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News & Views

VISUAL BASIC 5.0

At Last, VB Gets a Compiler!

Visual Basic 5.0 is finally due to be launched on March 19th. We have no firm details yet, but it is expected to include the following:

- **Developer Studio IDE** with "smart" editor, SDI or MDI, new forms engine, lots more
- **Native Code Compiler** (not in Standard) or p-code.
- **Create ActiveX Controls** and put them on your Office 97 toolbars
- **Function Addresses** allow callbacks (hurray!)
- **Rational Object Modeler** supports business process, data, object & application modeling, generates source code
- **Enterprise Edition** includes a repository (with API), advanced network OLE functions and database enhancements (high-speed local cursors, batch updates, cursor update events, asynchronous options, etc, etc)

Plus much, much more, as they say! Call us for full details and pricing, including updates.

VISUAL C++ 5.0

More Client/Server & Web Support

Visual C++ 5.0 is also due on March 19th - expected new features include:

- **ActiveX Template Library** (ATL)
- **Thin-Client** rapid development with MFC
- **Three-Tier** apps with COM and the new Transaction Server

Call us for full details on this exciting new release.

VISUAL J++ 1.1

Create COM objects

Visual J++ 1.1 is also due on March 19th - it will let you create COM objects and integrate them into a Web server for use by any browser.

Call for more details and update pricing.

ASYMETRIX SUPERCEDE

The New Java Champion?

Asymetrix's new Java RAD tool has some really outstanding features that make it well worth checking out:

- **Incremental Compiler** lets you modify apps *while they are running!*
- **Forms-Centric IDE** has been designed to minimise desktop clutter, has all the usual browsers
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- **Advanced Debugger** lets you modify a method and then call it again! Tracepoints can execute a series of Java statements
- **C++ Compatibility** - implement native Java methods in C++

There is no space to do justice to SuperCede - any Java developer should call us for full details. No pricing as we went to press - but it should be competitive.

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SoapFlakes

Practical issues arising from EMU

I never cease to be amazed at the way in which politicians simply ignore the realities of implementing their decisions. The latest example is the schedule for European Monetary Union (EMU) and the introduction of the Euro, which is set to start on 1 January 1999.

This date certainly can't be driven by anything as unusual as common sense. Because no-one who has experienced the year-end problems which bedevil all systems would choose Jan 1st as a start date; and 1999 clashes nicely with the year 2000 maintenance effort anyway. More than that, because European countries such as Germany will almost certainly be introducing the Euro at that time, the rest of us will have to do the hardest bit (writing software for international accounting) first.

The popular press, of course, is giving everyone the impression that EMU won't affect us in the UK. Its opposition seems based more on xenophobia than the manifest difficulties of getting the software working in time but, in fact, even if we don't join, anybody writing any sort of accounting software is probably going to need to be aware of the EMU regulations, especially if they work for big corporates or banks. This is because the Euro will be in use in some part of most organisations trading internationally, and in any case more and more companies are treating Europe as a single market. Some companies (such as Marks and Spencer) are even considering accepting the Euro in UK shops (for the tourist trade) regardless of whether the UK joins EMU. Perhaps because of the noise made by eurosceptics, however, many UK companies are starting late: Marks and Spencers has already spent 8 years preparing for EMU. However according to a KPMG survey (quoted by Dennis Keeling, director of BASDA – the Business and Accounting Software Developers Association – at a recent conference on the implications of EMU), although about 10% of German businesses are ready for EMU now, over 50% of UK business haven't even started – and almost none are ready.

The basic impact of the Euro is that the traditional national currencies will be used in parallel with the Euro for a time and multi-currency accounting is therefore important. There's also a bookkeeping issue, as you may need to keep and balance books in each currency (auditors expect exact balances) and you'll also have to consider what to do about historical time-series figures in MIS data warehouses. The main technical issue is that the rules for Euro currency conversions are precisely legislated so as to reduce the effect of rounding errors, and so any existing conversions will have to be checked for compliance. The rules are described in a series of papers published by the Bank of England called *Practical Issues Arising from the Introduction of the Euro* (ISSN 1365-9707) but the essential rules are (currently) as follows:

- Conversion rates must be adopted with 6 significant figures, and must not be truncated or rounded when making conversions.
- The official conversion rates must be used both ways (you can't use a reciprocal of one conversion rate to convert the other way), and conversions between 2 currencies must go through the Euro as an intermediary.
- When you round to the nearest cent or whatever at the end of conversion, a final .5 must be rounded up.

The regulations apply purely to currency conversions, not to calculations of daily loan interest, for example, but it seems to me that they'll become a standard of 'accepted good practice' for conversions in general. Thus, system designs which can be converted to Euro processing later (and back again – politicians do change their minds) will have a marketing edge.

Being Euro-compliant isn't difficult if you're starting from scratch. It isn't too hard if a package in use copes with multi-currency accounting already (the Euro is just another currency). But could require major changes if software doesn't store the currency anywhere and assumes a single local currency (there's a worrying potential for bugs caused by incorrect assumptions about currency in special case processing). EMU accounting could be a bigger maintenance project than Year 2000 compliance, as the logic is considerably more complex, although the good thing is that it's likely to keep unemployment in the programming industry low for years.

Whatever the politicians say, EMU is going to happen sooner or later (even in the UK) because it makes sense for big multinational companies – and it may fuel the rise of a few megabanks from the existing banks (mostly American – so we're sure this wasn't part of the politicians' plan) that can already provide 'one stop shopping' for pan-European money services.

EMU is one political initiative which really might end up being driven by the market rather than by politicians so, if you program financial systems, don't let the popular press damage your career by making you think that the Euro processing rules aren't going to be important to UK programmers.

David Norfolk
drhys@cix.compulink.co.uk

Mayhem!

Jules ponders the great equaliser...

There was a time that, when flicking through the adverts in *EXE* or *Dr Dobbs*, almost every name in every advert before your eyes would include the symbol '++'. If a product didn't have a pair of plusses in it somewhere, it was a definite minus. Then, the plusses fell out of favour, and every product became 'visual', presumably to distinguish the new products from the old audio or tactile varieties. Now, every advert sports a cup of coffee, because if a product can't speak Java, it's nothing. Soon, even printer drivers will be getting in on the act.

I've written before about the mad, unthinking rush to Java, but all these new products and all the adverts trumpeting them are irrefutable evidence that the Internet is going critical. Of course, the real problems of limited bandwidth, finite URLs, and so on are about to start limiting the growth of the Network. I don't care very much. I can always complain about day-long page loads, and when the mathematicians figure out how to make bandwidth too cheap to meter, then everybody will get their own address or five.

Don't misunderstand me: I'm not pouring scorn on the idea of the Internet. I like the idea of amateur publishing at almost zero cost, and I like the idea that a small company such as mine can advertise on equal footing with multinationals. I'm not even one of those people who laments the fact that business is moving in and spoiling it for the rest of us, because it seems to me that business will demand the kind of service levels that a loose-knit band of amateurs and techies could never achieve. No, I applaud the idea that, after 2000 years of grand words about democratising free speech, we finally have a medium which can bring it about.

But, surprisingly, there are those who disagree with me. Eyes have been cast towards Russia, when Yeltsin mobilised the populace right across the union in a couple of days, while the military had no idea what was going on, and the eyes have thought 'that could happen here'. Those same eyes were cast to Canada, where in a smaller event, details of a court action which were locally blacked out were distributed worldwide to safeguard the public interest, and those eyes asked 'what about the secrets on which our own power is based?' And those

eyes want to put a stop to all this talking to each other.

Europe represents old power, and old money. The things we do, we've done the same for hundreds of years. Not for us the kind of total social upheaval that Russia saw at the beginning of the century, or that China saw in the thirties. Not for us the 'virgin land' that the Americas represented two hundred years ago, and in which even fifty years ago they were still trying to invent themselves. Not for us the complete social and economic clearance and reconstruction that the 'tiger' economies are willingly inflicting on themselves right now. No, Europe isn't used to change, and generally doesn't like it.

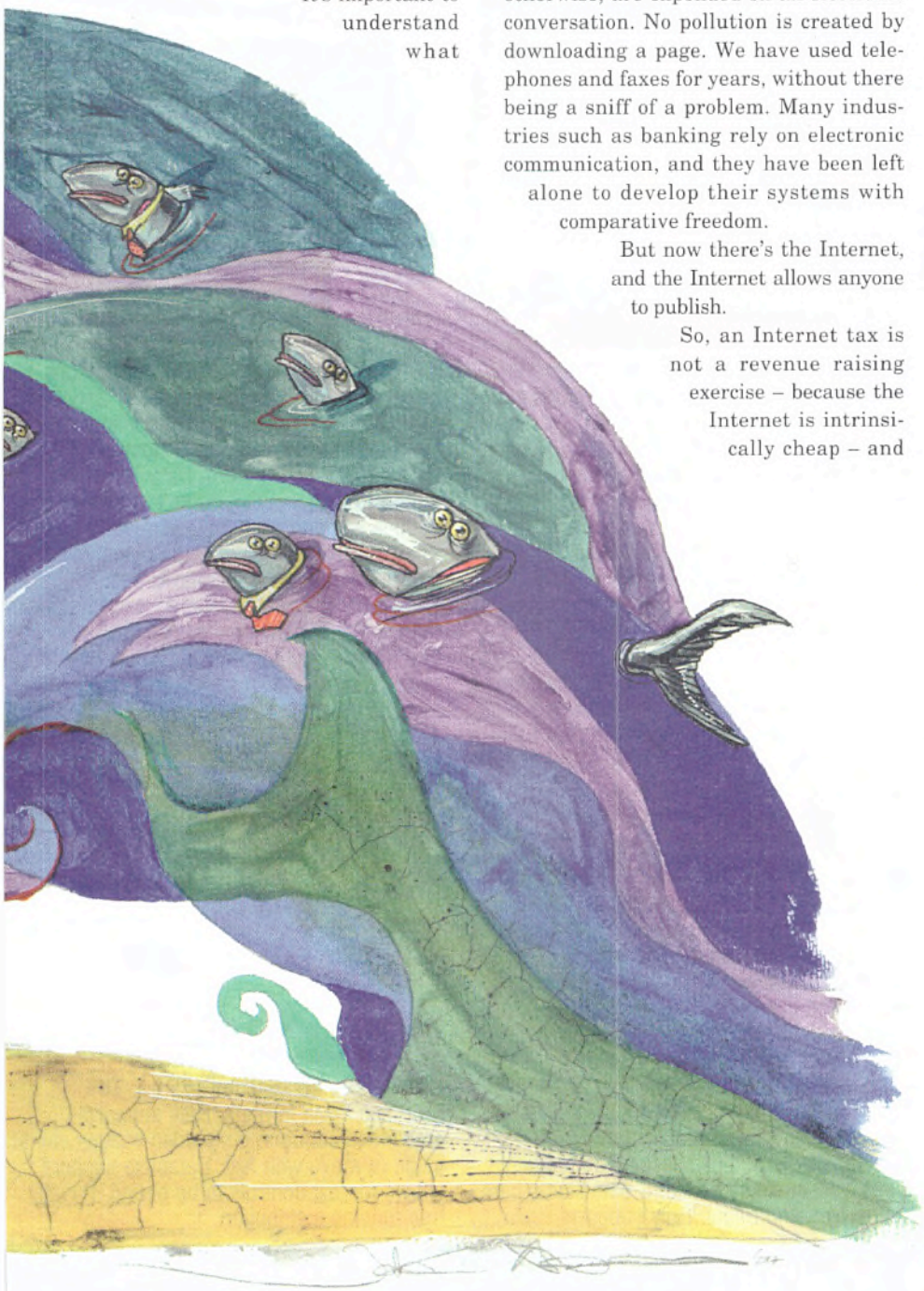
And, that's why Brussels has suggested imposing a tax on the Internet.

It's important to understand what tax is. Of course, it raises revenue for the government, so it can afford to supply such essential services as police, healthcare, and committees to discuss (in closed session) the morality of the government. But tax has a far more important effect: it distorts economic forces. If the government decides that it wants more people to use green petrol than red petrol, it increases the tax on red petrol and (if it's feeling particularly generous) decreases the tax on green petrol. In the case of petrol, this approach makes sense: taxing pollutants makes it more expensive to to pollute, and tax on non-renewable resources makes the resources last longer. In this context, the principle of taxation is good.

But, these arguments don't apply to the Internet. No resources, renewable or otherwise, are expended on an electronic conversation. No pollution is created by downloading a page. We have used telephones and faxes for years, without there being a sniff of a problem. Many industries such as banking rely on electronic communication, and they have been left alone to develop their systems with comparative freedom.

But now there's the Internet, and the Internet allows anyone to publish.

So, an Internet tax is not a revenue raising exercise – because the Internet is intrinsically cheap – and there are no environmental issues that don't apply equally to other forms of electronic communication. No, an Internet tax is one thing and one thing alone: an attempt to make free speech uneconomic. Remember Russia? Canada?



What makes the Internet tax so pernicious is that this same approach has been taken before. In the last century, the telegraph Networks were being developed by private companies. Alone in the world, the French government feared the effects of common people transmitting any message they wanted, so took the entire telegraph system under government control. They set back telecomms technology and its use fifty years, and it wasn't until the development of Minitel that France caught up. Even in Britain, while the campaign to legalise CB radio was going on, ministers would regularly lament the fact that, if common people could talk to each other willy-nilly, they would be aided in the commission of crimes.

Assuming that a tax on Internet usage is enforceable (and think for a moment about the level of intrusion, and the costs of monitoring, that such enforcement would demand), the effect of an Internet tax would be to restrict free speech. But more important, if the populace of Europe doesn't get used to using the Net, and if businesses don't publish on the Net because not enough of their target market are wired to justify the distorted costs of publishing, then business in Europe will not be able to compete on the world stage. While the Americas, Russia, and the Far East are busy trading with each other using basic technologies like cheap advertising, comprehensive indexing, electronic letters of credit and currency-independent funds transfer, we will still be using faxes, mailing lists, paper, and cheques. We won't be able to trade with them, and they won't be able to trade with us, and the Ecu, or Euro, or whatever stupid name they invent for the common currency will become as soft as the Rouble.

Just as Russia had to, Europe must realise that things can't be unindented, and the world is changing whether we like it or not. We cannot stand against events and command them, Canute-like, to turn back. We must embrace the changes. In contrast, an Internet tax is Stalinism all over again. It will have the same intolerable consequences. It must be stopped. ■

Jules is a programmer with quaint ideals about freedom of speech.

For tax purposes, he resides electronically at jules@cix.compulink.co.uk.

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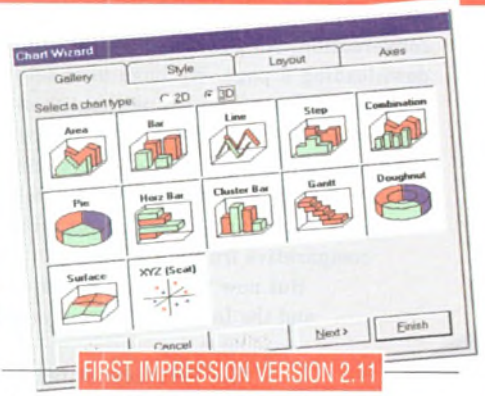

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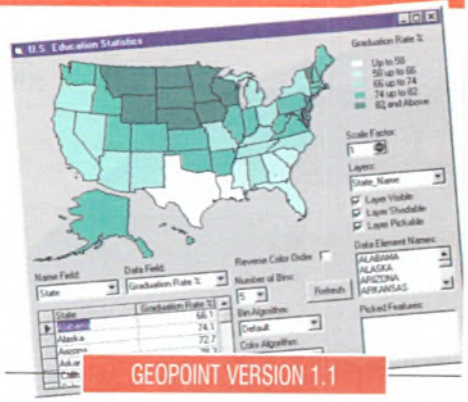

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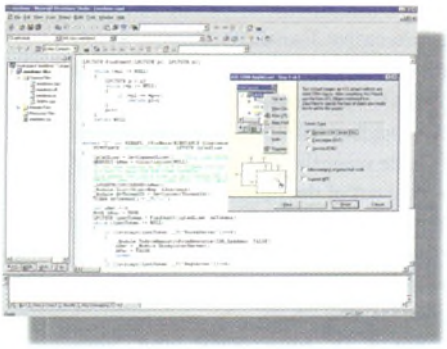
CIRCLE NO. 102

Visual C++ 5.0 focuses on faster, easier COM



Microsoft has finally announced the feature set of the forthcoming Visual C++ 5.0. New and improved facilities in the release focus on developing COM objects and ActiveX controls, and a revamped compiler which is claimed to produce smaller and faster executables than previous versions.

