While Rhapsody sports a number of Mac user-interface elements, this first release is primarily an OpenStep port to the PowerPC. It's for those developers who wish to start work with the Yellow Box APIs. There's no Mac OS–compatibility environment present (the "Blue Box"); that comes in the next major release, which is termed "Premier." The Premier release is slated to ship in the first quarter of this year. The first widely available release of Rhapsody, which is termed "Unified," will ship about midyear.

Can Apple make these deadlines? So far, the track record looks good: The Developer release was scheduled to ship at summer's end, and despite Apple's travails last year, engineers got it out only several weeks late.

For the time being, Mac developers have to work in a foreign environment to pursue Yellow Box development. But if the Blue Box in the Premier release offers good Mac OS–application compatibility, the job will be much easier. Developers might face a tough decision for a while: Either face a lot of pain now to get up to speed on the Yellow Box or wait it out for the Blue Box. Another option is to use Metrowerks Latitude, which routes Mac OS API calls to low-level kernel calls. Latitude thus provides a valuable shortcut for migrating existing Mac OS program code to Rhapsody and several flavors of Unix.

With all these cross-platform out-of-Mac experiences, we can only wait and see what more surprises Rhapsody will bring. B



Extranets Reach the Spotlight

Standards-based security and virtual private networks open up intranets to electronic commerce.

By Pete Loshin

In the world of face-to-face business, you can invite customers and business partners into your shop without giving them a key to the executive offices. Extranets give you the same opportunity to open up information and systems on your intranet to outsiders without putting confidential data and mission-critical applications at risk.

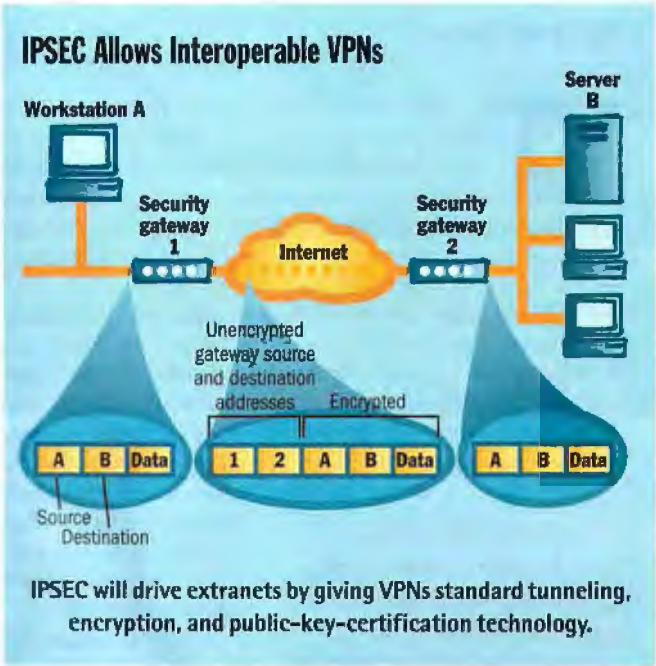
The key technologies that make extranets viable offer nothing new except the way they're put together: strong authentication and strong cryptography, the deployment of virtual private networks (VPNs), and the use of distributed-computing architectures and special-purpose products that permit electronic commerce on top of the extranet infrastructure.

AT A GLANCE: **Extranets use existing TCP/IP internetworking and connectivity technologies, combined with distributed computing technologies, to foster secure interorganizational communication through the open, global Internet.**

WHO SUPPORTS IT: **AT&T, Bay Networks, Cisco, IBM, Lotus, Microsoft, Netscape, Object Management Group, Oracle, RSA Data Security, Security Dynamics, Siemens-Nixdorf, Sun, TimeStep, VPNet.**

Extranet security comes in the form of standards-based authentication, encryption, and digital signatures. RSA Data Security offers tools such as JSafe (for Java), BSafe (for C++), and SMail (for S/MIME-enabling messaging products) and licenses its algorithms for encryption and cryptographic hashing. Many vendors are adopting the Internet Engineering Task Force's (IETF's) Secure IP (IPSEC) standard for virtual private networking.

VPN products encrypt and authenticate traffic among networks and between individuals and remote networks. Formerly a specialty product often bundled into firewalls, such as those from Raptor Systems and Check Point Software, VPN capabilities are now available wrapped inside products as mainstream as Compaq's Microcom 6000 series remote-access concentrators, Intel's routers, and Microsoft's Windows NT 4.0.

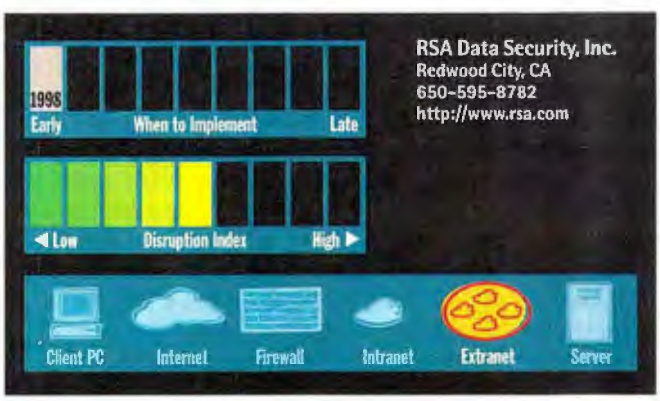


IPSEC will drive extranets by giving VPNs standard tunneling, encryption, and public-key-certification technology.

Distributed computing, whether by building a front end to legacy data through a Sun-approved Java/JavaBeans/IIOP/CORBA approach or by using the Microsoft-blessed ActiveX/Active Server Pages/DCOM approach, is an integral feature of extranets. Putting the program logic where it belongs and keeping the client side thin mean more opportunity for interoperability.

Electronic commerce should visibly accelerate the growth of extranets over the next year. Actra, an electronic-commerce joint venture of Netscape and GE Information Services, provides comprehensive software solutions for business-to-business and business-to-consumer electronic commerce. Meanwhile, Pandesic, a joint venture between database powerhouse SAP and chip-maker Intel, should be shipping early this year its first turnkey commerce systems aimed at simplifying entry into electronic business. The company's hardware/software/services bundle will be priced at about $25,000, plus some transaction fees.

Changes in the networked world tend to happen slowly. Electronic commerce, awaited by merchants and heralded by vendors and industry pundits since about 1994, will get here as extranets gain momentum. Once extranet wires and workstations are in place, an avalanche of electronic commerce will follow. B



Serving Up Storage

Faster SCSI and Fibre Channel SANs set the stage for servers that run and run.

By Scott Mace

Disk I/O subsystems, not CPUs, are the bottlenecks in today's servers. However, that will change in 1998.

The changes start with the venerable SCSI, which is suddenly doubling in speed and length, going from a 40-MBps burst rate to 80 MBps with PCI Ultra2 SCSI. At the same time, Adaptec has released technology to increase the length of SCSI cables from 3 meters to 12 meters.

The speed improvement will help servers keep up with processor improvement, while preserving investments in previous SCSI hardware. Ultra2's 25-meter distance will help drive disk storage out of the confines of the server cabinet itself and into rack-mounted external RAID and more exotic subsystems. Mixing and matching external disk to server will become commonplace. And next year, Adaptec will be sampling Ultra3 technology, doubling SCSI's burst rate again to 160 MBps.

AT A GLANCE: **SCSI improvements and Fibre Channel growth will let servers separate into compute and storage nodes, setting the stage for fault-tolerant, scalable cluster solutions.**

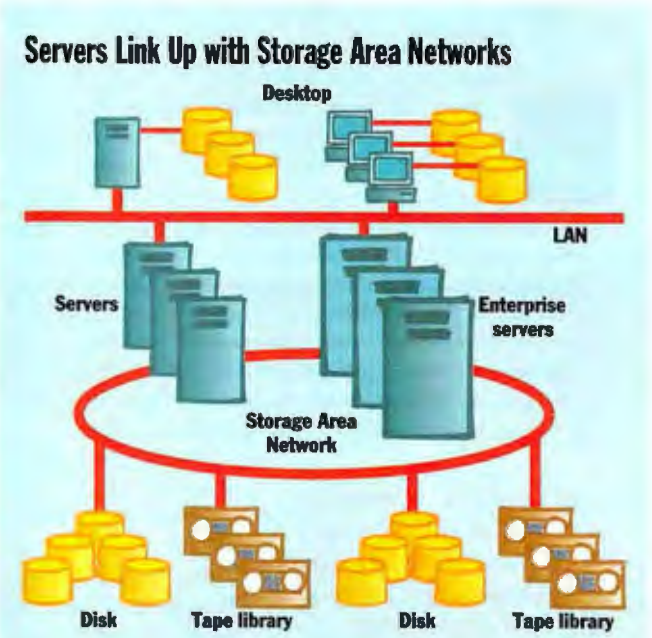
WHO SUPPORTS IT: **Adaptec, Intel, Computer Network Technology, Tricord, Compaq, Hewlett-Packard, Tandem, Microsoft, Novell, Sun, SCO, Data General, Fibre Channel Association, Vinca.**

But SCSI is just the beginning. Fibre Channel, an ANSI-standard network that can multiplex both SCSI and IP traffic, extends 30 meters over copper wires or as far as 10 kilometers on fiber-optic cables. It is capable of speeds in excess of 100 MBps in both directions. In 1998, expect to see host adapter offerings from HP, Compaq, and others. Fibre Channel networks will come to resemble Gigabit Ethernet networks, employing hubs and switches as the core of server farms.

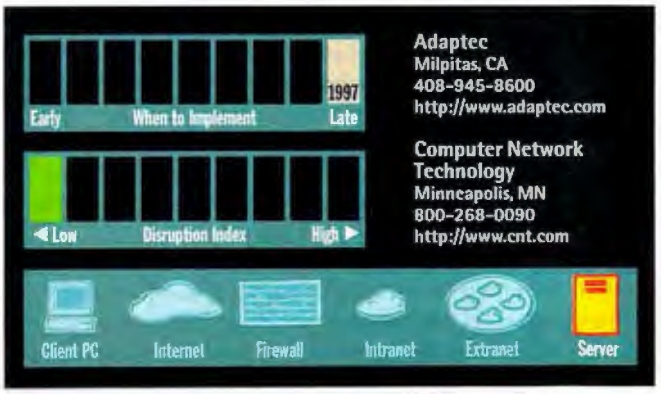
Overlaying both SCSI and Fibre Channel are emerging Storage Area Networks (SANs), such as those from Computer Network Technology and Tricord. SANs not only separate storage nodes from server nodes on networks, they also let different servers share a common pool of data. SANs let users expand disk capacity without having to bring down application servers.

Mere speed and capacity are one thing, but affordable disaster recovery and scalability are the holy grails of the data center. Unix systems have offered clustering technology, with automatic failover to backup servers, for years. Disk mirroring has been a feature of Novell's SFT III for almost as long. This year, Microsoft's Server Cluster option brings to Windows NT 4.0 similar reliability features. After NT 5.0 ships, Microsoft will expand Server Cluster to support more than two nodes, and NT will gain the scalability of those nodes working together to share the load of applications, such as database servers, which are written to take advantage of Cluster Server.

Not to be outdone, the next release of Novell's NetWare, known as Moab, will be able to support 16-server clusters when its Orion option, formerly known as Wolf Mountain, ships. Novell is promising Orion for the second half of 1998. B



High-speed storage subnetworks can employ SCSI, Fibre Channel, and wide-area media such as ATM or DS3 connections.



HTML Groupware

The latest browsers include clients that can compose and transmit HTML pages. Now there's a universal groupware platform.

By Jon Udell

Readers of my column know that I'm wildly excited about the uses of HTML-aware e-mail and conferencing. Here's why.

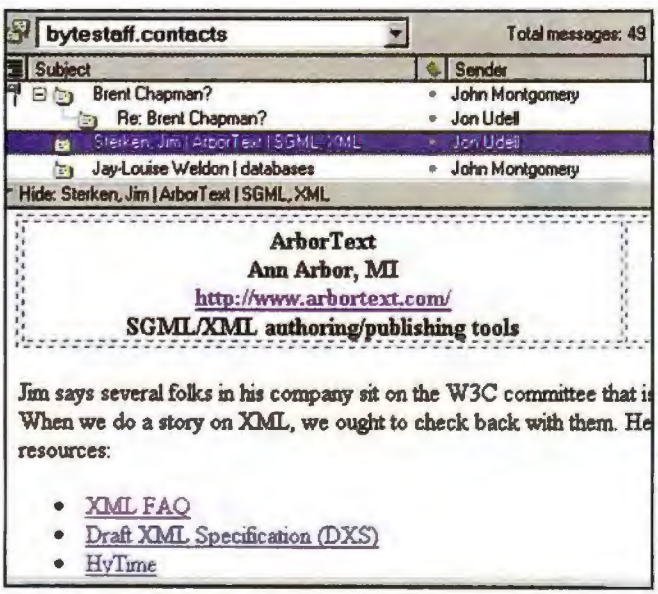
Zero install. The marvel of the Web is that your browser needs only the addresses of all the applications it runs, not the applications themselves. HTML-aware mail and news work the same way. In particular, the newsreaders that are built into the version 4.0 browsers are surprisingly capable groupware clients. Right out of the box, they enable you to collaborate on private and public networks with your own company, with your partners, or with anyone in the world.

AT A GLANCE: **The latest browsers come with HTML-aware mail and news clients. These provide a lightweight mobile-code infrastructure and bring the power of hypertext authoring to routine business communications.**

WHO SUPPORTS IT: **Netscape led the HTML mail and news initiative; its Collabra client and server define next-generation NNTP conferencing. Microsoft has followed closely with superior componentization and dynamic HTML technology.**

Lightweight mobile-code infrastructure. The mail and news clients in the 4.0 browsers can render most of what the browsers can—including style sheets, JavaScript, and dynamic HTML. On the Web, these features are opening up new vistas for applications that offer rich user interfaces yet are small and quick compared to client-side Java. In mail and news messages, these features become mobile in the same way that Java applets are.

Hypertext for everyone. Today the richness of the Web is produced by relatively few and consumed by many. However, everyone ought to be able to pound out business memos that use hyperlinks, tables, and graphics to communicate more effectively. Now everyone can, thanks to the HTML composition tools used in the latest browsers to create rich mail and news documents.



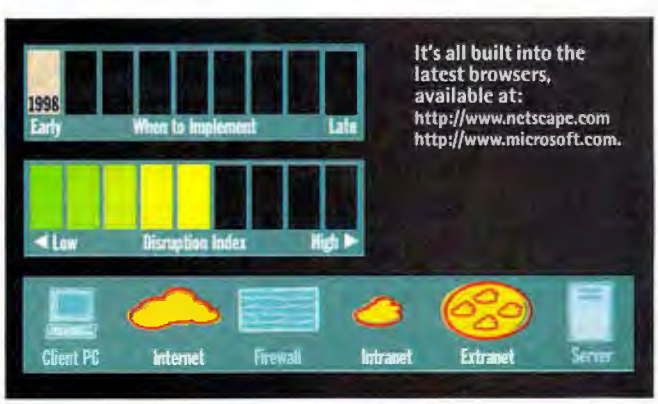
The message being composed here can include rich text, hyperlinks, tables, and graphics.

Open, extensible data stores. Under the covers, HTML mail and news messages marry two venerable Internet standards: the RFC8 22 message format and HTML. Text files containing one or both of these formats are what mail and news servers store. Many well-understood programming tools and strategies can produce, analyze, extend, redistribute, and search these files.

Flexible communications. The mail and news clients work together to create a rich environment for both push-oriented and pull-oriented information exchange. You can send an electronic form to a group by using a mailing list. Alternatively, you can post the form in a newsgroup. There it becomes part of a public record.

This mode has several advantages. For instance, current group members can refer back to the form even if their local mail store is unavailable. In addition, future group members will find the form when they join the group.

The technology that enables HTML groupware is already largely deployed. Why hasn't it made a large impact yet? Most people focus on the browser, and few realize the powerful capabilities of HTML-aware mail and news. In 1998, many more Web users will discover and apply these tools. B



Memories of Things to Come

Too many RAM technologies on the market at once could confuse system upgraders.

By Nebojsa Novakovic

Memory technology made a quantum leap in 1997 with nearly a dozen new DRAM and SRAM architectures. One of the new architectures, SDRAM, will be the prevailing standard in 1998 PC systems, but others will emerge toward the end of the year to rival it.

SDRAM

Synchronous DRAM provides burst rates of up to 150 MHz, significantly higher than the standard 60-ns, 40-MHz extended data out (EDO) DRAM in today's systems. SDRAMs with 64-Mb capacity are already shipping. Most of SDRAM's initial incompatibilities with Intel's strict timing specs for the i440LX (66-MHz bus) and i440BX (100-MHz bus) chip sets have been ironed out.

ESDRAM

Enhanced SDRAM is the latest in a string of enhanced memories developed by Ramtron, which focuses on chips with low latency and high sustained bandwidth.

DDR-SDRAM

To improve the per-pin bandwidth, you can transfer data on both edges of each clock. This technology is called double data rate (DDR). Most new memory architectures will use this capability. DDR-SDRAM, which is also known as SDRAM II, was finally approved as an official standard after vendor disagreements over data strobe and other design issues.

AT A GLANCE: A mess of acronyms are fighting to be the RAM in your next system; SDRAM is the choice for 1998.

WHO SUPPORTS IT: Intel, Ramtron, Rambus, MoSys, SyncLink, Mitsubishi.

Direct RDRAM

Some six years ago, a small California start-up, Rambus, shocked the memory community with its Rambus DRAM. RDRAM offered 500-MHz memory bus throughput by using 8-bit buses with 250-MHz clocks and dual-data transfers using both clock edges, all with a pin count one-third of comparable DRAM. You could even upgrade the memory in steps of one chip, offering unprecedented granularity. Rambus and Intel now have the specification for the next-generation Direct Rambus DRAM, which Intel hopes to use in its Willamette- and Merced-based systems in late 1999.

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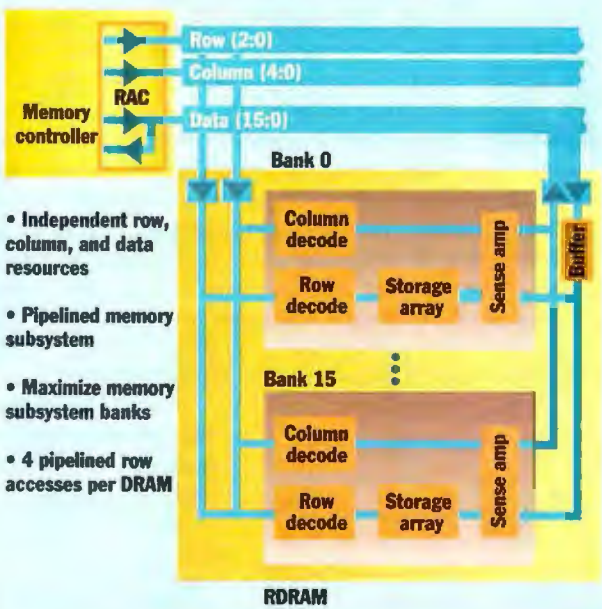
http://www.ramtron.com

How Direct Rambus Gets 95% Efficiency



SLDRAM

Designed by the SyncLink consortium of major DRAM manufacturers, SLDRAM is a new royalty-free, open memory standard. In some ways similar to Direct RDRAM, SLDRAM implements a command-driven, packet-oriented, 16-bit, 200-MHz dual-data bus with 400-MHz throughput (800-MBps bandwidth). Like Direct RDRAM, SLDRAM lowers memory-bus pin count by using a fast, narrow data path. Fewer signals means easier control of electromagnetic interference and skew, as well as simplified board routing.

CDRAM

Mitsubishi's cache DRAM, which is offered in 4-Mbit and 16-Mbit chips, uses a small amount of on-chip cache (16 Kb) together with a very wide 128-bit internal data bus to achieve both a very high burst rate of up to 100 MHz and a very short pipelined access time of 7 ns. Its SRAM and DRAM banks operate concurrently. B

Solving for the Year 2000

1998 is the watershed year for Y2K readiness. If you don't have a plan, plan on problems.

By Ed DeJesus

When considering the Year 2000 (Y2K) problem, 1998 is the point at which to start panicking. The reason, like the problem, is simple math. Many consultants estimate that it takes at least two years to fix the problem for medium-to-large enterprises. As of 1998, there simply isn't enough time left.

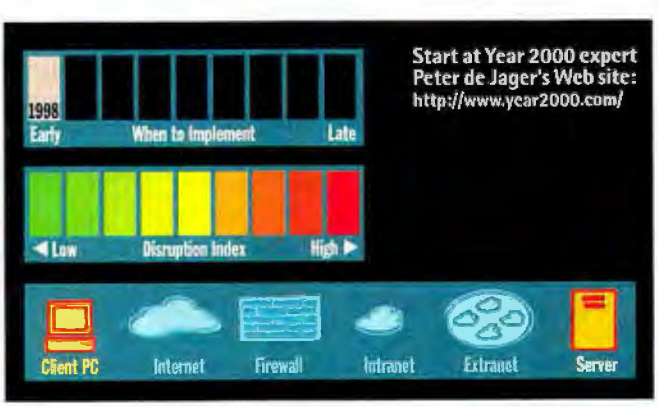
Y2K is a problem because programmers are too clever. Faced with managing millions of records (e.g., financial transactions, births, deaths, and so forth), using two digits to represent the "19" portion of every year like "1954" seems wasteful. Why not simply ignore the "19" and handle just the last two digits of the year? The problem is that, after 1999, the years don't start with "19" anymore. Changing records is a tedious process, but it's a straightforward one. It's finding all the references to years in compiled running code that makes CIOs head for the Prozac.

You may have the delusion that only ancient COBOL applications on primordial mainframes have Y2K problems. Sorry, but you're wrong. Your desktop computer, your applications, your database, your spreadsheets, and your form letters with "date here" codes could all have the same problem. This desktop perspective might inspire a boomlet of upgrades to Y2K-safe versions. Expect to see "Year 2000 Compatible" stickers on boxes.

AT A GLANCE: Machines and programs assume that years start with "19" and will start failing in 2000.

WHO SUPPORTS IT: Software vendors include Ascent Logic, Cayenne, Computer Associates, Micro Focus, and Viasoft. Consultants include Compuware, ConSyGen, Data Dimensions, IBM, Keane, KPMG, Peritus, and TRW.

You can uncover these errant pieces of code, but it's not a simple undertaking, and it's certainly not guaranteed to root out every single one. An entire industry has arisen to help enterprises find and fix everything before the odometer clicks over. (These consultants face a Y2K problem of their own, of course, involving unemployment and a very narrow set of skills on their résumés.)



Start at Year 2000 expert Peter de Jager's Web site: http://www.year2000.com/

Y2K Affects Everything

Area	What's affected	Problem
Enterprise hardware	Mainframes	Hard-wired to use two-digit years
Enterprise applications	COBOL code listings or records on computer cards	Records and programs assume two-digit years
Desktop hardware	Desktop computers	PC BIOSes can't handle years after 1999
Desktop software	Boxes representing databases, spreadsheets, word processors	Assume years are two digits long
Files	Spreadsheets, form letters	Give wrong years after 1999

This process involves a sequence of binary choices. First: Fix the existing code or replace it? Consultants can help you figure out the best choice, or you can perform a similar analysis yourself with software (from Ascent Logic, Computer Associates, Viasoft, and others). Fixing the code is most attractive when your code works and is stable. Your second binary choice: Fix it yourself or hire outside help? While tools (from Cayenne, Computer Associates, Micro Focus, New Art Communications, Platinum Technology, Viasoft, and others) can help you find and fix problems, many are looking to outside specialists for help.

Replacing your code instead is an attractive option if the code is buggy anyway or if the IS department has changes they've been dreaming of making. Again: Write the new code or get others to do it? This is straight development without Y2K overtones. Of course, you might want to make doubly sure that the new code will be Y2K compliant.

Hardware problems are, well, harder. Do you have thousands of desktops whose BIOS is toast after 1999? Then you have a problem. You could change all those BIOSes, but this is probably not one of your life goals. You could buy all new machines, but signing such an invoice is the equivalent of signing your own pink slip. Some programs claim to intercept the BIOS with software, an ideal solution if these programs prove to be utterly trustworthy with every application that will ever run on the machine they're installed on. But I wouldn't bet the ranch on it.

My own view? Give everyone the day off, if they don't have it already, and bring in a dustpan and brush on January 2.

The Smartcard Invasion

Smartcards, ubiquitous in Europe, are set to hit the United States at last.

By Udo Flohr

It's 1977. The French banking association, Cartes Bancaires, is looking for a way to combat huge losses through fraud. Using relatively simple equipment, criminals are reading data from magnetic stripes and copying it onto counterfeit cards. Working with French computer company Bull, Motorola Semiconductor designs the first smartcard microchip. Once the infrastructure is in place to replace magnetic-stripe cards, card fraud drops tenfold.

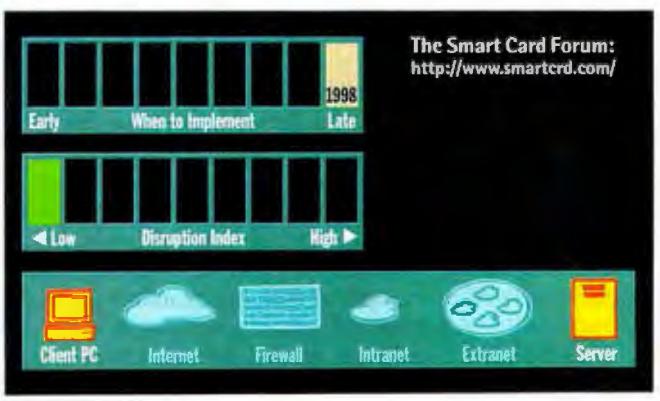
The four basic components of a smartcard are the controller chip, its packaging (called a module), software, and the card itself. Cards exchange data through a reader or, with the newer contactless variety, from a distance via a built-in miniaturized radio modem.

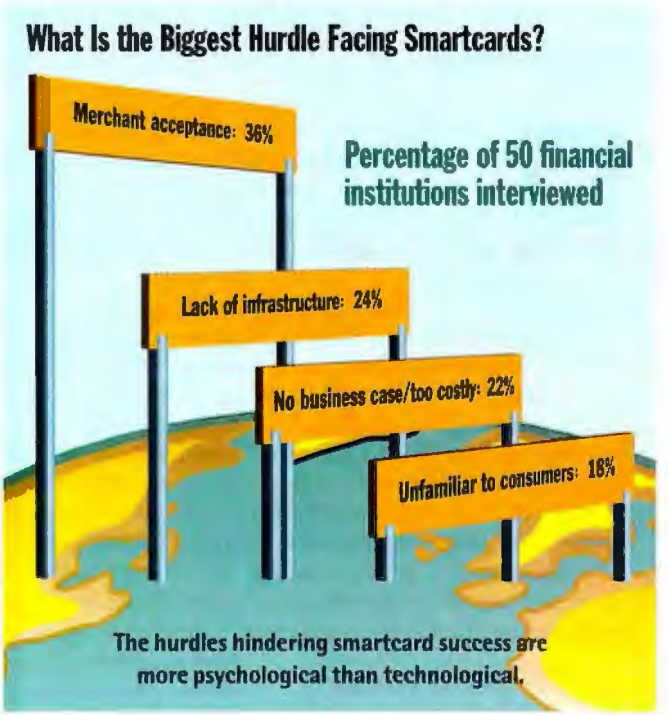
Smartcards can encrypt the data contained within them and generate digital signatures. For this, every smartcard has a unique key that it never reveals. The speed of the cryptography module is essential here: For acceptable transaction times, chips need to perform 1024-bit RSA sign functions in around 500 milliseconds, using a dedicated hardware cryptoprocessing module.

Smartcards have rapidly increased in sophistication and capabilities.

AT A GLANCE: Smartcards—credit-card-size, but with a chip that protects the personal or financial data within—are all over Europe; the U.S. market is expected to take off this year.

WHO SUPPORTS IT: The Smart Card Forum has over 200 members, including Gemplus, Microsoft, and Schlumberger. The Aladdin Smartcard Environment (http://www.aks.com/) is a well-known development platform.





Most smartcards today contain an 8-bit microprocessor, which makes them almost as powerful as the personal computers of the 1980s. ("Dumb" memory cards, often used in Europe as telephone cards, are not true smartcards because they can't process information or provide multiapplication facilities. But they can hold much more data than magnetic-stripe cards.)

A Motorola microcontroller, the MSC0406, is at the heart of the Visa Stored Value Card program, which began in October in Manhattan. The MSC0406 offers 1 KB of EEPROM, 9 KB of ROM, and 240 bytes of RAM and sells for $1.49 each in 100,000-unit lots. (The actual cards are manufactured by Schlumberger and others.) This first major U.S. smartcard cash trial—after the less-than-successful project at the Atlanta Olympics—may finally wake up the U.S. smartcard market.

In 1998, two technological trends will help consolidate the market. One is contactless cards. (These are useful as "commuter cards": Toll booths can deduct funds while motorists drive through, and public-transport systems can collect fares according to the distance passengers travel.) Such cards have been slow to appear on the market because of the technical challenges in supplying sufficient power to the microcontroller from an RF signal. (For contact cards, the reader supplies the power.)

The second trend is standardization. For some time, the industry has been chasing the idea of the "white card," which would allow consumers to buy a card and load it with applications according to their individual needs. B

DVD Stands for DiVideD

Political wrangling over incompatible DVD formats keeps "standards" out of reach.

By Russell Kay

Last year was not the year of DVD, after all. DVD (digital versatile—or video—disc; even the name isn't settled) has enormous potential to replace CDs for archival storage and mass distribution of software and entertainment. The 4.7-GB-per-side DVDs offer a clear advantage for many applications, and they play all current CDs, too. Today's expensive DVD drives and MPEG-decoding hardware ($500 per kit) will become more affordable.

In 1998, many new computer systems will come with a DVD-ROM drive as standard equipment instead of a CD-ROM drive. However, no recent technology has seen such a continuing, contentious, and confusing standards battle, a soap opera of Wagnerian proportions featuring competing equipment vendors, content providers, and merchants.

AT A GLANCE: **DVD is the next-generation CD, with at least seven times the storage (4.7 GB) and a near-perfect format for movies, video, and large databases.**

WHO SUPPORTS IT: **All the usual hardware suspects are pushing DVD players, though copy-protection concerns delayed their introduction. But the industry is split over incompatible, competing standards for recordable DVDs.**

Just a year ago, the major obstacles (primarily copy protection) had seemingly been overcome. But just last summer, Hewlett-Packard, Sony, and Philips proposed another new standard for recordable discs (DVD+RW) that was incompatible with the DVD-RAM standard the DVD Forum (an industry group *including* Sony and Philips) had agreed to only three months previously. Then NEC floated yet another rewritable format. However, it may align with Sony. Ricoh, Yamaha, and Mitsubishi have all indicated support for DVD+RW. Matsushita, Hitachi, and Toshiba are sticking with the DVD Forum.

DVD's Many Flavors

Format	Capacity per side	Hardware backers	Software backers
DVD-Video	4.7 GB	DVD Forum (Hitachi, Matsushita, Mitsubishi, JVC, Pioneer, Sony, Toshiba, Philips, Thomson)	Time-Warner, MGM/UA, Columbia Tri-Star, Polygram, Disney
Divx		Matsushita, Thomson, Zenith	Paramount, Universal, Dreamworks
DVD-R	4.7 GB	DVD Forum	
DVD-RAM	2.6 GB	Toshiba, Matsushita	
DVD+RW	3.0 GB	Sony, Hewlett-Packard, Philips	

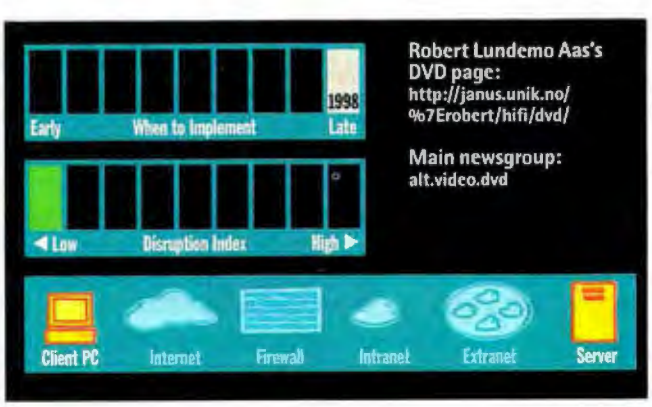
DVD-RAM uses a "land groove" format (recording signals on both the grooves formed on the disc and in the lands in between grooves) to store up to 2.6 GB per side. In contrast, DVD+RW uses signal-phase changes to get 3 GB per side and reportedly handle both RAM and ROM functions.

While it's hard to even imagine money influencing a technology decision, some in the industry do believe the dispute is grounded in royalty payments and marketing concerns, not technology. But there's one bright spot: Both systems read current DVD-video discs.

In the realm of DVD-audio, there are also competing standards, lined up just like the RAM versus +RW fight. And then there's the 4.7-GB-per-disc DVD-R, a write-once format aimed at developers, not consumers.

The beat goes on. The latest proposal, Divx, is based on a marketing model akin to video rentals. You pay a small fee to have a movie loaded on your DVD and can play it for up to 48 hours thereafter. Divx requires a modem connection to authorize playback and—of course—it's incompatible with current hardware. The system would be a clear nonstarter if it weren't backed by Disney, Dreamworks SKG, Paramount, and Universal. Divx has clearly muddied the DVD waters and has almost certainly pulled back the growth potential (or at least the timetable) for all DVD technologies.

I would be tempted to predict that DVD will never realize its potential, if there were any good alternative on the horizon. But there isn't, so 1998 looks like another year of slow growth and infighting. B



Broadband Goes Guerrilla

Forget slow phone companies and regulators; ADSL is coming anyway.

By Scott Mace

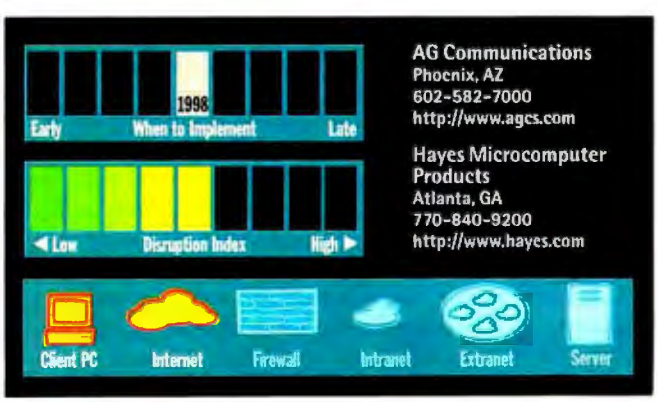
Thanks to some technical innovations, the usual culprits slowing down Asymmetric Digital Subscriber Line (ADSL)—regulated, so-called incumbent phone companies reluctant to cannibalize their lucrative T1 business and government regulators bent on suppressing investment by incumbent telcos in ADSL equipment—can't do a thing to slow down progress.

The catch: This new technology will appear first in apartments and office buildings, where it will be relatively easy for unregulated Internet service providers (ISPs) and upstart phone companies to install DSLs that look to an incumbent telco like one or more T1 lines. But ADSL remains vulnerable to rival technologies in the single-family home, because incumbent telcos control the local "copper loop" where their own DSL equipment would be located.