Native COM support has been added, allowing any old COM object to be reused in a VC++ project, regardless of the original source language. A novel feature called Visual COM provides a graphical guide to adding methods and properties to COM objects, removing the need to write the code by hand. As well as the latest version of MFC, VC++ 5.0 will ship with the Active Template Library (ATL). First previewed by Microsoft last year, ATL is a template source library which encapsulates the instantiation, handling and garbage-collection code normally associated with COM, and builds minimum-footprint objects based on the single-interface ActiveX standard. Wizards for generating ATL projects are included in the package.

Microsoft's claims for the revised compiler will take some living up to: on average, it is supposed to generate executable code which is 10% smaller and 10% faster than that built with VC++ 4.2, with the penalty of slightly slower compilation times. The compiler additionally supports optimisations for Intel's next generation Pentium Pro and MMX chips. The overhauled Developer Studio environment is now scriptable with VBScript, as included in Internet Explorer 3.0.

Pricing details are yet to be announced, but VC++ 5.0 is expected to be available on March 19.

- *For more information, point browsers at http://www.microsoft.com/visualc*
- *The new telephone number for public enquiries at Microsoft is 0990 228811*

Visual Studio bundles developer tools

In an unexpected move, Microsoft has announced that it will bundle all its professional-level developer tools in a single package, to be named Visual Studio. Spurred on by leaked reports in the US press about the product, code-named 'Boston', the company has released some details about the bundle earlier than planned. Visual Studio 97 will include the following products: Visual C++ 5.0, Visual Basic 5.0, Visual J++ 1.1, Visual InterDev 1.0, Visual FoxPro 5.0, and the MSDN library CD.

The focus of the bundle seems to be firmly on Internet development; each of the products is capable of building or utilising ActiveX controls, with full support for COM. Database access is high on the list as well, via ODBC (and in some cases JDBC). The full feature set of some of the tools is not yet known, although a number of details about Visual Basic 5.0 and Visual C++ 5.0 have been revealed (see above).

Another key element is the revamped Developer Studio interface shared by three of the products. Bringing the disparate languages together under a single interface and single set of development tools has been Microsoft's goal for some time, and rumours continue to circulate that the next version of Visual Basic will be integrated (like Visual C++, Visual J++ and Visual InterDev) in the Studio environment.

It seems that Microsoft is hoping that putting all its tools in one basket will have the same results as the bundling of the Office applications, ie a commanding lead over its rivals. If bundling catches on, we can expect to see similar offerings from other leading tool vendors over the course of the year. At the time of going to press, Microsoft had not revealed either the release date or pricing for Visual Studio 97, but a competitive upgrade plan for owners of a number of packages will be available.

- *See the Microsoft web site at http://www.microsoft.com/vstudio for more details*

DBWorld 97 helps 'build the extended enterprise'

The DBWorld 97 exhibition and conference, which takes place 19-20 March, will focus on Web-enabled information systems, intranets, OLAP, data warehousing, relational and object-oriented systems and information management in the 'extended enterprise'. Speakers at the conference, which adds two special seminar days on 'Data mining and knowledge discovery' and 'the Third Manifesto' before and after the exhibition, include Chris Date of Codd & Date fame, Roger Till of the Electronic Commerce Association, and the ubiquitous Robin Bloor.

The exhibition and conference take place at London's Olympia, with each visitor receiving a copy of the DBWorld 97 Survey results. The survey, taken last year, monitors trends in the database industry and makes some bold predictions about what will happen in the coming months. A number of well-known companies will be exhibiting at the show, including Unisys, IQ Software, and of course *EXE*.

Pricing for the conference is £1050 including VAT, while the pricing for each seminar day is £580 including VAT. A special price for all four days is available at £1750.

- *For more information, to reserve a place at the conference, or to pre-book for the exhibition, contact Expo Europe on 0181 541 4865.*

NEWS

- Rational Software has officially submitted the **UML** (Unified Modelling Language) 1.0 specification to the **Object Management Group**. UML is the result of work by **Booch**, **Rumbaugh** and **Jacobsen**, and has the support of companies including TI, Cayenne and Select Software Tools. 01273 624814

- USoft **WebRuler** and Visigenic **Visibroker** for Java are coming together to form the first rule-based Java client/server tool to incorporate an **IIOP**-compliant CORBA 2.0 **ORB** written entirely in Java. Promised additions include improved load-balancing. 0181 891 4000

- The benefits of Microsoft **Visual SourceSafe** are brought to **Unix** by **Mainsoft**, which has ported it for a variety of Unix variants, and added a number of features aimed at Web site developers. 01273 270270

- **QualityTeam** is a 'product life cycle management system that utilitises information from QA, sales, marketing, engineering and customer support' to make life easier for the development team manager. 01753 559724

- Borland's **IntraBuilder** is now available in a client/server edition which builds applications that work against industry standard databases from **Oracle**, **Sybase**, **Microsoft** and **Informix**. A trial version of IntraBuilder (in English, French or German) is available on the Borland web site, www.borland.com

News

- Data Views' **DV-Centro** is a tool for building visual programming environments, which require no textual programming at all. Version 1.2 has been released on **Windows NT** for the first time. 001 413 586 4144

- IONA's **Orbix ORB** is now available to **Smalltalk** programmers. Orbix/Smalltalk is the fifth product in a range which includes versions for **Ada95**, C++, Java and **COM**. The ORB complies fully with the requirements of **CORBA 2.0**. 001 617 949 9000

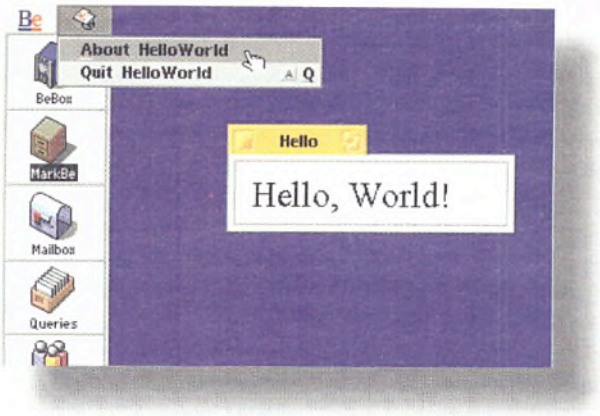
- From **Magic** Enterprises comes **MagicWeb**, an Internet/intranet transaction processing engine add-on to the Magic **RAD** development environment. Available for Windows 95/NT and **Solaris**, pricing starts at £995. 01344 303045

- The **Oracle** Web Developer Suite is a set of development tools for building intranet client/server applications. Compatible with Oracle's **Network Computing Architecture**, the suite takes advantage of existing Oracle tools such as **Developer/2000**. 0118 924 0000

- Database developers looking to get into Data Warehouses and **Datamarts** could do worse than look at **Vmark's DataStage**, a tool for precisely that purpose. The software breaks warehouses up into reusable components called 'stages' to make code reuse possible. 01344 355551

Let the PowerPC Be...

Be is a company formed by ex-Apple executive Jean-Louis Gassée, which launched the dual PowerPC BeBox and the BeOS operating system (see News in *EXE* October '96). Why the past tense? Well, Be recently announced that it was moving out of the hardware business. It had only been making computers in order to provide an affordable multi-processor desktop computer to run its operating system on.



BeOS is fully SMP and very scaleable, and today cost-effective single- and multi-PowerPC based Mac clones are appearing from a number of vendors. Thus, the BeBox is no longer needed (although Be will continue to support it for the next three years), and Be will focus solely on BeOS. The current release, DR8 (which stands for Developer Release 8) has been ported to the PowerPC Mac platform. The initial work on this took only one month back in August last year, though this was admittedly a very early prototype. This is not the BeOS's first platform jump: it was initially developed on AT&T's Hobbit processor before the PowerPC was adopted for the BeBox.

Since Microsoft is abandoning all future development of Windows NT for PowerPC, the OSs left for this processor are BeOS, MacOS and the Apple's forthcoming Rhapsody. With the Mac clone business thriving – Power Computing, Motorola, UMAX and DayStar are all competing – BeOS has the potential to grab a sizeable share of the desktop market.

Email: info@be.com *http://www.be.com* *Tel: 0033 1 49 06 73 77*

A developer's dream comes true

BeOS was first shown publicly in the UK last month, specifically DR8 running on a Power Mac single PowerPC-604 machine with 32 MB of RAM. The OS's multi-threading performance is very impressive: with several video streams, a MIDI sound file, a fractal calculation, a Web browser and a few other applications all running at the same time, one can move a window without impacting any of the performance (and no it doesn't stop anything). All in all, the demonstration included 100 concurrent threads! The system footprint is remarkable, too: about 7 MB of hard disk space is needed: 2.3 MB for BeOS (the microkernel itself weighs in at 280 KB) and about 5 MB for the GNU tools.

One of BeOS's characteristic features is a fully integrated database, which in DR8 is almost indistinguishable from the file system – and in DR9 they actually will be the same thing. Every application has access to the database, enabling some very powerful queries to be performed on the file system – this is extremely valuable to applications like the mail program. Of course, any changes to some data which impact the result of some query cause the folder displaying the results to be automatically updated.

DR9 is planned for April, and the first general release for sometimes during summer. Other promised features include better integration between the GNU tools and the database, and a fix to DR8's habit of dumping most configuration files in the root directory (old Unix habits die hard). Also the CodeWarrior C++ compiler from MetroWerks will be integrated with the AppSketcher development tool, which will additionally be able to script CodeWarrior.

The whole developers guide can be downloaded from the Be Web site.

TI Composer 4 makes sweet client/server music

Just out from Texas Instruments is a model-based client/server development tool which works solely with off-the-shelf or in-house components. Composer 4 features a visual development environment with UML diagrams as the interface. Applications are assembled from the available library of components, with the application logic developed through the diagrams. No code has to be written by hand.

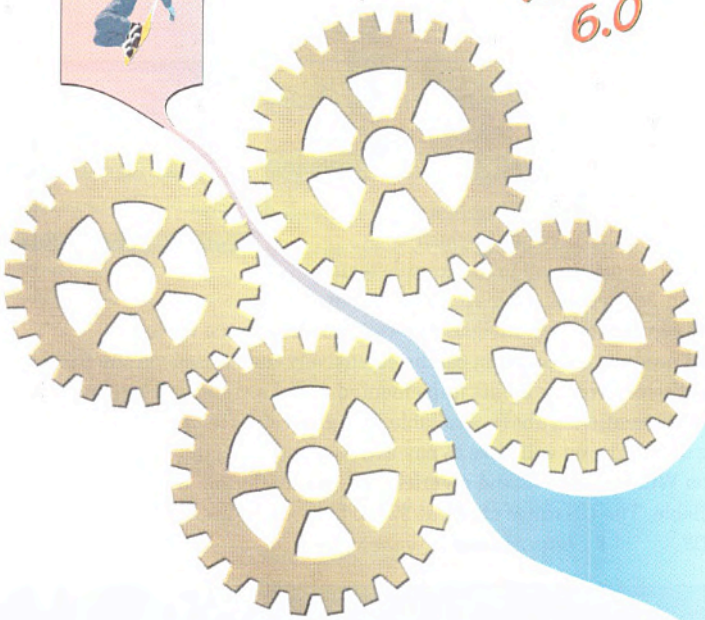
TI is predicting development by component assembly will become the norm by the turn of the century. Traditional techniques are argued to take too long, especially in the light of dramatically increased expectations of software from business. Much of the technology in Composer 4 has been developed jointly between TI and Microsoft as part of the repository project in which the Redmond giant has several other partners.

Composer outputs source code in a variety of forms including COBOL and C/SQL for multiple platforms, distributable across DCE, COM or MQSeries. TI will also be building a library of components for use with Composer which organisations will be able to license or purchase as required, although a variety of standard components are supplied with the product.

Pricing and availability details were not available at the time of going to press, but visit the TI web site for more information.

Texas Instruments: 01784 212000 *URL: http://www.ti.com*

New Version! 6.0



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CIRCLE NO. 103

- **Wavelet** analysis functions are provided by **National Instruments'** LabView Wavelet and Filter Bank Design Toolkit. The kit plugs into existing **LabView** setups, or can be incorporated into standalone C/Visual Basic applications. 01635 523545

- Borland's C++ Builder (the product previously known as **Pronto** and **Ebony**) is available for preview on the company's Web site. The **standard** edition will be priced at £69 and the **professional** at £399. A **client/server** version will also be available. 01734 320022

- Announced at the strangely-named OOPSLA conference in San Jose, **O2**'s Java Relational Binding is a middleware technology that allows for **persistent Java objects** to be written to and read directly from **relational databases**, for pure Java persistence. 01403 211020

- Centura **Web Developer** is an Internet client/server development system which builds three-tier applications across the Centura **ForeSite** application server. ForeSite interfaces with most major databases and browsers. **Download** it at http://www.centura.com

- Automated testing for **SAP/R3** applications comes courtesy of **AutoTester 2.0**, from the eponymous company. AutoTester's AutoController and Virtual DirectTest are required to use the new product. 01734 880224

A hot design tool

Cayenne Software has released version 5 of its repository-based ObjectTeam OMT analysis and design tool. The tool is designed to allow multiple views and model tiers (eg business models and data models) of a project to be worked on simultaneously. Code can be generated automatically in a large range of languages including C++, Java and Visual Basic. Integration with compilers is restricted to the command line, but there is support for manual changes to the code and reverse engineering (albeit via rather unwieldy tools) of existing components.

The core of the ObjectTeam is a centralised model repository (based upon Sybase SQL Anywhere), which offers full change and configuration management for large-scale team development. The repository can be accessed with an explorer-like interface, and there is extensive support for easy navigation between diagrams and models.

Unusually for a commercial product, ObjectTeam can be extensively customised via the freeware Tcl language. The code generators themselves are in fact implemented as Tcl scripts, and can be easily modified. In addition to the languages mentioned above, available code generators include Ada, CORBA IDL, PowerBuilder, and Smalltalk, although you will have to pay extra for these.

The package is available on Windows 95/NT and a variety of Unix platforms. At the time of going to press, UK pricing was unavailable. The US range starts at $2195 for a single user license.

- *Cayenne UK: 01344 300003*
- *http://www.cayennesoft.com*

Microsoft extends Java again with new SDK

Emphasising once again its desire to transform Java into a fully-integrated Windows technology, Microsoft has released version 1.5 of its Java SDK. Aside from the latest 'new and improved' version of the Win32 Reference Implementation of the Java Virtual Machine (JVM), the toolkit includes a plug-in for Netscape Navigator which replaces its own JVM with the Microsoft alternative, which the company claims is faster and more efficient.

Also bundled is the Script Debugger for IE (see last month's news for details) which can also debug Java applets on the page. An improved CAB compression kit for applets is included: Microsoft claims that CAB compression (the scheme first introduced with Windows 95 which has since become a standard for Microsoft products) makes smaller files than alternative techniques (up to 35% smaller in some cases), speeding up applet downloads. However not all browsers support the CAB format, particularly on non-Windows platforms.

With the Java SDK 1.5, Java applets can be built to run within the Internet Information Server (IIS) 3.0 environment as 'servlets'. Java, JScript, VBScript or ActiveX code can run under IIS at the remote side of a connection, outputting HTML to the local browser, and removing the need for the local platform to support any of these technologies.

As a final bonus, the SDK allows developers to compile Java programs as Windows NT services, which can be administered over a network if required.

- *The SDK is available to download, free of charge, from http://www.microsoft.com/java*
- *Microsoft: 0990 228811*

AFC takes the pain out of AWT

Microsoft has announced the Application Foundation Classes, a set of class libraries written in Java which extend the capabilities of the standard AWT. New control classes in AFC include toolbars, tabbed dialogs and tree controls, as well as other widgets which have come to be taken for granted on most GUI platforms but which were not available in AWT which was restricted to a 'lowest common denominator' set of controls to make it run across as many platforms as possible.

AFC (like Netscape's IFC) is written entirely in Java and implements the controls directly in software, which means that it is not restricted to Windows platforms. It will be made available to other tool vendors including Metrowerks and Borland, both of whom have pledged to incorporate AFC into their next version Java development environments. If AFC takes off, then Java programmers will have much less of an uphill struggle to produce interfaces as rich as users have come to expect from native code applications.