AT A GLANCE: **ADSL got off to a slow start, but new technology will make it easy for service providers to move it into office buildings and apartments. Cable modems will make inroads.**

WHO SUPPORTS IT: **AG Communications, Hayes Microcomputer Products, Amati Communications, Paradyne, Bay Networks, MediaOne, Comcast, PairGain, ADSL Forum.**

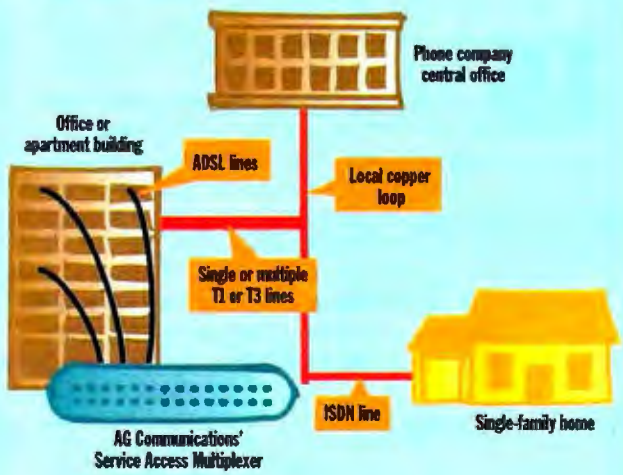
DSL is a modem-like technology that requires a terminal-like device at each end of the cable. This device accepts a data stream, usually in digital format, and overlays it onto a high-speed analog signal, so that the wire can carry both voice and data. In ADSL, one direction has comparatively high bandwidth (up to 8 Mbps), with low bandwidth in the opposite direction, ideal for Web surfing and some streaming multimedia.



AG Communications
Phoenix, AZ
602-582-7000
http://www.agcs.com

Hayes Microcomputer Products
Atlanta, GA
770-840-9200
http://www.hayes.com

Strength in Numbers



While home users must settle for ISDN, telecomm vendors can provide ADSL to customers who share a T1.

Conventional wisdom was that the economics of serving a large number of DSL customers still favored members of the old-boy phone network, because they owned the fat pipes (45-Mbps DS3 or 155-Mbps OC3) needed to serve a hundred or so DSL customers. But upstarts such as AG Communications have discovered that, based on average customer use of DSL lines, a single T1 can support between 30 and 150 2-Mbps DSL connections. Apparently, the bursty nature of most modem traffic today makes this possible; if each of those connections were doing straight file transfers, that kind of scalability would not be possible.

One small phone company that is already putting DSL into service this way is Harrisonville Telephone (Waterloo, IL), according to AG Communications, which is supplying its Service Access Multiplexer technology to the telco.

Incumbent phone companies will take longer to implement ADSL in their central offices, so cable modems will continue to have strong growth in 1998. Being a shared medium, cable modems are bound to run into two problems DSL doesn't face: congestion on the wire as users fill up local cable loops and inherently insecure communications.

Also in 1998, look for a revitalized Hayes Microcomputer Products to drive both cable modems and ADSL. At the fall Networld+Interop show, Hayes demonstrated a prototype $250 ADSL network interface card (NIC) and teamed with Cisco Systems to develop products to support the new Multimedia Cable Network System standard. Hayes will help heat up the broadband wars wherever they lead. B

Dynamic HTML and Scriptlets Add Life

Differences aside, both Microsoft and Netscape browsers let pages change on the fly.

By Rick Dobson

Dynamic Web pages promise content creators more precise rendering of their material and promise users more customized and interesting interfaces. Dynamic HTML (DHTML), the technology behind dynamic Web pages, offers faster-performing pages by eliminating the need to download pages for altered content, different styles, object repositioning, or data manipulation. Also, its Document Object Model (DOM) delivers highly graphic and interactive pages, because it converts all HTML elements to objects.

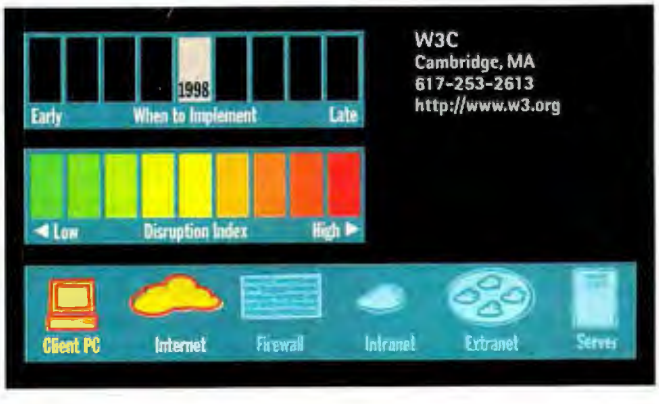
Each element exposes properties and methods that can enliven Web pages. A rich event model lets elements interact with their parents as well as page visitors. Content authors can also use scripting languages, such as ECMA-262 (European Computer Manufacturers Association) JavaScript and Microsoft VBScript, to animate their pages by manipulating properties, invoking methods, and responding to events. Event bubbling makes it possible to write one function to process events from many objects. Commercial component builders can design advanced tools with languages such as Java or C++.

Microsoft introduced Scriptlets with the final release of Internet Explorer 4. This technology lets DHTML developers create components for reuse by other Web authors. These DHTML-based components also serve as Component Object Model (COM) objects that any COM container, even Word, can run (see the table).

AT A GLANCE: DHTML is an object-oriented HTML that can make pages faster, livelier, and more interactive than your old HTML.

WHO SUPPORTS IT: Microsoft, W3C, Netscape, SoftQuad.

The W3C issued a series of preliminary specifications in 1997 that cover cascading style sheets (CSS), CSS positioning, and the DOM. The W3C will finalize its DHTML specifications in 1998. During 1997, both Microsoft and Netscape committed to an "interoperability pledge," which states among other things that their browsers will comply with W3C final specifications. Until—and even after—the browsers comply with the final specifications, HTML authors will face compatibility issues.



A Tale of Two DHTMLs

Netscape DHTML in Navigator 4.0	Microsoft DHTML in Internet Explorer 4
Lets scripts access style-sheet data, but you cannot change styles after the page loads.	Scripts can change page-element properties after load time.
Scripts can access properties of some page elements.	Scripts can access properties of every page element.
Animation via script manipulation of CSS-positioning data.	Animation via script manipulation of CSS-positioning data.
Layers—tags are used to section HTML pages into separate units that you can position as desired at any pixel coordinates on the page—can be loaded with new data from a new URL after load time.	Scriptlets can alter the HTML that comprises the page; these components can also serve as COM objects and be used by any COM container, such as Microsoft Word; complementary to DHTML, scriptlets won't be part of the W3C standard.

Both browsers have technology that relates to DHTML but is outside its immediate scope. Netscape browsers permit positioning with their Layers technology as well as the W3C positioning coordinates. The Layers approach is incompatible with the W3C specification. Microsoft's Scriptlets technology requires some code that is not part of Netscape browsers at the time of this writing. Because Scriptlets are an application of DHTML, they are beyond the scope of the interoperability pledge.

DHTML poses challenges for Web-site developers. There is the issue of incorporating the new technology into Web pages. This is more than learning a few scripting instructions and some HTML element properties, methods, and events. It includes making trade-offs between direct authoring versus relying on applets and components. Direct authoring promises faster downloading of pages and more customization, but using applets and components allows shared access to advanced developer skills.

Should Web developers bother learning DHTML? You decide after contrasting your static HTML site with a competitor's DHTML site. B

Extensible Markup Language

XML describes structured data packages that move around the Web as easily as HTML.

By Jon Udell

Applications based on simple, structured ASCII text—e-mail, Usenet news, the Web—make the Internet hum. These core applications all rely on fixed data-exchange formats. Extensible Markup Language (XML) enables extensible data-exchange formats. XML is Web-style Electronic Data Interchange (EDI).

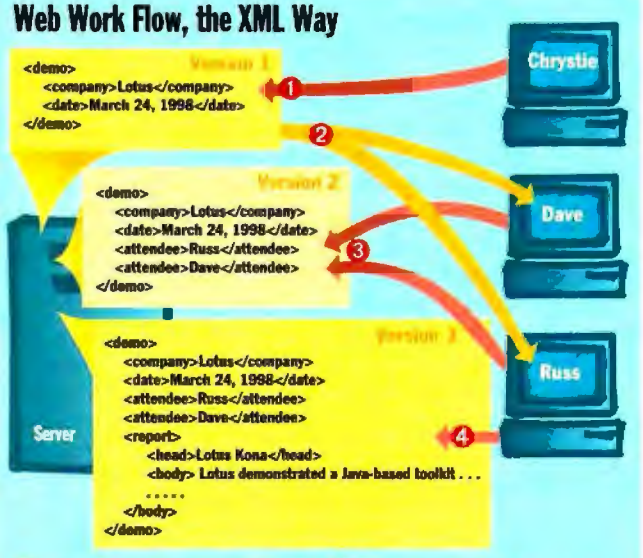
Here's how XML might enable a work-flow application at BYTE. A vendor schedules a demonstration. The appointment data, entered on a Web form, lands in an XML file that then acquires annotations as it moves through the system (see the figure).

Today, Web developers routinely invent such application-specific formats. But supporting them means a lot of custom work to read, parse, annotate, and store the data, plus format it for display. With XML and supporting tools, much procedural work should go away. Data definition moves to a declarative mode, using SGML-style (Standard Generalized Markup Language) Document Type Definitions (DTDs) or the newly proposed XML-Data schemata. Parsing and validation of data also don't need procedural logic. Even formatting for display can in theory be declarative. It's a mapping between an XML object model and a browser's object model.

AT A GLANCE: **XML lets Web developers represent object data as tagged text, easily exchange data among clients and servers, and allow rich tools for parsing, validating, and rendering data in browsers.**

WHO SUPPORTS IT: **Sun, Microsoft, and Netscape. Software distributors: Microsoft, Marimba. Webcasters: PointCast, DataChannel. XML tools: ArborText, Inso.**

Web Work Flow, the XML Way

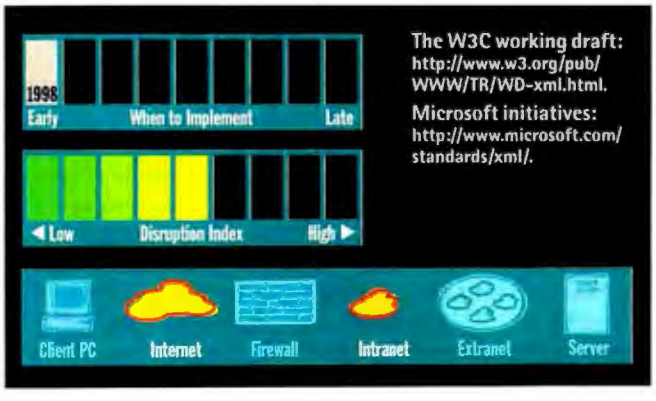


1 Chrystie creates a demo object (version 1).

2 Chrystie routes the object to Russ and Dave, requesting attendance. The object resides on the server but may be modified on the server or the client.

3 Russ and Dave confirm their attendance; the XML object is annotated and becomes version 2.

4 Following the demo, Russ files a report. Again, the XML object is annotated and becomes version 3.



The W3C working draft: http://www.w3.org/pub/WWW/TR/WD-xml.html.

Microsoft initiatives: http://www.microsoft.com/standards/xml/.

Because SGML DTDs aren't written in SGML, Microsoft is proposing XML-Data schemata. The idea is to write XML metadata using XML, speed development of XML applications, and simplify validation of both structure and (eventually) content. Extensible Style Language (XSL), proposed by Microsoft, ArborText, and Inso, addresses rendering XML data in browsers. XSL wants to "embrace and extend" the still-nascent cascading style sheets (CSS) model, which depends on script interaction with the browser's document object model. XSL aims to move toward a declarative model that relies on the advanced formatting of Document Style and Semantics Specification Language (DSSSL).

Early applications of XML include Channel Definition Format (CDF), which defines the packages of data that govern how browsers interact with Webcasting services, and Open Software Distribution (OSD), which aims to describe the resources and dependencies of installable software. But the field is wide open. In 1998, we'll see all kinds of line-of-business applications using XML to move structured data around on intranets and the Internet. For server-based applications, there are few obstacles. For client-based applications, though, incompatible Microsoft and Netscape implementations of DHTML and browser document object models will cause big headaches. B

Transacting On the Web

As the Web grows and we rely on it more, Web TP monitors make it more reliable.

By John Montgomery

It's been a long time since the Web has been about flat, read-only browsing. It's now as likely that you'll buy a book or make a plane reservation as read today's news. And even reading today's news can be an excursion through dynamically generated Web pages. All this means that the Web is increasingly relying on applications. Some of these are enterprise-class applications that handle thousands of users each day.

Therein lies a huge problem. Although many companies are starting to rely on Web technologies to run their businesses, much of the technology underlying the Web wasn't intended for large-scale client/server computing, with all its associated demands of consistent performance and high reliability. In other words, we're building enterprise-scale applications on a decidedly unenterprise-scale foundation.

Fortunately, help has arrived in the form of Web componentware. It could be a Java applet in a browser talking to a database on a server. It could be an ActiveX application on a server generating Web pages on the fly. But the key is that some part of the connection between you and the information you're after is written to a component standard such as ActiveX, JavaBeans, or Common Object Request Broker Architecture (CORBA).

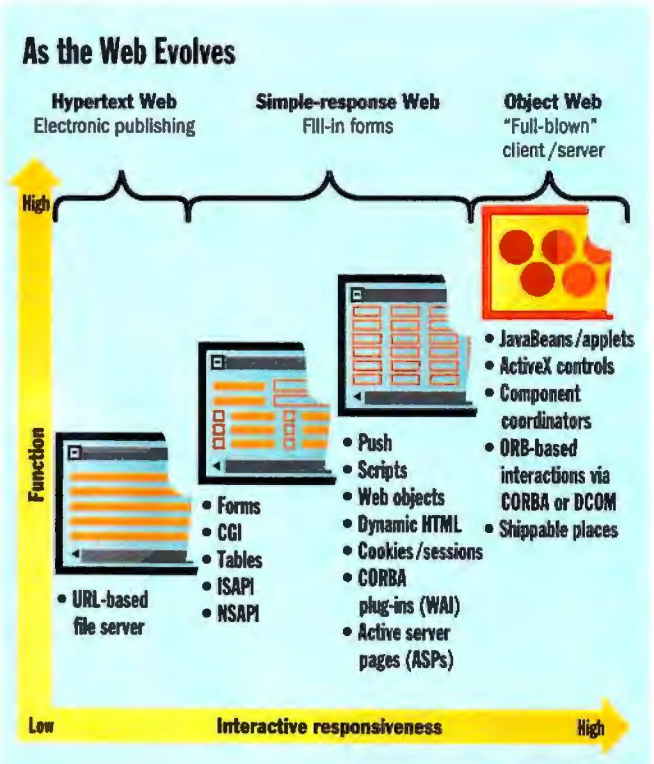
But the big problem with Web components tends to be managing them: That they start when you need them and close when they're done, and that their load gets distributed evenly across multiple systems. Transaction-processing (TP) monitors can balance loads, queue requests and responses, isolate processes, verify rights and permissions, and, most important, recognize which HTTP messages belong to which transaction, thereby creating state in an otherwise stateless architecture.

AT A GLANCE:
Web transaction-processing monitors will enable Web applications to be more reliable and scalable.

WHO SUPPORTS IT:
Microsoft, BEA, IBM, Kiva.

BEA
Sunnyvale, CA
408-743-4000
http://www.beasys.com

Kiva
Mountain View, CA
650-526-3900
http://www.kivasoft.com



Object technology will enable a rich worldwide transaction environment to propel electronic commerce.

Microsoft made a big splash in 1997 with the introduction of Microsoft Transaction Server (MTS), an ActiveX-based component coordinator. Integrated into Windows NT, MTS manages a pool of ODBC connections that clients can draw from, thereby reducing database load. MTS is now a part of Microsoft BackOffice, Windows NT Server, and Internet Information Server (IIS).

Microsoft is hardly alone. BEA is a company on the forefront of Web TP monitors, with products such as Tuxedo and Jolt. Tuxedo is BEA's distributed transaction monitor. It provides load balancing, security, and other features you'd expect from a TP monitor. IBM's Transaction Server provides similar features but includes close integration with Lotus Notes, as well as with IBM's message-queuing product, MQSeries. Kiva's Enterprise Server is another TP monitor, but it was designed for the Web.

As we grow to rely more on the Web, we must make it more reliable, and TP monitors look like one of the best ways to do that in 1998. B

The Next Internet

Layer 3 routing, IPv6, and IP Multicast are all technologies set to take off—or stay on hold.

By Scott Mace

The Internet is always changing. But the bigger it gets, the more painful change becomes. The Internet Engineering Task Force (IETF) continues to crank out new standards, and new technologies dazzle attendees twice a year at the Networld+Interop show. But in the real world, progress toward upgrading all routers with a common set of new services is proving to take longer than anyone thought.

Nevertheless, in 1998 we'll see some progress. IP Multicast, for instance: UUnet Technologies recently rolled out an IP Multicast service. UUCast lets content providers transmit a single stream of information and simultaneously reach hundreds of thousands of people by using standard IETF IP Multicast protocols. Prior to this, multicast-like services used proprietary multimedia streaming technologies.

But the outlook for IP version 6 (IPv6) tends to be a lot murkier. Originally designed to replace IP version 4, IPv6 was first and foremost conceived to provide a bunch more IP addresses at a time when the Internet was supposedly running out of them. But IPv6 also acquired a number of other capabilities along the way, including support for new real-time services, improved security, and automatic configuration.

AT A GLANCE: IP Multicast services will let Web sites present many more video streams, and MPLS will provide Layer 3 routing, but IPv6 addressing remains elusive.

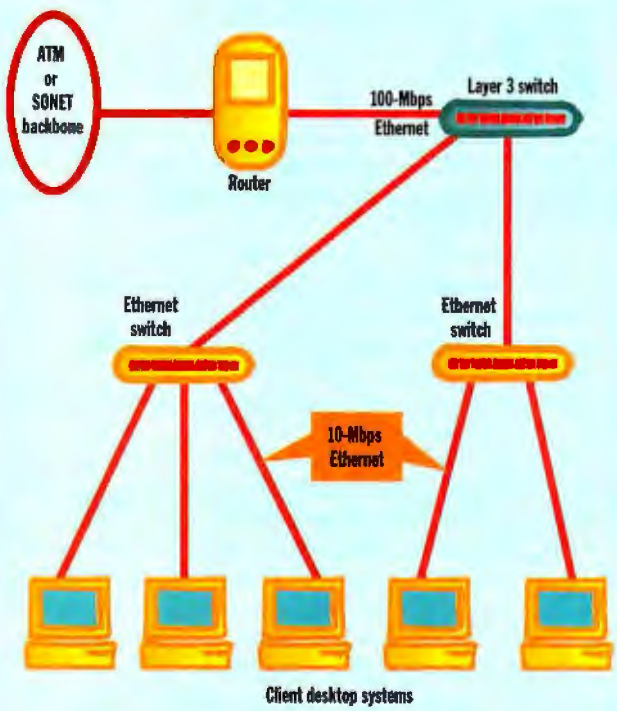
WHO SUPPORTS IT: Internet Engineering Task Force, Cisco, Bay, 3Com, Ipsilon, Cabletron, UUnet, StarBurst, Real Networks.

The result has been unwieldy, progress of standards has been slow, vendors have coded their own proprietary (and incompatible) extensions to IPv4, and users and vendors have grown their own techniques to get around IPv4's limitations.

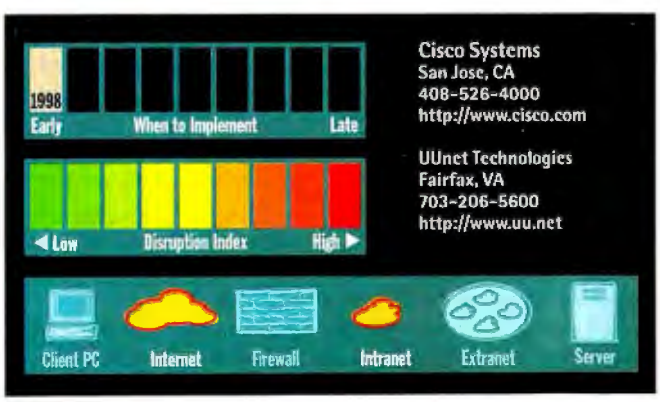
Consequently, IPv6, via the 6bone, will remain an experiment. Meanwhile, vendors are getting a lot more out of IPv4. For instance, Cisco Systems has a translator that lets devices reuse IP addresses in different, isolated subnets, translating from these private addresses to public ones only when the devices access the public Internet.

What's still missing from the Internet is a standardized way of providing Layer 3 routing in a switch. Offerings include IP Switching, from Ipsilon Networks, Fast IP, from 3Com, Tag Switching, from Cisco Systems, and Secure Fast Virtual Networking, from Cabletron. The IETF's Multi Protocol Label Switching (MPLS) has a good chance to become a standard for Layer 3 switching, and Cisco's IP product line manager, Martin McNealis, predicts that MPLS will find its way into Cisco products in late 1998. B

Breaking the Internet Router Bottleneck



Newer switches can route packets between networks at Layer 3. This routing relieves congestion on traditional routers but has not yet been standardized among all switches.



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I Am Virus: Hear Me Roar

Automation and tight desktop integration are needed to stop macro attacks from the Net.

By Earl Greer

Anywhere from five to 10 new computer viruses are created each day, according to the antivirus software company Sophos. Infected systems are on the rise—almost every midsize to large corporation has been infected within the last 12 months. And viruses spread more rapidly now, thanks to networks—chiefly the Internet. Five years ago, a virus typically took two years to spread worldwide. Today, it takes mere hours, IBM researchers say.

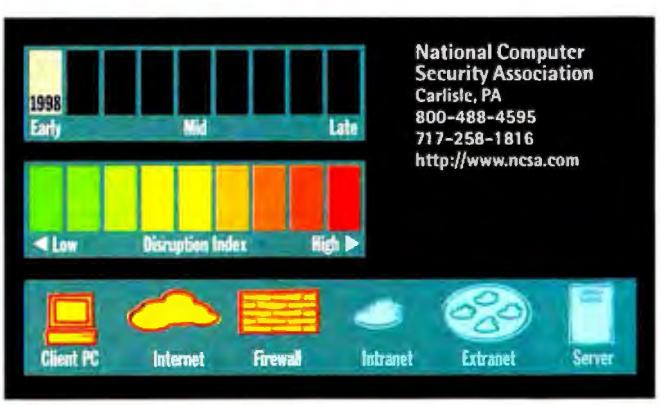
Now the threat is growing again. Although writing 32-bit Windows 95 viruses requires substantial programming skills, Word macro viruses require little skill, and consequently they now constitute 80 percent of all infections. ActiveX and Java already provide the technology making it possible for a computer to download and execute a program transparently to the user. And the number of environments viruses can live in will increase—a PowerPoint virus is likely within a year.

Not all antivirus methods that have worked in the past will work in the future. For instance, as encryption of e-mail becomes more prevalent, scanning at firewalls will become less effective.

AT A GLANCE: The antivirus industry gears up to combat a wave of new infections from macros and the Internet. Advances in e-mail encryption will thwart some antivirus scanners.

WHO SUPPORTS IT: Computer Associates, Data Fellows, Symantec, McAfee, Sophos, IBM, Trend Micro, Finjan, Dr. Solomon

Major antivirus companies, led by Symantec and Computer Associates' Cheyenne Division, are introducing automated updating of antivirus signatures and detection software. Such updating will soon be available as often as once an hour, via the Internet. Some vendors are updating their virus signature files on the Internet as often as six times a day.



Antivirus Bag of Tricks

Checksumming and integrity checking
Both methods store information about presumably uninfected files in a certain place. They perform periodic checks of the current status of the files against the stored information. If they detect change, they issue a warning. This method provides after-the-fact detection.

Heuristics
This is a method of analyzing files and boot areas in a general sense to determine if the code appears virus-like. Heuristics perform after-the-fact detection.

Decoys
This is a method of lying in wait for viruses, allowing certain files to become infected if a virus is present. Decoys detect viruses as they are infecting and are helpful in raising the warning flag.

Behavior blocking
This is a method of analyzing the behavior of all computing actions to determine if the sum of the parts adds up to virus-like action. If it does, then this method stops the action before infection can occur. Behavior blocking performs before-the-fact detection.

On-demand and scheduled scanning
This is a method of scanning for specific viruses at certain times. This is always after-the-fact detection.

Real-time scanning
The detection process occurs while other computer processes (e.g., copying a file) occur. This method notifies users of existing viruses before they can be triggered.

To cope with the speed at which new viruses can spread, Symantec is emphasizing development of heuristic analysis. This technique watches a program's behavior rather than examining its code for matches to virus signatures. Thus, a new virus can be detected and blocked even before the antivirus company has examined a sample.

IBM is pioneering automated extraction of virus signatures along with automatic testing for false alarms. This approach has the potential to tremendously shorten the time between the appearance of a new virus and distribution of the solution to customers. Software with this capability could be in beta stage late this year or early next year.

Antivirus programs will include more options, allowing customers to adjust scanning speed by varying the detection capabilities (see the table above). But there are other, more radical solutions emerging. Data Fellows recently unveiled F-Secure Anti-Virus Macro Control, which requires that any macros used in a Word document first be certified by a network administrator. And BIOS manufacturers such as Phoenix are putting code into their software that adds antivirus measures to the master boot record and code that forces PCs to boot off the hard drive. B

Gigabit Ethernet Gears Up

Screaming 1000-Mbps Gigabit Ethernet solutions will answer the increasingly loud cry for more bandwidth in late 1998.

By Deborah DeVoe

Bandwidth demands continue to rise. Internet and intranet traffic are also pushing networks to their limits. Gigabit Ethernet, the latest extension of Ethernet technology, offers a tenfold increase in speed. Compatible with existing 10/100 Ethernet standards—using the same frame format, frame size, and CSMA/CD protocol—the technology provides a smooth migration to 1000-Mbps bandwidth while protecting companies' investments in existing Ethernet infrastructures. Initial upgrades are expected at the backbone level. But 1000 Mbps to the desktop isn't due for years, following a standard (expected in 1999) for long-haul copper, supporting 100 meters over four-pair Category 5 unshielded twisted pair (UTP) wiring.

AT A GLANCE: Gigabit Ethernet is a new networking standard that delivers raw bandwidth of 1000 Mbps. It extends the 802.3 Ethernet standard and is fully compatible with existing 10/100 Ethernet.

WHO SUPPORTS IT: 3Com, Alteon Networks, Bay Networks, Cabletron, Cisco, Extreme Networks, Foundry Networks, Gigabit Ethernet Alliance, Gigabit Ethernet Consortium, GigaLabs, Packet Engines, Prominet, Sun, UB Networks, XLNT Designs.

The first Gigabit Ethernet standard, 802.3z, is expected in March, according to the Gigabit Ethernet Alliance; it will support full-duplex and half-duplex over fiber optic cable and short-haul copper (25 meters). Prestandard products are already on the market, but the slew of standards-based products from major vendors isn't due until late 1998.

As a result, most migrations won't happen until 1999 at the earliest. Analysts note that IS managers will need time to investigate multiple other upgrade options, including ATM with its promise of a homogeneous LAN and WAN environment. Companies will also need to test the equipment before rolling it out in a production environment.

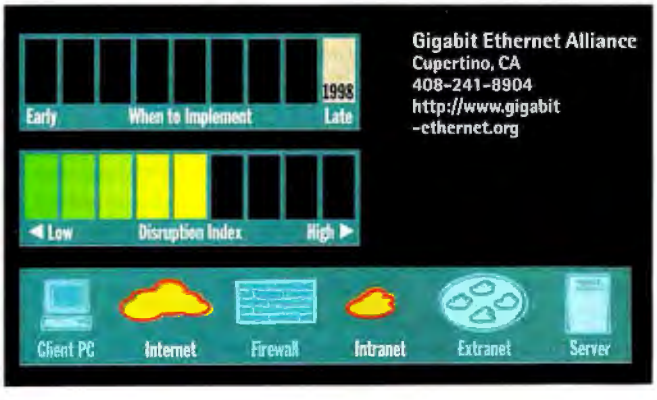
Esmeralda Silva, senior analyst at International Data Corporation (Framingham, MA), expects that the bulk of ports on Gigabit Ethernet boxes will remain 10/100-Mbps ports. The Gigabit Ethernet products, however, will offer companies room for growth, providing scalable high-density backplanes that can later be upgraded to 1000-Mbps ports when required. Initially, each Gigabit Ethernet port in a switch is expected to cost about $2500, with 10/100-Mbps ports in the switch priced in the $500 range, Silva says. This pricing is expected to drop quickly.

Vendors are touting Gigabit Ethernet as an easy upgrade. Analysts warn, however, that Gigabit Ethernet products will be much more sophisticated than those based on Fast Ethernet, requiring new training. Network management products will also need to handle greatly increased traffic moving 10 times faster. B

Five Most Likely Scenarios for Gigabit Ethernet Upgrades

Upgrade	What It Will Entail
Switch-to-switch links	Upgrading 100-Mbps link between Fast Ethernet switches or repeaters to 1000-Mbps link between 100/1000 switches
Switch-to-server links	Replacing Fast Ethernet switch with a Gigabit Ethernet switch for a 1000-Mbps connection to high-performance server farm; installing Gigabit Ethernet NICs in servers
Switched Fast Ethernet backbone	Replacing Fast Ethernet backbone switch with Gigabit Ethernet switch supporting multiple 100/1000 switches and other devices with Gigabit Ethernet interfaces and uplinks
Shared FDDI backbone	Replacing FDDI concentrator or hub or Ethernet-to-FDDI router with Gigabit Ethernet switch or buffered distributor; installing new Gigabit Ethernet interfaces in the routers, switches, or repeaters
High-performance desktops	Eventually, in later phases of adoption, installing Gigabit Ethernet NICs in high-performance desktops that connect to Gigabit Ethernet switches or buffered distributors

Source: Gigabit Ethernet Alliance



When Will E-Cash Jingle in Your E-Pocket?

Already successful in Europe, e-cash is hitting the U.S.—with answers and questions.

By Udo Flohr and Jelena Rupnik

It shouldn't come as a surprise that the first major U.S. trial of electronic cash is taking place in New York City. Try buying a newspaper or a hot dog in Manhattan with a $50 bill or a credit card!

Such is the promise of e-cash on a chip: Everyday transactions will be easier, faster, and more secure with e-cash than with cash, checks, or credit cards. E-cash targets transactions of about $30 or less and will coexist with, rather than replace, other payment instruments for the foreseeable future.

According to a report compiled by Ovum, a London-based consulting group, worldwide consumer payments have a value of US$7 trillion per year, 65 percent of which are in cash. (In fact, consumers hold most of the cash in circulation—about 60 percent.) This US$4.5-trillion market slice is what e-cash aims at.

AT A GLANCE: E-cash is a way to conduct financial transactions with electronic debits and credits. You can use it in the form of a smartcard that you carry or via the Internet.

WHO SUPPORTS IT: Cybercash, Digicash, IBM, MasterCard, and Microsoft. Banks include Advance Bank (Australia), Deutsche Bank (Germany), Mark Twain Bank (Missouri, U.S.), and Merita Bank/EUnet (Finland).

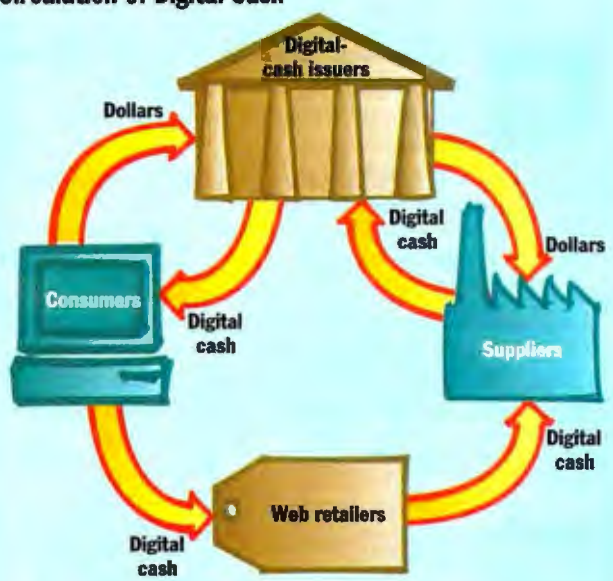
There are two fundamental approaches to e-cash: smartcard-based and software-only. Visa's Stored Value Card is an example of the smartcard-based approach. The best-known example of the software-only approach, which aims mostly at Internet usage, is Ecash, from DigiCash (Amsterdam). You can use Ecash on-line (on the Web, for example) or through e-mail, and it's suitable for other digital media, including smartcards. The Ecash system ensures privacy with "blind signatures," which authenticate payments without revealing the payer's identity. Several banks have started issuing Ecash, and a rapidly growing number of cyber-merchants now accept it.

Digital money sent across the Internet still requires digital signatures (which smartcards have the ability to generate). However, the majority of consumers still don't have access to PCs or the Internet. Therefore, the two main approaches will probably merge.

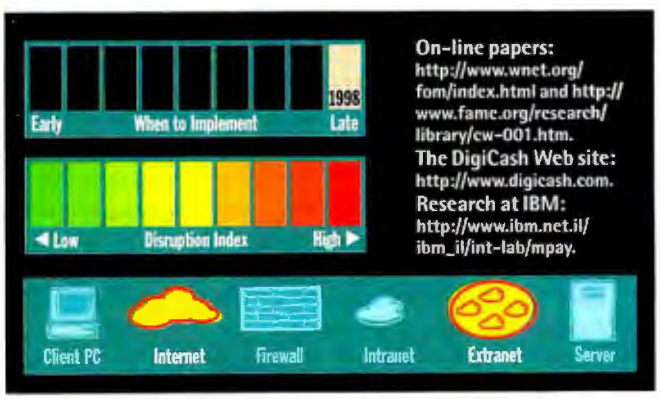
E-cash is always prepaid, as opposed to credit (pay later) cards and debit (directly access an account) cards. The issuing body—not necessarily a bank—allocates value to a coded digital message, which is stored on a smartcard or a computer system and guarantees a fixed reimbursement value, often through specialist "e-cash clearing" services.

The driving force behind e-cash is cost reduction. Handling physical cash is expensive for banks and payees, and paper checks are even more so. E-cash payments, on the other hand, can be authenticated off-line. Transactions are fast and convenient, and they reduce administrative overhead. In addition, e-cash is a proven technology: While trials are just beginning in the U.S., approximately 50 e-cash systems are already operational around the world. B

Circulation of Digital Cash



E-cash transmutes between digital and actual money as transactions proceed between various entities.



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Call Control for the Rest of Us

New technologies launch an end-run around computer telephony incompatibilities.

By Alan Joch

You've heard the computer telephony song before: screen pops for sales and service agents, routing of incoming calls, messages that jump from desktop to cell phone to pager. Right. Given a choice, most frustrated IS managers would rather hear the *Barney* theme once more than listen to that tune again.

"Computer telephony integration [CTI] hasn't been the golden goose we thought it was going to be," says Michael Carpenter, president of CT Source (Marblehead, MA), a computer telephony systems integrator. "The computer telephony market has been in a mess for years." But integrators and users foresee change this year. Not from new technologies, but from innovative uses of existing technologies. Telephony vendors had designed CTI servers that worked with PBXes (and got mired in API incompatibilities and proprietary hardware). But this year, telephony vendors will introduce CTI servers with new ways to wall off or encapsulate telephone switches. The result: reduced CTI budgets.

AT A GLANCE: Instead of relying on PBXes to trigger responses from CTI servers, a new generation of proactive servers intercepts communications from the central office and routes messages to the PBX or the LAN.

WHO SUPPORTS IT: Integrators and IS managers responsible for implementing complex CTI systems; makers of MAPI-compliant mail systems; PBX vendors, including Ericsson, Lucent, Mitel, Nortel, and Siemens.

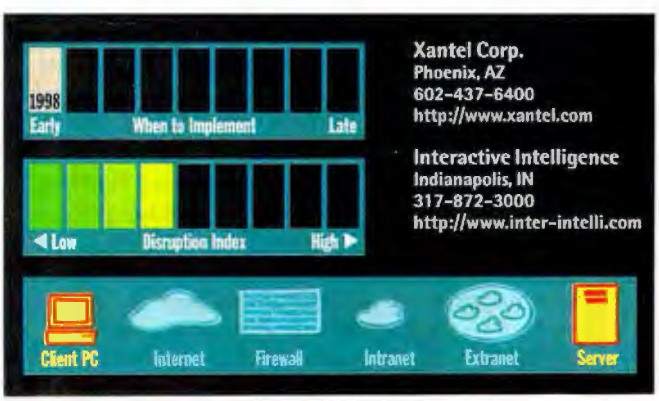
Xantel takes this approach with a CTI server that bucks the conventional telephony wisdom of the PBX being the first point of contact with a telco's central office. Xantel's Connex server captures communications directly from the central office, then routes voice to the PBX; it routes faxes, e-mail, and other messages to a TCP/IP LAN.

This twist has a big plus: no changing the existing phone system to handle new services. Since routing takes place before the switch, the PBX can be new and sophisticated or old and traditional. This also avoids trying to support Microsoft's Telephony API (TAPI), Novell's Telephony Server API (TSAPI), or a proprietary alternative from a PBX vendor.

Resellers say this can cut installation from weeks to days. At $125 to $250 an hour, this means saving thousands of dollars per project. Connex does have some shortcomings: The version out early this year does not work with Centrex systems and supports only Windows servers and clients. Xantel may address the former problem this year but plans to retain the Windows platform bias.

Interactive Intelligence tackles integration hassles another way: by making the PBX part of a centralized service center. Interaction Server, a Java application, provides the central intelligence for handling voice calls, faxes, e-mail, and Web forms. End users run either Interaction Client or a Java-enabled Web browser to retrieve messages or initiate outgoing communications. Interactive Intelligence is preparing a Java version of Interaction Client for multiplatform capabilities.

These products don't make CTI plug-and-play, but they could help simplify the merging of data and voice in the enterprise. That may be enough to bring CTI to more than just the richest and most patient companies. B



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Phoenix, AZ
602-437-6400
http://www.xantel.com

Interactive Intelligence
Indianapolis, IN
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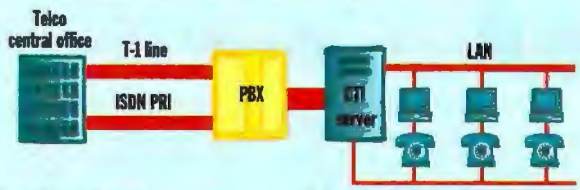
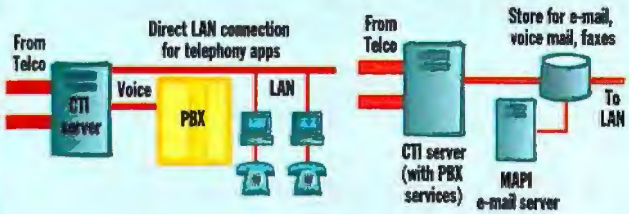
CTI Before the PBX

Old Way
Telco sends messages to PBX, which forwards them to phones or CTI services.



New Alternative #1
To avoid PBX-to-CTI bottlenecks, Xantel's server sits in front of the PBX and sends traffic directly to LAN-based applications.

New Alternative #2
Interactive Intelligence's server incorporates a PBX and sends voice, e-mail, and other communications to a central "unified inbox" storage area.



Getting the Message

Message-based queuing will liberate transactions from real-time considerations.

By Scott Mace

Given the instability of the Internet, applications aren't always connected to other applications. And yet for doing business on the Internet, that's exactly what those applications crave. A two-phase commit transaction can't go through if the transaction times out due to Net congestion or a bottleneck at the far transaction server.

Enter message-based queuing (MBQ), middleware for different applications to share store-and-forward transactions with each other, sending the intermediate steps of the transaction back and forth via messages. It's a delicate dance—decrementing an item in inventory before the purchaser's credit has been checked is probably not a good way to go—but MBQ is close enough to real time that scores of businesses are checking into it anyway.

The enabling multivendor technologies for MBQ are also coming together in a way that's refreshingly fast. In April 1997, the Business Quality Messaging Special Interest Group (BQM SIG) was formed at the Electronic Messaging Association's annual conference. IBM, maker of the leading proprietary MBQ product, MQ Series, worked with Microsoft on a BQM functional specification that could help link MQ Series, Microsoft's Message Queue Server component (code-named Falcon) of Windows NT 4.0 Enterprise Edition, and MBQ products from other companies. Customers such as Pfizer signed on, as did industry analysis firm the Meta Group.

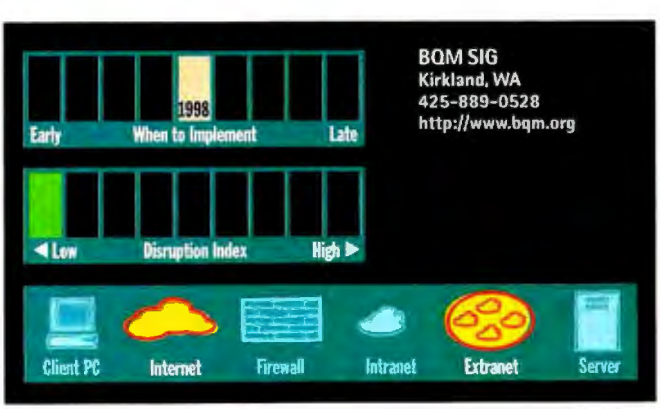
AT A GLANCE: **Recognizing that businesses must perform transactions over an intermittent Internet, message-based queuing is store-and-forward transaction technology. BQM, a functional spec, is finding its way into products.**

WHO SUPPORTS IT: **IBM, Microsoft, Candle, Hewlett-Packard**

The result: BQM interoperability demos in September 1997 that hinted that the technology is ready for prime time. Companies will use BQM to expand their existing e-mail systems into work-flow solutions. Snazzy new applications, such as Mesa's product that routes documents between Lotus Notes and Microsoft Exchange, are built on top of the BQM functional spec. Other applications will use BQM to support mobile computer users, who are chronically disconnected from networks.

The wave of BQM-enabled applications will pour forth in 1998. Microsoft will make it available to all NT 4.0 users via an option pack on Microsoft's Web site. Hewlett-Packard is building BQM into AdminFlow, a work-flow application.

BQM could also replace a lot of custom software development, since off-the-shelf BQM-compliant applications can exchange information without modification or added cost. "The [BQM] promise is that users can get packaged applications that can link into existing MQ networks," says John Smith, alliances program manager for IBM's MQ Series. B



What the Business Quality Messaging Spec Provides

BQM providers must allow asynchronous, connectionless messaging between senders and receivers, and support all the properties listed here, among others.

- ✔ A unique message identifier
- ✔ The name of an administration queue for acknowledgement messages
- ✔ Application-definable message-type indicator
- ✔ The security identity (if any) associated with the sending application
- ✔ An indicator that specifies the maximum amount of time a message should be considered "alive" after it is sent
- ✔ Uniquely identifiable message queues
- ✔ The name of a response queue
- ✔ Independence of message queues from any physical location
- ✔ The priority of the message
- ✔ Queues must be able to accept messages even when applications and networks are down
- ✔ The desired message delivery mode (survive machine failures, or not)
- ✔ Queues must be accessible by multiple applications simultaneously, and allow applications to access multiple queues simultaneously
- ✔ The desired message acknowledgment mode (none, message received, message not received within a given period of time, and so forth)
- ✔ Queues must not deliver the same message more than once
- ✔ The length of the message
- ✔ Transactional support

Action on All Fronts

LDAP version 3 and Microsoft's Active Directory will help NDS tie people and networks together.

By Mike Hurwicz

It's going to be an exciting year for enterprise directories, which provide a unified, network-wide store for data about network resources. These special-purpose databases make managers' and users' lives easier by providing a single, hierarchical interface to data about user accounts, servers, volumes, print queues, e-mail accounts, digital certificates, component object names, and any other information that human beings or applications may require in order to access or manage network resources. The three major players in this arena today are Netscape, Novell, and Microsoft.

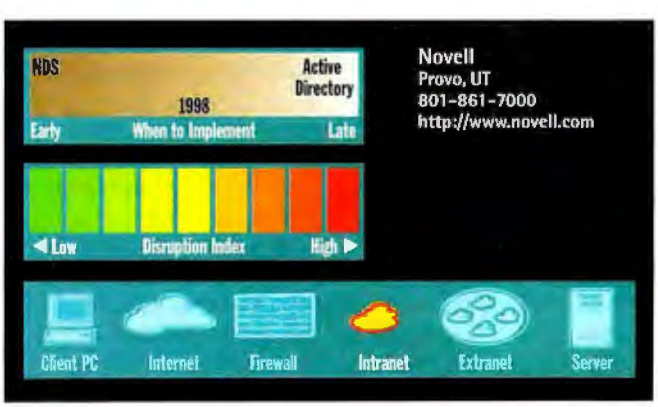
The big news will be the release of Microsoft's Active Directory, the company's first attempt at extensible, scalable, enterprise-level directory services. Some beta copies were released in 1997, but final shipment is due later in the year with NT Server 5.0. Given the complexities of implementing enterprise directory services, organizations committed to networking NT should start experimenting with Active Directory as soon as possible.

AT A GLANCE: **Common directories for looking up any network account or resource will proliferate in 1998, along with replication between different directories and unified ways to manage dissimilar directories.**

WHO SUPPORTS IT: **Novell, Microsoft, Netscape, Zoomit, IBM, Hewlett-Packard, Unisys, Santa Cruz Operation, Sun**

Novell-oriented shops will also have their hands full, checking out Novell Directory Services (NDS) for NT (scheduled for release soon) and versions from IBM (for the RS/6000 running AIX, and for S/390 mainframes), as well as from Unix vendors, including Sun, the Santa Cruz Operation (SCO), HP, and Unisys.

For many, this will also be the year to start serious testing of the Lightweight Directory Access Protocol (LDAP). LDAP is firmly ensconced as *the* multivendor directory protocol. Active Directory will support it, and, by the middle of 1998, so will all versions of NDS. The third major directory contender, Netscape, has always supported LDAP.



What's New in LDAP 3

Feature	Benefit
Intelligent referrals: Servers can refer a query to other servers.	Users can perform Internet-wide address book lookups. Users enjoy the illusion of a single directory even if directory data is scattered across multiple servers.
Support for international character sets such as UTF-8 encoding and language attribute tags.	Customers can deploy directories using their native language. Applications can display multiple languages in the same window.
Enhanced security such as LDAP over Secure Sockets Layer and Simple Authentication and Security Layer (SASL) framework.	Strong authentication and encryption protects directory data. Extensible SASL security framework allows use of existing security systems such as Kerberos.
Dynamically extensible schema: Schema can be published in the directory and managed through LDAP operations.	Applications can easily write private data to the directory, making the directory a perfect place to put user preferences, configuration data, and other shared data.

For now, LDAP defines only an access protocol, a way for clients to query servers. However, vendors such as Netscape and Novell are working on server-to-server replication based on LDAP. You'll see single-vendor replication based on LDAP in 1998. You'll probably be able to do some testing of multivendor LDAP-based replication, too, but it will most likely be 1999 before you'll be able to consider deployment in production environments.

If you need to continue to support directories from multiple vendors, you should also start educating yourself about metadirectories, such as Zoomit's Via. A metadirectory is specifically designed to provide centralized access and management for multiple dissimilar directories.

Because key components such as Active Directory, metadirectories, and LDAP-based replication are just emerging, most organizations will still be in experimental mode with enterprise directories in 1998. Those who build production systems must either rely on tried-and-true products like NDS or else be prepared to live on the bleeding edge. However, since enterprise directories affect everyone in the company, are typically costly to implement, and raise complex problems of integration, synchronization, interoperability, privacy, and data cleansing, a protracted period of testing and preparation is necessary. B

WHEREFORE Warehouse?

A glimpse at the past and a peek at the future of data warehouses, data marts, and data mining.

By Bill Inmon

In a half-decade or so, data warehousing and its mutant forms have gone from theory derided by academics to conventional wisdom. By all accounts, data warehousing is being embraced by practically every company that operates in a competitive environment. Data warehousing—while never hyped excessively by the press—has stood the test of reality and, in fact, has more than delivered on the hype made on its behalf.

This article will present some of the reasons data warehousing has delivered on its promises, briefly discuss some notable milestones associated with data warehousing, and take a look into the future.

Success Story

Prior to the data warehouse, when there were only legacy, operational applications, integration of data and information was only a dream. Each application had its unique view of who a customer was, what a product was, and what an order was. No two applications necessarily agreed on anything, and a corporate perspective of information was virtual fiction. In addition, legacy applications looked at and contained only very current data. Historical data didn't exist in any organized manner. And summary data was never anything but a very small part of the operational environment.

Data warehouses squarely address these inadequacies of the operational environment by integrating data, providing historical data, and providing detailed as well as summary data.

Integrated Data. Data in a warehouse is integrated, so it can support a corporate perspective of data. With a warehouse, an executive can immediately look at corporate information. The integration required to build a data warehouse is not an easy process. John Ladley of the Meta Group states that integration takes up to 75 percent of the development dollars for the building of the data warehouse. Integration is complex, painful, and requires much thinking—but it pays off handsomely.

Historical Data. A second fundamental characteristic of data warehousing is that the warehouse contains historical data. Typically, data warehouses contain five to 10 years of such accumulated data.

By looking across multiple quarters, corporations can start to see the forest from the trees. They can start to understand the seasonality of their business across multiple years. In understanding their seasonality, corporations can tell whether they are truly making progress or merely marking time.

Detailed and Summary Data. Summary data is important to management because management needs to see the larger picture before it can concentrate on the interesting details. In many regards, detailed data merely hides information that management will find interesting.

Two Warehouse Mutants

There are several notable mutant forms of a data warehouse. One form is the operational data store (ODS)—a data warehouse in the operational environment. An

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Data Warehousing Grows Up

	1984	1986	1988	1990	1992	1994	1996
Event	*Computerworld* notes "Two DBMS Types Seen Emerging"	AMS builds PacTel and Burlington Northern data warehouses.	QED publishes *Building the Data Warehouse*.	First conference on data warehousing by Barnett Data Systems.		First independent data marts appear.	First dependent data marts appear.
Product	Teradata DB/DC 1012				IBM, HP, Tandem announce warehouse initiatives.	Prism announces integration and transformation tools.	Web-based data-mining tools appear.
Technology		DEC's technical architecture manual (the "blue book") appears.	Apple unveils VITAL architecture.			Appearance of OLAP/ROLAP tools.	

ODS shares many characteristics of a data warehouse but has unique characteristics. For example, an ODS can be updated and can provide fast transaction response time, something a classic data warehouse cannot do.

Another mutant form of data warehouse is the data mart. A data mart is a departmentalized form of a data warehouse. They are similar to data warehouses except data marts:

- are customized for a single department;
- contain less historical data than a data warehouse;
- operate on technologies that are suitable for a much lower volume of data than a data warehouse;
- have many more indexes than a warehouse, so the optimal data structure for a data mart is the *star join* (for the more voluminous data warehouse, a more normalized structure is appropriate);
- have a fairly predictable usage pattern;
- contain much more summary data;
- look very different from department to department;
- hold very little, if any, detailed data.

A Brief History

Data warehousing rose from the origins of the notion that there should be a split between different types of databases. There are eight main reasons that it was a good idea to split processing across multiple databases.

1. Operational databases require split-second response time, whereas data warehouses and decision support systems (DSSes) processing do not.
2. The clerical community uses transaction-oriented databases; the managerial community uses data warehouses.
3. Up-to-the-second decisions are made from operational systems; long-term decisions are made from data warehouses.
4. Operational databases contain very current information; data warehouses contain historical information.
5. Operational databases are unintegrated and are often application-specific; warehouses contain integrated data.
6. Operational databases are designed for detailed data; warehouses are designed for detailed and summary data.
7. In an operational environment, the requirements for processing are known before the system is built; in a data warehouse environment, the requirements for processing are discovered as part of the development process.
8. Requirements for processing in an operational environment are static; requirements for processing in a data warehouse environment are heuristic and are discovered through iterative development.

From the notion that there should be a single database to serve the corporation's needs came the notion that separate and distinctly different database types were needed to serve the corporation's needs.

Creating the Warehouse

While the notion of data warehousing was enormously appealing, the first issue the corporation faced was that of creating the warehouse from the data found in the legacy, operational environment. At first, people thought the problem was as simple as moving data from an operational platform to a data warehouse platform. They thought that replication of data was all they needed. While data certainly needed to be moved, the data required integration and transformation during the moving process. Very quickly integration and transformation technology appeared. Sophisticated shops discovered that there was no need to have many programmers manually creating the code needed to integrate the data.

The next phase in the evolution of the data warehouse environment was the advent of the data mart. Data marts have always been a part of the DSS architecture. The earliest manifestation of the data warehouse/data mart architecture was in a form that can be called the independent data mart: The data mart is created directly from the legacy, operational applications. There is no data warehouse where there are independent data marts. Independent data marts are appealing because they can be built cheaply, quickly, and simply.

For a while, independent data marts were very popular. But they reached a point where several major architectural flaws appeared. When a corporation built more than one independent data mart, there was massive redundancy of data (primarily detailed data) from one independent data mart to another. Also, the number of interface programs from the independent data marts back to the legacy, operational application environment

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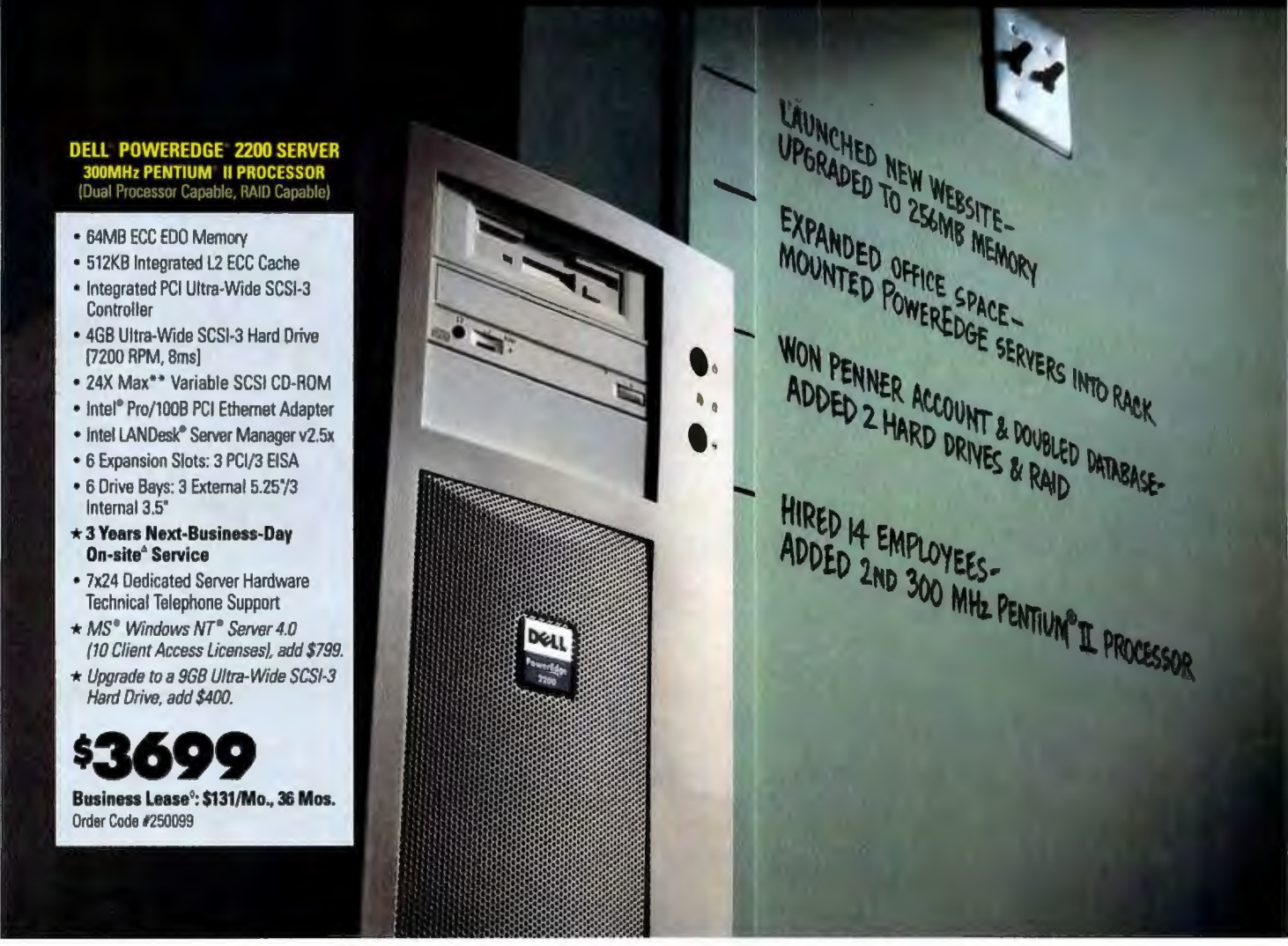

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Putting Your Ducks in a Row

Warehouse Structure

Data warehouses are built on lightly denormalized data, optimized for looking at data.

1. Basis is normalized model, denormalization done selectively.
2. Denormalization done by merging tables based on common key structure and use of data.
3. Small amounts of redundancy can be introduced.
4. Judiciously applied data arrays are possible.

Mart Structure

Data marts are built on star joins made up of fact tables and dimension tables.

1. Fact table represents most populous entity.
2. Dimension tables represent static data with many fewer occurrences than fact table data.
3. Fact table can contain foreign keys and non-key data.
4. Basis of "cube" or "dimension" design.
5. Access pattern of data must be known in order for the star join to be properly shaped.

grew exponentially. There was also no single corporate "source of truth"; as a consequence, different departments were saying quite different things about the same data based on analysis obtained from their independent data mart. Finally, the machine resources required for extracting legacy, operational data from the same application by each independent data mart grew intolerable.

In a word, organizations that built a series of independent data marts simply didn't get their money's worth from data warehousing. Independent data marts are not the solution to the corporate information problem. After a short period, data architects perceived that *dependent* data marts were the proper architecture.

In a dependent data mart architecture, there is a central corporate data warehouse that feeds the dependent data marts. This architecture is sometimes called the *hub-and-spoke* architecture, where the data marts are the spokes and the data warehouse is the hub. The hub-and-spoke architecture has much to commend itself. For one, there is integration of data and reconcilability of data at the hub. In addition, there is autonomy of processing at the spoke and no necessary redundancy of data at the spokes. And there is a rich amount of history at the hub.

The general patterns of database design have mimicked the evolution and sophistication of the data warehouse/DSS environment. In the early days, when there was a nascent data warehouse, classic data normalization was the basis for design. As independent data marts emerged, star joins and snowflake structures became the norm for design. And as the hub-and-spoke architecture evolved, normalized, data-model based designs for the hub and star join became the norm, as did snowflake designs for the spokes.

Data Mining

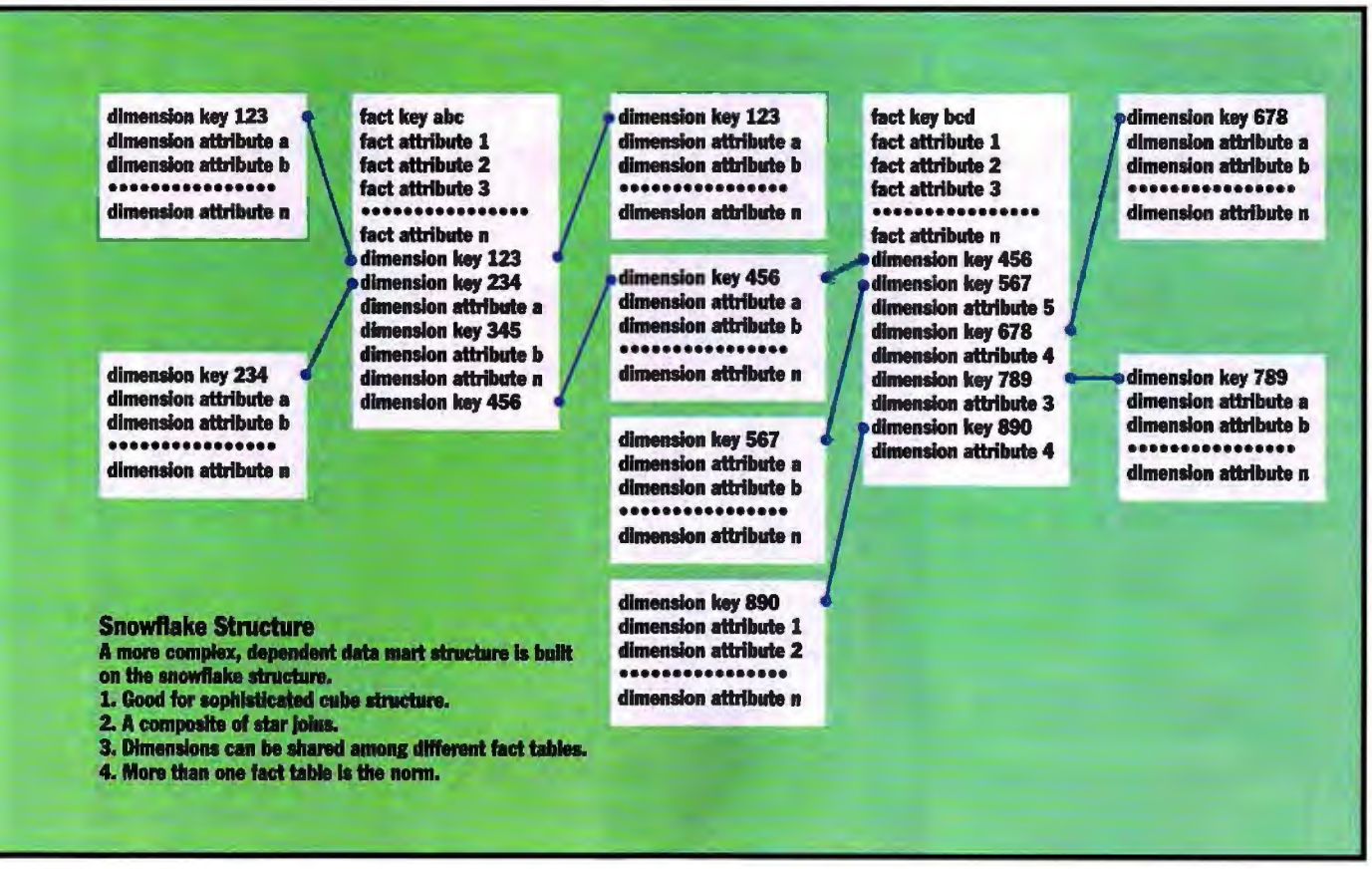
Once the warehouse and its architectural components are built, the next part involves exploiting the warehouse. Data mining is the next logical step in completing the circle of effective decision support. With data mining, you can discover important business patterns, examine relationships between obscure and otherwise unnoticed variables, and measure long-term trends. In short, data mining fulfills many of the expectations of data warehousing.

An interesting question that almost immediately arises is: Can data mining be done without building a data warehouse? Does a corporation really have to go through the effort and investment of building a warehouse in order to use data mining technology successfully?

The answer is that data mining can be done with no data warehouse or data marts at all. But just because data mining can be done does not mean that data mining can be done effectively. Can data mining be done *effectively* with no data warehouse/DSS infrastructure? The answer is that data warehousing is absolutely essential for effective data mining.

Why is a data warehouse/DSS infrastructure essential for corporations that are serious about data mining? Simply stated, warehouses prepare the raw data of the corporation for mining analysis in an optimal manner. This preparation before analysis shows up very beneficially in many ways.

One of the essences of a data warehouse is that data is integrated as it is placed in the warehouse. This means there must be uniformity and continuity to the understanding of common corporate objects, such as who is a customer, what is a transaction, and so forth. By building the ware-



Snowflake Structure
A more complex, dependent data mart structure is built on the snowflake structure.
1. Good for sophisticated cube structure.
2. A composite of star joins.
3. Dimensions can be shared among different fact tables.
4. More than one fact table is the norm.

house first, the data miner can dive into the analysis immediately and can start to achieve results immediately. But if the data miner does not have a data warehouse to operate from, then the miner must spend precious time gathering, cleansing, scrubbing, and integrating the data. It will be a long time until the miner is set to even start the analysis portion of data mining if there is no warehouse infrastructure.

The second reason the warehouse sets the stage for success in data mining is that it collects and organizes historical data. The data miner needs a wealth of historical data in order to find the patterns and relationships that are interesting. If there is no central collection of historical data like the one in the warehouse, then the data miner must go out and find the historical data. In some cases the data miner can find the historical data. But in other cases it simply does not exist. When there is a data warehouse, the miner can sit down and immediately start to work on the historical data inside the warehouse. The data miner is a long way from any meaningful analysis when he has to first gather and assimilate the historical data.

The third reason data warehousing opens the door to effective data mining is that the warehouse contains both summary data and detailed data. Unquestionably, the miner needs the detailed data in order to do analysis. But the summary data is useful at the outset of analysis, when the miner is planning an approach and needs to quickly look over the entire collection of detailed data. When there is a representative sample of different types of summary data, the miner can quickly survey what is and what is not in the warehouse. The summary data can save the miner fruitless iterations of analysis.

Emerging Trends

What is on the horizon for the data warehouse, the data mart, and data mining?

Data Management. One of the obvious trends is the need for the management of the warehouse environment. Data warehouses and data marts tend to grow at an amazing rate. As they grow, the volume of data that finds its way into the data warehouse becomes an obstacle to success. With this growth comes a slowdown in performance and an increase in budget. Soon the organization comes to the realization that the data warehouse infrastructure needs to be managed.

One of the first discoveries the manager makes is that managing the DSS/data warehouse environment is nothing like managing the classic operational, transaction-oriented environment. The DSS/data warehouse infrastructure has its own unique set of needs and peculiarities.

One of those peculiarities is that of dormant data that creeps into the warehouse. Dormant data is data that is never used. In the early stages of a warehouse, there is little dormant data. But as time passes, the amount of dormant data increases to the point that there is much more dormant data in the warehouse than data that is actively being used. At this point, the dormant data needs to be archived in order to keep processing streamlined.

Other management issues include the need to constantly monitor and cleanse data as it enters the warehouse and as it resides in the warehouse.

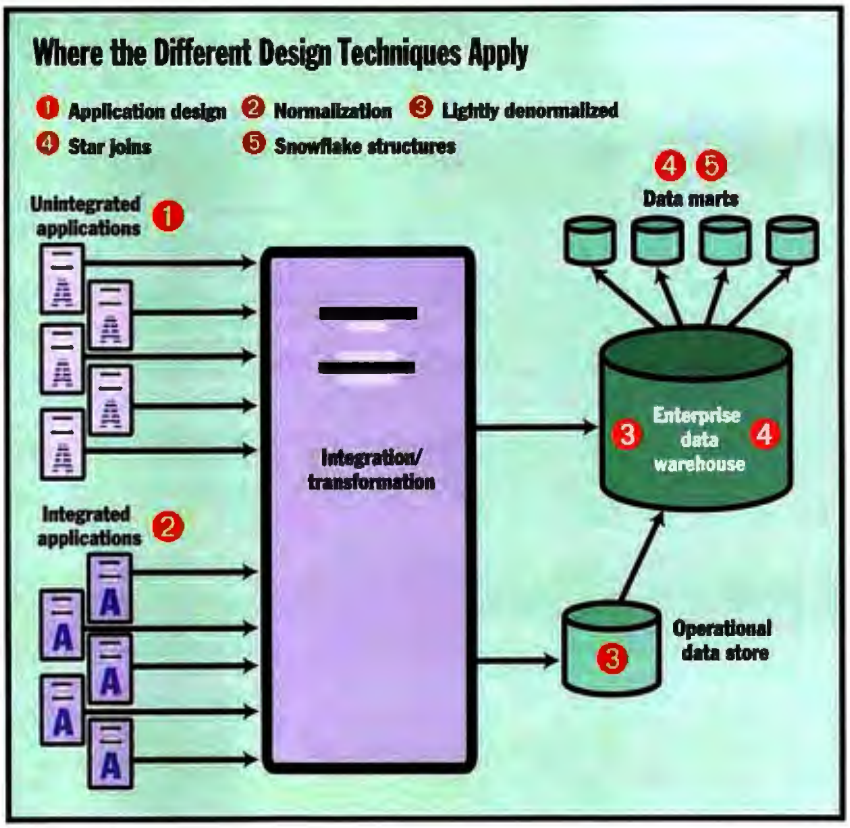
Metadata. As corporations mature in their understanding of the warehouse environment, one obvious technology that emerges as being very important is metadata. In its simplest form, metadata is data about data. But in a warehouse environment, you need a more sophisticated view of metadata. There are many types of metadata that are beneficial to

the DSS/data warehouse infrastructure.

But metadata was not part of the first generation of data warehouses for a variety of reasons. People were so anxious to get their first-generation data warehouses started that they went after only the most obvious parts of the warehouse. These first efforts concentrated merely on getting the data into the warehouse. But we are starting to see much more sophisticated, second-generation data warehouses being built now that do include metadata as an integral part of the infrastructure. Also, there really wasn't any appropriate technology for capturing and managing metadata in the early days of data warehousing. It took imagination back then to see why metadata was so important. There is only so much imagination to go around. Today, after real experience with first-generation data warehouses, people base decisions on experience rather than on imagination. An experienced warehouse administrator knows just how important metadata is.

One of the major issues of the DSS/data warehouse infrastructure is that every technology seems to be found in the warehouse environment—everything from HP, IBM, NCR, and DEC to Sun and Sequent. You'll find Oracle, Sybase, Teradata, DB2, Informix, and Red Brick. There is Information Advantage, Business Objects, Cognos, DSS Agent, and Brio. Trying to gain a consensus of opinion among these vendors is impossible. Yet in order to be successful, there must be shareability and manageability of metadata across these vendors and products. One of the biggest challenges facing the metadata manager in the warehouse environment is crossing the technological barriers found in the environment.

Of course, metadata in one form or another has been around for a long time, and there have been some limited successes. But there are some severe limitations with the repository approach to the management of metadata as it applies to data warehousing. The primary limitation is that it does not account for the need for autonomy of processing by the end user. When the end user is working away on a Saturday afternoon in Lotus 1-2-3, she is not about to let an administrator interfere with the flow of work and analysis. The very essence of much of end user processing is the freedom of the end user from IT control. End users simply are not going to stand for an administrator telling them what can and can't be done. And anyway, what are Lotus and the other spreadsheets but metadata?