The first tool to support AFC directly will be Microsoft's Visual J++, while the AFC libraries themselves will ship with Internet Explorer 4.0. Developers will also be able to freely redistribute the AFC libraries with their projects or for download over the Internet.

- *More information can be found on the Microsoft web site at http://www.microsoft.com/java*

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Scalable SQL ver 4.0 from Pervasive Software (Formerly Btrieve)

New Scalable SQL ver. 4.0 has ANSI SQL support, a Visual Basic Scripting Interface, and tools for creating and executing stored procedures. Scalable SQL is based on the same MicroKernal Database engine as Btrieve, and can be used to provide high level SQL organisation to a Btrieve based application. Scalable SQL ver. 4.0 is now available for Windows NT Server and Novell Netware. **£call**

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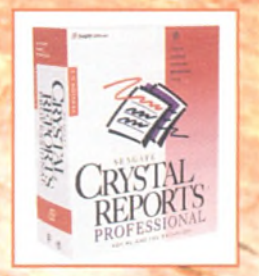

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Symantec Visual Cafe revolutionises Java development; whether you're simply adding animated graphics to a website, or creating sophisticated Intranet applications. Visual Cafe's Rapid Application Development Environment lets you build Java applets and applications visually. It comes complete with ready-made components that you can drag and drop onto forms. Simply select the component — button, text block, dialog box, etc. — and use the Interaction Wizard to specify interactions. **£149; Visual Café Pro. £359**

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MKS Toolkit gives Windows NT3.5+ and Windows 95 developers a full suite of powerful UNIX tools including KornShell, awk, awkc, vi and visual diff for Windows, make, a windows scheduler, grep, sed, tar, cpio, and pax - more than 190 utilities and cammands for performing a variety of computing tasks, with support for NT & 95 long filename. For Win 95 & NT—Intel, Alpha, Mips on one CD. **£259**

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CIRCLE NO. 104

Unix users will be glad to hear that version 2.1 of the **Common Desktop Enviroment**, the Open Group's standard GUI solution, has just been released. CDE 2.1 integrates **Motif** 2.0 and the X Window System into a common application interface. 0118 950 8311

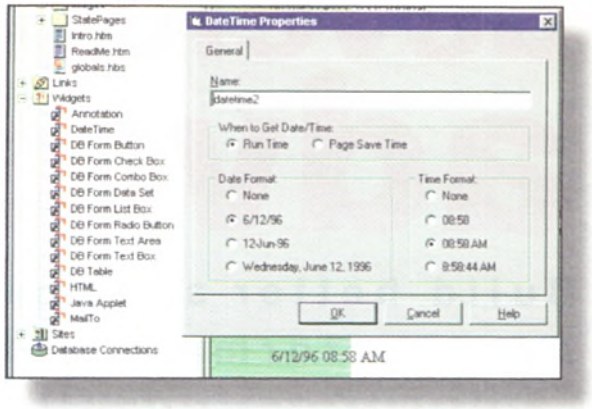
Real-time debugging for **Motorola's ColdFire** 5200 embedded processor family is the goal of Software Developer Systems' **SingleStep**. Using only a **parallel cable** to connect the embedded device to a Windows machine, the debugger avoids costly specialist testing rigs. 01442 876065

The **Voxel Sprite** System from Attention To Detail works with voxels (3D pixels) to display what ATD describes as high quality non-polygon 3D sprites viewable from any angle. 01926 843363

SmartMart is a data warehousing toolkit from Information Builders which provides tools for **multidimensional** data storage, **reporting**, and data **management**. A set of interface classes are supplied which can be **distributed** over the Web. 0181 982 4700

From **NetDynamics** comes the NetDynamics Studio visual development environment, featuring **WebExtend** technology for interfacing to **PeopleSoft**, SAP and CICS business applications, and the **scalable** NetDynamics Application Server. 01462 486087

Putting a Haht on your Web site



HAHTsite from Haht Software is a Web application server (which runs in conjunction with a Web server) and development environment. Separating the servers for HTTP and application functions greatly simplifies the operation of Web sites with dynamic content retrieved from (one or more) databases, and enables secure state information to be maintained for every user of the site. The state information can be used for selective access to the Web site and to keep a profile of users' visits.

HAHTsite applications are developed in a Visual Basic 3 compatible language which is compiled into p-code for running by the HAHTsite engine. This engine works as a CGI 1.0 system and so is compatible with most Web servers. Versions are available for Windows and Unix systems, but the development environment itself runs only on Windows 95 and NT.

The development environment is composed of an IDE and an optional extra SDK for creating additional I/O widgets. The IDE includes a dozen widgets (time, date etc) and an HTML editor, which you can drop Java applets and VBScript client-side objects into. Database access is currently through ODBC, but native access is planned.

A site can be developed and tested locally and when ready automatically transferred to the production site. Unlike some other Web development tools, Haht's tool keeps HTML pages in the file system, as opposed to its own database. To be truthful, though, they're not exactly HTML, being comprised of the real HTML plus any meta code such as scripts and database references.

The application server costs £1750, the IDE £750 and the SDK £650

- *Tel: 01189 254214*
- *http://www.haht.com*

StarTeam checks in, bugs check out

Change management and version control software which is as much at home working with Web sites and documents as it is with code? That's what StarBase Software claims to have in its StarTeam product. StarTeam is described as an Integrated Team Environment (ITE) rather than an IDE: the idea is that not just developers, but the designers, artists, technical writers and managers involved with a product should use it to co-ordinate their efforts. To this end, StarTeam exposes a Web browser interface for those who can't (or shouldn't) run the fully-featured Windows client software.

Alongside the usual check in/check out and file locking features, there is a useful defect tracking log which monitors defects on a per-file and per-project basis, allowing QA and beta testers to log faults for fixing. There is also a kind of newsgroup-style message board for discussions of issues of importance to the project or its team members. The repository doesn't distinguish between file types, which means that the software can be used to work on HTML or DOC files as easily as source code files.

As mentioned before, all these features can be accessed across an HTTP connection with a Web browser, with some restrictions on functionality, plus the full Windows client software can work remotely over a network or IP connection.

- *StarBase URL: http://www.starbasecorp.com*
- *UK distributors: Contemporary Software on 01344 873434*

SCO makes your old applications dance

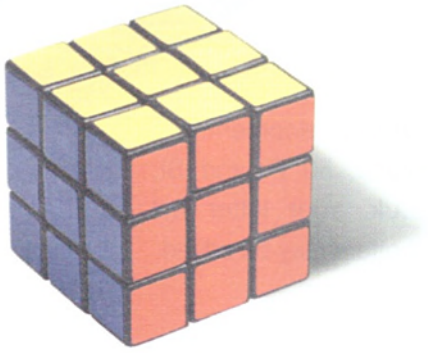
SCO has announced Tarantella, a revamping tool for moving Unix- or mainframe-based legacy applications onto the Web. The Tarantella server sits between your actual server and clients supporting HTML and Java (or X). Tarantella supports 3270, 5250, X and Windows applications through plug-ins. This middle-tier maintains the state of the application with the mainframe, with login via SSL. In addition, administration of the system can be done remotely from a networked computer. Tarantella includes a JDBC client and back-end server interfaces for most relational databases.

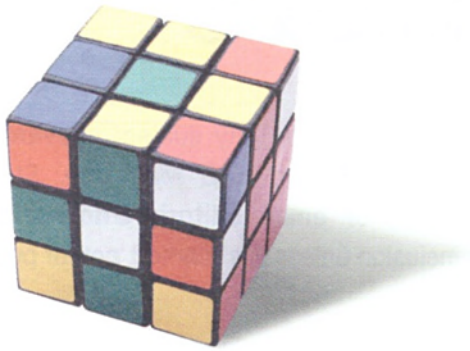
The first release of the SDK runs on SCO Unix, HP/UX, Sun Solaris and IBM AIX. The next release (expected to be the first 'final' release), will be available in the second half of 1997 and will be integrated into SCO Unix. The SDK is available today, but unfortunately details of the footprint and pricing of Tarantella are not.

SCO has also developed an Intel-based Network Computer OS which takes 1.5 MB of disk space and requires 4 MB of RAM.

- *Tel: 01923 816344 * http://www.sco.com*

Hitachi WebReuser





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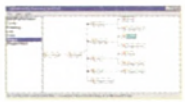

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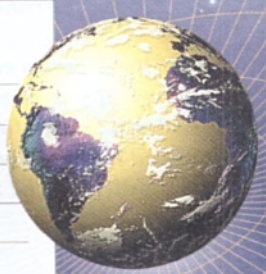

Letters

We welcome short letters on any subject relevant to software development. Please write to: The Editor, *EXE Magazine*, St. Giles House, 50 Poland St, London W1V 4AX, or email **editorial@dotexe.demon.co.uk**. Your letter will be considered for inclusion unless it is marked 'not for publication'. Letters may be edited.

Microsoft Visual C++

Dear Editor,

In the February '97 issue, Francis Glassborow said that Microsoft has no [low-cost] 32-bit C++ development environment [for Windows 95]. When I last looked MS was selling VC4 Standard for around £50.

I can understand that Francis might wish to forget the existence of this compiler as it isn't really very good. It compiles slower on my P90 than an equivalent compiler does on my ageing Amiga 500 and it uses around 4 MB of intermediate files in order to make a 37 KB executable. However unless Francis knows something I don't, it does exist, it is 32-bit and it is priced at entry level.

Robert Ennals
ennals@aol.com
(aol may be crap but it is fast)

Thank you for bringing this to my attention. I try to keep up with all that the market makes available but have one absolute rule, I do not write about what I have not seen. In this case not only had I not seen VC++ 4.0 Learning Edition but I have no recollection of being told of its existence. Microsoft has a habit of announcing vast numbers of products and minor releases while pushing the high-end products to technical journalists. This makes it easy for any one of us to miss a product. I note that only one reader has corrected me. This suggests that knowledge of VC++ LE is pretty rare.

I will try to do better in future.

Francis Glassborow

Microsoft itself seems confused about this product. If you check its Web site you'll notice it is sometimes referred to as Standard Edition and sometimes as Learning Edition. The naming is not consistent between pages. In addition, the learning edition of VC++ is still based on the year-old 4.0 version, it has not been upgraded to the current 4.2 version. Also, the license agreement stipulates that users may not redistribute code they build using it, restricting it purely to learning use. We'll have to wait for the announcements regarding VC++ 5.0 to see if Microsoft puts new blood in this product.

Ed

Lisp 'blood libel'

Dear Editor,

Please stop repeating the folk myth that Lisp is an interpreted language (*EXE* February '97, p.27).

Lisp is a large family of languages, and it has a wide spectrum of members with specifications which run from the very small (Scheme) to the very large (Common Lisp, for instance).

Each member of the Lisp language family has been implemented in almost every manner imaginable: as compiler or interpreter (or sometimes both in the same implementation), compiling to C or to a virtual machine or to native code (plus various combinations of these in the same implementation), and so on.

Take ANSI standard Common Lisp. The commercial implementations of it compile Common Lisp source code to native RISC or CISC instructions. They can do this for an individual definition, and you can interact with the updated running application immediately.

Java environments like SuperCede are just beginning to offer facilities that Lispers have taken for granted for decades.

For more information, the Lisp FAQ is available at *http://www.cs.cmu.edu/Groups/AI/html/faqs/lang/lisp/top.html*

Dr Jason Trenouth
jason@harlequin.co.uk

I never claimed that there were no LISP compilers! I was just making a point that to the best of my knowledge LISP was the first language written in itself and at that point it was only an interpreted language. Anyway, when you want to look at certain aspects of a language's semantics, implementing an interpreter in the same language is most often more illuminating than implementing a compiler in the same language. You can learn a lot from reading a small meta-recursive LISP definition. Common Lisp is rather big. Bootstrapping a compiler has many advantages, especially when porting between architectures is considered, but that's another issue.

In fact after scouring the Web I found that the first meta definition of a LISP interpreter predates the first implementation of the language. In Recursive Functions of Symbolic Expressions and their Computations by Machine. MIT AI Memo 8, Cambridge, MA, March 4, 1959, Jim McCarthy described a theoretical interpreter in the language itself. Herbert Stoyan has done a lot of very interesting work in retracing the early history of LISP. Two of his articles are available at http://www8.informatik.uni-erlangen.de/html/lisp-enter.html. McCarthy's seminal article, of which Memo 8 was a draft, is online (in Postscript form) at http://www-formal.stanford.edu/jmc/index.html. 'Writing a compiler to compile LISP programs into machine language' was one the goals mentioned hence it was an early concern. (Other sites of interest you might want to check out are the free compilers list at http://www.idiom.com/freecompilers/ and the retro-computing museum at http://www.ecil.org/retro/retromuseum.html).

Ed

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CIRCLE NO. 107

IntranetWare

IntranetWare is supposed to bring Novell into the Internet age. **Karl Dallas** puts his hand in the 'net tool' patch and waits to see if he gets stung.

Programming NetWare just got a whole lot easier. Up to now, things have been tough. Writing client or server applications for the NetWare Directory Services (NDS) environment with the NetWare SDKs is an enormous chore, requiring you to create zillions of lines of code even for seemingly trivial tasks. And that's after you've climbed, Sisyphus-like, up the steep learning curve the SDKs impose, which is no mean feat in itself.

Nigel Cattlin / Holt Studios

Well, as I say, in future it will be a lot easier. Buried in the pile of products mustered under the rather cumbersome IntranetWare banner is a set of capabilities that make programming NetWare Loadable Modules (NLMs) far more convenient. NLMs are, of course, the means of controlling and developing NetWare.

At the same time, Novell is continuing to develop and extend NetWare towards applications outside the pure NetWare environment. For instance, NetWare Directory Services have just been ported to Windows NT. When NT4 was delivered, the praise with which it was greeted was attenuated somewhat by Microsoft's continued failure to properly integrate its NT Directory Services (NTDS) with NetWare Directory Services (NDS). To be fair, though, NT4 does permit browsing of NDS resources, NDS printing, authentication to multiple NDS trees and processing of login scripts. What is missing is any native support for management of NDS and NetWare file and print services.

Novell has rectified this omission, and gone further in making it possible to manage NT workstations without having an installed NT4 server or domain controller, providing NT with the superior security provisions of NetWare, and making it possible to log into NT via NDS.

This functionality is being added to other Novell products. For instance, the ManageWise client for NT can be used to manage NT clients and servers, and the forthcoming ManageWise Administrator for NT, codenamed *Tabasco*, will enable administrators to drop the entire domain into a container, and to manage it from within NDS. Plus, now that Sun has taken NDS on board for Solaris, NDS functionality is reaching out to the Unix world.

Novell's relationship with Sun has valuable implications for the future, since it foresees NDS and the Java language working hand in glove. The multi-platform capabilities of Java mean that NDS authentication and its resource database will be able to function, potentially, on any platform. Novell is collaborating with Sun to develop a Java Directory Naming Interface and class libraries for NDS, X500 and the Internet's DNS. Java just-in-time (JIT) technology has been developed for compiling Java-written NLMs on the fly, and Novell plans to convert the entire set of NetWare utilities to Java.

Another important initiative is the implementation of the Lightweight Directory Access Protocol (LDAP) for NDS, which makes it possible to publish directory information to Internet and intranet servers, using NDS security to control data access. While making available NDS services like NDS replication, security, and administration, LDAP for NDS is still a fully RFC1777-compliant implementation of the Internet Engineering Task Force LDAPv2 spec.

So much for the future. Right now, perhaps the most significant part of the IntranetWare package – and one whose significance, to be frank, escaped me when I first opened my INW box – is the NetBasic programming language. When I saw it, and the NetBasic subdirectory created on my NetWare 4.11 server, I must confess I thought: just what I need, another proprietary Basic-type language. But I was being overly hasty in my judgement. In actual fact, NetBasic is essentially a superset of Visual Basic (without the IDE programming environment) designed for developing NLMs. It makes the job a lot easier, a great improvement over previous methods, which generally involved C, C++ or even assembler. Novell is licensing NetBasic from HiTecSoft, and although it is bundled with IntranetWare, it actually works with all NetWare versions after 3.x.

The sort of scenarios where NetBasic can be effective are the correction of NLM or user account errors over the Internet, scheduling deletion of files (for instance, those with a TMP or BAK extension past a certain age), scheduled updating of configuration files (the script can also ensure that none of the files are open, and can clear the connection of any users still logged in at that time), automatic backup of files, ensuring that all users are logged out, and control of the installation options for Windows applications. In the latter case, centralised management can be much simpler than trying to deal with multiple individual install options.