Warehouse, mart, and snowflake structures apply to different parts of an enterprise.

But there are other architectural issues relating to metadata management across the DSS environment. If you have no central control of metadata, you will never have any uniformity of definition of data. There will never be any consistency of processing across the organization.

There needs to be a balance between shareability of metadata and autonomy of metadata. The balance can be achieved only by a distributed metadata architecture, where the different nodes of the architecture have their own metadata. A distributed approach to metadata management is the only viable approach in the DSS/data warehouse environment.

Tools. There are cube technologies, relational technologies, and powerful spreadsheets. As more data becomes truly available to the end user, the tools that cater to the particular needs of the end user will have even greater variations and capabilities than they have today.

Storage and Archival Technologies. There is so much data pouring into the warehouse environment that standard disk storage cannot possibly—economically and technologically—hold it all. Furthermore, with data warehousing there is no need to hold all the data in an on-line mode. Near-line software and hardware that will allow data to reside on a hierarchy of storage will soon emerge.

On a little bit longer horizon, archival technology will surely appear. There is much to the subject of archival technology, and if there is one Achilles' heel of data warehousing, this is it. Today's archival technology is crude compared to what will be coming tomorrow.

Metaprocess. Metadata technology in one form or another has been around for a while. But metaprocess technology has an important place and will start to appear commercially in the next few years. B

Bill Inmon, the father of the data warehouse concept, is chief technology officer of Pine Cone Systems (Englewood, CO), a company that builds and markets software for managing the data warehouse/data mart environment. You can reach him **c/o editors@bix.com.**

Jon Udell

Web Project

HTTP Authentication

Web servers implement basic authentication in many ways. If they don't do what you need, create your own scheme.

The user/password dialog box (see the figure to the right) is familiar to every Web user. You encounter it when you try to fetch a URL that is protected. If you type in a user name and password that the Web server will accept, the request will retry and succeed. Otherwise, it will retry and fail, with a message such as "Authorization Required."

This simple scheme has a surprising number of permutations. Web servers, for example, can declare protected zones in very different ways. You can protect scripts as well as documents. There are all sorts of ways to manage lists or databases of users, passwords, and groups.

This month, I'll review the authentication features of my two favorite Web servers—Internet Information Server (IIS) and Apache. But first, by way of background, I'll show how I added HTTP authentication to ByteCal, my servlet-based group calendar (see http://www.byte.com/art/9708/sec8/art1.htm).

Authentication with ByteCal

If you run ByteCal under the Java Web Server (JWS), which supports HTTP authentication, you can protect it as you protect any other resource. Just run the JWS server-administration applet and associate ByteCal with a list of authorized users. But what if you run ByteCal under Acme.Serve, a Java-based Web server that does not support HTTP authentication? To explore how basic authentication works, I added authentication to ByteCal, so that the servlet itself, independently of any protection that its host may or may not provide, can authenticate users.

Here's how it works. When you issue a request to ByteCal, it checks the HTTP headers sent by the browser, looking for one called Authorization. If it's absent, the requesting browser has not yet authenticated itself to ByteCal. So, ByteCal issues a challenge in the form of this pair of HTTP headers:

```
HTTP/1.0 401 Unauthorized
WWW-Authenticate:
  Basic realm="ByteCal"
```

The crucial part of the first header is the 401 code; that's what provokes authentication. Although I'm declaring the protocol to be HTTP/1.0, HTTP/0.9 or HTTP/1.1 should work identically—basic authentication is the same in all cases.

The second header defines the type of authentication that will occur. In theory, this could be basic or digest. In practice, it's almost always basic, a weak protocol

Digest Authentication

Digest authentication (see http://www.w3.org/Protocols/rfc2069/rfc2069) will occupy a middle ground between basic authentication, which is very weak, and client authentication, which is very strong. You can use client authentication today (see "Digital IDs," http://www.byte.com/art/9703/sec8/art1.htm). But the administrative burden of client certificates and the overhead of the required Secure Sockets Layer (SSL) transport weigh against this option.

In digest authentication, as in NT LAN Manager (NTLM) authentication, the server sends the client a special value (nonce) that the client uses to encrypt the password. When it receives the encrypted password, the server applies the same operation to its own copy of the user's password and checks for a match. As a result, the password need not be sent in the clear.

The familiar user/password dialog box.

The protocol uses several techniques to restrict the scope of a transaction. First, the specification recommends that the nonce should include the client's IP address and a time stamp. The IP address helps prevent a man-in-the-middle attack by forcing an attacker to spoof the IP address of the original client. The time stamp limits the period during which such an attack might be tried. Second, the digest that the client sends back to the server is based in part on the URL it originally requested. If an interloper alters that URL, the digest computed by the server won't match the one computed by the client.

Couldn't a rogue server use a constant challenge, as with NTLM authentication, to mount a dictionary attack? Yes. The digest method is inherently better than the NTLM method, because it seeks to limit the scope of transactions and it doesn't permit the invisible handshake that Internet Information Server (IIS)and Internet Explorer currently perform. But the authors of RFC2069 are candid about the uses and limitations of digest authentication:

"Users and implementers should be aware that this protocol is not as secure as Kerberos and not as secure as any client-side private-key scheme. But it is better than nothing, better than what is commonly used with telnet and FTP, and better than basic authentication."

PHOTOGRAPH: KELLIE WALSH © 1998

that sends credentials as clear text. The digest method, which encrypts the credentials and is implemented in some servers (Apache, JWS), is unfortunately not yet supported by either major browser (see the text box "Digest Authentication"). For the exclusive combination of IIS server and Windows-based Microsoft Internet Explorer (MSIE) clients, there's a third option (see the text box "NTLM Authentication" on page 92).

The final piece of the WWW-Authenticate header is the realm, in this example ByteCal. It distinguishes this protected zone from others that might possibly be in effect on the same server.

When the browser receives the authentication headers, it displays its user/password dialog box to the user. When the user fills in the fields and clicks OK, the browser retries the request and tacks on an Authorization header. Here's the example given in the HTTP specification for user "Aladdin" with password "open sesame":

```
Authorization: Basic
 QWxhZGRpbjpvcGVuIHNlc2FtZQ==
```

This mangled representation of "Aladdin:open sesame" appears to be encrypted, but actually it's not. It's only MIME-encoded (Multipurpose Internet Mail Extensions), aka base 64–encoded. Routines to decode the credentials string are available for Java, Perl, and many other languages.

Let's recap. ByteCal looks for an authorization header. If it's absent, ByteCal issues a basic authentication challenge to the browser. The browser prompts the user for a name/password combo. Then the browser sends a MIME-encoded representation of these back to ByteCal in the form of an authorization header.

ByteCal decodes the authorization header and decides whether or not to grant access. For now, it's a simple match against a single name/password hard-coded into ByteCal on behalf of a group of users. The check occurs at the top of ByteCal's main service routine. If it succeeds, ByteCal dispatches the appropriate handler for the request. If it fails, the service routine prints an "Authorization Failed" message and then returns immediately. What if it did not? I made that mistake. The result: A user could simply bypass authentication by canceling out of the dialog box.

ByteCal looks for the environment variable HTTP_AUTHORIZATION, not for HTTP_REMOTE_USER, which is how Web servers normally pass the name of an authenticated user to a script. Why? HTTP_REMOTE_USER isn't one of the headers that a browser sends to a server. An authenticating Web server adds HTTP_REMOTE_USER when it invokes a script that's been accessed by way of an authentication protocol. (Some servers also subtract HTTP_AUTHORIZATION—more on this later.)

But recall that Acme.Serve is not an authenticating Web server. Thus, ByteCal sees different headers than a typical protected Common Gateway Interface (CGI) script sees: HTTP_AUTHORIZATION is present, but HTTP_REMOTE_USER is absent.

Note that ByteCal is now in a position to do some fancy things. It could, for example, deny everyone write access to user A's calendar except A and A's assistant, B. Basic authentication as typically implemented in Web servers can't offer you this flexibility. The reason is not that the protocol precludes it, but rather that the usual URL-oriented protections don't map to arbitrary application data. When an application bypasses the Web server's authentication mechanism and supplies its own, it can provide such a mapping.

TOOLWATCH

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BOOKNOTE

SGML and HTML Explained

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by Martin Bryan
Addison-Wesley
http://www.aw.com/devpress
ISBN: 0-201-40394-3

All the recent XML buzz is bound to create new interest in how SGML Document Type Definitions are constructed and how SGML relates to HTML. Here's the reference you'll need.

Apache Authentication

Apache supports two ways to protect directories from which you serve content or run scripts. You can use the <Directory> directive in the server configuration file (or in VirtualHost sections within that file), or you can use .htaccess files located in the directories they protect. The .htaccess method is more flexible but slower. It lets you adjust security policy on the fly but requires the server to reread the .htaccess file for each request. The <Directory> method is less flexible but faster. You have to restart the server to adjust policy, but there's no per-request overhead.

Where does Apache look up users and groups? There are all sorts of options. Here's an .htaccess file that refers to a text file containing user names and encrypted passwords:

```
AuthType Basic
AuthName OurUsers
AuthUserFile /plain/ourusers
require valid-user
```

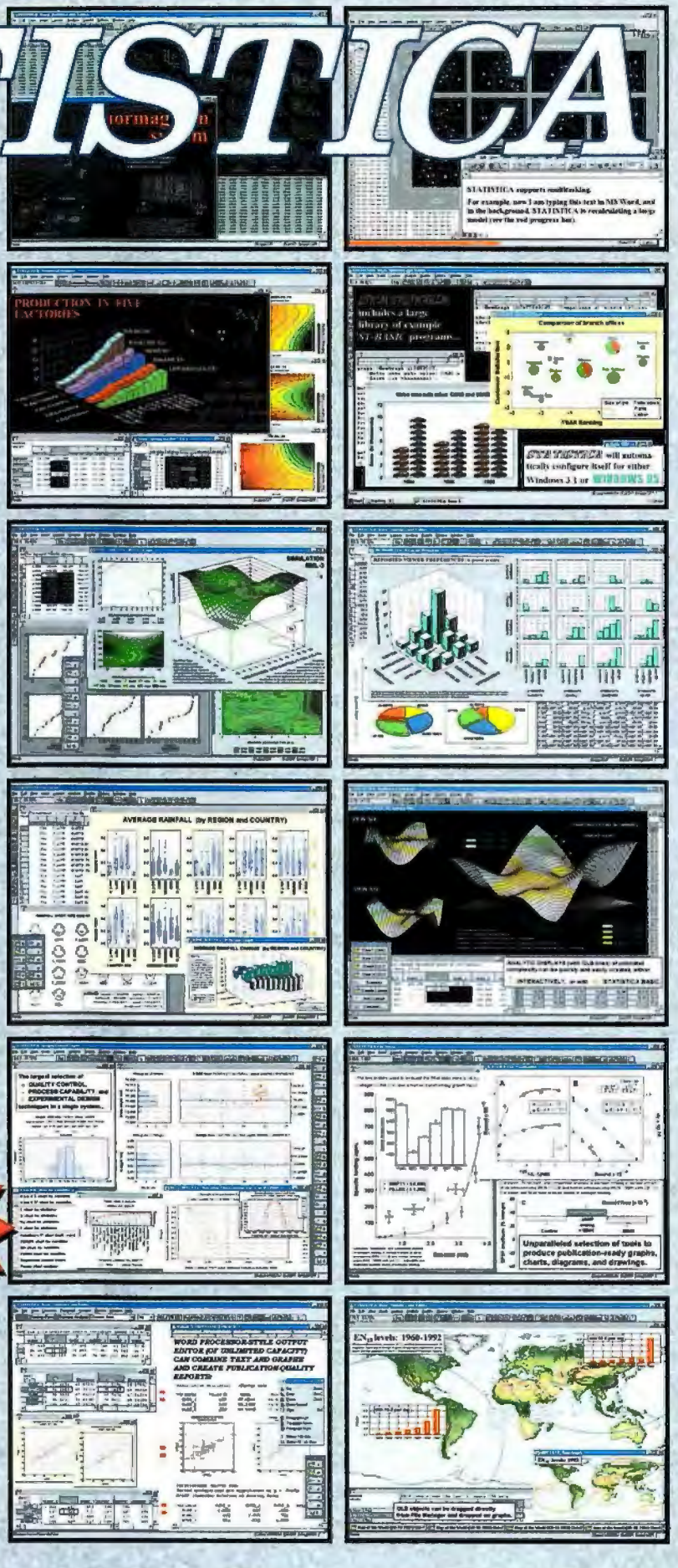
The file /plain/ourusers, created using the htpasswd command, is the Web analog to a Unix /etc/passwd file. If you're handling thousands of users, you probably don't want Apache to have to read a huge password file every time it authenticates. So, the same .htaccess file could instead look like this:

```
AuthType Basic
AuthName OurUsers
AuthDBMUserFile /dbm/ourusers
```

Now when a user authenticating to the realm OurUsers sends a name and password, Apache looks up the credentials not in a text file, but in a much faster DBM database (disk-based hash). The file /dbm/ourusers can be created using a Perl script called dbmmanage that comes with Apache. To use the DBM method, you'll need to edit Apache's Configuration file, activate the relevant module (mod_auth_dbm), and rebuild Apache.

It gets even better. With mod_perl, Doug MacEachern's implementation of

STATISTICA



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in-process Perl for Apache, you can write your own authentication module in Perl. Here's how it works. At each stage in the processing of a request, Apache calls a handler. These are usually written in C and linked with Apache (IIS users: Think "Internet Server [ISAPI] filter"). In the case of an AuthUserName directive, the handler is Apache's built-in authentication module. For AuthDBMUserFile, it's mod_auth_dbm. But if you have installed mod_perl and your .htaccess file looks like this:

```
AuthType Basic
AuthName OurUsers
PerlAuthenHandler Apache::Anon
```

Apache will call the Perl module Anon.pm. MacEachern wrote this module just to illustrate the concept of an Apache/Perl module. (IIS users: Think "ISAPI filter written in Perl," a lovely concept that sadly isn't yet possible with IIS and Win32 ISAPI Perl.) Anon.pm approves only requests from user name "anonymous."

But the point is that any Perl code can run in this context. A Perl-based authentication module can examine and modify Apache's internal request structure and use any algorithm and any Perl-accessible data source to decide whether to grant access.

Note that such a module has complete access to the HTTP headers sent by the client. If you write a CGI script to enforce a security policy, à la the ByteCal example above, that script will normally see only the user's name (HTTP_REMOTE_USER) and not the full credentials (HTTP_AUTHORIZATION).

That's because Apache, as a security measure, withholds the Authorization header from CGI scripts. (If you really want to build a CGI-based access-control script, you can tweak Apache to make it send this header.) But an Apache/Perl authentication module, running inside the server, knows everything that Apache knows about a request.

Authentication with IIS

IIS unifies Web-server security and native NT file-system security. Is this a feature or a bug? It depends. For intranet servers, it's a feature. You've already defined users and groups, and assigned file-system permissions accordingly, so why not leverage that infrastructure when building Web-server-based applications? There's also another advantage. With Apache and other Unix Web servers, there's no easy way to achieve file-level protection. Because IIS integrates with the NT file system, it's as easy to protect an individual file as it is to protect a whole directory.

For Internet servers, though, IIS's integrated security looks more like a bug. IIS itself can run only as a valid NT user. Internet clients become that user when they connect anonymously to IIS. To protect content or scripts, you revoke that anonymous user's rights to some directory. When a browser requests something in that directory, IIS issues a basic authentication challenge. (Alternatively, it can issue an NTLM challenge; see the text box "NTLM Authentication.")

What credentials will work here? The user name and password of any valid NT user who is listed in the local or domain accounts database and who has appropriate read or (in the case of a script) execute rights in that directory.

The problem with this scheme is that any accounts that you create for this purpose are meaningful not only to the Web server, but more broadly to the NT machine or even its entire domain. A rogue script running under such an account could be very dangerous. What's more, if you use basic authentication, you're sending in clear text the name and password of a real NT account.

Out of the box, IIS offers no good way to handle the authentication of thousands of users on a public Internet-connected NT box. Clearly, you're not going to create thousands of local or domain accounts to handle this situation. You'll need to write an ISAPI filter that intercepts and handles the SF_NOTIFY_AUTHENTICATION event or acquire one that does this—for example, Philippe Tenenhaus's Dynamic Authentication Filter (which is found at http://daf.simplenet.com/).

As you can see from this, basic authentication itself is a simple protocol. However, Web servers implement it in different ways, and those implementations govern what you can and can't do with the protocol. If you run into a roadblock, you'll have to modify your Web server, adding a module or filter that replaces the built-in authentication mechanism. Otherwise, you can bypass the Web server entirely and create your own authenticating application. B

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NTLM Authentication

If you configure Internet Information Server (IIS) to do Windows NT challenge/response instead of basic authentication, it sends the header "WWW-Authenticate: NTLM" when asked for a protected URL. Microsoft Internet Explorer (MSIE) and IIS then perform a security handshake that relays an encrypted password to IIS.

For transactions between IIS servers and MSIE browsers, this approach seems clearly superior to basic authentication, because no clear-text password travels on the wire. Note, however, that in all versions of MSIE prior to the shipping version 4.0, NT LAN Manager (NTLM) authentication has some unpleasant characteristics:

1 As part of the security handshake, MSIE sends your user name, NT domain name, and host name in clear text. That's more than you want random servers on the Internet to know about your LAN.

2 The client encrypts its password (actually, a hash of the password) using a challenge (aka nonce, or one-time pad) sent from the server. The challenge is supposed to be random, but, as Paul Ashton has shown (see http://www.efsl.com/security/ntlm), a rogue server can always send the same challenge, which it can also have used to precompute a large database of possible passwords.

3 The security handshake occurs invisibly to the user. Why? MSIE figures that because you've already logged on to Windows once, there's no need to be prompted again for a name and password. You can automatically pass those credentials to an IIS server, just as you automatically pass them to file servers on your LAN. Of course, the Internet is not your LAN. Paul Ashton summarizes the situation nicely: "Wouldn't you like to see a message: www.foobar.com has requested your NT user name and password. Would you like to send it [YES] [NO] [Don't bother me again]? I know I would."

Microsoft's response? Upgrade to the final shipping version of MSIE 4.0. It carves the world into zones and makes automatic log-on behavior the default for the intranet zone (your local network), but not for the Internet zone (everywhere else).

Rick Grehan

Javatalk

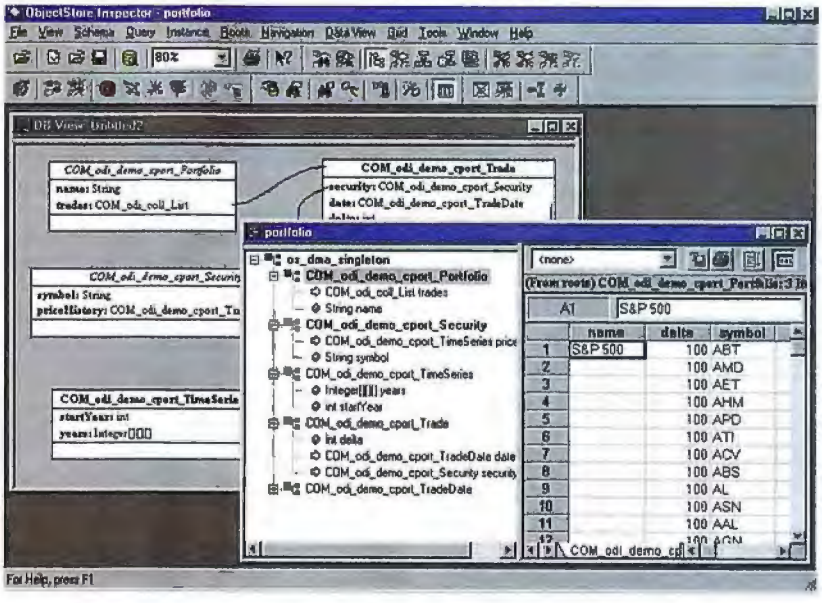
More Java Persistence

A look at another Java-enabled object database reveals what's in store for you.

In last month's column, I examined Poet's object-oriented DBMS (OODBMS) for Java. This month I look at the Java version of ObjectStore PSE (persistent storage engine) from Object Design.

ObjectStore PSE (PSE for short) is one of a triad of object database systems from Object Design. ObjectStore 5.0 is the company's flagship OODBMS, followed (in terms of capability) by PSE Pro. Finally, the entry-level OODBMS is PSE, which is available either as a free download from Object Design's Web site (at http://www.odi.com) or as a bundled addition to Java development environments. BYTE reviewed ObjectStore 5.0 in the October 1997 issue (see "The Object Is to Manage Data"); in this column, I discuss Object Design's Java interface.

I examined the version of PSE bundled with Asymetrix's Supercede. Note that PSE's capabilities are essentially a subset of those found in PSE Pro and in the full-blown, multiuser ObjectStore.



PSE lacks ObjectStore 5.0 capabilities, such as multiuser support and the database inspector.

PSE uses the concept of "persistence by reachability" (as does Poet). That is, an object is persistent if it's referenced by or contained in another persistent object. This naturally generates a kind of chicken-and-egg question: How does any object become persistent in the first place?

The answer is the `createRoot()` method. It creates a persistent object in the database and associates that object with a string. This is analogous to Poet's named objects. Once you have created a persistent root, it becomes a kind of anchor to which you can attach other objects. (Or the root could be a container storing persistent objects.)

A single database can hold an arbitrary number of roots. Furthermore, the referencing and containing can be nested arbitrarily deeply. If the root references an object that in turn references another object, and so on, the entire referenced chain of objects is accessible and therefore persistent.

Objects that can be stored in the PSE database are referred to as being "persistence-capable." Objects whose class includes methods that manipulate persistence-capable objects, but that themselves are not persistent, are called "persistence-aware" objects. All other objects are "transient objects."

To confuse you even further, a persistence-capable object can be in one of three states with regard to usability of the contents of its data members. A "hollow" object has default values in its data members. (For example, if you fetch an object from the PSE database, the objects that it references—as yet unfetched—are hollow.) Once you read a hollow object's contents from the database, the object becomes "active." Finally, if the object participates in an aborted transaction (I'll discuss transactions below), the object is regarded as "stale"; its contents should be treated as indeterminant.

In addition, an active object becomes "dirty" if, after its contents have been read from the database, any data member has been modified. Dirty objects are written back to the database when their enclosing transaction completes.

As implied above, all access to a PSE database occurs within the bounds of a transaction. Manipulating objects within a database follows this sequence: Begin

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a transaction, read and write persistent objects, and then close that transaction. New or updated objects are written to the database only if the transaction closes successfully. If the transaction is aborted, the database remains in the state it was in prior to the beginning of the transaction.

Unique to PSE is how invisibility—as far as the programmer is concerned—does its work. Remarkably, you need not insert any explicit method calls to fetch and store persistent objects. Consequently, if you peruse the source code to a program that uses PSE, you'll see only calls to methods for opening and closing the database, and calls to methods for starting and committing transactions.

How, then, does anything get into or out of a database? This magic is wrought by PSE's postprocessor. When you build your PSE-enabled application, you need only bracket with transaction begin and end methods, stretches of code that operate on persistent objects. You compile your code and then run the resulting class files through the postprocessor.

When a persistent object is referenced, the postprocessor precedes the reference with a call to the method to fetch that object. When a persistent object is modified, the postprocessor follows the code with a call that marks the object as "dirty." (In fact, the calls are named `fetch()` and `dirty()`.) The postprocessor also adds classes that can initialize the contents of fetched objects and write persistent objects' contents back into the database.

The postprocessor does the best job it can at deducing where to place calls to `fetch()` and `dirty()`. But sometimes it can pepper your code with more calls than are strictly necessary. A savvy programmer, knowing where those calls ought to go, can override the postprocessor and place `fetch()` and `dirty()` calls only where they must be (and thereby simultaneously reduce execution size and increase execution performance). The documentation includes guidelines that lead you through inserting explicit calls to `fetch()` and `dirty()` and exercising the final application to verify correctness of execution.

One side effect of the postprocessor's modifying the class file is that debuggers can become slightly confused. Fortunately, because the Java class-file format associates source code line numbers with generated code, the postprocessor can make adjustments so that a debugger never gets completely befuddled. But sometimes, if you execute a "step into" on a statement that the postprocessor has—in the class file—inserted a `fetch()` or `dirty()` just after, you might find yourself suddenly stepping into PSE code. Executing "step out" solves the problem.

Although the full ObjectStore product supports indexes, PSE and PSE Pro don't. PSE has a persistent hash table that you can use to index on a collection of objects. But there's a catch if you want to generate a hash from a persistent PSE object: You must define such "persistent hashable" objects so that they descend from the persistent hashable superclass supplied with PSE.

The reason for this has to do with the fact that Java's default `hashcode()` method can be confused with PSE's internal goings-on. PSE creates invisible transient objects that are equivalent to persistent objects during transactions. The standard `hashcode()` method can return different hash values for the transient objects that represent the same persistent object in the database, potentially making a hash table unusable as an indexing scheme.

PSE's persistent hashable superclass includes a "hidden field" for holding a hashcode. PSE defines a new `hashcode()` method that reads that hidden field. When an instance of the object is created, PSE calculates and stores a hash value in that hidden field so that subsequent calls to `hashcode()` return the same hash value.

Although I might have made PSE's near-invisible interface sound unconventional, the latest releases of PSE and ObjectStore support the Java binding as defined in the Object Database Management Group (ODMG) 2.0 specification. I recommend downloading PSE and working with it for a few weeks (it's good for files with up to tens of megabytes of data). Then, if it looks right for your application, you can graduate to PSE Pro or ObjectStore. B

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A JVM for Embedded Real-Time Apps

In my July column, I discussed PERC from NewMonics. If you recall, PERC is an implementation of Java for real-time systems. Now Israel-based NSI Com (+972 3 533 1976; fax +972 3 533 2371; http://www.nsi.co.il) has developed what it calls a "Java Software Coprocessor," called JSCP, for embedded real-time systems.

A quick run-through of JSCP's features set leaves you with the idea that you're looking at no more than a Java virtual machine (JVM) ported to a real-time system. True, JSCP has been ported to several real-time OSes (RTOSes), such as VxWorks from WindRiver, pSOS from ISI, LynxOS from Lynx, and Nucleaus from ATI, but other RTOSes (OS9, for example) already have JVMs available. What's so special about JSCP? And how does it differ from PERC?

First, JSCP is more than a JVM. The reason it's more has to do with its target environment: an embedded real-time system. While that's the same target that PERC is aimed at, PERC's approach is more rigorous. PERC provides hard real-time (i.e., deterministic) performance, and it does so at the expense of adding nonstandard syntax to the Java language (which is why it's called PERC, and not "Java-something"). JSCP does not provide hard real-time performance. Instead, it provides a well-isolated JVM that runs as its own process within the parent RTOS.

This isolation of the JVM to its own process has an unexpected benefit, which becomes apparent if you consider the alternative: a JVM that's integrated into the RTOS. Such a JVM might, for example, use the RTOS's thread support for managing Java threads. Consider, however, what it would mean to debug such a heterogeneous thing. You would be dealing with the application itself, the bytecode interpreter, and the JVM-to-RTOS interface. NSI maintains that implementing the JVM as its own process (with well-defined communications between RTOS tasks and JVM applications) makes for an easier-to-debug solution.

JSCP's other strength is its configurability. For example, you can set an external memory-limit parameter to set the memory-size limit that JSCP will use. JSCP regulates its memory consumption automatically. Similarly, you can set the maximum processor time slice given over to the JSCP. (Remember, JSCP is running as one of a number of tasks that share RTOS resources.) Constraining system resources—memory and processor utilization—is critical in a real-time system.

Rick Grehan is coauthor of The Client/Server Toolkit *(NobleNet, 1996). You can contact him at* **rick_g@bix.com**.

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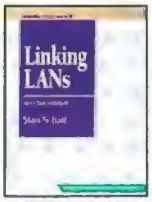

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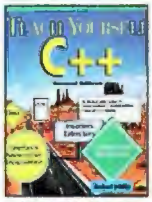

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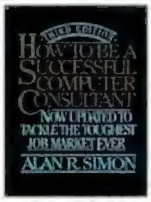

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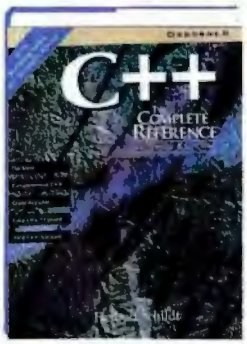

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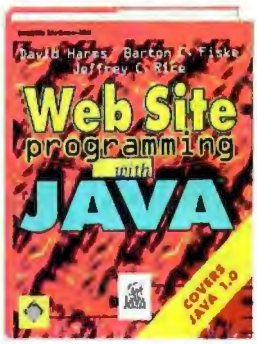

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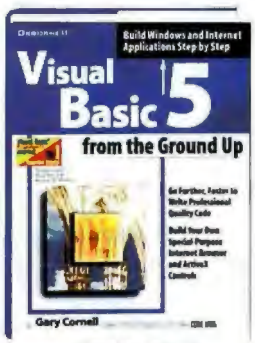

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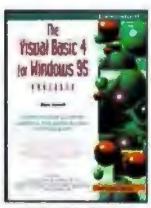

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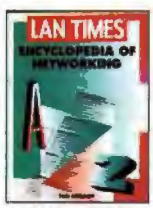

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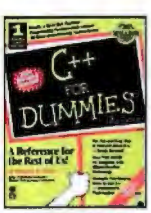

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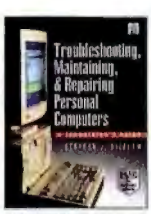

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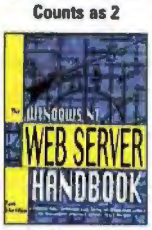

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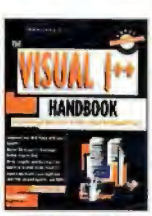

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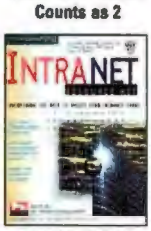

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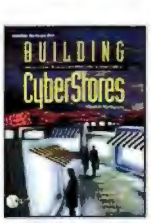

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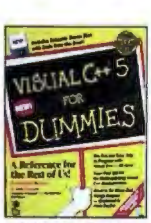

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With the 440LX chip set at the helm, the Pentium II steers its way clear to workstation nirvana.
By Michelle Campanale

Eight Heavy-Hitting NT Workstations

You can't ignore the dramatic shift occurring in the PC industry now. Traditional Intel-based Windows systems are aggressively moving into markets previously dominated by Unix workstations and high-powered Macs. These PC workstations, which run Windows NT and are based on the Pentium II (PII) processor with the 440LX chip set, run at breakneck speeds of 300 MHz. Many vendors even provide the power, drivers, and BIOSes that allow an upgrade to the 333-MHz version of the PII processor, soon to be released. At such speeds, these systems are fully powered for applications such as CAD, animation, financial analysis, and digital-content creation.

Future-generation PII processors are expected to run even faster, at a speed of 400 MHz. With Intel's upcoming 440BX chip set, these processors are expected to support a 100-MHz system bus. Therefore, PII systems with the 440LX chip set may have limited upgradability beyond 333 MHz.

On the up side, the PII with the 440LX chip set has add-ons that can better capitalize on the PII's abilities. In our roundup, we see some exciting new features of the 440LX, such as support for Accelerated Graphics Port (AGP), error-correction code (ECC) RAM, synchronous DRAM (SDRAM), and Ultra DMA hard drives.

Indeed, the 440LX chip set surpasses the 440FX chip set (which is its predecessor) on several levels, making it ideal for use in high-end workstations. Additionally, when the PII with the 440BX chip set rolls out, you can expect prices to drop on systems based on the PII with the 440LX chip set.

Habits of a Highly Effective Chip Set

The 440LX chip set is compatible with AGP, which gives graphics chips dedicated access to main memory. Many gamers and content creators have recently become aware of the possible applications for this technology, which provides a 66-MHz pipeline between the 440LX chip set and the graphics processor, and boosts system performance. AGP's main benefit, though, is that it removes the graphics accelerator from the PCI bus.

Motherboards based on the PII with the 440LX chip set also support PCI graphics cards, which we based our graphics tests on. In truth, few applications can currently exploit AGP other than games and perhaps Virtual Reality Modeling Language (VRML). Nor is there native OS support for AGP, though Windows 98 and NT 5.0 should change that. For this roundup, standards-based OpenGL application tests did the trick for us, in our quest to name the best graphics subsystem.

Another important addition to the 440LX is ECC RAM, which detects and corrects both single-bit errors and double-bit errors on the fly. This makes the PII with the 440LX chip set ideal for high-end workstations, because it works well in systems that are designed to run critical applications where data integrity is vital.

We're also seeing support for SDRAM, which can boost overall system performance by synchronizing itself with the CPU's bus. Replacing extended data out (EDO) DRAM in many newer computers, SDRAM is capable of running at 100 MHz, about three times faster than conventional fast page-mode (FPM) DRAM. That's about twice as fast as both EDO DRAM and burst extended data out (BEDO) DRAM.

The 440LX chip set also has Ultra DMA hard drive support, which enables faster IDE-device transfer rates. Ultra DMA, which is a protocol that was developed by Quantum and Intel, supports burst-mode data transfer rates of 33.3 Mbps. This is twice as fast as the previous disk drive standard for PCs and is necessary to take advantage of faster Ultra ATA disk drives. (However, all the systems we tested included hard drives with anywhere from 4.3 to 9.1 GB of space with SCSI-based controllers, running the

BYTE BEST
300-MHZ NT WORKSTATIONS

Intergraph TDZ 2000 3D
If price is no object, the Intergraph TDZ 2000 3D workstation is a good choice. The system represents the best combination of overall product performance, especially in the 3-D graphics arena.

Xi 600 MTower DP
If you have a real-world budget, the Xi 600 MTower DP will get the job done and makes a great match for compute-intensive spreadsheets and scientific calculations.