NetBasic could also be used to check all the HTML files at a central Web site (which might be a Novell Web server), and automatically ftp any that have been updated to other platforms in the organisation – Unix or NT, say.

Although Novell does not supply any sort of IDE for NetBasic, there is one available from HiTecSoft. It would always be possible to write your code within Visual Basic, so long as you remember that NetWare is fundamentally character based, so none of the Windows functionality is available. Obviously, any old editor that can save ASCII text files with a .BAS extension could be used, if you're sure you know what you're doing.

GUI things

Though NetBasic does not support a Windows-style GUI display, it does have access to the NetWare console's basic windowing functions. These include pop-up windows (which can display messages of up to 20 lines of 78 characters per line), display windows for information or user input, menu windows and desktop windows. Most windows are positioned by specifying the coordinates of their upper left and lower right corners, with the exception of menus (whose bounds are calculated from the upper left coordinates and the width and number of items in the menu), and of course desktop windows.

The `WIN:Close`, `WIN:Hide`, `WIN:Show` and `WIN:Title` commands are used for both display and menu window types. It is usual (and produces shorter code) to set the system up so that when a window is closed or hidden, the parent window is selected automatically as the default window. NetBasic uses an internal linked list to keep track of the order of windows as they are created and destroyed, so overlapping windows should be closed in reverse order from which they were opened, otherwise the screen may not be properly restored.

NetBasic applications are executed using the NetBasic interpreter, which is loaded into memory by typing `LOAD NETBASIC` at the file server console. The console `RUN` command is then used to start programs. Within the NetBasic environment, programs are started by just typing in their names, and normal DOS-like utilities are accessed through the SHELL command.

Here is a typical NetBasic program:

```
Do While True
DateObj = NET:Server:Date:Get
If DateObj.Error !=0
WIN:At(1,70);
WIN:Say(DateObj.Time)
EndIf
SYS:Delay(1000)
EndDo
```

This uses the `SYS:Delay` command to create a one-second delay every time the file server's time is displayed. It is a good idea to place a delay command within all CPU-intensive loops, to allow NetWare OS to gain control of the CPU during the delay period and run other tasks.

There are obvious security implications in allowing user-written applications to run on a server, since NLM programs have full access to all NetWare services. If an application is logged on as a user, its process has the same security rights as that user, but if

```
Example: #include "NET.H"
Sub Main
BindObj = NET:Bindery:Get
If BindObj.Error != 0
Quit
EndIf
BindObj.Name = "SUPERUSER"
BindObj.Type = NET_USER
BindObj = NET:Bindery:Set(BindObj)
If BindObj.Error !=0
Quit
EndIf
SuperObj = NET:Bindery:Get("SUPERVISOR",NET_USER)
If SuperObj.Error != 0
Quit
EndIf
If NET:Bindery:Property:Add(BindObj,"SECURITY_EQUALS", SuperObj)
Print("Superuser has been created")
EndIf
Quit
```

Listing 1 – A user-level NetBasic program which creates a supervisor-level account without a password on a NetWare server.

```
#include A..\include\NMXLIB.H
void main (void)
{
  void *cp,*rv;
  CP=NMXC_ContextCreate(GetcurrentScreen()); // Create a context
  // call the function
  rv=NMXC_EZCall(cp,"SCREEN:TEXT",NMX_STRING_C_TYPE,"System
                 Console",NULL,NULL);

  // Use the NMXC_RV...functions to access the value returned

  NMXC_RVFree(rv); // free the value returned from the function
  NMXC_ContextDestroy(cp);
}
```

Listing 2 – Accessing the NMX API from C.

it is not associated with any user, it effectively has supervisor rights. A user with access to the file server's console could run the program in Listing 1 to create a user with a security level equal to the supervisor, and without a password.

Some notes on the code. The `#include` command is used to include files, which in the NetBasic package all have the H extension. The command must be in lower case and positioned outside of the main subroutine, with the file name in quotation marks, for example:

```
#include "NET.H"
```

NetBasic commands are grouped into classes, with the class name forming the first part of the command name. For clarity, it is a good idea (followed in all the examples quoted here) to write the class name in capitals, though in actuality NetBasic is not case sensitive. Where commands are grouped into subclasses, the name of the subclass also appears as part of the command name, so the `WIN:Cursor:Column` and `WIN:Cursor:Show` commands are in the `CURSOR` subclass of the `WIN` class.

The `WIN` class covers the server console screen handling functions. Other classes include `NDS` (which provides access to NetWare Directory Services), `NET` (networking services), and `PORT` (communications).

Variable declaration is automatic: memory variables and array elements are created inside the application when assigned a value. Names may be up to 32 characters in length, with the usual restrictions on valid constituent characters. All memory variables are global and can be accessed from anywhere within the source file, unless they are declared as `local`, in which case they can be accessed only from within the functions or subroutines in which they were created. Neither arrays nor their elements can be declared as local.

Bound to happen

The language contains a large number of NetBasic-specific objects, which encapsulate such things as dates, directories, environment settings, files, and Internet functions. One of the most important is the bindery object, which provides identification information for the various types of network resources (eg file, database and print servers and printing queues), and clients (eg users and user groups). Each bindery object contains `ID`, `Name`, `Type`, `Flag`, `Read security`, `Write security`, `Internet.Socket`, `Internet.Node`, `Internet.Network` and `Error` attributes. Identification information in the form of bindery objects is obtained from the bindery, using commands in the `NET:Bindery` class. For instance, the command `BindObject = NET:Bindery:First ("*", NET_USER)` will display the attributes shown in Figure 1.

Interestingly, the read-only attributes of the `date` object, returned as strings, display an awareness of the 'Millenium bug' problem. The `Year` attribute contains a two digit number representing the year (eg 96). But don't panic. There is also a `UTF.Year.Century` attribute, which represents the full four digits of the year, eg 1996. It might have been better, considering we now know all about the Year 2000 issue, if the `Year` attribute contained the full four-digit year string, but at least the problem has been dealt with.

File-access functionality is divided up between three distinct objects: files are represented as `file` objects, and file pathnames are encapsulated by `path` objects. The directory information associated with a pathname is parsed by `directory` objects, which retain all of the attributes of a path object, and some of the attributes of a file object. For instance, when the command `DirObj=DIR:Object("..\filename")` is issued (with an actual filename substituted for the *`filename`* string), the attributes of the `directory` object `DirObj` will be:

- `DirObj.File.Name`, the filename.
- `DirObj.File.Extension`, the file's extension.
- `DirObj.Path`, the full path to the file.
- `DirObj.Volume.Name`, the name of the volume where the file can be found.
- `DirObj.Server.Name`, the name of the file server hosting that volume.
- `DirObj.Error`, a code to indicate if an error has been encountered.

`ID`, a read-only integer, representing the ID of the bindery record, unique only within the bindery of that file server.

`Name`, a read-write string representing the name of the resource or client in the bindery. Note that wildcard characters can be used when searching the bindery by name.

`Type`, a read-write integer (though changing the type of an existing object is not recommended), identifying the type of the record in the bindery list. A set of type constants is defined in the NET.H file to identify the type of common resources and clients, but custom values can of course be used.

`Flag`, a read-only integer, defining the state of the bindery record, which can be either static (a record which is to remain permanently, such as the records for users or user groups, which will remain until deleted) or dynamic (temporary records which are removed automatically when the service for which it was created is no longer available, for instance the record for advertising servers, which is created when the service is made available and removed when the service is terminated).

`Security.Read`, and `Security.Write`, read-write integers indicating the security level required in order to read and or write the information from and to the bindery record. Common values include:

- Any client logged in;
- Anyone, even clients not logged in;
- Logged-in clients with the same name, type and password as the record being modified.
- Logged-in clients with supervisory rights:
- NetWare operating system only.

`Internet.Socket`, a read-only string, containing the socket address identifying the server's process. When multiple processes are running on the same computer, the socket address provides unique identification for each process.

`Internet.Node`, a read-only string, containing the physical node address identifying the computer running the server's process. The node address uniquely identifies each computer within a network.

`Internet.Network`, a read-only string, containing the network number identifying the network of the server's process. Each network has a number which uniquely identifies it among all other networks of an internetwork system. The Internet attributes are provided only when the bindery record is for a server that has advertised its services.

`Error`, a read-only integer, indicating any error encountered during an operation on the object. The Error attribute is zero when no error is encountered.

Figure 1 – The components of a bindery record.

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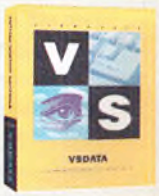

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The most significant aspect of NetBasic, however, is a well-rounded set of NDS extensions, which provide high-level 4GL functions for access to the management, maintenance and administrative operations, normally only accessible from within the lower-level SDK environment.

The NDS tree actually has an upside-down structure, headed by the name of the tree or [Root] (Directory tree name) object at the top of the tree and branching downward through container objects (which may contain other container objects), terminating in leaf objects. Containers represent logical divisions such as Country, Locality, Organisation, and Organisational Unit. Leaf objects represent actual network entities such as users, servers, printers, or computers.

NetBasic can access data from NDS without any of the manual labour associated with allocation, initialisation, access and configuration of NDS buffers (the structures and linked lists that are used for communicating requests and responses between NDS and clients) necessary at the lower SDK levels.

Beyond NLMs

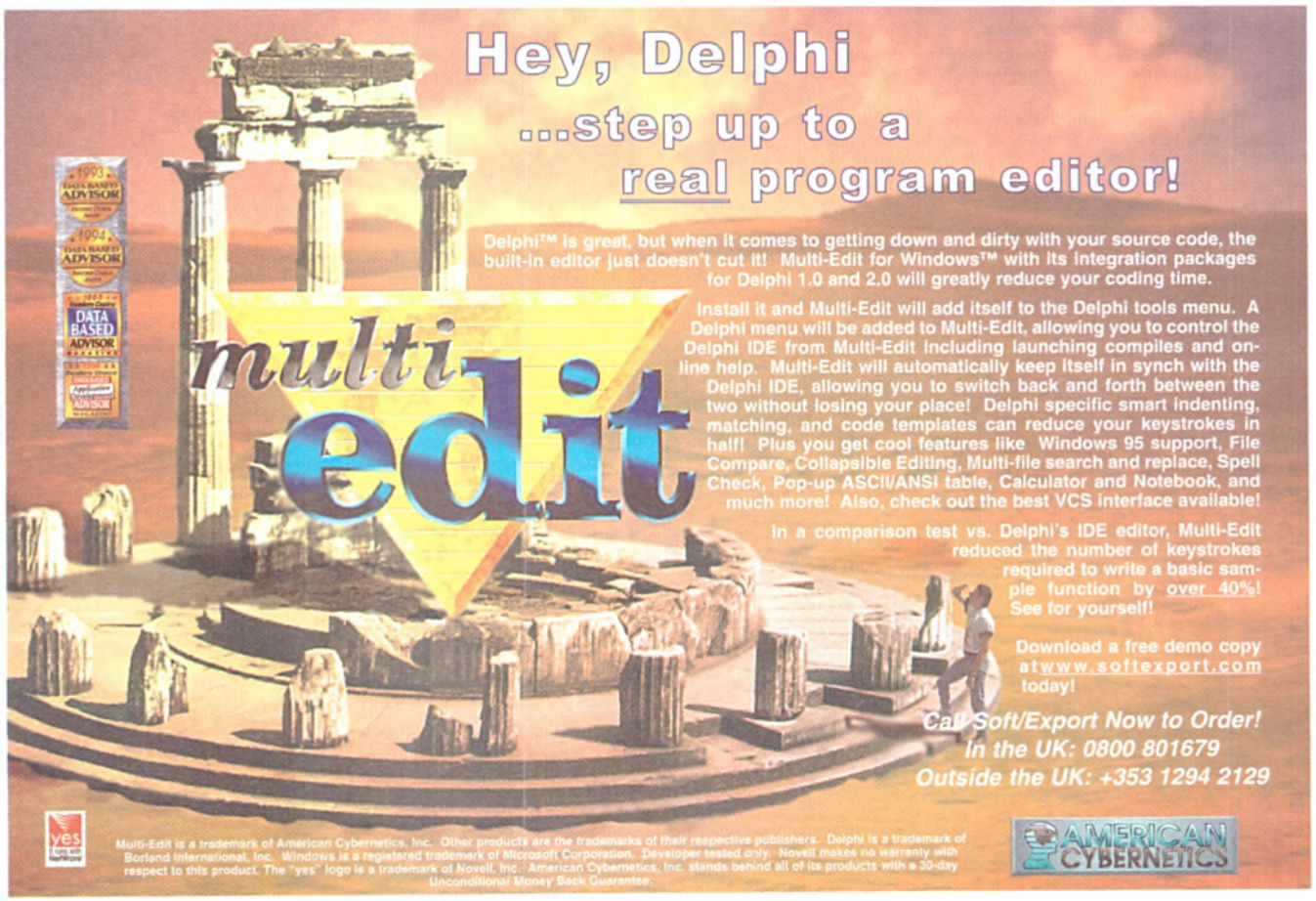
IntranetWare includes a set of Network Modular Extensions (NMXs), also licensed from HiTecSoft, for developing applications which can query databases, monitor network servers, load and unload normal NLMs and manage and automate script execution across networks, including the Internet.

NMXs are supported by the *NMX.NLM* engine, which provides the NMX interfaces, and performs all the necessary memory management, library registration and management, and loading and unloading of components, in a rather similar manner to Windows DLLs. Applications access the module through a set of NMX APIs. As well as NetBasic, the NMX engine is open to other tools such as Visual Basic and Java, and there is support for the CGI interface to Novell's Web server.

To access components registered to the NMX Engine using the C API, you use three simple calls: `NMXC_ContextCreate`, which establishes a pointer to the client context, `NMXC_EZCall`, for access to the actual components and functions in the engine, and `NMXC_ContextDestroy`. A typical program to call the NMX Engine might look like the code in Listing 2.

In addition to those provided with IntranetWare, HiTecSoft also supplies NMX components for access to Oracle, ftp, SNMP, APC and Cheyenne FaxServe. In the latter case, all of Cheyenne's fax services can be controlled by a single call from a NetBasic script. It would be possible, for instance, to create a fax and transmit it to various offices throughout the world via the Internet, where the system could retransmit them on the local phone system, cutting down international call charges. Components for ArcServe, dBase, and Arcada Backup Exec are in the pipeline. Other NetBasic packages available from HiTecSoft include the *WebPro* Internet API extensions, which come with an IDE for creating and using Web-enhanced NLMs, for running remotely across the Internet.

WebPro Internet functions all support the `DOC` class prefix, simplifying the generation of dynamic HTML pages on the fly. Since the package also includes the database module for Btrieve, it is possible to incorporate dynamic data in such pages, and where the supplied NetBasic Secure Web Server is empoloyed, all transactions are protected by RSA encryption and Secure Sockets Layer (SSL) technology. Included with WebPro are sample utilities permitting secure login to a NetWare 4 server over the Internet, after which it is possible to browse the NDS tree, load and unload NLMs, view snapshots of current monitor screens, edit configuration



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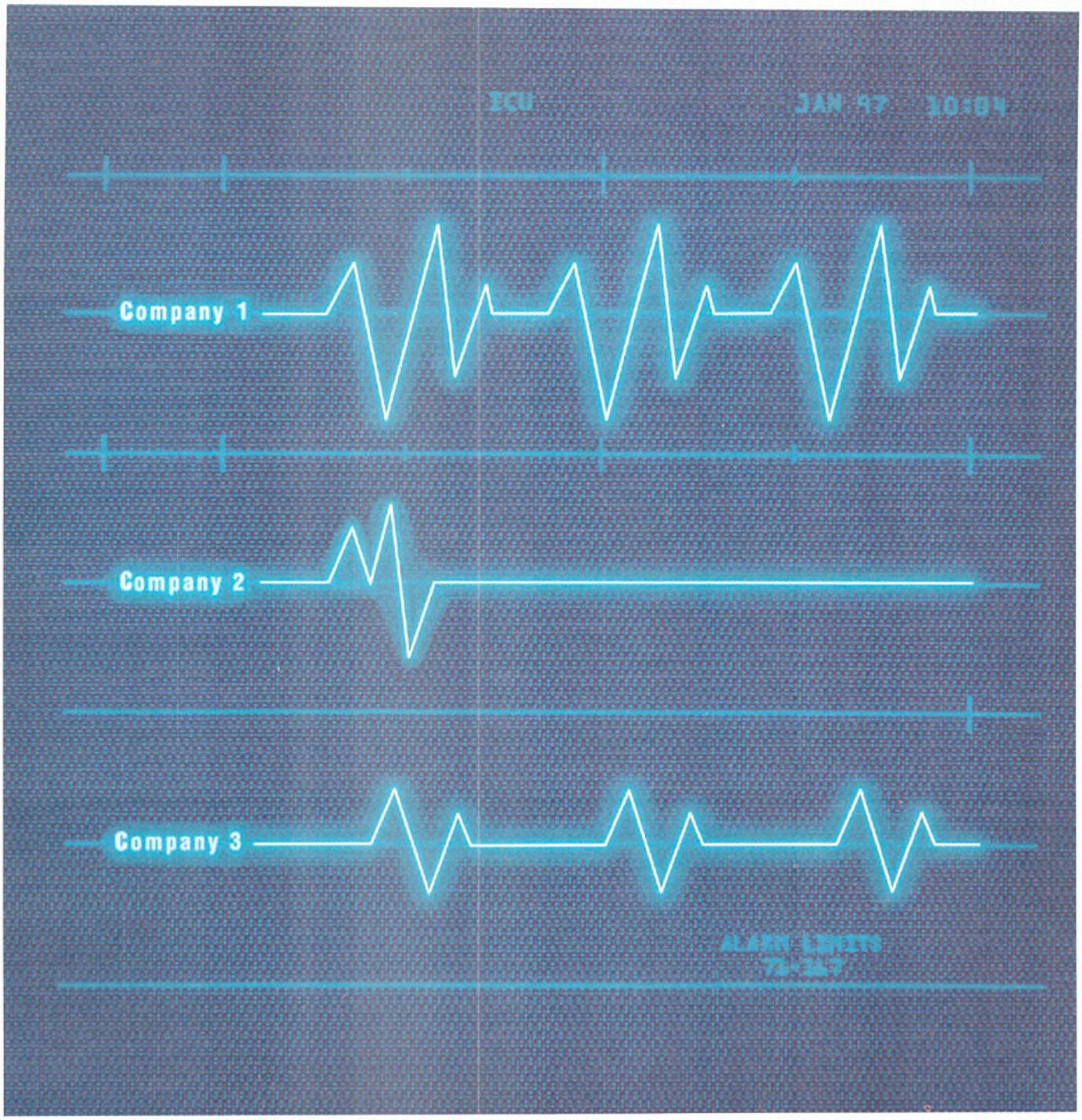

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settings and Autoexec.Ncf – all as if the user were logged into the actual server console.

Java

So much for NetBasic. Interesting and effective though it is, it pales to relative insignificance alongside the potential of Java running on the NetWare server. Novell's plans in this area are not so well advanced, though it has already publicly announced its support for Java's cross-platform capabilities. In keeping with this, it has released the Novell Software Development Kit for Java (NJDK), downloadable as an 11Mb self-extracting zipped executable, from *http://www.novell.com/java/dl/jvm.html*. There is also an alpha of its just-in-time compiler (JIT), at *http://www.novell.com/java/dl/jit.html*.

The NJDK is basically a port of the JavaSoft 1.02 compiler and run-time environment for Java classes, and at present does not include any NetWare-specific services such as the directory, DS objects, or the bindery. (A set of IntranetWare-specific class libraries are promised for spring 1997). But since it does include the Abstract Window Toolkit (AWT) – actually the TinyAWT developed by JavaSoft, which runs natively on the server using XFree86 for NetWare – it will be possible for the first time to run GUI-type applications on the server. At a price: a minimum of 64 MB of server memory is recommended for AWT programs; the minimum for text-based Java apps is 32 MB. Drivers are available for popular video cards (with support for multiple screen resolutions) and an automatic utility for recognising and configuring your video card is included with the NJDK.

When the NJDK has been installed, typing `load java` at the console will load the Java virtual machine into memory and allow the command interpreter to recognise when a Java application or applet is launched. Typing `startx` starts up the AWT, and by pressing *Alt+Esc* shows the checked background of the default AWT workspace, where AWT applications and applets are displayed. Using the mouse obviously requires an appropriate mouse driver to have been loaded: it may be necessary (and is, if you use a serial mouse) to edit *Xf86conf* and *Startx.Ncf* either on the server or workstation to load the appropriate driver.

As the name of *Startx* indicates, the AWT is an X implementation, but Novell does not recommend writing software that uses X, since the underlying peer model might change at any time. Applications written exclusively for AWT should avoid any such problems if the peer model should change.

Regaining control

Clearly, Novell and its strategy have changed considerably since the days when it was strictly a single-product NOS company. Many of its attempts to diversify seemed to result in it just veering around, seemingly out of control, in particular the days when it bought products like WordPerfect and Digital Research's DR-DOS, only to sell them on again, it is now more focused, and in directions which make NetWare a much more attractive development environment. As can be observed from the foregoing, NetBasic and Java for NetWare have implications that are only just beginning to be explored. As Al Jolson said in *The Jazz-Singer*: Baby, you ain't seen nothin' yet! ■

Karl Dallas has been writing about computers since he taught himself on an 8 KB Commodore PET in 1979. He currently runs his own Web publishing and WWW design consultancy business (URL: http://www.houstonmedia.com).

All the examples quoted are taken from the NetBasic online guide, available at http://www.hitecsoft.com.

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Delphi developers. One word. **Piparti**. This delightful report writer is written for Delphi, in Delphi, by Delphi-heads. It's had widespread thumbs-up in various Delphi forums. Standard version: £175, Pro version : £350. Stop us and buy one!

Other Delphi News. From SuccessWare International, look out for new **Apollo Version 3**. Free upgrade to existing version 2 users, direct from SuccessWare. Full versions available from QBS. SuccessWare have just launched **DB Power** for Delphi. A set of more that 30 data-aware components, including a grid control, navigator bar (adds cool buttons), calendar, spin-edit, Rich Text editor etc. Pre-release special is just £99 (save £40).

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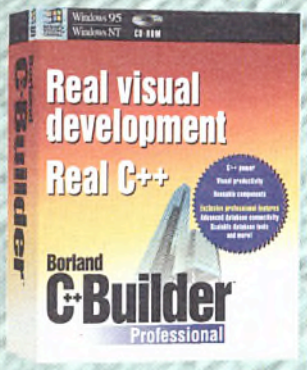

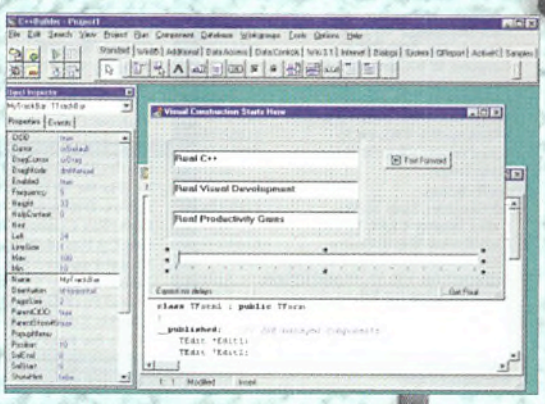

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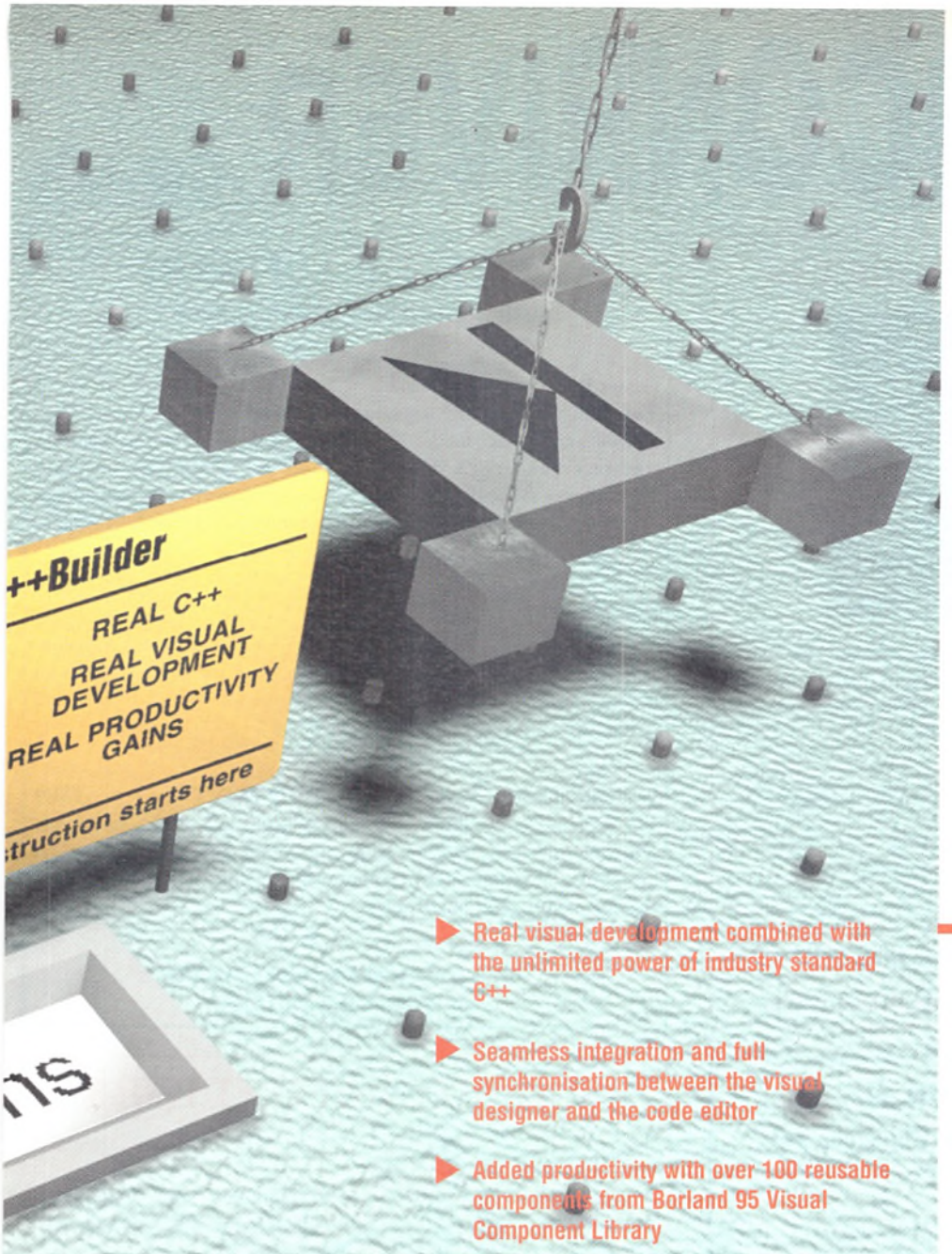

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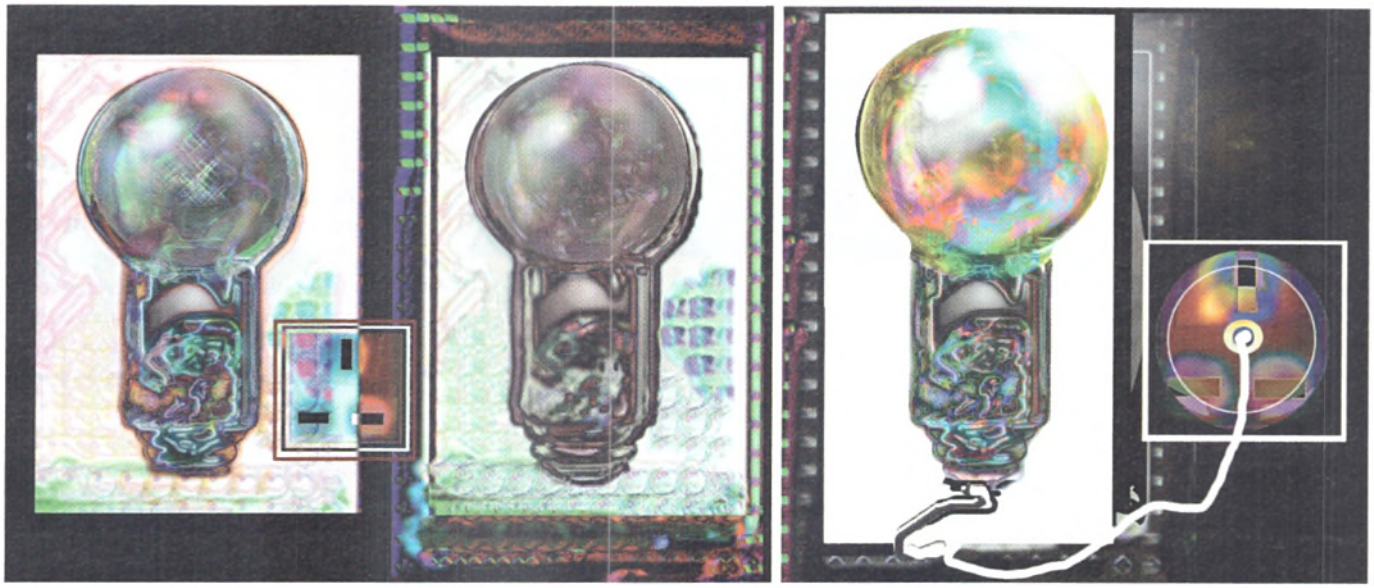
CIRCLE NO. 114

Designed as Unix's base networking facility, sockets have spread all over the world as the foundation of the Internet. **Peter Collinson** gets plugged in.

Socket programming



Patricia Deardorff

Interprocess communication via sockets was officially introduced to the world in the Berkley 4.2 BSD Unix release in 1986. It was not an entirely new idea: Berkley had implemented an earlier version of the interface in an intermediate release of the 4.1 BSD system, and there was some weeping, wailing and gnashing of teeth when it came to light that the API had changed and programs would need recoding.

Sockets were rather enigmatically defined only as 'endpoints of communication'. In reality, they represented a new entity in the Unix kernel specifically designed to allow communication between processes both on the same machine and over a network. This broke with the traditional Unix notion that programs should access the outside world via files in the file system. Actually, it's not impossible to implement networking in a system using this model – the research group in Bell Labs that works in 'the Unix room' followed Unix with the Plan 9 OS, which does just this. The idea has persisted to the modern day, appearing in Bell's recently announced *Inferno* system for distributed multimedia. These projects both use a generalised file system mechanism for intercepting path names, so a path string like:

```
/dev/tcp/host/telnet
```

can be interpreted as a connection to a `telnet` server on a remote machine. Note that `host` and `telnet` are dynamic strings which address a service, and don't refer to fixed files in the file system.

Of course, it is possible to create device drivers that map entries in `/dev` onto network connections. I did this in the 1980s for the Cambridge Ring network that provided local network infrastructure at the University of Kent. Our aim was to make the network invisible to processes running on the system, in order to avoid having to write code to deal specifically with the network. To this end, we created several distinct device drivers to supply different facilities to standard processes. For example, terminal connections from the network popped up as `/dev/tty`*something* just like normal directly connected terminals. Line printers were referred to as `/dev/lpt`*something* and you just had to sling data down the device to have it travel over the network and appear on a printer nearby. Of course, we had to write a line printer spooler to manage the printing operations, but its work was invisible to applications. There was a single reel-to-reel magnetic tape on one machine with a device driver that allowed remote access over the network. We even had shared file systems, implemented somewhat poorly at the block device driver level.

Nearly all processes that accessed the device drivers were 'network naive', using just the standard Unix `open`, `close`, `read`, `write` and `ioctl` system calls. However, talking on a network means that at some point it's necessary to provide some network addressing information. Clients that want to use a service need to supply a machine name to reach a remote machine, and a service type to select a server on that machine. Servers need to supply some service type information so that the kernel can route requests from the network to the right one. So, there needed to be some way for the device drivers to get hold of the network-specific information. Our solution was to use special control devices to preload addressing and protocol information into the drivers, usually at bootstrap time.

This approach worked fairly well at the time, but it was not really dynamic enough, since we were mostly providing access to

fixed resources on our local network. Nowadays network facilities need to be considerably more flexible.