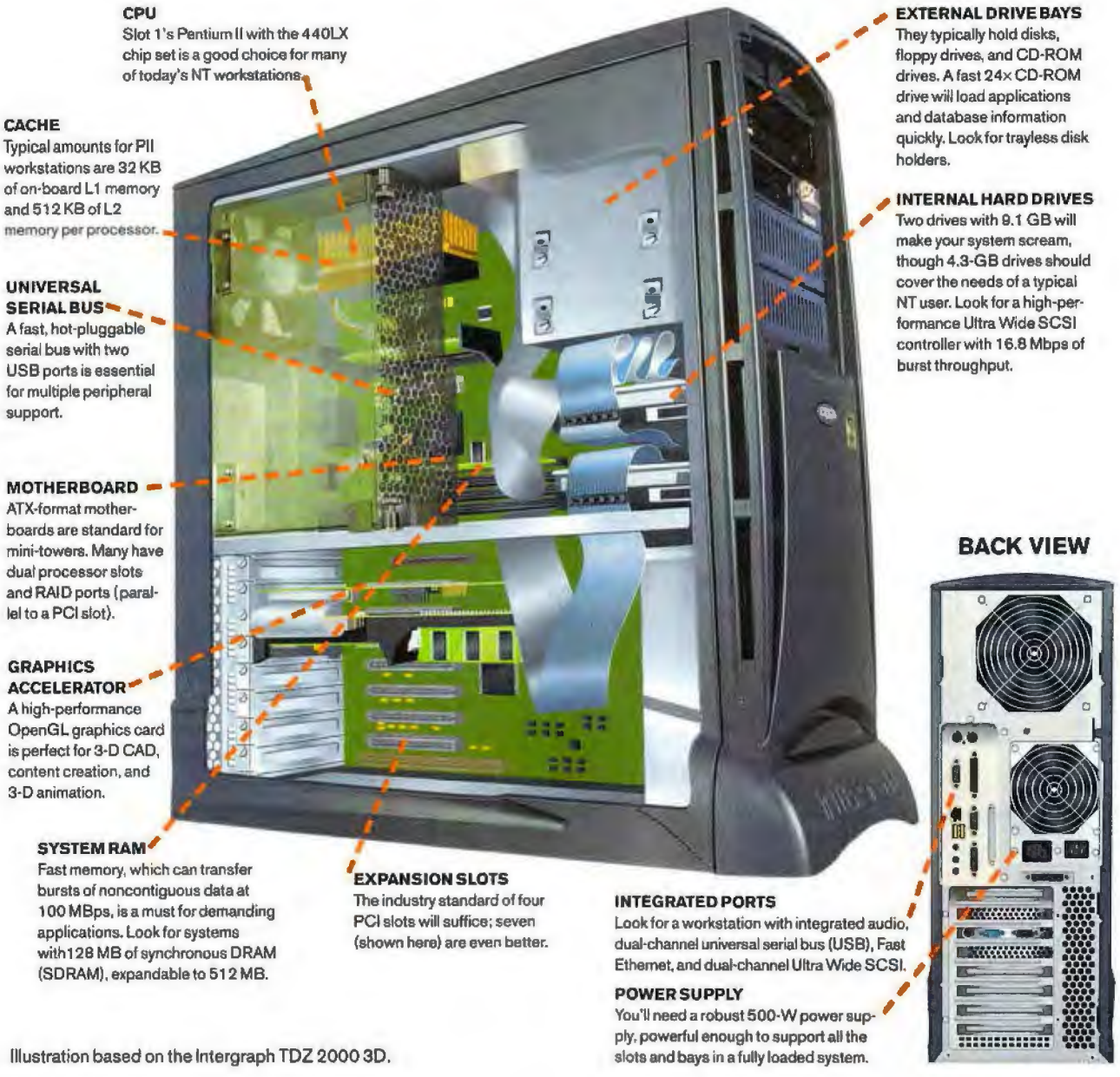

Illustration based on the Intergraph TDZ 2000 3D.

gamut from SCSI-2 to Ultra Wide SCSI.)

Finally, like the 440FX chip set, the 440LX chip set also supports symmetric multiprocessing (SMP), which provides fast performance by making multiple CPUs available to complete the individual processes simultaneously. Many of the workstations that we tested were available with an extra, empty slot.

Heavy-Duty Hardware

Makers of high-end workstations are racing to provide 300-MHz systems that scream. We asked vendors to send in their best-performing systems based on the PII with the 440LX chip set. We were sent eight systems, from Compaq, DTK, Hewlett-Packard, IBM, Intergraph, Micro Express, Polywell, and Xi. All were high-performance NT-based PC workstations. Unfortunately, Dell didn't have any NT workstations with the 440LX chip set. Also, Digital Equipment, NetPower, NEC, Gateway 2000, and Micron were not able to send systems in time to meet our test deadline.

For this roundup, we wanted to see how NT workstations with PCI-based graphics cards and a minimum of 4 MB of video RAM, 128 MB of system RAM, and a 3-GB or higher hard drive stacked up against each other. We looked for top performance across the board and used a number of standards-based benchmarks, paying special attention to C++, Viewperf, and Fourier tests, which represent the bit-crunching applications that are synonymous with high-end workstations. We ran all tests under NT 4.0 Workstation with Service Pack 3, including C++, Fourier, Viewperf (CDRS-03, DX-03, and AWADVS-01), Bapco Sysmark 4.0 for NT, Access, InterMark, and BYTEmark.

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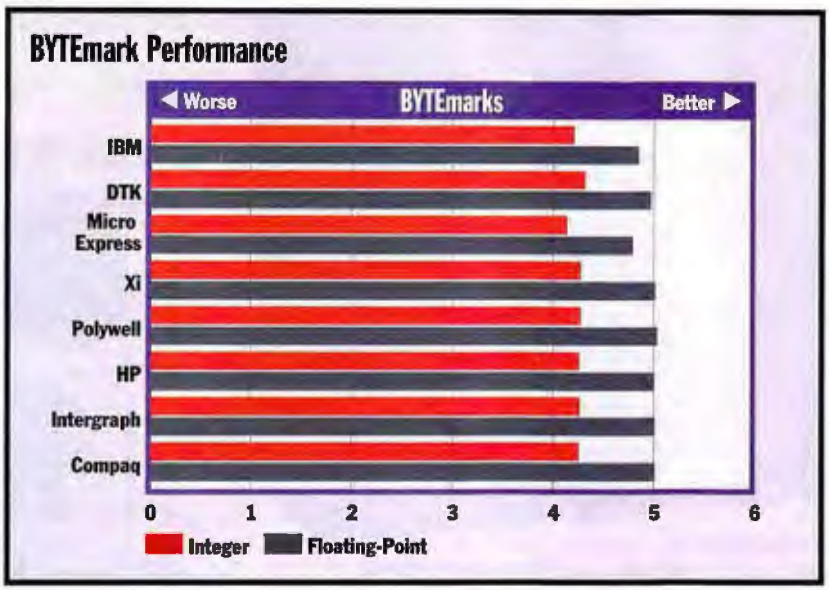
To determine our Best Overall winner, we relied primarily on performance. Because the systems we tested are high-end NT workstations, we focused on C++ (a language test), Fourier (WAV-file analysis), and Viewperf (an OpenGL graphics test). We gave less weight to Bapco's Sysmark 4.0 for NT (an application-based test) and our own low-level BYTEmark (a CPU-specific test).



The cross-platform BYTEmark CPU test shows little performance disparity among systems powered by the PII with the 440LX chip set.

The indisputable champ was the Intergraph TDZ 2000 3D, which turned in the overall best results in our tests. It was also the fastest in 3-D graphics, but only by a nose. In the Viewperf tests, for example, we measured how fast a system could render a series of 3-D images. In these tests, the TDZ 2000 3D had the fastest combined score of all the systems in our roundup. Its Viewperf CDRS-03 score alone was a whopping 65, about 80 percent better than midrange systems from Compaq, IBM, and DTK that scored 36.

The TDZ 2000 3D also scored quite high in our Fourier tests, tying with Polywell and DTK for the second-highest score of systems that can handle compute-intensive functions well. The TDZ 2000 3D was also a top scorer in BYTEmarks (both the floating-point and integer tests), proving that it can handle most compute-intensive jobs.

The Hewlett-Packard HP Kayak XW followed the TDZ 2000 3D closely in the graphics arena. Its score of 62 on the Viewperf CDRS-03 test (the second-highest score) merits an honorable mention. Additionally, the Kayak XW had decent Fourier test and BYTEmark scores. Not only did it excel in high-end application tests, it was a top scorer in our Bapco test, which tests business applications. Also, it scored the second-highest number for InterMark, which exercises 2-D graphics.

In the real world, raw performance is weighted against cost. Bang for the buck in a pure graphics environment means systems that can generate graphically rich pictures in a short amount of time for the least amount of money. For the performance-oriented but budget-conscious, the Xi 600 MTower DP is the best choice. When you compare its good overall benchmark scores with its low price tag, it shows up as a real bargain. Its Viewperf CDRS-03 score was midrange (20), but still nothing to squawk about. It was a top scorer in Fourier and BYTEmark floating-point tests, and it had the second-highest Microsoft Access–based database score. It got middle-of-the-road results on C++, yet it's certainly still a strong choice for programmers.

Following the 600 MTower DP closely in price/performance was the Polywell Poly 7300L5. This system deserves an honorable mention for its value. It ranked second fastest in the Fourier tests (along with the Intergraph and DTK machines) and had decent C++ results (in the top two-thirds percentile). Its Viewperf CDRS-03 rating was slightly better than average (25), and it had strong Fourier and BYTEmark results. It even did well on the Bapco business applications test, tying for first place.

In a roundup full of fast graphics subsystems, Compaq, DTK, and IBM also offer graphics performance to be reckoned with. All three scored a 36 on the Viewperf CDRS-03 test. Each machine has strong features. For example, the IBM IntelliStation M Pro handles database chores well; it had the fastest Access score in our roundup. It also did well with 2-D graphics, having a better-than-average score on our InterMark tests. DTK's APRI-76M/K300 and Compaq's Professional Workstation 6000 Model 6300 were among the fastest in our C++ tests. The systems also did well with a number of tests we threw at it, including Fourier, BYTEmark, and Bapco.

If it's a high-end graphics system you're after, you'll want to avoid the Micro Express MicroFLEX-PII/300. Its abysmal Viewperf CDRS-03 score was just 4. But it could be a perfect choice for programmers, because it was a top scorer on the C++, Fourier, and BYTEmark tests.

What the Tests Revealed

During our evaluation, each system proved itself quite capable as we exercised it in the role of both desktop workstation and graphics (CAD-style) workstation. Our testing included comparative analysis in four areas: performance, usability, price, and features.

The systems we tested had a wide disparity in prices. The cheapest system cost $2199, and the highest was $17,759. It should come as no surprise that there was a sharp difference in performance among the lowest- and highest-priced systems. Though they came comparably equipped, we found a 130 percent difference on the

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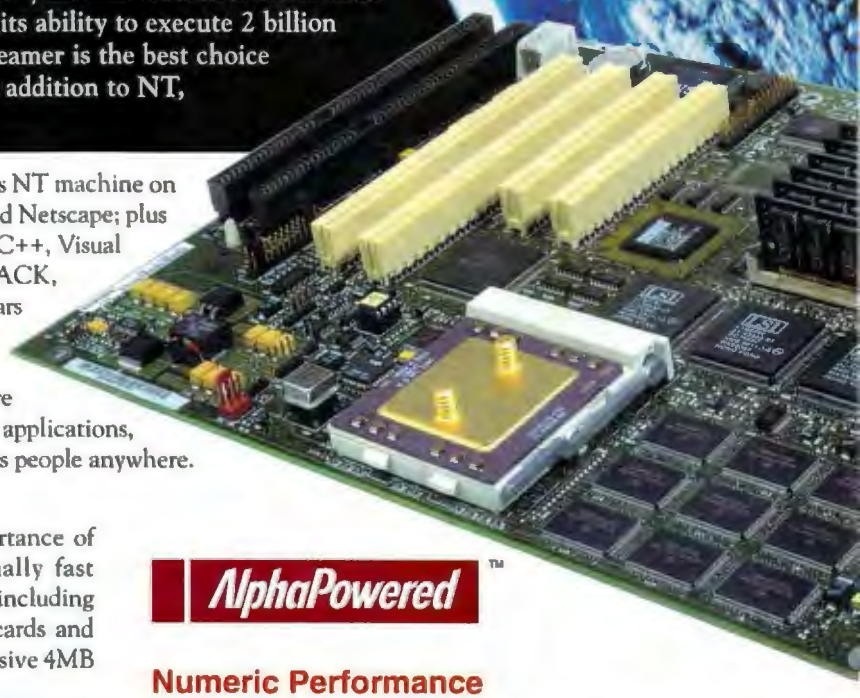

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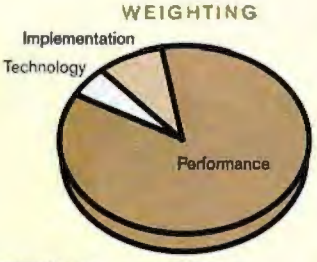
LAB RATING RESULTS

BEST OVERALL SYSTEM

Intergraph TDZ 2000 3D

Fine-tuned for graphics, Intergraph's TDZ 2000 3D workstation topped all other systems in our 3-D graphics tests. It also flew through many of the other tests we gave it, such as Viewperf CDRS-03, Fourier, and Bapco, proving its capabilities in running graphics, floating-point-intensive, and business applications.



	PRICE	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
Intergraph TDZ 2000 3D	**$15,385**	★★★★★	★★★★	★★★★★	★★★★★
Hewlett-Packard HP Kayak XW	$17,759	★★★★★	★★★★	★★★★★	★★★★★
Xi 600 MTower DP	$2999	★★★★	★★★★★	★★★★★	★★★★
Polywell Poly 7300L5	$3858	★★★★	★★★★	★★★★★	★★★★
IBM IntelliStation M Pro	$7695	★★★	★★★★	★★★★	★★★
DTK APRI-76M/K300	$5062	★★★	★★★	★★★	★★★
Compaq Professional Workstation 6300	$7695	★★★	★★★★	★★★	★★★
Micro Express MicroFLEX-PII/300	$2199	★★	★★★	★★★★★	★★★

BEST VALUE

Xi 600 MTower DP

Sporting a fast CPU and a low price, the Xi 600 MTower DP should make a great Windows NT workstation. With solid overall performance scores, better-than-average graphics performance, and a $2999 price tag, it represents the best bang for your buck.

	PRICE	PRICE	PERFORMANCE	FEATURES	USABILITY	OVERALL RATING
Xi 600 MTower DP	**$2999**	★★★★	★★★★	★★★★★	★★★★★	★★★★★
Polywell Poly 7300L5	$3858	★★★★★	★★★★	★★★★	★★★★	★★★★
DTK APRI-76M/K300	$5062	★★★★	★★★	★★★	★★★★	★★★
Micro Express MicroFLEX-PII/300	$2199	★★★★★	★★	★★★	★★★★★	★★★
Intergraph TDZ 2000 3D	$15,385	★★★	★★★★★	★★★★	★★★★★	★★★
Hewlett-Packard HP Kayak XW	$17,759	★★★	★★★★★	★★★★	★★★★	★★★
IBM IntelliStation M Pro	$7695	★★★★	★★★	★★★★	★★★★	★★★
Compaq Professional Workstation 6300	$7695	★★★★	★★★	★★★★	★★★	★★★

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

C++ benchmark results between the fastest and slowest members of our testing group. On the Fourier benchmarks, the spread was about the same, with the slowest system taking about 119 percent longer to complete the job than the fastest system. The biggest gap, however, was with the graphics subsystem, where the lowest-scoring system ranked 868 percent below the highest-scoring system (though the midrange systems were just 190 percent below the fastest).

It's no shocker that the two most expensive systems were also the most powerful, especially in graphics tests. The HP Kayak XW and Intergraph's TDZ 2000 3D had double the graphics performance of their closest rivals (Compaq, IBM, and DTK) and cost much more. While many of the midrange systems in our graphics test (IBM, Compaq, DTK, and Xi) would certainly work well for graphics-intensive jobs, the low-scoring MicroFLEX-PII/300 is best suited for less-intensive graphics functions such as programming.

In addition to these large performance jumps and slumps, during our tests we also noticed that vendors brought some new and better technologies to the PC. RAID, for example, was seen in a few systems we tested. HP sent us a system equipped with a SCSI hardware controller for its disk drives, along with a RAID card. Intergraph achieved the same through software, under NT.

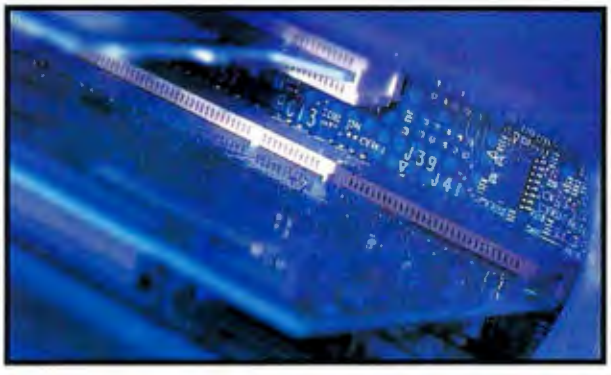
The variety of high-end graphics cards seems almost limitless, and vendors continue to allow customization and your choice of 3-D graphics chip sets and cards. Additionally, the systems we tested were more manageable than ever.

Vendors have continued to improve bundled management programs, such as HP Top tools, Intergraph's Intersite, and IBM's Netfinity manager software. They offer a collection of tools that show available system resources and functionality, and inform you of potential problems.

DETAILS

Separated at Birth

Compaq's slot-load CD-ROM drive will remind you of something you'd find in a car stereo. It scores points for convenience. Compaq claims its trayless device has fewer mechanical malfunctions than typical CD-ROM drives that repeatedly open and close a tray loader.



No Sketchy Security Here

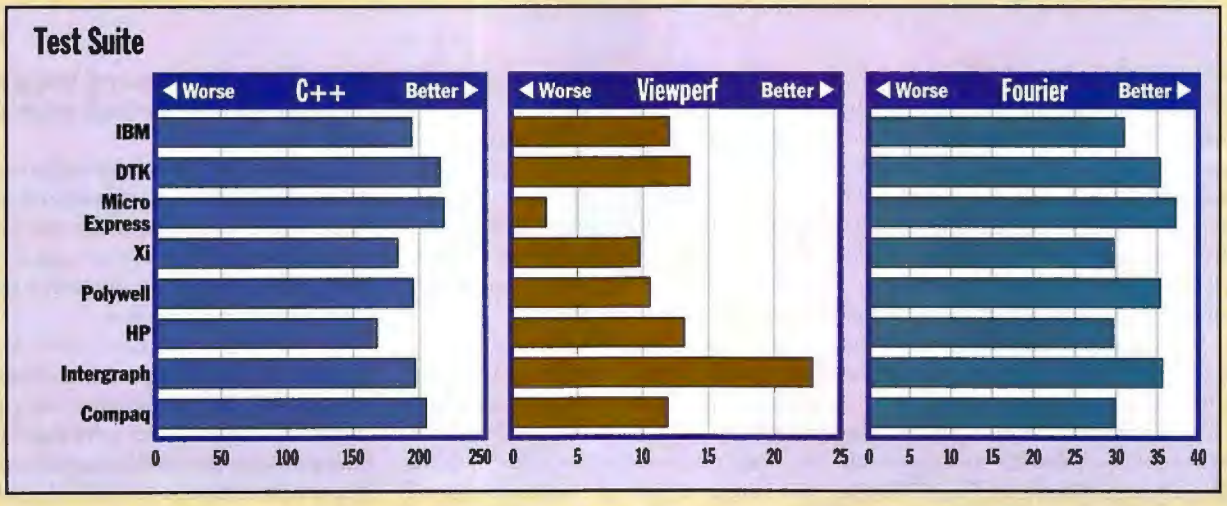
To deter theft, IBM provides physical laser etching of a 22-digit serial number on its DIMMs and CPU. Additionally, it stores a digital serial number on the EPROM. There's a security company (Retainagroup), with which businesses can register the serial numbers.

RAID Invades the PC

The HP Kayak XW workstation has FastRAID technology, which provides hard disk caching and RAID level 0 (disk striping). RAID is a technique for combining a number of disk drives to form a single storage system. The benefits include increased data security and higher levels of data throughput and I/O. Until now, this technology has been primarily available only on dedicated file servers. Based on Adaptec's RAID port Option (ARO) technology, it consists of a specially modified system board, PCI adapter card, and hard drives.

Performance Matters

Because most high-end workstation users will need to compile programs, use compute-intensive spreadsheets, and run 3-D graphics, we weighted the C++ (language test), Fourier (WAV-file analysis), and Viewperf (OpenGL graphics) tests double in our overall performance calculations. Because business applications are important to measure, but not crucial, we gave them a single value. For example, C++, Fourier, and Viewperf tests each comprised 18.18 percent of the total performance score. Access, InterMark, BYTEmark integer, BYTEmark floating-point, and Bapco garnered 9.09 percent apiece of the overall performance score. These performance tests combined equal 70 percent of the total score, with usability making up 20 percent and features making up 10 percent of the overall score.



No single benchmark can tell you everything you may want to know about how well a system will perform. However, run seven industry-standard benchmarks ranging from real-world business applications to high-end OpenGL graphics tests, and you'll have a pretty good idea.

We asked vendors to send us workstations loaded with a single partition of NT Workstation 4.0 (with Service Pack 3). All systems had to conform to our specification minimums, including a PCI-based, OpenGL graphics card with a minimum of 4 MB of video RAM, 128 MB of system RAM, and a 3-GB or higher hard drive.

Performance

The C++ test helped us gauge how well a system would perform while compiling Microsoft Foundation Classes (MFC). We ran the multiprocessor test that measures how fast the system can build (compile and link) a big chunk of source code by running two simultaneous instances of Visual C++ 4.2.

Three single-threaded suites from Spec's Viewperf 5.0 comprised our high-end graphics tests for judging high-end graphics performance. The Viewperf CDRS-03 makes works of industrial-design elements, DX-03 tests scientific visualization elements, and AWADVS-01 tests 3-D animation. All tests were run at 1024- by 768-pixel resolution with true color.

To analyze each system's raw floating-point power, which is crucial to many applications such as advanced spreadsheets, we used the Fourier test. This program analyzes the spectral content of a WAV file and loads two simultaneous copies of the test, while NT handles the multiprocessing session.

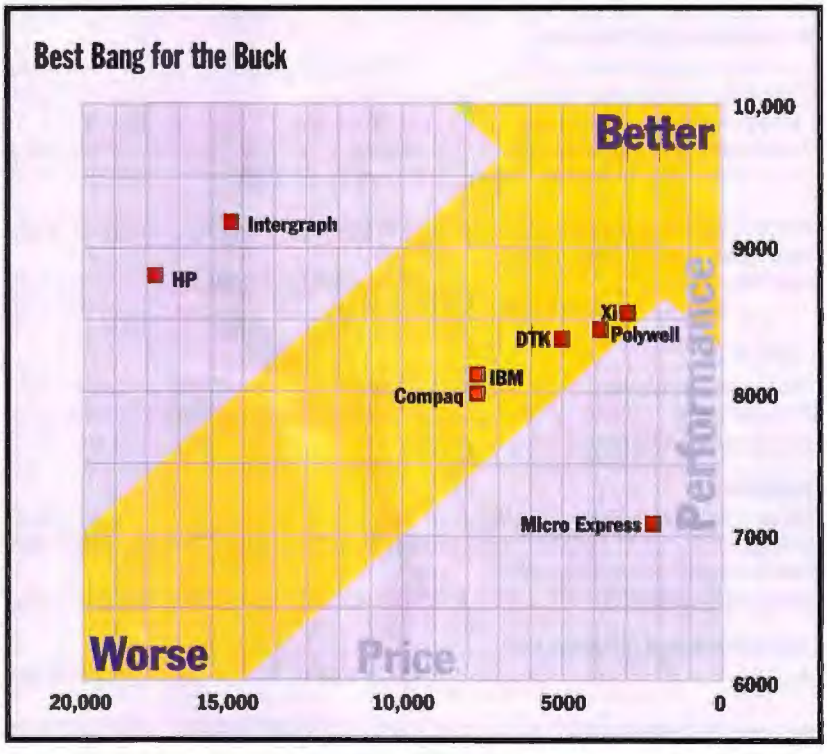
Also, release 2.0 of the BYTEmark benchmark helped us expose the system's CPU, FPU, and memory systems.

The Access test, an application-based benchmark that uses Microsoft's Test 4.0 compiler, measures how well a system can generate multiple business database transactions.

We also used Bapco's Sysmark 4.0 for NT, which measures NT client PC performance across a spectrum of business-application mixes, such as Word for Windows 6.0 (native 32-bit), Excel 5.0 (native 32-bit), Texim Project 2.0e (native 32-bit), Orcad MaxEDA 6.0 (native 32-bit), and PowerPoint 4.0 (16-bit emulation).

Finally, the InterMark video test measures primitive Graphical Device Interface (GDI) operations and displays entire pictures generated by applications such as Excel, Word, CorelDraw, PowerPoint, Freelance Graphics, and others.

The 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.*



At $2999, Xi's 600 MTower DP offers the most bang for the buck.

Usability and Features

We examined each of the eight machines for usability by focusing on two areas: system design and documentation. 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.

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. Those that lack specifications for the motherboard, hard drive, and graphics subsystem are rated lower.

Each vendor completes a lengthy questionnaire and provides a detailed description of each system's features and support options. We weigh 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 drive controllers, network adapters, and graphics adapters on the motherboard frees up expansion slots and earns a system extra points. Finally, it's important to note that warranty and support policies are what frequently separate major vendors from second- and third-tier vendors.

300-MHZ NT WORKSTATIONS FEATURES

	Compaq Computer Corp.	DTK Computer, Inc.	Hewlett-Packard Co.
Models	Compaq Professional Workstation 6000 Model 6300	APRI-76M/K300	HP Kayak XW PC Workstation
Price as tested (MSRP)	$7695	$5062 (without monitor)	$17,759
Overall rating	★★★	★★★	★★★★★
PROCESSOR			
Location of CPU(s):	Riser	SEC on slot 1	SEC on slot 1
BIOS manufacturer and version	Compaq 8/97	Award 1	Phoenix SHB.01.02
ISA PnP Flash BIOS	✔	✔	✔
DMI-compliant	✔		✔
System setup on	ROM, disk	ROM	ROM
EQUIPMENT INFORMATION			
Sound adapter manufacturer and model	ESS Audio Drive Chip	Creative Labs AWE-64	Analog Devices AJ16AS
CD-ROM drive manufacturer and model	Various	Toshiba XM-6102	Panasonic CR-585-B
Fax/modem manufacturer and model	Optional	Optional	N/A
Motherboard manufacturer and model	Compaq	DTK PRM-0076I	HP
Graphics chip/card manufacturer and model	Diamond Fire GL 4000	3D Labs Glint MX	HP Visualize fx4
Video adapter (external bus type)	64-bit PCI	32-bit PCI	AGP for 3-D accelerator, 32-bit PCI
Video memory installed/maximum (in MB)	31/31	40/56	18/34
Video memory type	DRAM (SDRAM, CDRAM)	VRAM, EDO RAM	SGRAM
Maximum video resolution without upgrade	1280x1024	1920x1200	1600x1200
I/O PORTS			
Total number of serial ports	2	2	2
Parallel-port type	Extended, enhanced	Selectable	Selectable
Available SCSI-2/USB ports	1/2	1/2	1/2
MEMORY			
Standard/max. RAM on motherboard (MB)	128/512	128/1024	128/512
RAM type	Buffered EDO	64-bit SDRAM	ECC SDRAM
Both EDO RAM and L2 cache installed	✔		✔
Maximum RAM cache (KB)	512	512	1024
HARD DRIVE AND CONTROLLER			
Hard drive	4.3-GB various	4.3-GB Seagate ST34501W	4.3-GB Seagate Cheetah
Hard drive controller manufacturer and model	Compaq Integrated Ultra SCSI	Adaptec AHA-2940UW	Adaptec AIC-7880
Hard drive interface type	Ultra Wide SCSI	Ultra Wide SCSI-2	Ultra Wide SCSI
Access time (ms)	8	8	7.5
EXPANSION SLOTS			
Primary architecture	PCI	ISA, PCI, AGP	PCI
Local-bus architecture	PCI HPSA	PCI	PCI, AGP
Bus-mastering slots	✔	✔	✔
Filled/vacant 16-bit slots	0/4	2/1	0/1
Filled/vacant local-bus (PCI) slots	1/1	2/1	2/1
Shared slots	4	1	1
DRIVE BAYS			
Half-height 5¼-inch bays (total/exposed)	8/2	4/4	2/2
Half-height 3½-inch bays (total/exposed)	0/0	4/2	1/1
VENDOR INFORMATION			
Warranty (in years)	3/P, L, F, R	2/P, L, R	3/P, L, R
Corporate phone number	281-370-0670	626-810-0098	415-857-1501
Toll-free phone number	800-345-1518	800-289-2385	800-322-4772
On-line address	http://www.compaq.com	http://www.dtkcomputer.com	http://www.hp.com
HotBYTEs number*	**1061**	**1062**	**1063**

BYTE Best ✔=yes; N/A=not applicable.

Warranty: P=parts; L=labor; F=freight to repair center; R=return to customer.

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

IBM PC Co.	Intergraph Computer Systems	Micro Express	Polywell	XI Computer Corp.
IBM IntelliStation M Pro	TDZ 2000 3D Graphics Workstation	MicroFLEX-PII/300	Polywell Poly 7300L5	Xi 600 MTower DP
$7695	$15,385	$2199	$3858	$2999
***	*****	**	****	****
Motherboard	Motherboard	SEC on slot 1	Motherboard	SEC on slot 1
IBM 17	Intergraph 926B	Award	AMI 4.5	AMI 81997
✔	✔	✔	✔	✔
✔	✔	✔	✔	✔
ROM, disk	ROM, disk	ROM	ROM	ROM
Crystalwave 4236	Crystal CS4237B Integrated	Opti 32W-3D	Creative Labs AWE64	Creative Labs AWE64
Sony 24× Max	Panasonic CR585-BN7-1	Toshiba 6100B	Toshiba 6102B	Toshiba 6201B
Optional	Optional	Databridge 56K	Diamond Supra 56K	Optional
IBM	Intergraph TDZ 2000	Micro Express P2 6×	MicroStar MS-6111	Supermicro P6DLS
Intergraph Intense 3D Pro2200/4t	Intergraph RealiZm II VX25-GT 16 Graphics	ATI Expert@Work	3D Labs Permedia II	3D Labs Permedia II
32-bit PCI	32-bit PCI	64-bit AGP	64-bit AGP	64-bit AGP
20/20	32/32	8/8	8/8	8/40
SGRAM, SDRAM	SDRAM	WRAM	SGRAM	SGRAM
1280x1024	1824x1368	1600x1200	1600x1200	1600x1200
2	2	2	2	2
Selectable, extended	Selectable	Selectable	Selectable	Selectable
3/2	1/2	0/2	0/2	1/2
128/512	64/512	128/256	128/512	64/1024
SDRAM ECC	64-bit ECC SDRAM DIMMs	ECC SDRAM	64-bit SDRAM	ECC SDRAM, EDO
✔	N/A	✔	N/A	✔
512	512	512	1 MB	512
4.51-GB/7200-rpm IBM	4.3-GB Seagate Cheetah	4.3-GB Quantum ST4300	4.3-GB Seagate Cheetah ST34501W	4.3-GB IBM DCAS-34330
IBM	TI EA-73AF2EW	Quantum ST4300	Adaptec AHA-2940UW	Adaptec AHA-2940UW
SCSI	Ultra Wide SCSI-2	Ultra DMA EIDE	SCSI-2	Ultra Wide SCSI-3
7.5	8	9	7.5	8
ISA, PCI, AGP, ISA	PCI, ISA, AGP	PCI	ISA, PCI, AGP	PCI
PCI, AGP	Chained PCI	PCI	PCI, AGP	AGP
✔	✔	✔	✔	✔
0/5	0/1	2/1	2/0	1/2
0/5	3/3	1/2	1/2	0/4
5	1	1	1	1
2/1	3/3	3/3	2/2	4/4
4/2	5/3	3/2	1/1	4/2
3/P, L, F, R	3/P, L, F, R - 1/site	4/P, L, R (limited F)	5/P, L, R	3/P, L, F, R - 1/site
See Web site	205-730-2000	714-852-1400	650-583-7222	714-498-0858
800-426-2968	800-763-0242	800-989-9900	800-999-1278	800-432-0486
http://www.pc.ibm.com	http://www.intergraph.com/ics	http://www.microexpress.net	http://www.polywell.com	http://www.xicomputer.com
1064	1065	1066	1067	1068

NOTE: All are Intel Pentium II 300-MHz systems. *at http://www.byte.com/hotbytes/

Sending faxes over the Internet can save time and money.

By William Wong

Nine Fax Programs to Serve the Internet

Faxing has become a fact of life in modern business. In little more than a decade, the once-simple art of faxing has become much more complicated. The move to network faxing, in particular, often seems a big and complex step.

For network faxing, you need a fax server plus individual clients. Increasingly, network fax clients are being integrated with e-mail clients and Web browsers. IP faxing (see the Tech Focus on page 111) is now available with every high-end fax-server product. Also, the servers' least-cost-routing services can determine the most cost-effective way to deliver the fax. Web support is increasingly common and may include fax delivery, viewing, and submitting.

Especially at the enterprise level, most fax servers require a robust server OS such as Unix, Novell IntranetWare, or Windows NT Server. Most servers target just one or two platforms. These days, it's mainly Windows NT Server, while some also require Microsoft Exchange Server to be running.

Workgroup or Enterprise?

Workgroup fax servers typically support a single modem, while enterprise servers can handle up to 32. Enterprise servers often feature multiserver support, load leveling across servers, and IP faxing. These servers often provide fail-safe operation, sophisticated logging, billing support, event support, SNMP compatibility, and better control, often hooking into NT's user and security mechanisms.

Many enterprise fax servers provide more complex messaging functions and better integration with mail systems, such as Microsoft Exchange and Lotus Domino. Most forward faxes and attachments in their original file formats instead of as Group 3 fax files, so users can transfer richly formatted, editable documents with the simplicity of faxing.

Many fax servers are wedded to specific e-mail servers, usually Microsoft Exchange, which might be a benefit or a disadvantage in any specific situation. Enterprise fax servers tend to be pricey for small workgroups, but they provide an excellent growth path. They are also less expensive when amortized across a large number of users.

BYTE BEST
ENTERPRISE FAX SERVERS

RightFax Enterprise
provides a comprehensive, scalable fax solution with least-cost routing, IP fax support, and load leveling.

Testing the Servers

BYTE collected six enterprise fax servers: Fenestrae's Faxination for Microsoft Exchange, GFI's FAXmaker, Computer Associates' FAXserve for Windows NT, Omtool's Fax Sr. 2.0, Optus Software's FACSys, and RightFax for Windows NT. We looked mainly at NT-based servers, although most also have versions for other platforms, such as Novell's IntranetWare and Unix. We also looked at workgroup servers: Alcom's LanFax NT 5.0, LanSource Technologies' FAXport, and Symantec's WinFax for Networks.

In our testing, we used a Brooktrout TR114, Dialogic GammaFax Cpi, and 3Com/U.S. Robotics Sportster, all internal ISA fax modem boards. The TR114 is a four-port fax board that's configured to support two voice lines and two direct inward dialing (DID) lines.

The GammaFax Cpi, a dedicated, single-line fax modem with on-board processing like the TR114, supports DTMF (Touch-Tone) signaling for incoming fax routing.