However, it did have the advantage that nearly all of the network code was located in the kernel. We were always worried about efficiency and the lack of available CPU cycles (how the world has changed). We hated the notion of a packet of data coming in from the network, being sent to a protocol handler in user space, altered in some way, and sent back to the kernel for passing to an application process. This 'yoyoing' of information is common during socket operations on modern Unix systems, but with 50 to 60 people logged onto a machine, a significant amount of time could be saved by avoiding it. Unfortunately, kernel code is hard to maintain and debug: we needed a test machine to move the code forward.

Our Ring drivers ended up in 4.2 BSD systems alongside the socket code. We took a hard look at implementing sockets for the Ring, but it would not have bought us anything. The 4.2 BSD socket code was inextricably linked to TCP/IP. (It's interesting that it is the Winsock definition that has finally dislocated the socket API from the underlying protocol). The standard networking applications had TCP/IP burnt into them, so inventing a new protocol for sockets would not have bought us anything. To enable TCP/IP based applications to run, we implemented what was essentially an IP hardware driver to tunnel IP over the Ring to machines on the network. As time progressed, the machines started to move to Ethernet connections and the Cambridge Ring died.

In the long run, it's been a good thing that the BSD designers decided to invent a whole new kernel entity to handle interprocess communication, since it has meant that a body of network code has been built up that is operating system independent. I would guess that it was the desire to gain access to this code that led Microsoft to invent sockets (ahem, adopt sockets as a Microsoft Standard API). The Winsock API means that socket-based programs are just about portable from Unix to the Windows world. The port is not a clean one, admittedly: you have to do some work to change types and add some extra functions. Of course, in the finest 'not invented here' tradition, there are some Microsoft extensions to the original socket API, necessitated really by the lack of proper pre-emptive task scheduling in the original Windows flavours.

How to make a pipe dream

The socket system implemented for 4.2 BSD was intended make access to the network as open and easy as access to the file system. Sockets implemented two different types of basic communication. First, they would provide on-machine process-to-process communication, as an alternative to using pipes. Second, they would enable communication between processes on different machines based on IP.

Pipes have always suffered from what was known as the 'rendezvous problem'. They can only be used between processes originating from the same parent – there is no way to start a process that connects to some other random process using a pipe. The System V world coped with this problem with 'named pipes'. BSD's socket system

Of course, in the finest 'not invented here' tradition, there are some Microsoft extensions to the original socket API.

implements the 'Unix domain socket', a name in the file system that acts as a rendezvous point for two processes to communicate via a pipe.

The socket design recognised that there was a need to allow sockets to be used with processes that were socket-naive. On Unix, when a new process is started with the `exec` system call, it inherits access to its parent's open files, in the form of file descriptors. The process can then deal with these files as anonymous byte streams, using the standard Unix I/O functions. Conveniently, Unix's socket calls also deal with file descriptors, and the kernel's standard I/O API can work with sockets. Thus, socket-naïve programs can have transparent access to networking facilities.

On Unix, sockets are created by a call to:

```
int socket(int domain, int type,
           int protocol);
```

On Windows, the `socket` call returns an object of type `SOCKET` (which in Winsock v2 is simply an unsigned integer) so this is the first change that you need to make when porting code from Unix to Windows. In addition, the Winsock DLL must be initialised before use via a call to `WSAStartup`, and cleaned up with `WSACleanup` at shutdown.

The call to `socket` essentially registers a program's intention to use the socket interface, and stakes out kernel space for later use. The parameters specify some details of how the interface will be used. Firstly, `domain` specifies the 'communications domain', which on Unix can be `PF_INET` for an Internet connection, or `PF_UNIX` for a Unix domain socket. On Windows, this parameter selects an 'address family', the options being TCP/IP, IPX and NetBIOS.

The second parameter, `type`, indicates what type of communication the socket will handle. Setting it to `SOCK_STREAM` specifies the connection to the remote process as a byte stream: a reliable, two-way, guaranteed sequence, connection-based transfer medium. The transport system may support 'out of band' data, which is not subject to the normal sequencing rules, and will zoom to the head of any *receive* or *transmit* queue. It is this type of message that is used to transmit emergency messages, like sending a keyboard interrupt in `telnet` to stop a running process. Of course, for the usual Internet protocols, stream connections use TCP.

If the `type` parameter is set to `SOCK_DGRAM` then a datagram communications method is assumed. For the TCP/IP family, this means the UDP protocol. Datagrams are 'unreliable': they can be lost or delivered in any order. However, they avoid the overhead of an explicit connection between the source and destination.

The final parameter, `protocol`, is intended for further expansion. Should a protocol family have more than one protocol with the same characteristics, then this value will select the specific protocol that is to be used. It is usually set to zero.

The parameters to the `socket` call are supposedly intended to be scanned from left to right, going from the least to the most specific. I've always thought that this was wrong: very few applications care about the protocol family that they are using to talk to a remote process but they do care about whether they are doing it via a reliable byte stream or datagrams. If I want to reliably send a chunk of data to some other machine, I don't care about machine addressing or how the data gets there. I just want to write my data to a normal byte stream and forget about it.

Binding

Having obtained a socket with the correct characteristics, you sometimes want to diddle with its various default settings via the `setsockopt` and `getsockopt` routines. You can customise all the levels in the protocol stack, defining things like buffer sizes and connection behaviour. To choose one example, there

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CIRCLE NO. 115

Further reading

The definitive books on Unix networking are written by W. Richard Stevens. His first book *Unix Network Programming* was published by Prentice Hall in 1990 (ISBN 0-139-49876-1). Sadly, it doesn't occupy my bookshelf and I wish it did. His two volumes of *TCP Illustrated*, published by Addison-Wesley, are well worth getting if you want an understanding about how all these interfaces work and are used.

I've been using *Network Programming in Windows NT* by Alok. K. Sinha, published by Addison-Wesley (ISBN 0-201-59056-5), as my touchstone for Winsock. It seems to describe the interface as it might be, rather than the one described by the help files on my version of Visual C++.

If you want to take a peek at Inferno, then the web site is *http://inferno.lucent.com*. You can get a free version of the system from there too.

is a socket option for broadcasting messages to all the machines on the network.

What is more important, however, is that we may need to supply the kernel with information about our address (or parts of it). We do this with the `bind` system call:

```
int bind(int s,
    const struct sockaddr *name,
    int namelen);
```

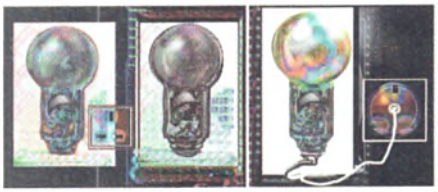
The initial parameter conveys the socket handle into the kernel, and the remaining two different structures depending on the protocol family and addressing scheme that is used. The `name` parameter usually points at a structure whose type maps onto the particular protocol, and generally needs a cast to stop the compiler complaining. The IP address and port number must be supplied in network order, which means byte swapping on many machines. However, this is usually done using the preprocessor macro `htons` that does the correct thing on the target architecture.

The information that has to be supplied by the program is context-specific. For a Unix domain socket, the bind call is used to specify the pathname in the file system to which the socket is to be bound. In the case of connections over the network, the bind call is mostly used by server applications wishing to listen for connections. Even then, all that you probably need to supply is the port number on which to listen – if you supply nothing, the kernel will specify a port for you. Client applications connecting to a particular server rarely have to tell the system anything about their IP addresses, since it already knows. However, binding gives you the flexibility to override the system defaults for socket connections.

Connecting

Assuming we have our stream socket, the next step is to deal with establishing connections. The server waits for connections to come in from the outside world with a call to:

```
int listen(int s, int backlog);
```



Assuming we have our stream socket, the next step is to deal with establishing connections.

This puts the process to sleep until a client attempts to connect to the port, at which point control returns for dealing with the request. The `backlog` parameter is used to control the number of pending connection requests that can be queued on the port before the system starts automatically refusing connections on behalf of the process. Usually, this value is set to zero, which allows some system-wide default to be used.

OK, the server is listening. The client now wants to connect using:

```
int connect(int s,
    const struct sockaddr *name,
    int namelen);
```

As before, the first parameter is the process's socket. The remaining two parameters specify the destination address to which we want to connect. We'll probably have looked up the IP address from DNS and obtained the port number from the local `/etc/services` file. As mentioned above, we don't have to issue a call to `bind` unless we want to establish something special about our address, say specifying a known port for a reply. Control does not return from the call to `connect` until either a successful connection has been made or the call has failed.

Having been woken up by the request from the remote machine, the server now needs to extract the incoming connection from a list maintained in the socket it is listening on. It does this via:

```
int accept(int s,
    const struct sockaddr *name,
    int namelen);
```

which returns a socket bound to the new connection. The optional address parameter contains information about the remote connection, which can be used to see if the server really wants to deal with the call. If not, the socket can be closed.

Data transfer

Most Unix programmers use the standard `read` and `write` calls to obtain and send data on a connected socket, and variants of `recv` and `send` when dealing with datagrams. This is another porting worry when moving code from Unix to Windows, since Winsock only supports `recv` and `send`. Thankfully, these use the same parameters in the same order as `read` and `write`, with one extra `flags` argument that is normally set to zero.

The datagram routines `sendto` and `recvfrom` are intended to allow you to write code that contains a single transfer in one line. You have to be careful about how much data you are dealing with at once. Systems tend to have rules about how much data you can expect to place into a single outgoing datagram and how much buffer space you must allocate to ensure that you receive all the data that was sent to you from a remote system.

Unix systems also have `sendmsg` and `recvmsg` interfaces that permit scatter/gather I/O using a single system call for moving data from arbitrary places in a process in and out of the kernel. These interfaces have not made it into the Windows specification, but truth be told, they are rarely used.

In closing

When data transfer is over, a Unix system will expect you to use the `close` system call to free the resources attached to the socket. You should note that the call can be destructive, causing the deletion of any pending data that remains in the kernel. To avoid this, you need to tell the socket to hang around in the kernel until the data goes by using the `SO_LINGER` mechanism provided by the `setsockopt` call. Winsock has transmuted this function into the `closesocket` routine. ■

Peter Collinson is a freelance consultant specialising in Unix. He can be reached electronically as pc@hillside.co.uk, by phone on 01227 761824 or on the Web at http://www.hillside.co.uk.

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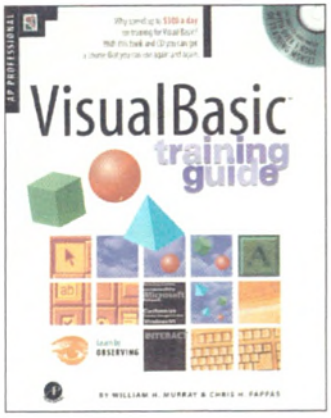

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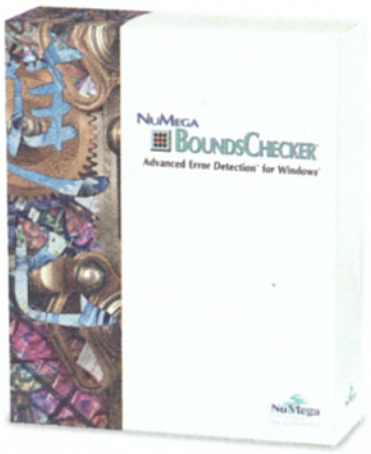

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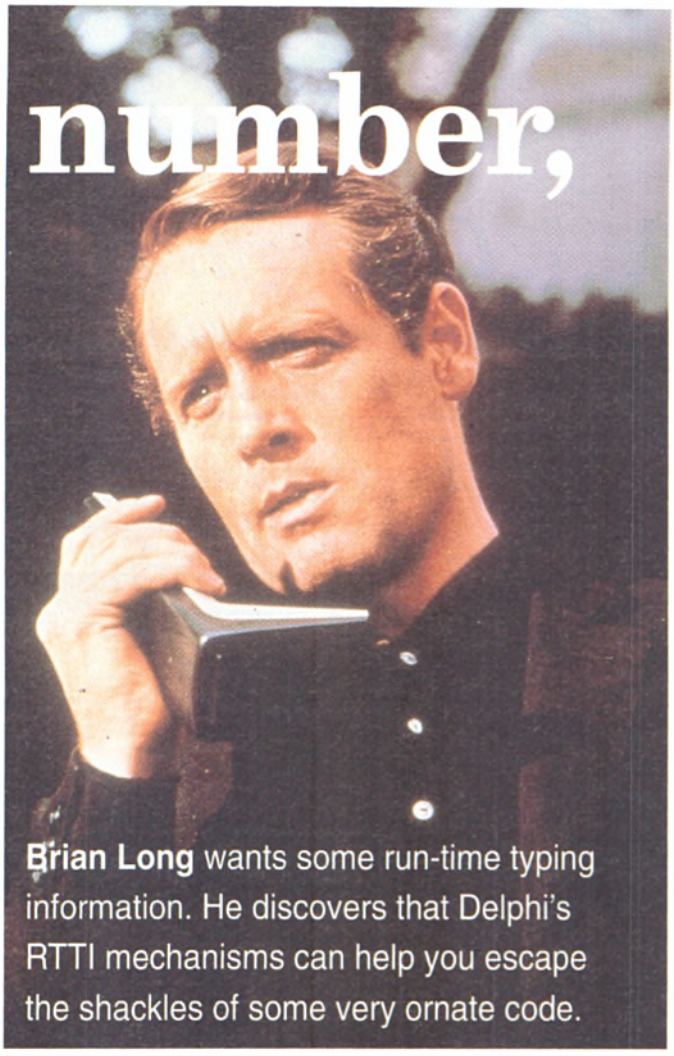

Brian Long wants some run-time typing information. He discovers that Delphi's RTTI mechanisms can help you escape the shackles of some very ornate code.

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I am a TMenuItem!

Run-time type information is information about data types which can be analysed and processed at run-time. So for example, being able to ask a Delphi object what type it is (by its `ClassType` method) and what type its parent is (by its `ClassParent` method) relies on RTTI. The `is` and `as` operators operate by using RTTI to ensure objects are of an appropriate type. Also the `FieldAddress` and `MethodAddress` methods make use of RTTI. The most common usage of RTTI is with objects – it is used to implement Delphi's principal design-time operation, form construction. However RTTI can be generated on demand for a variety of data types, and can be analysed with the undocumented, but rather useful `TypInfo` unit.

The familiar: is and as

The `is` operator is a binary `Boolean` operator that acts on an object reference and a class reference, and indicates whether it would be valid to consider a certain object as being of a certain class. In other words, the expression:

```
ObjectRef is TButton
```

will evaluate to `True` if it is valid to refer to `ObjectRef` as a `TButton` and `False` if it is not. Many wrongly consider the above to be equivalent to:

```
ObjectRef.ClassType = TButton
```

In fact, `is` checks whether the object reference is an object of the type specified *or* a descendent of it. The condition `if Sender is TButton` is functionally the same as `if Sender.InheritsFrom(TButton)`.

The `as` operator is similar, but is used for safe typecasting of objects. The expression

```
(Sender as TButton).Caption := 'Caption';
```

can be considered to be the functional equivalent of:

```
if not (Sender is TButton) then
  raise EInvalidCast.Create
            ('Invalid class typecast')
else
  TButton(Sender).Caption := 'Caption';
```

So if the typecast is a valid one it goes ahead, otherwise an exception is raised. Because of the similar execution of the two operators (both execute the functionality of `InheritsFrom`), the following construct should be avoided for efficiency:

```
if Sender is TButton then
  (Sender as TButton).Caption := 'Caption';
```

and instead you should use `is` in conjunction with a normal typecast:

```
if Sender is TButton then
  TButton(Sender).Caption := 'Caption';
```

or if you prefer, an exception handling block with the `as` typecast (although this is less efficient than the above):

```
try
  (Sender as TButton).Caption := 'Caption'
except
  on EInvalidCast do { nothing }
end;
```

Published sections & form files

Delphi stores design-time form information in custom resource DFM files (standing for Delphi ForM), accessed at run-time via object streams. These files store such information as component class names and property values, used to put together an application's forms and components.

Delphi identifies what to store in the stream files by taking advantage of certain pieces of run-time type information that gets generated for components' `published` sections. Any component can have a `published` section, but not all Delphi 1 objects can. Entries designated `published` have the same visibility as `public` entries, with information about each entry stored in the object's RTTI.