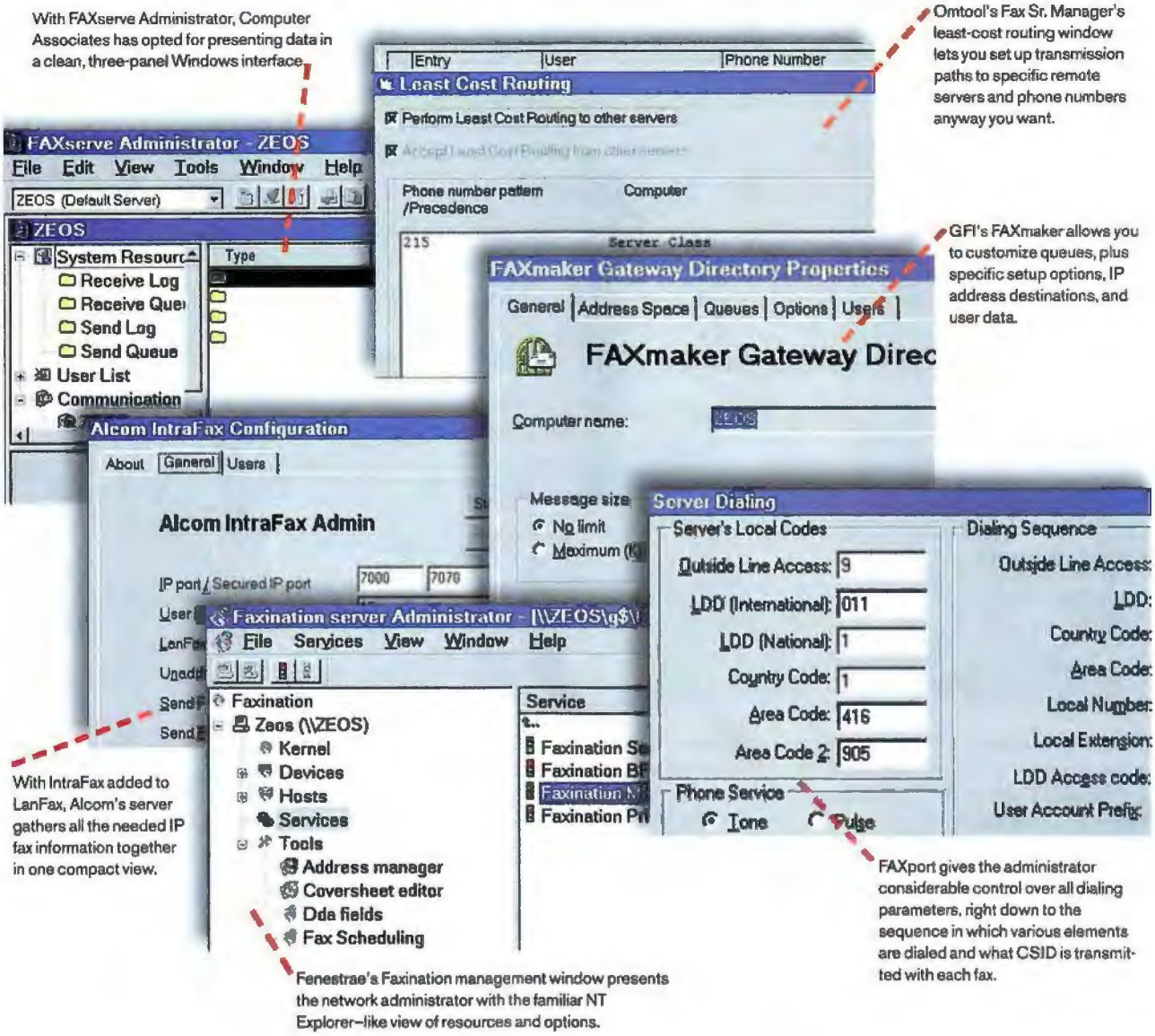
The Sportster is an inexpensive, standard data/fax modem; it's fine for a PC but usually only adequate for small fax servers. Each modem also supports Transmitting Subscriber Identification (TSID) and Calling Subscriber Identification (CSID), both of which are based on sending machine (not user) data and thus of limited use for routing.

Our primary test platform was a 166-MHz Pentium PC running NT Server 4.0. We used Windows 95 for Symantec's workgroup product, which doesn't run under NT Server. We concentrated on administrative features and advanced client features, looking at Web-browser access, remote management, IP fax support, and load leveling.

FAXport

Besides faxes, this workgroup server can also coordinate shared modems (called WINPort) and, under NT, shared Remote Access Service (called RASport), letting a fax/data modem be used for standard communication or RAS use. Both require an active client, and all three servers can share a single modem.

You manage the security through the



Most of the fax servers, especially the enterprise-class packages, offer good management tools.

FAXport client independently of the OS. You can limit access to most server options such as job control, phone books, user profiles, and server setup.

FAXport provides cc:Mail, Microsoft Mail, and Exchange Server gateways. There's also an API for developers, including a number of sample Visual Basic programs. With the TR114, FAXport supports inbound routing via DID.

We found FAXport's management and monitoring tools quite limited. For example, the server-monitoring dialog box simply lists job totals. The log provides more detailed connection information, but even the billing support is limited. If all you need is to share fax modems, FAXport is a good choice. For more complex tracking or management, look elsewhere.

LanFax NT 5.0

This sophisticated workgroup fax server has a number of enterprise features. It integrates with Alcom's IntraFax, which lets a Web browser submit and view received faxes. Though it's most often used on an intranet, IntraFax (which is also the basis for Alcom's IP Fax Service) works equally well if a router connects the server to the Internet.

LanFax is an NT service for improved security and reliability. Multiserver user support is provided through NT domain support. LanFax provides MAPI mail client and Microsoft Exchange Server support, so Exchange and Outlook clients can access LanFax.

LanFax worked with all three of our fax boards, handling DID, DTMF, TSID/CSID, and channel routing. LanFax provides clients for Windows 3.x, Windows 95, and Windows NT, and IntraFax provides Web-based access.

WinFax for Networks

Symantec's entry allows WinFax Pro users to share fax modems. Although comparable to FAXport in functionality and operation, supporting up to four modems, WinFax for Networks (WFN) runs only under DOS and Windows 3.x and 95, not

FAX SERVERS FEATURES	Faxination	FAXmaker	FAXport	FAXserve for NT	Fax Sr. 2.0	FACsys 4.1
SERVER CLASS	Enterprise	Enterprise	Workgroup	Enterprise	Enterprise	Enterprise
Web-browser client						Option
Runs under Windows NT	✔	✔	✔	✔	✔	✔
Requires Microsoft Exchange	✔	✔				
Other OS versions			Windows 95	IntranetWare	VMS, Unix	
NT service	✔	✔	✔	✔	✔	✔
IP faxing	✔	✔		Option	✔	✔
Least-cost routing	✔			Option	✔	
SMTP gateway	Part of Exchange	✔		Option	✔	Part of Exchange
Billing/accounting	✔	✔		✔	✔	✔
MAPI-compliant	✔	✔	✔	✔	✔	✔
Types of lines supported	Voice, ISDN	Voice, ISDN	Voice	Voice, ISDN, T1	Voice, ISDN	Voice, ISDN, T1
Remote multiserver management	✔			✔	✔	✔
Load sharing between servers				✔	✔	✔
INBOUND ROUTING						
Direct inward dialing, Touch-Tone	✔	✔	✔	✔	✔	✔
Line routing	✔	✔		✔	✔	
Other routing		OCR option	CSID		CSID, cover page	CSID

B =BYTE Best ✔=yes

on NT Workstation or Server. There's network support for IPX and NetBIOS, but unfortunately not for IP, which seems to be the de facto standard.

Because WFN takes such a low road, you can use it with even a 286 PC to handle multiple lines. As with FAXport/WINport, you can install WFN with Delrina CommServer 1.0 for coordinated modem sharing.

The client package is WinFax Pro 8.0 on Windows 3.x, 95, or NT—and, actually, this is the best part of the system. WinFax Pro is a good fax program that you can also use in single-user mode. It includes TalkWorks (an answering machine/fax-on-demand system) and Xerox's Textbridge for OCR.

The client supports two modems, even through WFN, so you can send and receive at the same time. Outgoing faxes contend for the modem pool, so a fax may be delayed until a modem is free. Incoming faxes are directed to a designated "receptionist" PC.

If no designated PC is running WinFax Pro, however, the incoming fax call is rejected. Moreover, faxes that are received by a receptionist must be viewed and forwarded individually to the appropriate person. Obviously, this won't do for unattended operation or broadcast faxes.

The WFN server has limited management and monitoring; it's sufficient to determine what modems are active but doesn't compare to the other products. WFN will appeal to smaller organizations that already use WinFax Pro, and it can help them get some use out of an old 286, 386, or 486.

Faxination for Microsoft Exchange

Fenestrae has a line of Exchange Server faxing add-ons, including packages for SAP/R3, telex, and mobile/pager use. Faxination for Microsoft Exchange (FME) comes in two-line standard and 16-line corporate editions. Both provide the same functionality, and both require Microsoft Exchange to be running on the same server. FME integrates with Exchange Server clients, so that incoming fax messages can be put in the user's inbox and viewed from there.

FME supports inbound fax routing using DID, single-port and multiport analog fax modems, and T1, E1, and ISDN digital lines. Mail clients can send faxes with attachments (even ActiveX documents), and applications can create faxes using a special fax print driver. The server handles all format conversion, so we were able to send Exchange messages to both mail and fax recipients. Mail users get native files, while fax users receive graphically rendered documents.

FME does least-cost routing based on data set up by the network administrator. It provides billing and accounting reports based on programmable tariff tables. Customized cover sheets can use Exchange directory information as well as names and phone numbers. FME's Remote Gateway Manager monitors fax queues and views log files in real time.

FME won't appeal to all organizations, but those using Microsoft Exchange Server will really like it.

FAXmaker

GFI has fax products for the various environments: FAXmaker for Exchange, for Intranet, and for Networks. All services work on NT and Windows 95 except FAXmaker for Exchange, which requires Windows NT Server and Microsoft Exchange Server. FAXmaker for Intranet supports POP3 mail clients, and it's also an SMTP gateway. FAXmaker for Networks comes with clients for Windows 3.x, 95, and NT. All three products are comparable in functionality, except for the degree of client integration, and they can be used on the same server.

Incoming fax routing includes DID, DTMF, and CSID. You can also use optional OCR routing with fax archiving for searching. Fax annotation is supported. FAXmaker's Internet routing uses e-mail,

LanFax NT 5.0	Right Fax	WinFax for Networks
Workgroup	Enterprise	Workgroup
✔	✔	
✔	✔	
		Windows 3.x, 95
✔	✔	
	✔	
	✔	
✔	Option	
	✔	
✔	✔	Client
Voice, ISDN, T1	Voice, ISDN, T1	Voice
	✔	✔
	✔	✔
✔	✔	DID, DTMF
✔	✔	
	CSID, cover page, OCR option	

which means that FAXmaker servers don't have to connect directly to one another.

FAXmaker supports four lines in its standard configuration, and this is expandable to 32 lines. Voice-mail and fax-on-demand options weren't in our test software, but they're available. We found FAXmaker to be easy to install, though its documentation was sparse. It has many enterprise features, but it lacks important services, such as load leveling.

FAXserve for Windows NT

FAXserve for Windows NT (FSNT) provides integration with Microsoft Exchange Server, complementing FAXserve for NetWare, which works with GroupWise. FSNT runs as an NT service and uses NT security, allowing single log-in access to fax services. With FSNT, you can even limit long-distance usage by user.

FSNT provides many enterprise features in the basic package, including multiple server support with load leveling. Optional least-cost routing can use the Internet or an intranet, and an SMTP gateway gives e-mail integration with GroupWise, Exchange Server, and Lotus Domino mail systems. FSNT clients are MAPI-compliant.

FSNT also supports ISDN and T1 adapters in addition to analog fax modems. Its installation was simple, helped by automatic hardware detection.

Billing reports are available directly, with no need to export information. Remote management eases administration of large networks. FSNT uses an ODBC-compliant database, so you can exchange data with other applications.

FSNT forwards attachments to the destination server, where the appropriate application converts them. If the destination is a fax machine, rendering occurs just before the call is made.

Because its many options are separately priced, the basic cost of FSNT is reasonably low, making it applicable for both workgroup and enterprise solutions.

Fax Sr. 2.0

Omtool's Fax Sr., available in NT, VMS, and Unix versions, comes standard with a host of features, including least-cost routing, gateways for Microsoft Exchange and SAP/R3, and support for cc:Mail and Microsoft Mail.

This latest release is intranet/Internet-savvy, starting with an SMTP gateway and Web-browser support. Fax Sr. also has a broad range of clients, including DOS; Windows 3.x, 95, and NT; Mac; and Motif.

Fax Sr. creates a lot of NT services and uses a fair share of virtual memory. It provides good control of fax servers, and we found its remote management capabilities especially handy in WANs using least-cost routing. The program has very good tracking and billing, plus a history-analysis program that makes finding peak-use times a snap.

FACSys 4.1

Optus Software's enterprise fax server doesn't do least-cost routing, but its Exchange Server option allows load sharing among servers. Its second version of Web Agent, a browser interface, extends the product's reach to non-Windows clients.

FACSys gateways support SAP/R3, SMTP/POP3, Microsoft Mail, and Lotus Notes/Domino and cc:Mail, plus Novell's GroupWise and MHS SMF 70/71. Third-party solutions provide fax-on-demand and OCR support.

FACSys renders attachments when they're actually sent, but it's limited to specific file formats, such as Office 97 (including Word, Excel, and PowerPoint), and graphics files (including PCX, TIFF, and BMP). There's support for fax printer drivers, Printer Control Language (PCL), PostScript Level II, and forms.

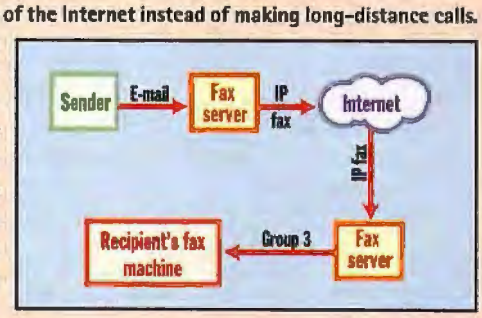
FACSys provides remote management and extensive housekeeping. We could set up alerts for a variety of conditions, including low disk space or channel error thresholds on a specified line. Accounting and billing are very good. FACSys uses its own security system, letting it work on multiple server platforms; the NT version also includes user synchronization with NT, Microsoft Mail, and Exchange Server. However, FACSys won't equal other enterprise fax servers until Optus moves some

TECH FOCUS: FAX FLOW

Fax About IP

IP faxing lets a fax server send faxes via the Internet or an intranet to another server closer to the desired destination. In theory, this saves money and can improve quality.

One way to do this is to make use of the Internet instead of making long-distance calls. You send a fax from a workstation to a local fax server. Using least-cost-routing software, the server determines the most efficient delivery method—by calling the destination directly or by sending the fax to a remote fax server that then makes a local call to the final destination and sends the fax (see the figure for details).



With better enterprise-level systems, the fax server determines what are the best route and transmission methods (i.e., fax call, e-mail, local fax machine, or printer) for each recipient, based on stored cost data. This feature is called least-cost routing.

Proprietary IP fax links are the bane of current implementations. Standards here could revolutionize IP faxing, which is currently limited to direct server-to-server links.

LAB RATING RESULTS

BEST OVERALL: ENTERPRISE FAX SERVERS

RightFax Enterprise

A fully featured, highly scalable fax server for the enterprise.

	PRICE PER SERVER	PRICE PER CLIENT	PRICE PER LINE	TECHNOLOGY	IMPLEMENTATION	FEATURES	USABILITY	OVERALL
RightFax Enterprise	**$2995**	**$1295 per server**	**N/A**	★★★★★	★★★★★	★★★★★	★★★★★	★★★★★
Computer Associates FAXserve for Windows NT	$295	$395 for five to $3995 for 100, server included	N/A	★★★★	★★★★★	★★★★★	★★★★	★★★★
Fenestrae Faxination for Microsoft Exchange	$2495 for corporate edition	$545 for 10 users, $1035 for 20 users	N/A	★★★★	★★★★	★★★★	★★★★	★★★★
GFI Fax and Voice FAXmaker	Free with clients	$349 for five users and four lines	$495 for eight lines	★★★★	★★★★	★★★★	★★★★	★★★★
Omtool Fax Sr. 2.0	$2495	N/A	N/A	★★★★★	★★★★	★★★★★	★★★★	★★★★
Optus Software FACSys 4.1	$995	$45	N/A	★★★★	★★★★	★★★★★	★★★★	★★★★

BEST OVERALL: WORKGROUP FAX SERVERS

Alcom LanFax NT 5.9

Solid, easily installed and managed, with Web-browser access but not IP fax support.

	PRICE PER SERVER	PRICE PER CLIENT	PRICE PER LINE	TECHNOLOGY	IMPLEMENTATION	FEATURES	USABILITY	OVERALL
Alcom LanFax NT 5.0	**Free with clients**	**$995 for 10 users and one line**	**$695**	★★★★	★★★★	★★★★	★★★★	★★★★
Symantec WinFax for Networks	Free with clients	$399 for five users	N/A	★★	★★★	★★	★★★	★★
LANSource FAXport	Free with clients	$399 for five users to $2999 for unlimited use	N/A	★★★	★★★	★★★	★★★	★★★

★★★★★ Outstanding ★★★★ Very Good ★★★ Good ★★ Fair ★ Poor N/A = not applicable

of the Exchange Server features into the main product and adds least-cost routing.

RightFax Enterprise

Overall, RightFax's server was the most impressive enterprise product we tested. It comes in two flavors: NT and Enterprise. The latter handles more than a dozen fax channels, and it won't even work with low-end serial modems such as the Sportster, requiring instead the higher-end Brooktrout and Dialogic fax boards that would be more common on enterprise fax servers supporting dozens of fax lines.

RightFax Enterprise provides gateways for Microsoft Mail and Exchange, Novell GroupWise, and Lotus cc:Mail and Notes/Domino. An SMTP/POP3 gateway offers e-mail-to-fax with any POP3 mail program.

RightFax clients support Web browsers, plus Windows 3.x, 95, and NT clients. Least-cost routing works over the Internet or intranet and sports a variety of features, including encryption, cascading routers, load balancing, and advanced dialing plans. OCR helps route incoming faxes based on cover-page data and offers document conversion for clients. There's support for PostScript printers and for native document attachments, providing you install the appropriate application on the server.

Many features are optional, so RightFax may prove less expensive than it first seems. ■

PRODUCT INFORMATION

FACSys
$995/server; $45/client
Optus Software, Inc.
Somerset, NJ
732-271-9568
fax: 732-271-9572
http://www.facsys.com
Enter HotBYTEs No. 1045.

Faxination for Microsoft Exchange
$2495/server; $545/10 users, $1035/20 users
Fenestrae, Inc.
Duluth, GA
770-622-5445
fax: 770-622-5465
http://www.fenestrae.com
Enter HotBYTEs No. 1042.

FAXmaker
$349/five users, four lines
GFI Fax and Voice, Ltd.
London, U.K.
+44 171 226 2866
716-266-1380
http://www.gfifax.com
Enter HotBYTEs No. 1043

FAXport
$399/five users; $2999, unlimited use
LanSource Technologies, Inc.
Toronto, Ontario
Canada
800-677-2727
416-535-3555
fax: 416-535-6225
http://www.lansource.com
Enter HotBYTEs No. 1047.

FAXserve for Windows NT
$295/server; $395/five users to $3995/100 users
Computer Associates International, Inc.
Roslyn Heights, NY
800-243-9462
516-465-4000
http://www.cai.com
Enter HotBYTEs No. 1044.

Fax Sr. 2.0
$2495
Omtool, Inc.
Salem, NH
800-886-7845
603-898-8900
http://www.omtool.com
Enter HotBYTEs No. 1048.

LanFax NT 5.0
$995/10 users, one line
Alcom
Mountain View, CA
650-694-7000
http://www.alcom.com
Enter HotBYTEs No. 1046

RightFax NT and Enterprise
$2995/server; $1295/unlimited use
RightFax, Inc.
Tucson, AZ
520-320-7000
http://www.rightfax.com
Enter HotBYTEs No. 1049.

WinFax for Networks
$399/five users
Symantec Corp., Delrina Group
Toronto, Ontario, Canada
416-441-3676
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SAPIENS

Don't fire your stenographer or unlearn your keyboard skills just yet, but quality continuous-speech dictation software has arrived. By Russell Kay

Do You Hear What I Say?

It's an old dream: to talk normally to a machine and have it take down your words, accurately, in written form. In the December 1995 BYTE, Judith Markowitz wrote: "Existing laboratory systems for continuous-speech dictation can take from three to 10 times as long to process a speech sample as the person takes to say it." She also noted that "greater commercial use of continuous-speech dictation awaits more powerful, less expensive CPUs."

Well, guess what? I've just looked at two products that provide practical, affordable recognition of normal speech. And most computers that you're likely to buy now can do the job.

IBM's ViaVoice and Dragon Systems' NaturallySpeaking both require a powerful Pentium-based computer with 32 MB of RAM (for Windows 95; NT needs 48 MB), a good-quality sound card, and a significant amount of disk space. I tested them on a 166-MHz non-MMX Pentium with 64 MB of RAM.

Speech software is different, however; it isn't really ready-to-go out of the box. Installation requires time and effort, and you have to commit at least a half hour to read in text and train the software to your voice and pronunciation. I spent an equal amount of time training each product so that my evaluations and comparisons would be fair. And after completing the initial training, I ran the same vocabulary file through each product.

This software presents two distinctly different capabilities: transcription of what you say, and control (using voice commands to navigate, edit, or format a document). ViaVoice offers only the barest formatting and editing, while NaturallySpeaking has more power—but only in its own dictation window. Neither package has the flexibility and power of Kurzweil Voice Command for Microsoft Word (see the text box "A Commanding Voice for Word" on page 116).

NaturallySpeaking Personal Edition

ADVANTAGES

+ Powerful editing and navigation with voice commands.
+ Training process more interesting, with a choice of texts.

DISADVANTAGES

– Expensive.
– No integration with word processors.

NaturallySpeaking has been on the market longer than ViaVoice has, and it costs more. So, I had high expectations, and I wasn't disappointed. Every step of the way, NaturallySpeaking was better at correctly recognizing what I said. During the testing period I never quite achieved the company's claimed 95 percent accuracy, but recognition clearly improved with time and use.

Performance is highly dependent on the computer's sound card. NaturallySpeaking's initial microphone setup told me that mine was below average and would degrade performance and accuracy. Dragon's Web site lists some tested sound cards, so I installed an inexpensive Hi-Val SounTastic16 card. The noise-canceling microphone that comes with NaturallySpeaking was similar to that for ViaVoice, but it had a noticeably heavier-duty cord and a black-box battery adapter.

Correction is efficient, and you can select text by either content or form. For example, say "Select [word]," and it highlights that word, or you can say "Select last [or next] word [sentence, paragraph, and so on]. Then you simply say "Correct that" or "Spell that," two modes that are useful in different situations. As with ViaVoice, after correction, the system might ask you to record that word.

With NaturallySpeaking Personal Edition, you can dictate into its own window and then cut and paste text into your word processor. The $695 Deluxe Edition, which was released after this review

was finished, integrates with Microsoft Word, supports multiple user profiles and vocabularies, offers text-to-speech and voice recording, and works with DragonDictate, a discrete-speech product, to provide additional command power.

ViaVoice

ADVANTAGES

+ Integrates nicely with Word and WordPro.
+ Relatively inexpensive.

DISADVANTAGES

– A stand-alone product; you can't add to vocabulary efficiently.
– Slow; sometimes asks you to stop.

ViaVoice works fairly similarly to NaturallySpeaking. The key differences are ViaVoice's correction process, its inability to add mass vocabulary, and its greater integration with other software.

When you install ViaVoice, it hooks directly into Microsoft Word, giving you a Dictation menu pull-down and toolbar. I also tested a new release of Lotus WordPro that includes ViaVoice. Curiously, this version has an important feature not in the stand-alone product: Vocabulary Expander, which lets you read in text files to increase the system's vocabulary.

Correction is somewhat awkward. The process seems to presume that one person will dictate a document and another will edit and correct it. First, you select up to three words of incorrect text using the mouse; you can't use a voice command, as you can with NaturallySpeaking. Next, you click a correction icon or press F2. ViaVoice reads the recorded text and shows it in a correction window.

This can be helpful. For example, my clearly spoken "feed it additional text" became "Lafayette's additional taxes." You enter your corrections from the keyboard.

Unfortunately, after I selected a word or phrase, the highlighted area sometimes changed, forcing a second correction. For example, I highlighted the phrase "14-inch monitors" and pressed F2 for correction, and the selection area suddenly changed. When I entered the correction, the final text then read "14-inch monitorsrs."

Also, ViaVoice has a feature that NaturallySpeaking doesn't: It can read text in any of several synthetic voices.

Can We Talk?

To provide a simple measure of accuracy and speed, I read a 473-word passage from a book into each test platform—NaturallySpeaking, and ViaVoice in its SpeechPad, in WordPro, and in Word. I did not look at the on-screen text or correct errors while dictating. I noted the overall time, counted recognition errors, and computed the number of correct words per minute as an overall performance index (see the figure above for more details).

NaturallySpeaking was faster and made fewer errors. ViaVoice/SpeechPad was a bit slower and less accurate. With either word processor, ViaVoice dictation took twice as long because I was periodically asked to stop dictating so the system could catch up. Each time, I had already read at least 100 words beyond the system's limits. In addition, after I finished dictating into WordPro, for example, the system continued processing for a full minute; NaturallySpeaking needed but 10 seconds.

Both products are useful, but I'd pick NaturallySpeaking for its friendlier training, speed, ability to add vocabulary easily, and overall better accuracy. If you're not sure whether speech recognition is for you, then ViaVoice is an inexpensive way to get started, plus it integrates nicely with Word and WordPro. But for serious productivity, catch hold of the Dragon's tail. B

Russell Kay is a BYTE technical editor. You can reach him at **russell.kay@byte.com**.

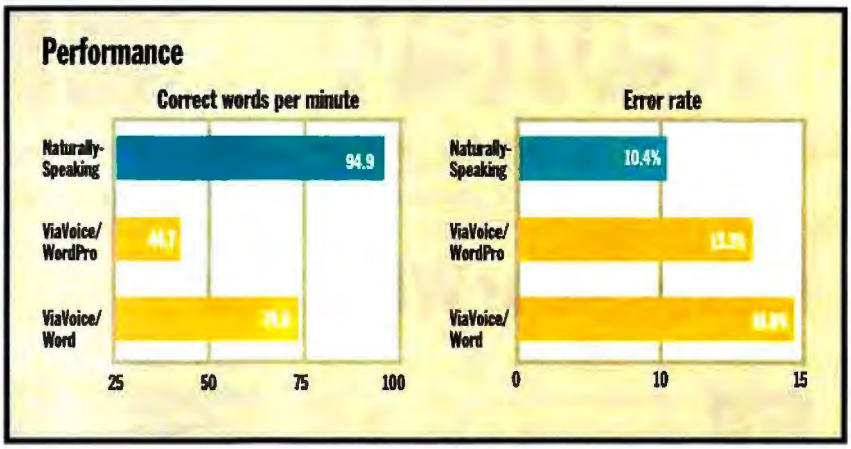
PRODUCT INFORMATION

NaturallySpeaking Personal Edition
$150 (street price)
(133-MHz or faster Pentium, 32/48 MB of RAM [Windows 95/NT], Sound Blaster 16–compatible sound card, 60 MB of disk space)
Dragon Systems, Inc.
Newton, MA
617-965-5200
http://www.dragonsys.com/
Enter HotBYTEs 1033.

ViaVoice 1.0 $99
(150-MHz or faster MMX Pentium, 32/48 MB of RAM [Windows 95/NT], Sound Blaster 16–compatible or IBM Mwave sound card, 100 MB of disk space)
IBM Corp.
Somers, NY
800-825-5263
http://www.ibm.com/

Kurzweil Voice Command for Microsoft Word
$59.95 (Pentium 90, 16/32 MB of RAM [Windows 95/NT], Sound Blaster–compatible sound card)
Lernout & Hauspie Speech Products
Burlington, MA
781-238-0960
http://www.lhs.com/
Enter HotBYTEs 1035.

at http://www.byte.com/hotbytes/



A Commanding Voice for Word

Lernout & Hauspie's (L&H) command-and-control product, Kurzweil Voice Command for Microsoft Word, illustrates the basic trade-off in speech recognition: speaker dependence (including training time) versus vocabulary size. Because Voice Command needs to know only a relatively limited number of words (compared to the 20,000+ that both ViaVoice and NaturallySpeaking recognize), it can use available computing power to eliminate the need for speaker training. Right out of the box, and with only minimal setup, it ran well and recognized commands spoken by a wide variety of voices.

Voice Command lets you say something a number of different ways and put together complex commands, such as: "Move the next three sentences to the end of the document."

Where does Voice Command fit in? Although there's no input or dictation capability, it has all the control power of NaturallySpeaking with a lot more flexibility, so it's a great choice for doing a lot of editing on existing copy. And by the time this review sees print, L&H may have already launched its own continuous-dictation product, Voice Express.

RSA's cryptographic toolkit targets Java as the platform of choice for secured Internet applications. By Peter Wayner

Making Java Development JSafe

The write-once, run-anywhere philosophy optimizes Java as a tool for network computing. And enabling Internet applications for digital commerce probably tantalizes developers more than any other use. The generally accepted solution to security concerns—bundling an application with encryption and digital signatures—was just made easier with the release of JSafe 1.0, RSA Data Security's Java-toolkit implementation of its cryptographic algorithms.

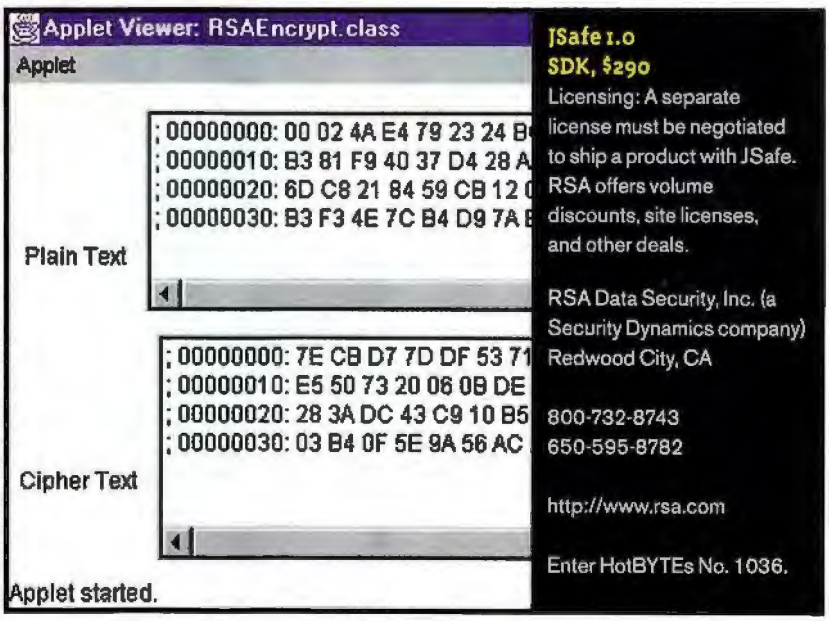
Computationally intensive, cryptographic functions drive most developers to code Internet applications tightly, often by using assembly language or C to optimize performance. Applications tuned for single platforms lack Java's run-anywhere feature, and RSA believes developers will trade the speed of native code for Java's platform independence.

JSafe offers RSA's "brand-name" algorithms, including symmetric key ciphers, such as DES; triple-DES; and RSA's proprietary RC2, RC4, and RC5 ciphers for high-performance block encryption. It also includes RSA's public-key-encryption and digital-signature algorithms, as well as the Diffie-Hellman algorithm for key negotiation over an insecure channel like the Internet. The package's secure hash-function support, integral to the tamper-proofing of data, includes RSA's MD5 and SHA1, the Secure Hash Algorithm.

JSafe was clearly designed to expand and include more algorithms with time. Available options might grow as RSA's patents expire; right now, JSafe steers users toward RSA's algorithms.

JSafe lacks the prosaic routines that programmers need to produce a complete implementation. For example, while the package includes routines to output standard BER-encoded data, which can in turn be converted to BASE 64 for 7-bit encoding, it lacks the routines necessary to convert certificates to and from PGP format. These extra routines would certainly simplify the programmer's job.

JSafe handles most of the grungiest work for the average developer of crypto-enabled Java applications and applets. The JSafe SDK costs $290, but developers must negotiate licensing directly with RSA for any JSafe-developed programs they distribute, either as part of shipping products or for use within an organization or by an organization's customers. While JSafe represents a solid basis for cryptographic programming in Java, it could benefit from added support for programmable interoperability. B



This simple JSafe applet takes random text from the top window and encrypts it in the bottom window.

TECH FOCUS

Java and Encryption

Java programming differs from C programming because the Java virtual machine controls all the memory. While a blessing for the programmer, this can be a curse for encryption-software designers: The memory often stores sensitive bits of data, which anyone can read. One early encryption program left copies of passwords in the virtual-memory swap file. JSafe solves this by creating a random block of numbers to XOR with secret data, just as it does for the key. JSafe XOR's the key with the random data to render it usable again; it then XOR's the key yet again to hide it after use.

RATINGS	
TECHNOLOGY	★ ★ ★ ★
IMPLEMENTATION	★ ★ ★ ★

Peter Wayner is a BYTE consulting editor based in Baltimore. His home page is at **http://www.access.digex.net/~pcw/pcwpage.html.**

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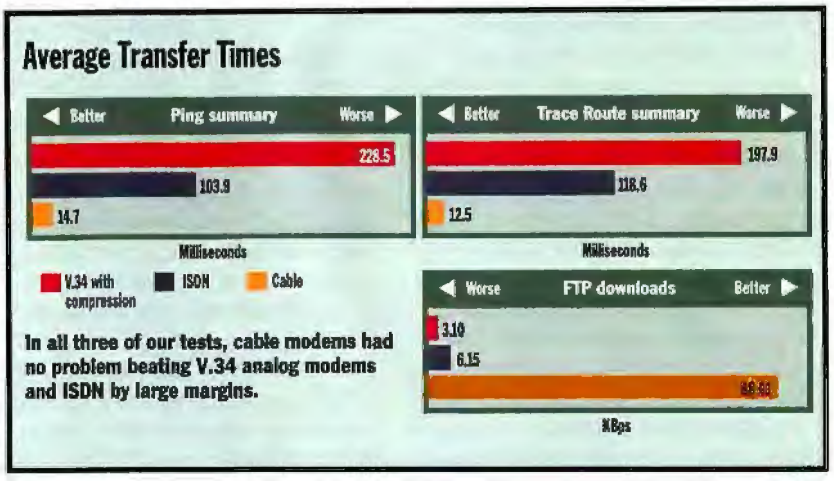
In our tests, cable modems provide faster Net access than analog modems or ISDN. By Andrew W. Davis and John W. Irza

Cable Modems Take the Early Lead

Broadband data services for consumers are so hyped that many people probably wonder when they will even get such services, let alone whether they're any good. We're fortunate to live in suburban Boston, where several Internet service providers (ISPs) sell access via ISDN and cable modems, both of which promise substantial speed improvements over analog modems.

We compared these three types of devices in real-world tests that provide some of the first published results on commercially available cable modems. (BYTE's October 1997 Hardware Lab Report, "Bandwidth on a Budget: 34 Fast Modems," covered 56K devices, ISDN, and ADSL units; cable modems were not sufficiently standardized or widely available in time for those tests.)



Three Scenarios

To compare cable modems to analog modems and ISDN, we used three test vehicles. We tested a Bay Networks (http://www.baynetworks.com) cable modem using our cable provider, MediaOne (http://www.mediaone.com). This modem was connected to a Micron 166-MHz Pentium computer with 32 MB of RAM and Windows 95. Even though the Bay Networks device is capable of supporting 10 Mbps downstream and upstream, MediaOne throttles it down to 1.5 Mbps downstream and 300 Kbps upstream.