The VCL gains access to this information via the `TypInfo` unit. We'll look at this unit below, but at this point let's look at the issue of why Borland claims that any component can have `published` sections, but something derived from `TObject` will not (by default) be allowed one. The reason I made reference to a claim is because

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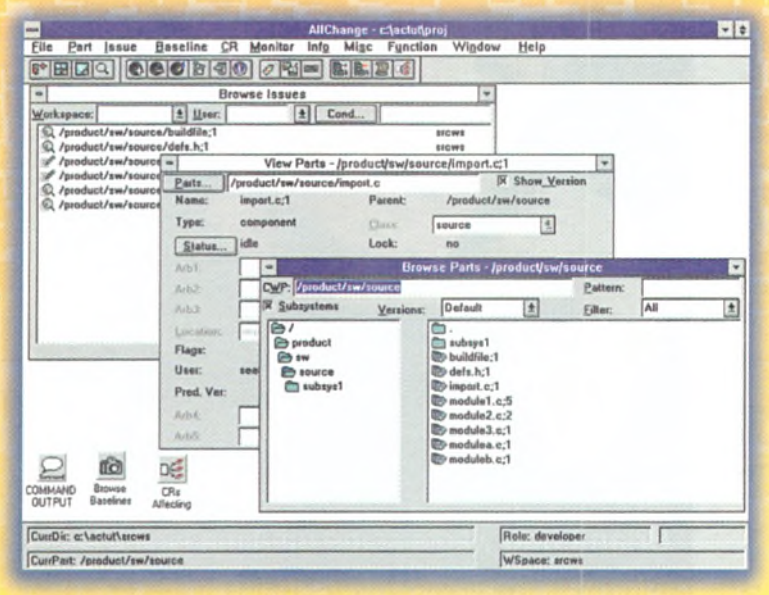

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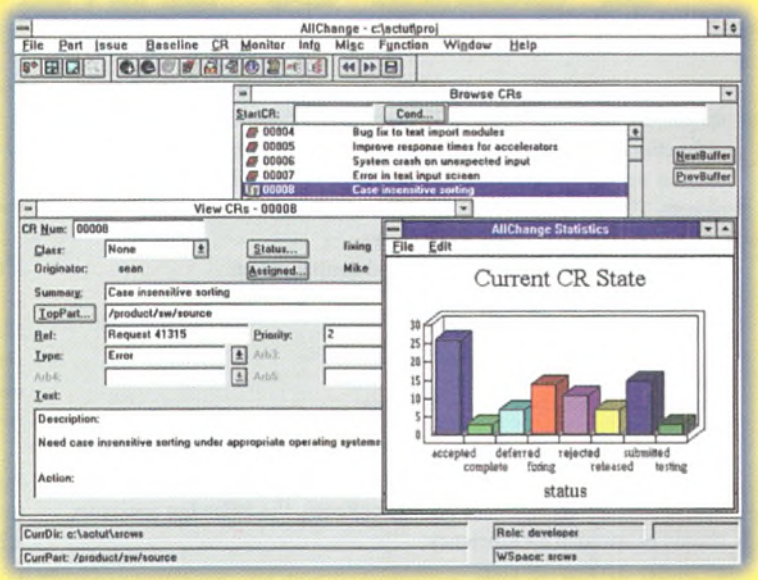

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```
tkInteger, tkChar, tkEnumeration, tkSet, tkWChar: (
  OrdType: TOrdType;
  case TTypeKind of
    tkInteger, tkChar, tkEnumeration, tkWChar: (
      MinValue: Longint;
      MaxValue: Longint;
      case TTypeKind of
        tkInteger, tkChar, tkWChar: ();
        tkEnumeration: (
          BaseType: PTypeInfo;
          NameList: ShortString));
    tkSet: (
      CompType: PTypeInfo));
...
tkClass: (
  ClassType: TClass;
  ParentInfo: PTypeInfo;
  PropCount: SmallInt;
  UnitName: ShortString
 {PropData: TPropData});
...
tkMethod: (
  MethodKind: TMethodKind;
  ParamCount: Byte;
  ParamList: array[0..1023] of Char
 {ParamList: array[1..ParamCount] of
    record
      Flags: TParamFlags;
      ParamName: ShortString;
      TypeName: ShortString;
    end;
  ResultType: ShortString});
...
TMethodKind = (mkProcedure, mkFunction);
TParamFlags = set of (pfVar, pfConst, pfArray);
```

Listing 1 – Excerpts from the TTypeData record, showing the RTTI for ordinal, class and method types.

the restriction does not apply in Delphi 2. To prove the point, declare a class as:

```
TNoRTTI = class(TObject)
private
  FData: Integer;
published
  property Data: Integer read FData write Fdata;
end;
```

Compiling it in Delphi 1 results in `Error 200: PUBLISHED not allowed in this class.`, but Delphi 2 passes it as fine. To remedy the Delphi 1 problem, you must derive your component (directly or indirectly) from `TPersistent`, or use the `$M+` compiler directive, for reasons which will be explained below.

```
TYesRTTI = class(TPersistent)
private
  FData: Integer;
published
  property Data: Integer read FData write Fdata;
end;
```

$M compiler directive

All Delphi classes have a certain amount of RTTI generated for them by default, for example class name and ancestor class reference. The `$M+` (or optionally in Delphi 2, the `$TypeInfo On`) compiler directive tells the compiler to generate additional RTTI for a class (there is no project option which turns this on or off). In short, the `$M+` directive allows `published` sections in a class. If a `published` section is added, RTTI is generated for everything in it: data fields, methods and properties (including event properties). Note that the only fields which can be validly declared in a published section are object references. If your class is derived from a class declared in the `$M+` state, you do not have to set this option explicitly: the extra RTTI is generated by default. The `TPersistent` abstract class in the VCL is declared in this way, and the `TComponent` class is derived from it, which explains the common use of `published` sections in components.

The `$M` directive was undocumented in the original Delphi 1 product, other than in the information given by the DCC.EXE command-line compiler which offers a `-$M+/-` switch to turn it on or off. One of the supplemental Delphi 1 manuals (the Object Pascal language guide) does describe it. Contrary to any documentation available at the time, Delphi 2 allows published sections in any class, regardless of its ancestor, ie it appears to compile in the `$M+` regardless of the compiler options set.

This would imply that `TObject` is compiled in the `$M+` state, although the source code for the Delphi 2 `System` unit does not back this up. It would appear that is a bug in Delphi 2.

The TypeInfo function

`TypeInfo` is one of a special class of functions that are evaluated by the compiler at compile time. If you pass a type identifier to `TypeInfo` (as opposed to a class reference variable that would need to be evaluated at run-time) then, presuming it is an appropriate type, at run-time you will have some RTTI for that type to play with. If the type is a class, then the RTTI will exist in your executable anyway, but for other types such as enumerated types and sets, it won't necessarily exist.

Types not appropriate for passing to `TypeInfo` include any pointer types (eg `PWideChar`, `PString` or `Pointer`), types defined locally in a subroutine, array types and record types. Type information will exist for a given type if a call to `TypeInfo` is made for it, or if the type is referred to in the `published` section of a class that is referenced in the program source. Note that type information is not duplicated: calling `TypeInfo` on one type a second time will return a pointer to the same RTTI table.

```
const
  tkAny = [Low(TTypeKind)..High(TTypeKind)];
  tkMethods = [tkMethod];
  tkProperties = tkAny - tkMethods - [tkUnknown];
PPropList = ^TPropList;
TPropList = array[0..16379] of PPropInfo;
function GetPropInfo
                      (TypeInfo: PTypeInfo;
  const PropName: string): PPropInfo;
procedure GetPropInfos(TypeInfo: PTypeInfo;
                       PropList: PPropList);
function GetPropList(TypeInfo: PTypeInfo;
                     TypeKinds: TTypeKinds;
  PropList: PPropList): Integer;
```

Listing 2 – TypInfo's property routines.

```
procedure TForm1.FormCreate(Sender: TObject);
var
  Count, Loop: Integer;
  List: PPropList;
begin
  New(List);
  try
    Count := GetPropList(TypeInfo(TForm1), tkAny, List);
    Listbox1.Items.BeginUpdate;
    for Loop := 0 to Pred(Count) do
      Listbox1.Items.Add(List^[Loop]^.Name);
    Listbox1.Items.EndUpdate;
  finally
    Dispose(List);
  end;
end;
```

Listing 3 – Code that retrieves the names of all the properties of a listbox.

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An object's or class's `ClassInfo` method performs the same job, returning a pointer to the RTTI. The only real difference is that `TypeInfo` is evaluated at compile time. The implication of this fact is that you must pass `TypeInfo` an actual type, rather than a class reference variable. When you know what type you are dealing with, `TypeInfo` will be the more efficient choice. The Pascal re-implementation of `ClassInfo` (from the `ObjInfo` unit discussed last month) looks like this:

```
function CRClassInfo(C: TClass): PTypeInfo;
begin
  Result := PTypeInfo(VMTEntry(C, vtTypeInfo));
end;
```

`TypeInfo`'s declaration is very similar, as it too returns a pointer to the RTTI. More specifically it returns a `PTypeInfo`, a pointer to a `TTypeInfo` structure as defined in the `TypInfo` unit. We'll now examine this unit in detail.

TypInfo and its data types

This unit has been a bit of a tease for a year. It was undocumented by Borland and the implementation was not supplied in Delphi 1. The only source of information was the interface section found in \DELPHI\DOC\TYPINFO.INT and the calls to its routines that are scattered through the VCL. An additional concern was a warning in the interface file in Delphi 1: `Warning: The interface section of this file will change in future versions of Delphi`. Delphi 2 eases the burden a little, as the full source to `TypInfo` comes along with the source for the VCL.

```
uses TypInfo;
...
procedure SetDataSource(Comps: array of TControl;
                        DS: TDataSource);
var
  Loop: Integer;
  PropInfo: PPropInfo;
begin
  for Loop := Low(Comps) to High(Comps) do
  begin
    { Get info record for DataSource property }
    PropInfo := GetPropInfo(Comps[Loop].ClassInfo,
                            'DataSource');
    { If property exists, set value to DS }
    if Assigned(PropInfo) then
      SetOrdProp(Comps[Loop], PropInfo, Longint(DS));
  end;
end;
...
Table1.Open;
SetDataSource([DBEdit1, DBText1, DBNavigator1],
              DataSource1);
```

Listing 4 – Using run-time property information to efficiently set any component's DataSource property.

```
procedure DisableThem(Comps: array of TComponent);
var
  Loop: Integer;
  PropInfo: PPropInfo;
begin
  for Loop := Low(Comps) to High(Comps) do
  begin
    { Get info record for Enabled property }
    PropInfo := GetPropInfo(Comps[Loop].ClassInfo,
'Enabled');
    { If property exists, set value to False }
    if Assigned(PropInfo) then
      SetOrdProp(Comps[Loop], PropInfo, Longint(False));
  end;
end;
```

Listing 5 – The DataSource and DataField properties

The unit defines a number of types, many of which have fields that have been commented out. This is because the types are there to try to provide a Pascal framework around the RTTI that the compiler generates in a space-efficient format.

Let's start at the beginning. Both the `TypeInfo` pseudo-function and the `ClassInfo` class method return a `PTypeInfo` pointer. This is a pointer to the most important type in the unit, the `TTypeInfo` record, which looks like this:

```
TTypeInfo = record
  Kind: TTypeKind;
  Name: string;
 {TypeData: TTypeData}
end;
```

`Kind` is a value from the `TTypeKind` enumerated type, which rather dictates the sorts of general types that can have RTTI. Table 1 shows the possible values of `TTypeKind`, including the four new ones added by Delphi 2.

The last `TTypeInfo` field, `TypeData`, is commented out because the `Name` field (a string holding the type name) is not what it seems. It is implemented as an old-style Pascal string, but only takes up as many bytes as are required for the type name, rather than a fixed number. Thus, the position of the `TypeData` field is variable. To get the type name of an appropriate type at run-time we can use something like:

```
TTypeInfo(TypeInfo(Integer)^).Name
```

If we want to get access to the `TypeData` field we have to fiddle around somewhat, but the `TTypeData` record is where things get interesting/messy (delete as appropriate). It is a large variant record with different fields being used depending on the value of the `TTypeInfo.Kind` field. Let's look at a simplified view of it. More detailed excerpts showing the information held for various types are contained in Listing 1.

```
TTypeData = packed record
  case TTypeKind of
    tkUnknown, tkLString, tkLWString, tkVariant: ();
    tkInteger, tkChar, tkEnumeration, tkSet, tkWChar (...):
    tkFloat: (FloatType: TFloatType);
    tkString: (MaxLength: Byte);
    tkClass: (...);
    tkMethod: (...);
end;
```

As you can see, in the case of a long string or variant, there is no additional type information recorded. Short strings on the other hand have their maximum length stored. For a floating point type, a value from the `TFloatType` appears to specify what variety it is.

```
TFloatType = (ftSingle, ftDouble, ftExtended, ftComp, ftCurr);
```

There are two thing to notice here. Firstly, there is no symbol to represent the `Real` type, since its use is dwindling (nothing other than Delphi understands it, and Delphi itself advises against its use). This explains why published properties of type `Real` are not supported: RTTI cannot be generated for them. More information is stored for ordinal, class and method types, as we shall see.

Ordinal types have a field `OrdType` of type `TordType`, indicating how many bytes are required for their storage, and whether signed values are supported.

```
TOrdType = (otSByte, otUByte, otSWord, otUWord, otSLong);
```

Note that Delphi does not support any unsigned four byte types, hence the lack of `otULong`. Interestingly, a Delphi 2 `Cardinal`, ostensibly an unsigned four byte number, is implemented as a `Longint` without the negative values, using `otSLong`. Maybe one day...

If the type is not a set, the minimum and maximum values are available in terms of `Longints` and if it is an enumerated type you

can gain access to all the enumerated type value names. There is also a field called `BaseType` which presumably is meant to point to the RTTI table for the enumerated type used as a basis for the current one, but I have been unable to get it to point to anything other than the same type's RTTI. If the type is a set, you can get to the RTTI table for the base ordinal type of the set's members.

Classic RTTI

RTTI for a class type includes a class reference, a pointer to the ancestor class's RTTI table, the number of published properties and the name of the defining unit (again, only as long as it needs to be, hence the commented field that follows). In addition, there is a `TPropData` record that follows containing data about all the published properties.