For our ISDN test, we used a U.S. Robotics (now 3Com; http://www.3com.com) Courier I-modem ISDN with V.Everything to connect to Netcom (http://www.netcom.com), a nationwide ISP that supports 64- and 128-Kbps ISDN connections. The test-bed we used was a Hitachi MX133 Notebook computer (a 133-MHz Pentium system with 32 MB of EDO DRAM) with an embedded 33.6-Kbps 3Com modem and running Windows 95.

The Courier I-modem uses 3Com's TurboPPP with AT commands, software that allows it to use both B-channels to send and receive data over ISDN. Another feature, called Dynamic Bandwidth Allocation, is intended to save money by using the second B-channel only when it's needed for data transfers. In practice, we found that the second B-channel was activated too rarely and erratically to provide meaningful test numbers.

Finally, for the analog modem tests, we used the same Hitachi MX133 portable. None of the four ISPs involved in this test supported 56K service, so all results shown are for 33.6-Kbps V.34 modems with compression enabled.

The figure above shows average times for all three types of hardware. The cable modems are the clear winner in every case.

Test Sequence

Our test sequence consisted of three types of measurements. Each battery of tests began with 10 "pings" (short for packet Internet groper), a basic networking utility that tells if you can establish a connection to the server and gives the round-trip travel time from client to server.

The second set of tests used "traceroute," which determines the number of hosts or routers between client and server. The number of such "hops" can affect performance since each router adds latency and, thus, potential delays.

The analog modem consistently made the connection in six hops, and the cable modem in eight. The ISDN connection, however, tended to be made over eight hops in the early morning and late evening, and over 12 or 16 hops during the day. We're not sure why this happened and hope to repeat the tests in the future using multiple ISPs with ISDN access.

The third battery of tests measured FTP "gets" and "puts" to determine upload and download speeds to a file server connected to the Internet via a T1 line. The file server we used is part of Marinet, a directory serving the marine-biology community and run by one of the authors.

The FTP calculation takes the file transfer in kilobytes and divides that by the elapsed time to calculate Kbps. We used a small, highly compressible 250-KB file and a large, uncompressible 1.1-MB file.

Cable Modem Results

We created a program to run a test battery every hour and plotted the results

TECH FOCUS | NETWORKING

Cable Modems, For and Against

Cable modems send and receive data from a TV coaxial cable, typically connecting to a PC via 10Base-T Ethernet. Download speeds on the coaxial cable are typically 10 Mbps, although some vendors tout speeds as fast as 40 Mbps. Uploads are usually in the 0.5- to 2-Mbps range, but 10 Mbps is possible.

Cable-modem detractors point out that since this cable bandwidth is shared (as on a LAN), if 100 subscribers are active on a 10-Mbps wire, the bandwidth available to each is only 0.1 Mbps. They assert the superiority of a switched Ethernet environment, a model similar to that of the familiar voice-telephone system.

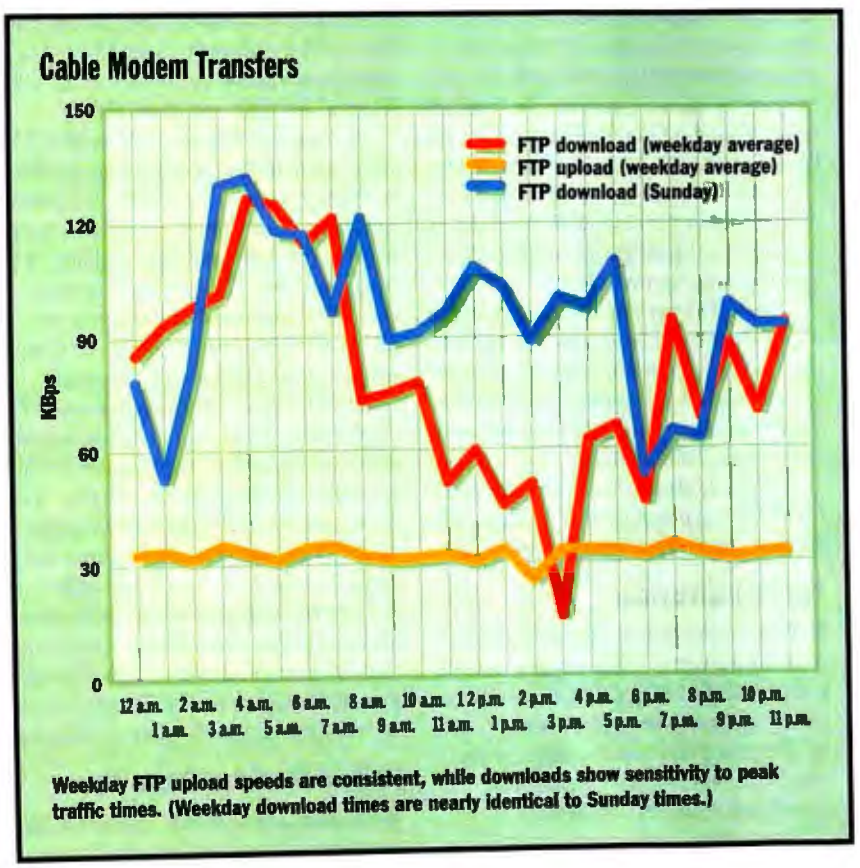
The same architecture is the basis of the Digital Subscriber Line (DSL) services now being pushed by the phone companies. With a switched architecture, you're temporarily connected to the destination endpoint, and the bandwidth is all yours. But DSL services are not yet commercially available, and since the Internet portion of the link puts users back onto a shared resource, we wonder if switched networks might provide only a small, temporary advantage.

Still, our tests indicate that cable modems offer by far the fastest Internet access of any technology currently available. And we believe that cable operators can easily segment their systems to accommodate a growing number of users, much as LAN managers do today. Nobody puts 100 users on an Ethernet; rather, they put 10 users on each of 10 segments. In fact, we were unable to find out from MediaOne exactly how many subscribers were on our cable system.

to show upstream and downstream transfers as a function of time of day. The figure below compares the weekday and weekend results to illustrate the effects of Internet congestion. Uploads were consistent at approximately 32.5 KBps when the data contained start and stop bits. Downloads are highly variable and primarily reflect backbone traffic and server loading. (The cable modem appears to use no compression, since the results were the same for all files.)

The figure below shows the averages of FTP results for cable modems. The fastest download took place at a rate of 135.9 KBps, while the slowest was 11.2 KBps; the average for 96 tests was 88 KBps.

The cable-modem ping results (96 runs with 10 pings per run) averaged 14.7 milliseconds, while the Trace Route test indicated six hops between server and client. This number was constant for all tests, an indication that the network configuration between endpoints didn't change.



Weekday FTP upload speeds are consistent, while downloads show sensitivity to peak traffic times. (Weekday download times are nearly identical to Sunday times.)

But What About the Competition?

While ISDN file-transfer speeds occasionally topped 100 Kbps, the average speed was around 56 Kbps, not much above what the notoriously underachieving 56K analog modems might attain. We were disappointed in how seldom the second ISDN B-channel kicked in, but we were unable to determine where the limits to performance really lie.

Results with the analog modem were highly variable and exhibited the familiar dependency on time of day. Furthermore, for all V.34 tests that we ran with compression enabled (a likely real-world setup), the average FTP transfer rate was 31 Kbps (with start and stop bits). The slowest transfer rate was less than 500 bytes per second.

Taking the Lead

While Internet congestion continues to be a problem, it appears that all three access technologies are destined to deliver about 80 percent to 90 percent of their rated performance when averaged over time.

Cable modems, though fast, face an imminent threat from Digital Subscriber Line (DSL) technologies, which promise to carry broadband data services over existing copper loops (see the Tech Focus above). But for now, cable companies are taking the lead in high-bandwidth residential services. B

Andrew W. Davis (**andrewwd@ultranet.com**) *is managing director of the Wainhouse Consulting Group, a market research and communications firm in Brookline, Massachusetts. John W. Irza* (**jirza@sygnus.com**) *is president of Sygnus Technology in Arlington, Massachusetts.*

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BYTE

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We test the latest C++ compilers from Borland, Intel, Microsoft, Symantec, and Watcom. By Al Gallant

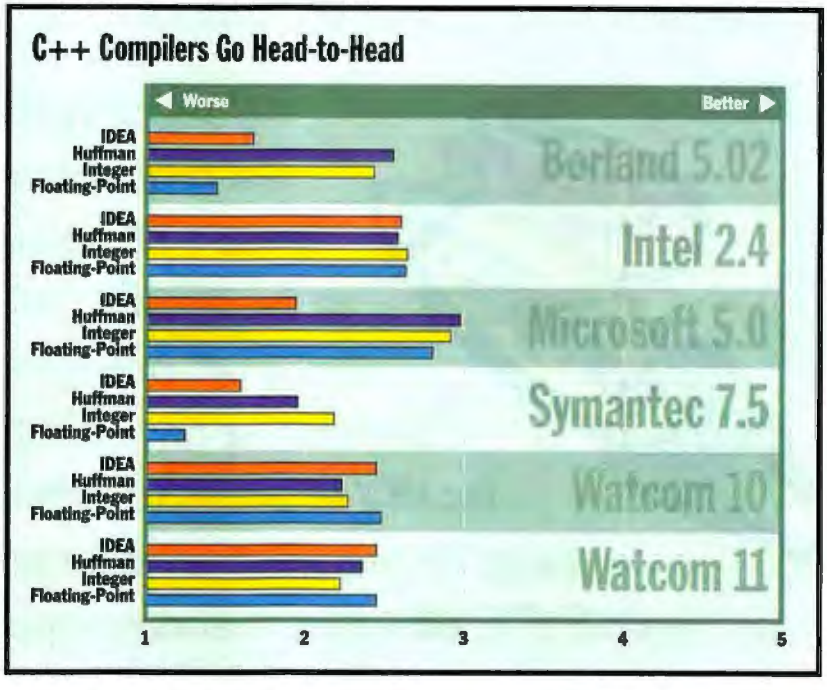
Which Compiler Is Fastest?

While many developers choose C++ compilers based on market share, cost, or ease of use, I believe that performance should be the dominant criterion. I recently investigated this issue while recompiling our BYTEmark CPU benchmark on the latest versions of five well-known C++ compilers. The results uncovered surprising differences in how each compiler handles BYTEmark's CPU-intensive kernel code.

I worked with compilers from Borland International (version 5.02), Intel (2.4), Microsoft (5.0), Symantec (7.5), and Watcom (11), using the following options on each: fastest possible code, 4-byte word alignment, Pentium code generation, and Pentium register base calling. The test systems were a Dell 90-MHz Pentium, two Gateway 200-MHz Pentiums (one with MMX), a Compaq 266-MHz Pentium II, and a Gateway 300-MHz Pentium II, each running Windows 95. The reference BYTEmark rest is version 2.0, released in 1995 and compiled with the Watcom version 10 C++ compiler. (To recreate the tests, look for the BYTEmark source code and documentation at http://www.byte.com.)

Microsoft was the fastest in both the BYTEmark integer index and the floating-point (FP) index, yet it had somewhat lower-than-expected results in the International Data Encryption Algorithm (IDEA) block-cipher test, which is a measure of raw speed. Microsoft admitted that the code created by the compiler generates two unnecessary memory references and promised to fix the bug in version 6.0.

The Intel compiler was next-fastest in overall performance. But it, too, did poorly in one test: Huffman text and graphics compression. Intel found that the Pentium register base calling option generates an Integer Multiply (IMUL) instruction that takes 10 clock cycles on Pentium processors, compared to only three cycles on Pentium IIs and Pentium Pros. Intel says it is less efficient to use IMUL instead of Load Effective Address (LEA, an instruction that loads a specified register with the offset of a memory location) to multiply by a constant. The company said it will consider modifying the next version of the compiler.



Microsoft outperforms the rest in overall floating-point and integer performance, but underperforms on the IDEA encryption test.

Borland had good integer but poor FP performance. Borland says the compiler's math libraries appear not to be optimized for Pentium code generation. The company promises a fix in the next release.

Symantec's compiler lacked the Pentium register base calling option, so we couldn't duplicate the switch settings of the other compilers. Symantec's integer numbers were good, but FP was poor. Symantec could not provide a reason.

Watcom's version 11 compiler has a known bug involving integer operations (see the August 1997 BYTE, page 23). The company provided us with a patch that, unfortunately, did not fix everything, leaving version 11 still performing slower than version 10 in some tests. Watcom promised a complete patch by the time this article is in print.

Microsoft C++ is the best performer not just because of its faster results but because of its consistency across Intel Pentium platforms. It's the smart choice for developers who want their products to have comparable performance on a wide range of Wintel systems. B

Al Gallant (al_gallant@mcgraw-hill.com) is technical manager of the BYTE Lab.

Jerry Pournelle

Chaos Manor

From the Workbench

Jerry builds yet another system, his first with an AMD K6 processor, and adds a second Pentium Pro to Fireball.

The computer revolution has mostly been helpful, but computers also give companies chances to make mistakes that would never happen without them. A case in point: BankAmericard, the original Visa. I've had once of those since they started, 30 or so years ago. Always paid my bills, usually on time, so over the years they kept increasing my credit rating.

Then one month I had a balance of three bucks or so. They had sent the bill late, so it arrived after I'd paid the bills for the month, and I ignored it. Come next month, they had a late fee that was larger than the bill. Plus interest. That bill came late, too—I sometimes wonder if they program their mailing system so that the bill will arrive after the date you have been accustomed to pay—so I paid it with some extra.

I was angry enough about 224 percent per month interest disguised as late fees that I didn't use the card for a month or two. So this month, I get a notice that my credit limit has been reduced, presumably because I have a positive balance. No skin off my nose. I have other credit cards that don't try to roll me. It seems a stupid way to persuade me to use the card more.

Meanwhile, a storage company where I keep a bunch of mathoms—stuff I can't quite bring myself to throw away—has lost all record of the fact that I paid two months in advance and keeps socking me with late-payment fees. When I call them, the people I talk to, managers included, keep telling me that, "The computer says..." Apparently, they have no other line. One day, I'll take the trouble to find an intelligent human being with some authority—there must be one somewhere, mustn't there?—and suggest they hire a competent programmer, since the one they had probably died of senility.

And now since that's out of my system, I can go back to my love affair with little computers.

THE LEGEND HAS IT THAT THE cobbler's children go barefoot. Not quite true, but when my son Phillip went into the Navy, he needed small systems to use aboard ship; this meant rugged rather than fast. Now that he's in the Navy's postgraduate school, he can use a better one, and I figured it was time I built him a system.

As always, I started with a PC Power & Cooling case and power supply. Their Personal Mid-tower AT/ATX, which does either form factor, is $69, not much more than the el cheapo no-names and worth every cent. Then I got one of the better no-name PCI motherboards from Fry's. This one came with decent documentation written in the weird translated English computer tinkers have become accustomed to. Fry's is good about warranties, so I felt safe enough in buying one of their boards even if I never heard of the Taiwanese company, in this case, Iwill (http://www.iwill.com.tw/), that made it.

Ninety percent of all failures take place in a computer's first few days of life.

Normally, I would have bought a Micronics motherboard, but Fry's didn't have any that day, and I wanted to get the system built immediately. I planned to deliver the machine to Phillip as part of a trip to the Bay Area, and I wanted to be sure I had enough time to test everything. Ninety percent and more of all failures take place in a computer's first few days of life. Therefore, it's important to burn it in while the warranties are still current.

I got a Western Digital hard drive kit—they come in all sizes and are all quite good; a 32-MB dual in-line memory module (DIMM)—largely because all my systems have had SIMMs and I wanted to see how this worked, and DIMMs are supposed to be faster; and a Sony floppy drive. I got a Diamond Multimedia 12× Multimedia Kit with a Mitsumi FX120 CD-ROM drive, a 32-bit Sound Blaster–compatible sound board, and pretty good Labtec LCS-1012 Space Saver speakers. Apparently it was a closeout item, because it was at a very good price.

Now for the CPU. Phillip likes games, so I wanted a multimedia extensions (MMX) chip. I have Intel CPUs in most of my own machines. I know they work. I've had good experiences with Cyrix chips but had never worked with one from AMD. The 200-MHz K6 MMX Enhanced processor was on a bargain sale at Fry's while I was there, so this looked like a good opportunity.

Putting the system together was easy enough, although I did have to make one more trip to Fry's to get more of those little plastic standoff insulators that hold the motherboard up. The board I got had a "big" keyboard socket (AT form factor, as opposed to ATX, which has the PS/2 keyboard socket) and used a slot cover to bring the PS/2 mouse port out. I saw no need to waste a slot on that, so I bored a hole in the case and installed the mouse-port connector there. I then called Larry Aldridge at PC Power & Cooling to complain, and their next release of cases will

have a knockout for a PS/2 mouse port.

The board came with connectors for the serial and parallel ports. The PC Power & Cooling case has knockout holes for those, so it was mostly a matter of deciphering the documents and fooling around until everything was connected up. The PC Power & Cooling case comes apart in interesting ways, making the mechanical installations quite easy; without that feature, I would have gone nuts trying to mount disk drives.

I had a choice of video boards. If I thought Phillip would mostly use this system for 3-D CAD and other high-end professional graphics, I would have installed a Number Nine Revolution 3D. At $300, it hands down gives the most bang for the buck of any professional-quality video board out there. (There are better boards, but they cost a lot more; the Revolution 3D stands alone in its price/performance class.) However, Phillip is far more likely to be doing games, and STB boards are not only cheaper, but have some features that make them better for game purposes. Thus, I used an STB Nitro 3D board.

Once I had everything but the CPU installed, I did a smoke test.

The Diamond sound board and CD-ROM kit were a breeze to install. The CD-ROM drive uses a standard IDE interface, and while, of course, there's an IDE connector on the sound board itself, it was just as easy, and much more convenient, to plug the CD-ROM drive's data cable into the second primary IDE connector on the motherboard.

The Western Digital hard drive is on the first one. IDE supports two devices per interrupt, as opposed to SCSI, which allows seven. If you use the IDE off a sound board, you will in general need two interrupts: one for the sound itself (which is almost always interrupt request [IRQ] 5 now) and one for the CD-ROM drive. The primary IDE already uses an interrupt to access the hard drive, so I got the CD-ROM drive "for free."

The Diamond 12×Multimedia Kit came complete with DOS drivers for the CD-ROM drive as well as for the sound board, and the setup installation knows how to install the CD-ROM drive to either the motherboard or the sound board; it's a very well-designed kit. The sound quality is quite good, and the speakers, although small, are good enough for the things I use a computer for.

ONCE I HAD EVERYTHING BUT the CPU installed, I did a smoke test: turn on the system and watch for smoke. Nothing happened, so I put in the AMD chip and tried again.

It came close to working. No smoke, a few BIOS messages, but we never got to the floppy disk. No power-on self test (POST) codes—beep patterns, which tell you precisely where things stopped. Restarts got hang-ups at a different point in the boot-up process, and once we got a POST code, but still no boot-up. I tried to get to the

BIOS editor, but that I couldn't do.

Any one of several things could have been wrong, but since it almost worked, the most likely problem was a bad CPU. Back to Fry's, which is about 10 minutes from here. I presented the bad chip and all my paperwork proving when and where I bought it, and they exchanged the chip no questions asked. I brought the new AMD 200 chip home, installed a PC Power & Cooling CPU-Cool Z1 cooler on it, plugged it in, said a prayer, and turned the system on. Voilà. Everything worked just fine. Lightning fast, and no problems at all.

Installed DOS, partitioned the hard disk, and installed the CD-ROM drive using the Diamond installation software. Got a certified copy of Windows 95 that came with a system since destroyed (gutted for parts) so Phillip would have a legal OS and did the CAB trick (see last month's column), after which installation was a breeze.

I installed a bunch of software. Over the years, I have collected many handy utilities that tend to go on every system. Copyright isn't generally a problem for systems I'm going to keep, since each new machine tends to replace an old one. In this case, I was careful to stay with freeware and programs the authors want me to test on a variety of machines.

Then there are orphans: programs from publishers who don't even admit their existence, much less any obligation to provide updates and support; or in some cases, whose publishers have disappeared. I never quite know what to do about those. I guess you have to let your conscience be your guide. Finally, I attached the Philips CD Recordable (CD-R) drive to the built-in SCSI and installed Adaptec Easy CD Creator Deluxe. That's one wonderful program. I used it to make backup CDs of everything on the system. I can't let the drive go, but at least Phillip starts with a backup of his system as delivered: OS, utilities, application software, the lot. CD-Rs are great for doing that sort of thing.

Then we packed Phillip's machine in the Bronco and drove up to the Bay Area for a conference. The system worked perfectly when we set it up at Phillip's house, and the last I heard, it was doing a fine job of killing rat cats in Origin's Wing Commander: The Kilrathi Saga, a new release that contains the first three Wing Commander games in one box. Longtime readers will recall that I've always been fond of Wing Commander, which has gotten smoother and slicker over the years. I do have to confess I haven't found the recent releases as purely enjoyable as I did the first one, but this collection is a real bargain that would make a great Christmas gift.

The moral of this story is that you can save some money building a system on your own, particularly if you watch for sales. Some of the components of Phillip's system could have been bought for half what we paid if I'd been willing to wait a couple of weeks. You will not, however, save a lot of money over what you will pay for full systems on sale, from either a big discount place like Fry's or a mail-order outfit like Dell. The main advantage of building your own system is that you'll know exactly what's in it. If you do decide to build, start with a PC Power & Cooling case and power supply, and deal with a reputable company like Fry's that honors its guarantees.

Of course, it helps to have some general familiarity with computer systems, but you certainly don't have to be a hardware guru. The hardest part isn't the electronics. It's figuring out what things mount where and what hardware you need to do it with. Mounting brackets are almost never standard, there are often no instructions at all, and finding ways to insert mounting screws on both sides of a floppy drive can drive you bats if you don't have a case that comes apart easily.

For a Windows 95 system, there is no problem with using the AMD K6.

The second moral of this story is that for a Windows 95 system, there is no problem with using the AMD K6 CPU. I do have reports of problems with some application software under NT Server, but none with Windows 95, and certainly we found none. The AMD K6 is at least as fast as the corresponding Pentium with MMX and costs quite a bit less. It ran all the programs I tried, including both old and new games, and while a couple of games reported that "This game requires a Pentium and you only have a 486" or words to that effect, ignoring that message caused no problems.

The chip runs hot. Don't even think about using one without a good cooling fan, and my advice is to get the proper one

from PC Power & Cooling. Moreover, if you don't use a PC Power & Cooling fan, be sure to get some of their heat-conducting compound. This is a white goo you spread in a thin layer on the chip to give it better thermal contact with the heat sink/cooling fan.

My first installation of the AMD chip was with the chip fan recommended by Fry's and no conducting compound. Even though the chip fan had proper mechanical connection and was running fine, that chip got hot enough to fry eggs on. After I converted to the PC Power & Cooling CPU-Cool Z1 cooler—a heat sink with a fan in the center—with the conducting compound, I could put my finger not just on the heat sink but on the chip itself; and while it was warm, it certainly wasn't hot.

Given proper attention to cooling, the AMD K6 chip is plenty good enough.

THIS HAS BEEN THE MONTH FOR new hardware. Last month, we built Fireball, our new RAID-capable server, from a Micronics dual Pentium Pro board, using a single 200-MHz Pentium Pro with a megabyte of cache memory. I tested that machine under Windows 95. This month, we added the second processor.

Adding the processor was simple: just drop in the chip, spread the heat-conducting goo, attach the PC Power & Cooling fan (with this chip, there is no other cooling system I'd recommend), and then put in the voltage regulator unit that comes with the motherboard if you buy the dual-processor configuration. There's only one place the unit can go, so you won't have any problems at all.

Fireball is, as you would suppose, a blazingly fast system.

Unlike previous dual-processor systems, there's no BIOS notification that a second processor has been detected. The only way to know that the second chip is working is to install an OS that can use it. In our case, we installed NT 4.0 Workstation and then NT 4.0 Service Pack 3.

It all went very smoothly, with only two minor glitches.

I installed NT 4.0 from Windows 95 simply by running an NT 4.0 Workstation original equipment distribution disk under Windows 95. At the end of the process, I was told to remove all floppy disks, shut down the system, and then let it boot up in DOS. The instructions didn't make it clear whether it meant shut down or let Windows 95 bring it up in DOS. I decided that shut down meant exactly what it said, and for good measure turned the machine off; in general, it's good to get in the habit of shutting a machine down entirely rather than just rebooting.

When I turned it back on, it came up in what looked like DOS and immediately continued the installation. Getting Fireball attached to my local Ethernet was just as easy, as were installing the NT drivers for the Revolution 3D board and installing the NT Service Pack 3 upgrades.

Fireball came with Sound Blaster Pro–compatible sound on the motherboard. Windows 95 installed that automatically, but NT 4.0 didn't know it was there. I'd anticipated that, and before I shut down Windows 95, I went to the Sound properties and wrote down the I/O address (220) and IRQ (5) for the sound system.

When NT was up and running, I installed the sound, and that brought the second glitch. At one point, NT asks for the SB16 drivers from the NT installation CD. Alas, the program doesn't know where to look, and it is exceedingly difficult to find precisely where the SB16 drivers are. Eventually, I discovered them in E:\DRVLIB\AUDIO\SBPNP\PPC\, which I suppose should be obvious but wasn't to me. That done, I had no more problems.

Fireball now offers the choice of Windows 95 or NT 4.0 on boot-up; that got installed more or less automatically as part of installing NT 4.0. It is, as you would suppose, blazingly fast. With the Revolution 3D video board, we get a WinTach of almost 700, which is incredible. It is certainly the fastest machine at Chaos Manor.

The Distributed Processing Technology SCSI controller, incidentally, makes the external drives in the RAID box almost as fast as the internal primary SCSI drive. If you're looking for a fast system, a good caching controller is a must, and DPT pretty well wrote the book on those.

The next step is to install NT Server. With the dual Pentium Pro 200 by 1-MB cache chips and the DPT SCSI RAID controller, Fireball will then be one of the

fastest servers around; both fast enough and large enough to host a Web site.

I'VE BEEN EXPERIMENTING WITH Web tools. There are a lot of them.

I am no fan of Office 97. In particular, I can't recommend Word 97, because, as I write this, it's not stable, and, while Microsoft has improved file conversion between it and Word 95, Word 97 doesn't do a lot that I need done that Word 95 doesn't do. That said, Word 97 is a pretty good Web tool. It will convert normal text into HTML, preview pictures and illustrations, give you some cool background textures, insert links, give you WYSIWYG previews, and shift into HTML editing mode. All this comes quite naturally to a Word user. I created my first Web pages with Word 97.

Better is FrontPage 98. The problem with FrontPage is that it really wants you to set up a Web server on your local system. It will let you use a toy server, but it spends little time explaining how to do this. I don't think there's much wrong with Front-Page 98 that some good tutorials won't cure, and it's certainly a very powerful tool; more than one professional Web-page designer will find FrontPage 98 all the Web tool they will ever need.

The problem is that FrontPage 98 is almost too powerful.

Comes now Web Express from Micro-Vision Development. It is a WYSIWYG Web-page editor that keeps track of all your links and builds a map of your Web site's activity. It has both WYSIWYG and HTML edit modes. It understands frames and tables. It doesn't have as convenient a system for previewing illustrations as Word 97 or FrontPage 98, but it does work well with large and small image files.

Best of all, you can take an existing Web site, import it into Web Express, and automatically build a complete map of all the links: bookmarks, page links, external links, recursive links, all get mapped into a comprehensible diagram. It then tests all those links and shows you which ones are broken. The other night, I did a complete reorganization of my Web site—http://home.earthlink.net/~jerryp—with Web Express. I'd put that off precisely because I had built a complex system of links that I no longer understood. Web Express took care of that problem immediately.

Web Express doesn't have the background patterns built into Word 97, but it handles pages built by Word 97 just fine;

and by examining the way Web Express deals with those backgrounds, you can discover how to apply them to new pages created in Web Express.

In a word, I like Web Express just fine, and unless you do really complicated Web sites (in which case my advice is to bite the bullet and learn FrontPage 98), you will probably find that Web Express is all the tool you need. Recommended.

IN A PREVIOUS COLUMN, I described some of the difficulties of keeping CD-R, CD-ROM, and digital versatile disc (DVD) drives on the same system. I suggested that one way is to turn off the CD-R drive until you need it and then turn it on and reboot.

Readers have since pointed out that you may not have to reboot: it is possible to get Windows 95 to see a SCSI device turned on after boot-up. Go to Control Panel/Systems/Device Manager and push the Refresh button. That will sometimes cause Windows 95 to see the device. I say sometimes, because it doesn't always work, and it has unpredictable effects on drive-letter changes. I have never seen any harm in trying it, but I generally expect to have to reboot if I turn on a SCSI device I'd left turned off at boot-up.

GOOD NEWS: I HAVE BEEN SENT a new "OmniKey" keyboard. It is called the Avant Stellar and is sold by Creative Vision Technologies. It was designed by Inter-Fatron, the same people responsible for the Northgate OmniKey. Same heavy-duty construction, same clicky feel, same everything, with function keys across the top as well as on the side. Switchable position for Ctrl. "Windows" keys. This will definitely be one of my products of the year.

Alas, it doesn't have the Backspace key where it belongs. The [ ] keys are there, and Backspace is up on the numbers row where two-finger typists always put it, but no new keyboards have Backspace in the right place. Other than that, it's about perfect. If you bang keys a lot, you will love this. Recommended.

OLYMPUS NOW HAS NEW SOFTware, in particular, a TWAIN32 driver, for their wonderful cameras. It is easy to use. It's not so easy to find unless they have revised their Web site, which they promised me they would do. If all else fails, send them e-mail, and someone will give you an exact URL. I won't give it to you here, because I can't swear it will work when you read this. So it goes, but it's well worth finding.

Olympus has discontinued the D-300L camera I have, but their new ones are in many ways even better, and now the software is easy enough for Aunt Minnie. It sure makes it simpler to put pictures on a Web page. If you are looking for a camera, be sure to check out the Olympus digital cameras. Highly recommended.

I KNOW I PROMISED A REPORT ON Memphis, but, alas, the new build we got was even less stable than the earlier one. I think you will like Memphis—now officially Windows 98—when they get it finished, but stay tuned.

Two books this month. Terry Pratchett's *Maskerade* (Harper/Prism, ISBN 0-06-105251-5) is "yet another novel of Discworld," in which Granny Weatherwax meets the Phantom of the Opera. If you don't know about Pratchett and his insane Discworld novels, you have a treat in store for you. Incidentally, the Psygnosis game Discworld II (which includes Discworld I) would make a perfect gift for any computer-using science fiction reader.

The other book is by the late Walter M. Miller Jr., *Saint Leibowitz and the Wild Horse Woman* (Bantam, ISBN 0-553-10704-6). The cover says it is a sequel to Miller's *A Canticle for Leibowitz*, one of the truly great science fiction works of all time, but it's better than that. This story takes place after part two of the novel but before the remodernizations of part three. *Canticle* was a story of fall and redemption, and by God's grace, its post-atomic war setting is far less likely than when it was written, but Miller was a wonderful writer.

The computer book of the month is Steve Heller's *Who's Afraid of Java?* (AP/Harcourt, ISBN 0-12-339101-6), in which Heller teaches his wife all about Java. Well written, thorough, humorous, and filled with examples. If you want to know what Java is all about, this is probably the best single book I have seen for learning it.

The game of the month is Microsoft's Age of Empires. It's like Civilization only with real-time play like Warcraft; you start in the Stone Age and try to build a civilization as one of 12 peoples, including my favorites, the Minoans. The artwork is gorgeous, and the game is well thought out. There's good AI for the opposing sides, and you get a choice of civilizations.

continued

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There's only one problem: it's no fun as a game. Command and Conquer and Warcraft started a trend toward "real-time" strategy games in which you start with a dark screen and few resources; you have to build your base and your army. Both of those games have a very slow option, and they are designed so that you don't need to control all that many units at once; moreover, the scenarios are constructed so that you seldom operate on more than one "front" at a time.

marching orders to ships and troops while the clock is stopped. Given those fixes, this would be the best game I've seen in years; as it stands, it's the most gorgeous whack-a-mole you will ever see.

If intellectual games of construction don't appeal to you, try MicroProse's 7th Legion, a sort of *The Empire Strikes Back* meets *King Kong*. Fair warning, the artwork is terrific, and there's enough blood and gore for Hannibal Lecter. Don't give this to small children, but I have to say I

There's only one problem: it's no fun as a game.

Microsoft apishly copied the real-time strategy and build-your-base features of these predecessors but set the clock speed so high that at its slowest, it's impossible to control very many units at once. Moreover, the free-form aspects of the game, which ought to make it fun, make it excruciating, because you always have to run from one place to another and click like a maniac. To make it possible to play at all, they limit the number of units you can have to 50, which isn't nearly enough for a mature civilization engaged on several fronts plus defending the homeland. As a result, it's impossible to build the large and complex civilizations depicted in their ads.

Age of Empires is worth buying for the scenery, but you won't play it much until they get at least two fixes: a way to slow the clock *way* down, and a "stop action" that lets you look at your units, plan research and construction, and give

haven't got this involved in this kind of game since Wing Commander I. This one claims to be real-time strategy, but in fact it's best thought of as a shooter.

John Dvorak and I are about to test the commercial promise of the Web, and David Em has an important graphics report in the Web Exclusive section, including a big win for Apple; don't miss it. Next month, I'll tell you how to deal with a failing memory. B

Jerry Pournelle is a science fiction writer and BYTE's senior contributing editor. You can write to Jerry c/o BYTE, 29 Hartwell Ave., Lexington, MA 02173. Please include a self-addressed, stamped envelope and put your address on the letter as well as on the envelope. Due to the high volume of letters, Jerry cannot guarantee a personal reply. You can also contact him on the Internet or BIX at **jerryp@bix.com**. *Visit Chaos Manor at* **http://home.earth-link.net/~jerryp/**.

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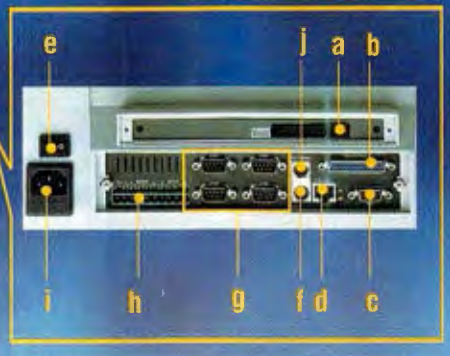

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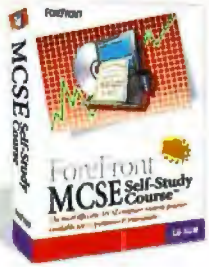

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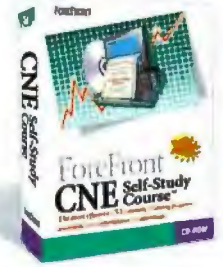

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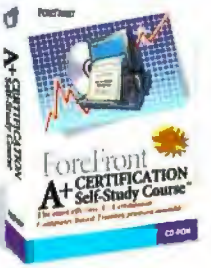

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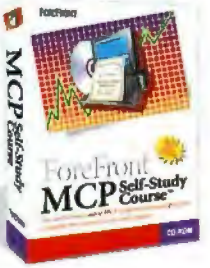

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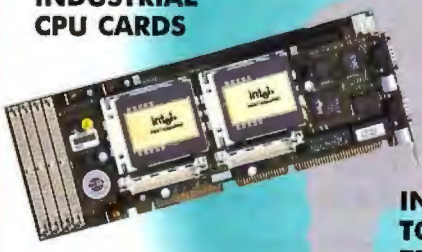

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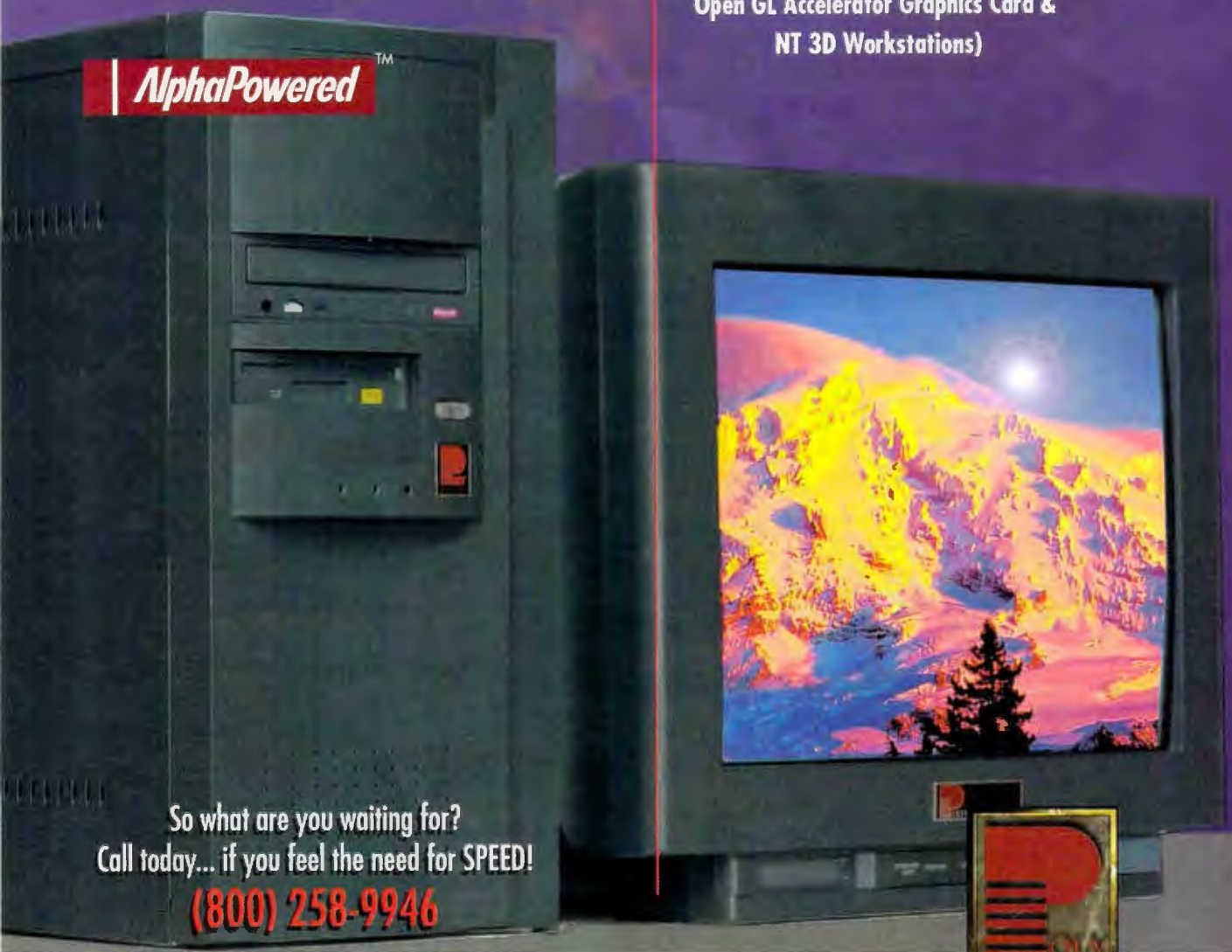

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100	TERN INC	144	918-758-0180
149	TRI-MAP INTERNATIONAL INC	137	510-447-2030
*	TV INTERACTIVE/.COM	114	800 311 8001
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110	VALUE WEB	145	800-934-6788
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131	VIEWSONIC	67	800-888-8583 AGENT 81057
	W		
135	WIBU SYSTEMS AG	124	800-986-6578
361	WINBOOK COMPUTER CORPORATION	11	800-468-0712
	Z		
94	Z-WORLD ENGINEERING	142	916-757-3737

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EDITORIAL INDEX

For more information on companies covered in articles in this issue, enter the HotBYTEs number in the HotBYTEs form on the BYTE Web site at http://www.byte.com/hotbytes/. Page numbers refer to the first page of the article in which the company appears.

New Product Information Service: www.byte.com/hotbytes/

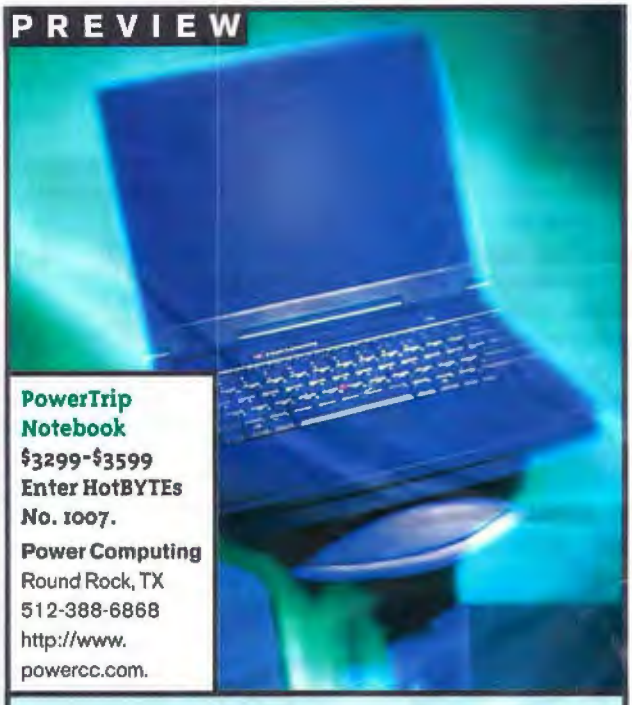
IS pages appear only in the International edition. C and I pages appear only in the Reseller edition.

What's New

Hardware

Wintel notebooks from a former Mac cloner, HP's Kayaks, NT clustering, network watchdogs, and tools for Web commerce.

PREVIEW



PowerTrip Notebook
$3299-$3599
Enter HotBYTEs No. 1007.
Power Computing
Round Rock, TX
512-388-6868
http://www.powercc.com.

Power Computing's Wintel Notebook

The day after Apple announced it was buying out Power Computing's Mac clone business, Power Computing representatives came by our office to show us the company's new Wintel notebook, the PowerTrip. It was a little surprising to see the biggest seller of Mac clones with a new Pentium laptop so soon after the announcement. Especially surprising because these are not only the first laptops Power Computing has ever made, they are also the first Wintel systems the company has ever produced.

The system I checked out has features for power users, like a 13.3-inch active-matrix SVGA display, 2.1- or 4-GB removable hard drive, 56K modem, and up to 128 MB of RAM. Current models have the mobile 200- or 233-MHz Pentium with MMX and will offer compatibility with mobile Pentium II processors when available. The systems range from $3299 to $3599 for 200-MHz configurations and $3599 to $4999 for 233-MHz.

The PowerTrip is a very functional machine. It has both a touchpad and a pointing device, which can be used interchangeably. Unfortunately, the touchpad is right in front of the spacebar, so it's easy to inadvertently move the cursor while typing. The laptop weighs 7.7 pounds. The case is rugged, with molded bumps to keep it from slipping out of your hand while carrying it. One design flaw: The door covering the ports on the back of the machine cannot be locked down when open and is susceptible to breaking.

We will never know how powerful the Mac PowerTrips might have been. But the world has gained another solid, high-end Windows laptop for less than $4000. **– Jason Krause**

PHOTOGRAPH: JIM COON © 1998

Antivirus Card

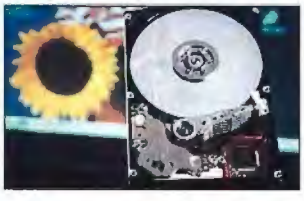
PCI Card Kills Boot Sector Viruses

THE NEW PCI VERSION OF FULL CIRCLE Technologies' VirusBlaster defends against boot sector virus infection during power-up or rebooting, when your system's operating system and antivirus software haven't yet loaded. It is a half-slot card that fits into any open slot in a PC system and loads at boot time, before a virus can sneak into your machine's memory. The basic VirusBlaster card costs $59.95; an $89.95 version with McAfee antivirus software is also available.
Contact: Full Circle Technologies, North York, Ontario, Canada, 416-447-7171; http://www.fcircle.com.
Enter HotBYTEs No. 1071.

Hard Drives

Small but Dense Hard Drives

IBM INTRODUCES THE NEW TRAVELSTAR 8GS hard drive for notebooks. The disk has a capacity of 8.1 GB. The 8GS is only two-thirds of an inch thick (about the size of a music



cassette tape) but, IBM says, the little device can hold 3 billion bits per square inch, which accounts for its comparatively large capacity. It has a 512-KB data buffer, 4900-rpm speed, and 107.6-Mbps transfer rate. Priced at $649, the Travelstar will be available as an upgrade option for notebook systems. IBM also has a thinner drive, called the 3GN, that holds 3 GB.
Contact: IBM Storage Systems Division, San Jose, CA, 800-426-7777 or 408-276-4009; http://www.ibm.com/storage.

Storage

Have Gigabytes, Will Travel

ADDING STORAGE TO A SYSTEM, ONE GIGAbyte at a time, is simple and inexpensive with the portable SyQuest SparQ. A 1-GB removable cartridge system with a 512-KB buffer, the $199 SparQ and $39 cartridges afford users expanded storage space in an EIDE configuration. A SCSI version is slated to be released by the end of 1998.
Contact: SyQuest Technology, Fremont, CA, 800-245-2278 or 510-226-4000; http://www.syquest.com.
Enter HotBYTEs No. 984.

Notebooks

Full-Featured Notebooks Under $4000

STARTING AT $3599, THE WINBOOK XL offers a 233-MHz Pentium with MMX, 256-KB Level 2 cache, 32-MB EDO RAM, 3-GB hard drive, 16-bit stereo sound, and 20x CD-ROM drive. These notebooks have a 13.3-inch XGA active-matrix color screen, 2-MB video RAM, and MPEG-I support for multimedia functions. The units come with a touchpad, pointing device or, for another $79, both, which can be

used simultaneously.
Contact: WinBook, Hilliard, OH, 800-254-7806 or 614-481-7460; http://www.winbook.com.
Enter HotBYTEs No. 977.

DVD Comes to Laptops

PANASONIC'S CF-63 ($5999) INTRODUCES DVD-ROM to portable computing and delivers enough power and resolution to take advantage of the new medium. The DVD player has MPEG-2 playback and doubles as a 20x CD-ROM reader, so you don't forfeit CD-ROM capabilities by adopting the DVD standard. The computer has a 13.3-inch 1024 x 768 XGA active-matrix LCD screen, an S3 graphics controller with 4-MB SGRAM, a 166-MHz Pentium with MMX, a 3.2-GB hard disk, 256 KB of Level 2 cache, and 32 MB of EDO RAM (expandable to 96 MB). The CF-63 weighs in at 8.7 pounds (with battery).
Contact: Panasonic Personal Computer Company, Secaucus, NJ, 800-662-3537 or 201-271-3182; http://www.panasonic.com/ruggedpc.
Enter HotBYTEs No. 976.

Switches

Bandwidth Bonanza

ACCORDING TO GIGALABS, THE GIGAStar 8000 Gigabit Enterprise Switch can route 2 billion bits per second (2 Gbps) of dedicated bandwidth through each of the 32 chassis slots in the unit. That equals 64-Gbps switching throughput capacity and 128-Gbps total capacity. Prices start at $350,000.
Contact: GigaLabs, Sunnyvale, CA, 408-481-3030; http://www.gigalabs.com.
Enter HotBYTEs No. 978.

Fibre Channel Fabric

FIBRE CHANNEL CARRIES LARGE FILES ACROSS building or campus backbones, lessening throughput and distance limitations for both peripherals and LAN infrastructures. McData's ES-4000 ($150,000) provides connection past 1000 meters with an aggregate bandwidth of 32 Gbps, extending connectivity between storage and server devices. Cascading multiple switches can extend distances even further.
Contact: McData, Broomfield, CO, 800-545-5773 or 303-460-9200; http://www.mcdata.com.
Enter HotBYTEs No. 985.

Videoconferencing

Simplified Videoconferencing

THE VIDEOFLYER ROCKET ($5995) OFFERS computerless videoconferencing in a self-contained unit that plugs

into standard TVs, speakers, video cameras, or projectors (as well as Windows PCs and Macintoshes). This H.320-compliant device with 128-Kbps image transmission supports standards-based videoconferencing protocols and bridges. With a splitter, it supports multiple monitors, TVs, or projectors.
Contact: RSI Systems, Edina, MN, 800-496-4304 or 612-896-3020; http://www.rsisystems.com.
Enter HotBYTEs No. 982.

Printers

New Printer, New Technology

THE HEWLETT-PACKARD LASERJET 4000 ($1099) replaces the popular HP LaserJet 5, offering a host of new features for workgroup laser printers. It is the first HP printer to be enabled with the new JetSend protocol. The 4000 has a 100-MHz RISC processor and 32-bit PCI-bus architecture. A new heating element in the drum is designed to make the unit warm up and print the first

page 14.6 seconds after the printer comes out of sleep mode. Another new technology, called FastRes 1200, can eliminate some speed performance penalties while printing at the maximum output of 1200 dpi. The print engine is rated at 17 ppm. Paper capacity is 600 sheets. HP says the unit can handle heavier paper without warping because it has a straight paper path.
Contact: Hewlett-Packard, Palo Alto, CA, 800-527-3753 or 650-857-1501; http://www.solutionjet.hp.com/lj4000 or http://www.hp.com.
Enter HotBYTEs No. 987.

Scanners

Digitize Images at Home

The EasyPhoto ImageWave ($149) is a flatbed scanner that simplifies and enhances the scanning process for home PC users. It includes the new ClearScan II imaging software, which detects dark areas and corrects color inaccuracies in scanned images. Storm's new scanner has 30-bit color capabilities and scans pages up to 8.5 x 11.7 inches with 600 x 300-dpi optical resolution. The hardware is bundled with Xerox's TextBridge for text scanning.
Contact: Storm Technology, Mountain View, CA, 650-691-6600; http://www.stormtech.com.
Enter HotBYTEs No. 1032.

A Handy Flatbed Scanner

IBM'S COLOR FLATBED SCANNER ($299) delivers 30-bit software-enhanced color resolution at up to 9600 x 9600 dpi. Standard resolution goes up to 600 x 1200 dpi. The unit's cover can be removed for scanning bulky objects. A parallel port pass-through connection eliminates the need to open your computer to configure a SCSI adapter during installation. It comes loaded with Xerox Pagis SE with TextBridge OCR software for document handling and character recognition and Adobe PhotoDeluxe 2.0 for image editing.
Contact: IBM, Somers, NY, 800-772-2227 or 416-383-5152; http://www.ibm.com.

Scanning Made Simple

EPSON'S PERFECTION 600 ($299) HAS A new driver designed to make scanning more foolproof. This 30-bit color flatbed scanner has 600 x 1200 optical resolution. The bundled SilverFast driver, from LaserSoft, adjusts highlight, shadow, midtone, brightness, contrast, hue, saturation, and color correction automatically. The scanner also comes with Visioneer PaperPort, Adobe PhotoDeluxe, Xerox TextBridge, and Adobe PageMill for OCR, image editing, and publishing capabilities.
Contact: Epson, Torrance, CA, 310-782-0770; http://www.epson.com.
Enter HotBYTEs No. 989.

Multifunction

One-Stop Shopping

SAVE TIME, EFFORT, AND SPACE WITH MITA'S multifunction fax, printer, scanner, copier, and phone machine. For $699 the MIP-650 has a 600-dpi, 6-page-per-minute laser printer, a 14.4-Kbps modem, up to 1 MB of fax memory, and PC phone and fax-handling software. The built-in scanner can

scan 64 levels of grayscale at 400-dpi resolution.
Contact: Mita USA, Fairfield, NJ, 800-222-6482; http://www.mita.com.
Enter HotBYTEs No. 990.

Cameras

"Traditional" 35mm

THE FUJIFILM DX-7 DIGITAL CAMERA ($499) is designed to handle more like a conventional 35mm film camera than a typical entry-level digital camera. It has an optical viewfinder and an automatic flash, and it lets you manually control some camera settings to accommodate varied lighting situations, like a traditional camera does. At the same time, you can preview the image on the built-in 1.8-inch color LCD. The 4-MB storage media, which can hold as many as 60 images, fits into the optional PC Card adapter or floppy disk adapter for downloading to a PC.
Contact: Fuji Photo Film USA, Elmsford, NY, 800-378-3854 or 914-789-8100; http://www.fujifilm.com.
Enter HotBYTEs No. 1072.

UPS

The Little UPS That Can

APPROXIMATELY THE SIZE OF A VIDEOCASSETTE and weighing 3 pounds, the Pulsar Desktop 220+ UPS system ($129) offers 10 minutes of battery protection in the event of power loss, surge, or fluctuation. Smart power management can automatically close files and shut down a computer system in the event of a power interruption. The device monitors power coming into a system, offering protection for equipment, for data stored on a hard drive or in RAM, and for data going out from the modem.
Contact: MGE UPS Systems, Costa Mesa, CA, 800-523-0142 or 714-557-1636; http://www.mgeups.com.
Enter HotBYTEs No. 981.

Server

NT Clustering Is Here

CLUSTERING HAS BEEN AROUND FOR YEARS on platforms like VMS and Unix, and now Windows NT users are getting some of the improved database and applications-server performance the technology provides. Tandem's CS150 ($15,000) combines two Pentium Pro-based servers. In the event of a crash in one node, running processes automatically failover and transfer to the other node. Interprocessor communication is mirrored for fault tolerance. The CS150 supports Microsoft's Cluster Server ("Wolfpack"), as well as Tandem's NonStop SQL/MX and Oracle clustering technology.
Contact: Tandem, Cupertino, CA, 408-285-6031; http://www.tandem.com.
Enter HotBYTEs No. 986.

Workstations

Kayaks Powered by Pentium II

HEWLETT-PACKARD'S KAYAK PC WORKstations are Windows NT-based machines designed for 2-D or 3-D graphics applications. The systems are built around the Pentium II 440 AGP chip set and single or dual 266-MHz or 300-MHz Pentium II processors. Prices range from $2250 to $17,760, depending on configuration. For 2-D applica-

tions, the Kayak XU has a Matrox Millennium II graphics card. The Kayak XW PC features the AccelEclipse or the HP Visualize fx4 3-D graphics subsystem.
Contact: Hewlett-Packard, Palo Alto, CA, 800-527-3753 or 650-857-1501; http://www.hp.com.
Enter HotBYTEs No. 983.

SOFTWARE

The Web

Personalized ISP Service

BRIDGEWATER SYSTEMS' WIDESPAN IS A domain name service server that identifies registered ISP clients, letting Internet providers build customized services and billing plans. It has systems management software

on top of the server software for creating customized service, and it uses LDAP authentication on the front end for dealing with directories. The software can support tunneling protocols for working with firewalls. The authentication server supports RADIUS. Pricing is based on the number of users ($15 per subscriber). Some of the things WideSpan can support are: outsourced dial-in services to replace modem pools, billing for intranet outsourcing, roaming capabilities across ISP service areas, and IP-based VPNs.
Contact: Bridgewater Systems, Kanata, Ontario, Canada, 613-591-6655.
Enter HotBYTEs No. 992.

If You Build It, They Will Chat

ICHAT'S CUSTOMER INTERACTION SUITE SIMplifies hosting large-scale on-line product launches, sales events, and chats on commercial sites. The suite includes the Ichat Events application, which integrates audio, video, and Ichat's Rooms chat server for hosting on-line events, and the Assist application for posting customer service information like FAQs and searchable message boards. Ichat Assist creates threaded HTML discussion archives and can be used for real-time on-line sales support. Ichat Events starts at $1595 and Assist at $2495. They run on a variety of server architectures.
Contact: Ichat, Austin, TX, 888-242-8669 or 512-425-2200; http://www.ichat.com.
Enter HotBYTEs No. 991.

Security

Barbarians at the Gateway

IF YOU CAN'T DEPEND ON DESKTOP BROWSERS to give you sufficient Internet security, SurfinGate 3.0 can add enterprise-wide Java and ActiveX protection at the network gateway. It scans for ActiveX controls and Java applets and determines if the components it finds in Internet traffic fit rules you have set governing acceptable behavior by these scripts. SurfinGate for NT ($1250 to $14,950) can also protect against unwanted JavaScript, VB Script, plug-ins, and Internet cookies.
Contact: Finjan, Santa Clara, CA, 408-727-8120; http://www.finjan.com.
Enter HotBYTEs No. 993.

PC Guard Dog

WITH AN ORDINARY DESKTOP VIDEO CAMERA you can leave a PC or laptop alone to defend itself against thieves. PC Snoop ($99) is sensitive to motion, recording any activity within the view of your desktop camera (recording the movements of an intruder, for example). Plus, it can be set to trigger an audible alarm. When no motion is detected, the application goes into sleep mode. The system can also be set up so that people can leave video messages on your computer. PC Snoop can pro-

tect a system with, minimally, a 75-MHz Pentium, 16 MB of RAM, and a parallel-port video camera.
Contact: Darim Vision, Los Angeles, CA, 800-432-8905 or 213-637-1700; http://www.darvision.com.
Enter HotBYTEs No. 994.

Analysis

Enterprise-Wide Reporting

CRYSTAL INFO 5.0 ($749 PER USER) BUILDS on Seagate Software's Crystal Reports application, creating an enterprise-wide reporting and analysis tool. It is designed to make OLAP functionality available on the desktop and offers a new three-tier architecture for greater scalability (versus a two-tier architecture with Crystal Reports). It has new security features and administration modules that control

Expedia Trip Planner 98
$39.95

Enter HotBYTEs No. 1008.

Microsoft
Redmond, WA
206-882-8080
http://www.microsoft.com.

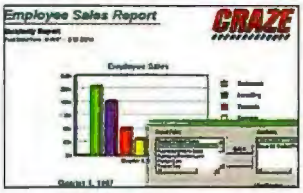
Help for Getting from Point A to B

The classic question "Where are we on the map?" is now a lot easier to answer with Microsoft's Expedia Trip Planner 98. This comprehensive travel and trip planner, which was formerly called AutoMap, is a valuable tool for business or personal travel throughout the U.S., Canada, and Mexico. The heart of the program is the updated route planner, which allows for customized and rapid point-to-point planning from start to destination. It includes numerous automated features for tweaking and fine-tuning your trip.

The new version provides excellent travel information, including 17,000 restaurant listings from the Zagat survey and detailed listings on 19,000 hotels. Direct links to the Microsoft Expedia on-line service let you book flights, hotels, or rental cars for a trip. Trip Planner has plenty of detail on points of interest and stopovers, though this is probably of more appeal to a family on vacation than to a typical business traveler. Still, this extra information, along with attractive and well-done maps, helps round out this product. Support for the Global Positioning System is built in, though you need to purchase a GPS receiver separately.

Overall, the features in Trip Planner 98 are pretty much on par with Rand McNally's new TripMaker (and TripMaker Deluxe). Both products let you plan your itinerary, print out detailed directions and maps, and access their additional resources. Trip Planner has superior hotel and restaurant information, while TripMaker has a few more features for route planning. Still, for $39.95 (including a single-use Kodak camera), Trip Planner 98 is an excellent and well-priced resource for any type of general business or family travel in North America and Mexico.

– Jon Pepper



group and individual rights to access data. New scheduling applications automatically generate reports for an individual or for groups of users. The application can support clustered servers and 25 databases, and it can be accessed with a Web browser.
Contact: Seagate Software Information Management Group, Vancouver, BC, Canada, 800-877-2340 or 604-681-3435; http://www.seagatesoftware.com.
Enter HotBYTEs No. 995.

Drill-Down Reporting Tool

THE RAIMA REPORT WRITER ($495) HAS two levels: a DBMS driver for accessing the Raima Velocis database server or Raima's Database Manager++, and a report server that can be implemented in two- or three-tier configurations. The report writer is designed to work with embedded Raima databases as well as standard ODBC databases, and it can access embedded data like arrays and C data structures that might be beneath the reach of ODBC reporting tools without access to Raima data types. An OLAP extension is slated to appear in 1998.
Contact: Raima, Seattle, WA, 206-515-9477; http://www.raima.com.
Enter HotBYTEs No. 996.

Visual Data Analysis for NT

STATSERVER 2.0, THE LATEST VERSION OF the program for electronically distributing statistical analyses and graphics to business users, adds new Web publishing functionality and access to MathSoft's latest data-mining technology. New Web wizard tools make it easier to create and deploy applications that have custom models and graphics. The program integrates with MathSoft's new S-Plus 4.0 compute engine for enhanced graphing and statistical methods. Native HTTP support lets you deploy the software on your intranet. The NT-based package costs $200 to $500 per user.
Contact: MathSoft, Cambridge, MA, 800-628-4223 or 617-577-1017; http://www.mathsoft.com.
Enter HotBYTEs No. 997.

E-mail

E-Mail Made Easy

SUN'S INTERNET MAIL SERVER AIMS TO simplify e-mail by eliminating the gateways and translation mechanisms that can lead to unreadable or undeliverable messages. The software supports native Internet standards, including LDAP, ESMPT, TCP/IP, MIME, and POP3 instead of proprietary e-mail standards. Prices start at $1495 for a departmental server and $3495 for an enterprise configuration. The server scales from a single-processor architecture up to 64-way multiprocessor systems and runs on Intel-based machines or Sun SPARC-based Solaris systems.
Contact: Sun Microsystems, Palo Alto, CA, 650-960-1300; http://www.sun.com.
Enter HotBYTEs No. 998.

Networking

Real Security for Virtual Networks

AN OPEN TCP/IP ENVIRONMENT NEED NOT compromise the security of your network traffic. V-One's SmartGate supports virtual private networks (VPNs) with secure sessions and centralized management. The software works transparently behind a corporate firewall. Users employ software-based tokens (virtual smartcards) or physical smartcards for authentication. SmartGate provides security across multiple VPN

communication layers (application, session, and network) and supports standard security protocols like SSL, PCT, TLSP, SET, and PPTP as well as X.509 and LDAP certificate protocols. SmartGate costs $6000 for server-side software, $25 for client-side software.
Contact: V-One, Germantown, MD, 301-515-5200; http://www.v-one.com.
Enter HotBYTEs No. 999.

Software Update

For professionals who want to create 3-D animations and special effects with video, **Infini-D 4.1** for Win 95 and NT adds numerous features, including support for Real Time Geometry's multiresolution geometry, as well as new over-video compositing capabilities. File support for multi-res geometry lets artists interactively change the resolution on any 3-D model and customize the number of polygons a model uses. This lets designers give models that appear closer to the user more polygons for higher-resolution images; models that appear further away are rendered with fewer polygons, reducing rendering times. New preview-over-video shows how an animation will composite over background video, eliminating the need to render test animations. Field rendering, nonsquare pixels, and NTSC/PAL color correction support make the program more applicable for broadcast video. Other features of the $899 program include a new interface with floating toolbars, targeted cameras, and visible light beams and rays for creating videos with that fashionable *X Files* look.
Contact: Metacreations, Carpinteria, CA, 800-846-0111 or 805-566-6200; http://www.metacreations.com.
Enter HotBYTEs No. 1004.

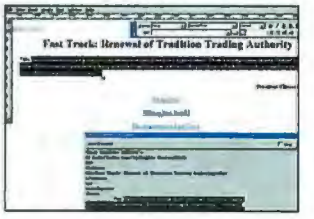
Norton Utilities 3.0, now with a redesigned console-style interface, comes with new features like a rescue tool that works with Iomega Zip disks; a utility for monitoring the Windows 95 registry, system files, and software applications; and a quick-start function for launching applications. This latest release of the Windows 95 utility program comes with a limited-time Norton Web Service subscription for downloading patches or new drivers; Anti-Virus is incorporated into the software. System Doctor, which runs continuously in the background, monitors more than 80 system operations. The package includes Norton CrashGuard 3.0, which can unfreeze applications and save your work in the event of a crash. Utilities 3.0 costs $79, or $30 to upgrade.
Contact: Symantec, Cupertino, CA, 408-253-9600; http://www.symantec.com.
Enter HotBYTEs No. 1005.

Accounting for the vicissitudes of the business world can be maddening, so **Forecast Pro Version 3** ($595) takes rules-based, multilevel event modeling and makes adjustments for strikes and other irregular occurrences that can affect a forecast. Using the same procedures as the U.S. government to estimate major macroeconomic indexes, Forecast Pro helps large and small businesses project sales, revenue, and public demand for services. It recommends the appropriate forecasting techniques for specific functions, analyzes data, and explains the reasoning behind its recommendations. It includes procedures like smoothing models, Box-Jenkins, and dynamic regression methods. The software works with ODBC-compliant databases, and it reads and writes directly to Excel or 1-2-3 worksheets.
Contact: Business Forecast Systems, Belmont, MA, 617-484-5050; http://www.ourworld.compuserve.com/homepages/ForecastPro.
Enter HotBYTEs No. 1006.

Authoring

Professional Web Design Tools

DREAMWEAVER ($299) IS A WEB-authoring tool for professional designers. It has a single dialog box where you can program default styles, create your own custom styles, or define how your elements are deployed across a Web site. Another interface, called Roundtrip HTML, ensures that when you



download source code, the editor does not mangle it, a problem with some graphical editors. You can drag and drop graphical elements, and the HTML editor keeps track of where the image is, changing x and y coordinates and creating the appropriate tags. Macromedia has integrated its familiar Director graphical interface for controlling multimedia as well as Dynamic HTML elements. It lets you build frames and tables using a drag-and-drop approach. There's also an extensible UI for custom palettes.
Contact: Macromedia, San Francisco, CA, 415-252-2000; http://www.macromedia.com.
Enter HotBYTEs No. 1000.

Utility

Keep Your Hard Drive Clean

CLEANSWEEP DELUXE ($59) RECOVERS hard drive space by deleting files unintentionally downloaded while you surf the Internet. It prevents downloads from happening without your knowledge and removes files transparently. Quarterdeck's TuneUp AV software provides antivirus protection. The package identifies "Internet debris" like cached items, Web cookies, ActiveX controls, and browser plug-ins, then removes them without affecting files you've intentionally installed.
Contact: Quarterdeck, Marina del Rey, CA, 800-683-6696 or 310-309-3700; http://www.quarterdeck.com.
Enter HotBYTEs No. 1001.

Modems

K56 Software Modems

PC-TEL'S PCT388 HOST SIGNAL PROCESSING (HSP) modem offers K56Flex technology without forcing you to buy any new modem hardware. HSP software modems use a host computer's CPU to perform the signal processing usually handled by dedicated processors on a modem. This software modem currently provides 33.6-Kbps baseline data/fax/voice and HSP speakerphone functionality, but you can upgrade it to 56K for $59.
Contact: PC-Tel, Milpitas, CA, 408-383-0452; http://www.pctel.com.
Enter HotBYTEs No. 1002.

Programming

Write Once, Run Anywhere

THE SUPERLINGUIST MANAGER MAKES IT possible to simultaneously launch multilingual versions of Windows applications without affecting your source code. The Manager ($3000) creates a dictionary file containing the origin language and words and phrases from the language(s) into which you wish to translate an application. A desktop client ($80 for 25 client seats), the Superlinguist Engine, performs real-time translation using the application dictionary, automatically producing multiple versions of the same program in different languages.
Contact: KT International, East Hartford, CT, 860-289-0728; http://www.ktintl.com.
Enter HotBYTEs No. 1003.

improbable

Advances and Retreats in Computing

A high-tech solution for pet owners whose dogs won't shut up and won't obey.

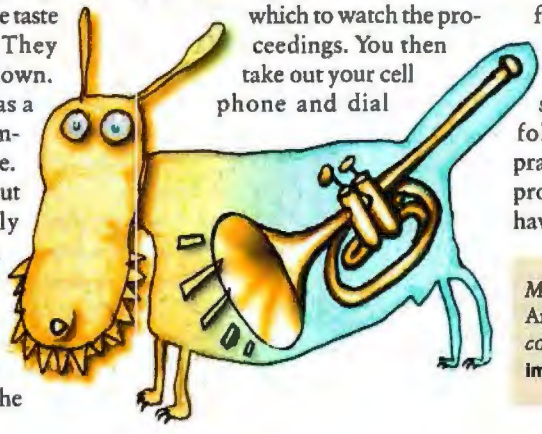
PET SOUNDS

Three of the most annoying things about modern life are endlessly blaring car alarms, ceaselessly barking dogs, and incessantly in-their-own-face cell-phone users. On the theory that three wrongs can be combined to set things right, Q-Smith, Ltd., of Toronto, has come up with a nifty new product called Doggie Don't, which combines cell-phone technology with a miniature car alarm.

Doggie Don't may exist at the fringe of legality, but it is sure to create a huge market for itself. The whole thing is the size of a big wad of chewing gum. The outside consists of latex chewing gum laced with extract of beef. The inside is a battery-powered mini car alarm joined to a cell-phone receiver. You feed the whole thing to a dog, especially an annoying bark-bark-barking dog. Barking dogs love the taste of Doggie Don't. They happily gobble it down.

Doggie Don't has a second, separate component: a cell phone. You can use your own cell phone, but the manufacturer conveniently includes one in the package, just in case you need it. When you come across a dog that won't stop barking, toss it some Doggie Don't. No matter how much Rover is frothing at the mouth, he will not resist the temptation to gulp down a yummy wad of chewing gum that tastes like beef.

After the hound has taken the bait, you can stroll to a nearby park bench, wander down the road, or just stand where you are. It makes no difference—you are simply selecting the best spot from which to watch the proceedings. You then take out your cell phone and dial the number assigned to the Doggie Don't that poochie just swallowed. Scant milliseconds later, Rover's insides will commence wailing and howling something fierce. The dog will immediately stop barking.



This product is reusable. In three to five days, Doggie Don't will have passed through, and from, the dog. Finding and retrieving the unit is a snap. You merely dial its number, then follow the alarm sound. Of course, pranksters will have a field day with this product, but that's the price we pay for having such flexibly useful technology.

TECHNO-INTESTINAL FEEDBACK

Q-SMITH has a companion product to Doggie Don't. It is called Doggie Do. The technology is the same, but instead of a loud car alarm, Doggie Do makes the familiar soft beeping sound that comes from most cell telephones. This is a useful tool for conditioned-response canine obedience training.

Doggie Do has not one but two phone numbers assigned to it. Dial the second number and instead of beeping, the Doggie Do unit makes a cat-purr sound. It is profoundly thought-provoking for a dog to hear a cat-purr sound coming from its own innards. There is a mixture of (a) prideful delight at the thought that "Maybe I just swallowed a cat!" and (b) dismay at the nagging notion that "Maybe I *am* a cat!" Psychologically, this prepares the dog not only to accept criticism, but to use that criticism to effect meaningful personal change.

Marc Abrahams is the editor of the Annals of Improbable Research. *You can contact him by sending e-mail to* **marca@improb.com.**

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