```
TPropData = packed record
  PropCount: Word;
  PropList: record end;
 {PropList: array[1..PropCount] of TPropInfo}
end;
```

This time the commented out field at the end can be accessed because it is not preceded by an indeterminately long string. However because this `PropList` field is supposed to be an indeterminately large array, its declaration is commented and substituted. `PropCount` dictates how many `TPropInfo` records there are, and each `TPropInfo` record contains all the characteristics of a published property. Here it is:

```
TPropInfo = packed record
  PropType: PTypeInfo;
  GetProc: Pointer;
  SetProc: Pointer;
  StoredProc: Pointer;
  Index: Integer;
  Default: Longint;
  NameIndex: SmallInt;
  Name: ShortString;
end;
```

We have a pointer to the RTTI table for the property's type, and pointers to the property reader and writer methods. The record contains a reference to the method, field or value that is used to determine whether to store the property value in the form file (specified with the **stored** directive), the property index (specified with the **index** directive), a default value (specified by the **default** directive, which is also used to dictate whether the property gets stored in the form file) and the property name.

Information about published methods is also quite full. The RTTI includes whether the method is a procedure or function, how many parameters it takes and a set of parameter description records (commented out). Each of these indicates whether the parameter has a **var** or **const** prefix, if it is an array, and basic details like its name and type etc.

Once you see the extent of the information recorded in RTTI (automatically in **published** component sections), you can begin to get an idea of how the Object Inspector does its job. It knows how to let you edit values, because it can find out all the details about the type. The *Events* page can manufacture event handlers because event properties have a `tkMethod` type identifier, and Delphi can use the rest of the RTTI to find out what sort of event handler it needs to manufacture.

The `TTypeData` record has a lot of useful stuff in, but of course with all these non-standard strings dotted here and there, accessing the various records proves a bit tricky. There are a number of routines in the `TypInfo` unit to help us out, however, as the next section explains.

Swotting with TypInfo

The routines available in the `TypInfo` unit are much the same in Delphi 1 and 2, although they differ in how strings are returned – as pointers to strings in Delphi 1, but as actual strings in Delphi 2. The routines tend to take either a `PTypeInfo` or `PPropInfo` pointer – a pointer to an RTTI table or to a property information record.

Remember that a `PTypeInfo` pointer can be obtained both from the `TypeInfo` function for most types and from the `ClassInfo` class method for object and class references. In fact, to make things simple, the `TTypeData` record for a class type has a `ClassType` field that points back to the class reference.

We can gain easy access to the `TTypeData` record using `GetTypeData` which returns a pointer to it:

```
function GetTypeData(TypeInfo: PTypeInfo): PTypeData;
```

To show the unit in which the class of the main form was defined in (by default, this would be `Unit1`), we can use:

```
GetTypeData(TypeInfo(TForm1))^.UnitName
```

Or, more generically (the class name may have changed):

```
GetTypeData(Application.MainForm.ClassInfo)^.UnitName
```

Since all of the `TypInfo` routines that operate on properties want a `PPropInfo`, there are several ways of getting one. `GetPropInfo`

TtypeKind value	Types that yield this value
TkUnknown	A place holder value. Never used.
TkInteger	Used for any ordinal type and sub-range types.
TkChar	Char and AnsiChar types (Char and AnsiChar are synonyms).
TkEnumeration	All enumerated types. This includes Boolean, ByteBool, WordBool, LongBool and Bool.
TkFloat	Any floating point type except Real, which explains why Real properties are not fully supported.
TkString TkSet	Old-style string types, e.g. String[12] and ShortString. Set types.
TkClass	Class types.
TkMethod	Procedure and function method types.
TkWChar	WideChar type.
TkLString	Delphi 2+ long strings (made of AnsiChars).
TkLWString	Long strings made of WideChars. For support of future Pascal Unicode string.
TkVariant	Variant type.

Table 1 – Possible values of the TTypeKind enumerated type from TypeInfo.

TypInfo routine	Properties to use them with
GetOrdProp, SetOrdProp	Ordinal or class properties
GetStrProp, SetStrProp	Long or short string properties
GetFloatProp, SetFloatProp	Floating point properties
GetVariantProp, SetVariantProp	Variant properties (new in Delphi 2)
GetMethodProp, SetMethodProp	Method properties (events)

Table 2 – The routines for reading and writing property values.

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gets a `TPropInfo` record for a named property. `GetPropInfos` gets `TPropInfos` for all published properties in the class and its ancestors, and puts them in a `TPropList` array. Lastly, `GetPropList` will retrieve all the properties whose types match the values in the set parameter `TypeKinds`, returning the number it finds. If you pass `tkProperties` as this parameter, it acts much the same as `GetPropList` (except `GetPropList` does not return how many properties were found – you have to use `TTypeData.PropCount` instead). See Listing 2 for the actual declarations.

As an example, to get the names of all properties in a listbox called `ListBox1`, you could write something like the code in Listing 3.

There are five pairs of routines (four in Delphi 1) for reading and writing property values of a given name, shown in Table 2.

The `Get/SetOrdProp` routines both take an object reference and a pointer to a property information record and either take or return a `Longint`, since a four-byte `Longint` is big enough both to represent any Pascal ordinal value and any object reference. Note, though, that you have to use a typecast to translate between your value of interest and the `Longint`. Here are the declarations:

```
function GetOrdProp(Instance: TObject; PropInfo: PPropInfo):
                                                    Longint;
procedure SetOrdProp(Instance: Tobject;
  PropInfo: PPropInfo; Value: Longint);
```

The other procedures and functions are laid out in a similar way, but take or return a value of the specific appropriate type. These routines are used by the VCL streaming mechanics to read and write form files. Once a property value is read from a form file, the appropriate information is looked up (via a `TPropInfo` record) and its type category is identified (`TTypeKind`). Then the relevant property writing routine is invoked to set the property value with the data read in from the form file.

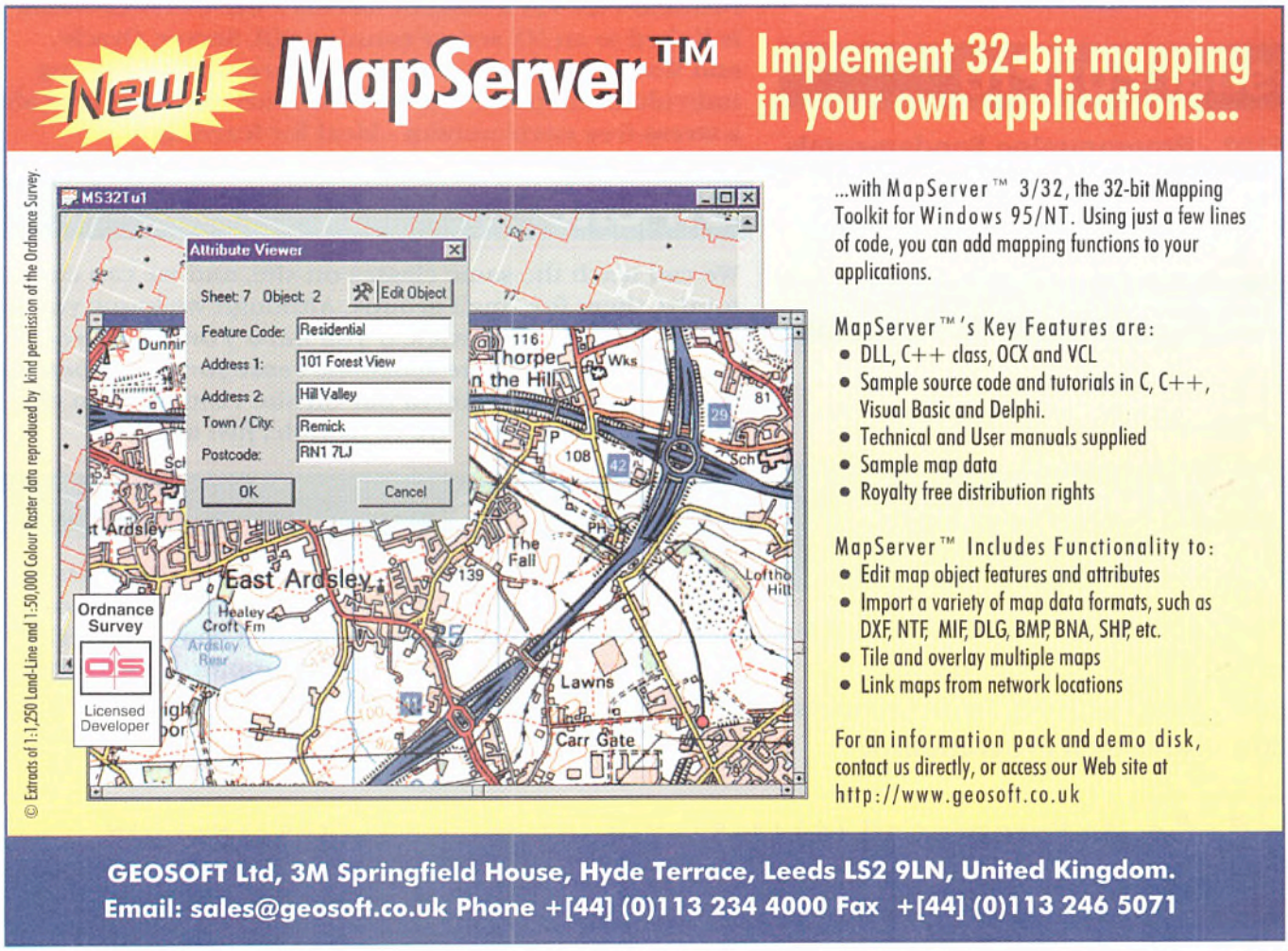
No common ancestor

We can encounter problems with common properties which have no common ancestor similar to the issues outlined last month about fields and classes.

Consider this scenario. You have a form with a number of controls (say a button, an edit control and a check box) that all need to be disabled by having their `Enabled` property set to `False`. You could implement a routine called `DisableThem` as shown below that disables all of your controls.

```
procedure DisableThem(Comps: array of Tcontrol);
var
  Loop: Integer;
begin
  for Loop := Low(Comps) to High(Comps) do
    Comps[Loop].Enabled := False;
end;
...
DisableThem([Button1, Edit1, Checkbox1]);
```

Now consider that you also need to disable some menu items, which also have an `Enabled` property. The problem here is that the `TMenuItem` class adds `Enabled` as a new property: it is derived from `TComponent`, which does not have an `Enabled` property. The `TButton`, `TEdit` and `TCheckBox` classes all inherit `Enabled` from their common ancestor type `TControl`. So the `Enabled` property of the `TMenuItem` and that of all the other classes are actually *different* properties, which just happen to have the same names. This means we have to use a different coding approach.



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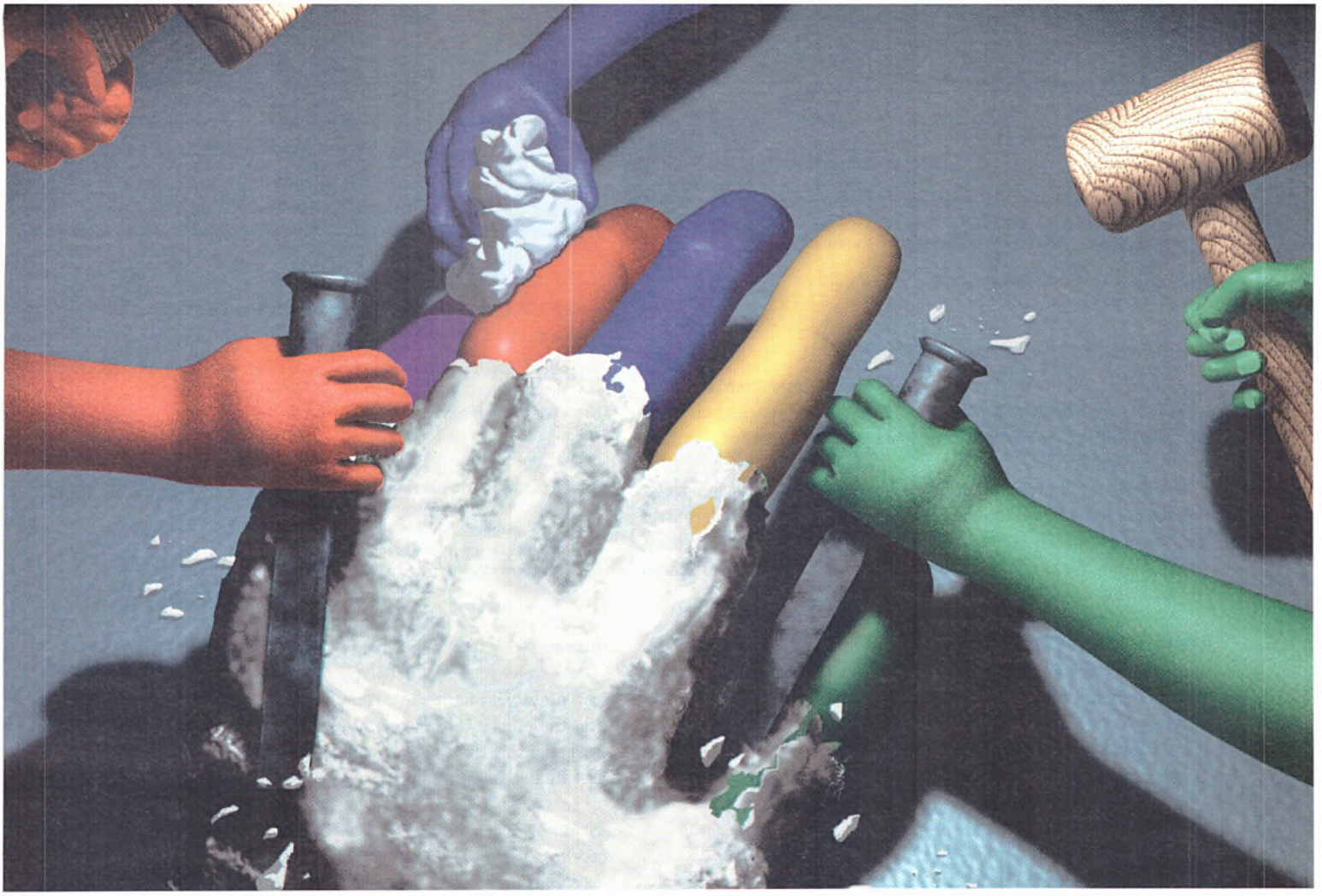

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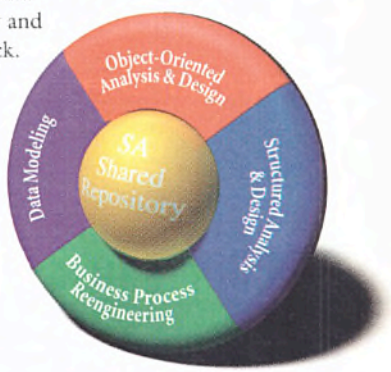

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```
procedure DisableThem(Comps: array of Tcomponent);
var
  Loop: Integer;
Begin
  for Loop := Low(Comps) to High(Comps) do
    if Comps[Loop] is TMenuItem then
      TMenuItem(Comps[Loop]).Enabled := False
    else
      TControl(Comps[Loop]).Enabled := False;
end;
...
DisableThem([Button1, Edit1, Checkbox1, Menu1]);
```

If we need to address other components with unique **Enabled** properties, this code lengthens. A (possibly) better approach that takes advantage of the **SetOrdProp** routine from the **TypInfo** unit is shown in Listing 5.

Similarly, all data-aware controls have a **DataSource** property, and most of them have a **DataField** property. However each control adds these properties individually – none of them come from a common ancestor. We can take the same approach as above to set these properties en masse, as the routine in Listing 5 does.

Enumerated strings

Enumerated types are programmatic devices to make programs easier to read and write by substituting recognisable terms for numeric values (which are used to implement them). Normally all the information about these textual terms is removed from the executable at compile time, but RTTI can change that. Given a type:

```
TDayOfWeek = (Monday, Tuesday, Wednesday, Thursday, Friday,
  Saturday, Sunday);
```

RTTI makes it possible to start with a string 'Tuesday' and get the **TDayOfWeek** value **Tuesday** out, and do the reverse. The two routines **GetEnumName** and **GetEnumValue** do this and to work with them requires a typecast between any enumerated value and an **Integer**.

```
function GetEnumName(TypeInfo: PTypeInfo; Value: Integer): string;
function GetEnumValue(TypeInfo: PTypeInfo; const Name: string):
                                                        Integer;
```

Given the enumerated type **TFormBorderStyle**, used for a form's **BorderStyle** property and defined as:

```
TFormBorderStyle = (bsNone, bsSingle, bsSizeable, bsDialog);
```

then we can write:

```
uses TypInfo;
  { Write current border style on form caption }
  Caption := GetEnumName(TypeInfo(TFormBorderStyle),
                         Ord(BorderStyle))^;
{ Change current border style to single-line }
  BorderStyle := TFormBorderStyle(
    GetEnumValue(TypeInfo(TFormBorderStyle), 'bsSingle'));
```

One point of note: in Delphi 2 you do not use the ^ symbol in conjunction with **GetEnumName**.

As we have seen, knowledge of Delphi's run-time typing facilities can prove very handy in a number of common cases, greatly improving the efficiency and readability of your code. You may find that investigating the **TypInfo** unit yourself could be a very useful source of valuable information. ■

Brian Long is a freelance Delphi consultant and trainer. He's been working withDelphi since its first release and before that worked for Borland. Brian can be contacted by email at 76004.3437@compuserve.com.

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Welcome to the machine

Java has colonised the globe with promises of everlasting platform independence. However, as **Francis Glassborow** explains, there are a few places left in which they don't quite speak the language.

It can be difficult to remember in today's culture of Java-everywhere that Java was in fact designed for rather specific applications, to wit interactive media and the WWW. In order to serve its purpose, its creators saw that it needed three important characteristics: compactness, portability and security.

The first and second of these requirements were met by coupling the concept of p-code with the potential for using local components. For example the presence of the AWT means you can avoid having to ship large amounts of GUI code over a network. I think proponents of Network Computers would do well to admit that substantial frequently-used blocks of code should really be kept locally rather than shipped over the network each time they are required (perhaps with automatic code updating). The cost of bulk data storage is becoming so small that it will be totally eclipsed by dial-up connection charges – yesterday my son bought one of the latest 5.1 GB EIDE drives for £350 all-inclusive. It surprises me how often we have to relearn the same lessons. Look at graphics cards and printers: in both cases performance gains have come from making the peripheral do the work.

Security is a different issue, as it is about protecting the very lowest layers of your equipment. The only way to ensure that your equipment is not invaded is to make sure that no invasion route exists. I remain unconvinced that the Java Virtual Machine achieves this objective because I can visualise several points of attack. However the design of something like the JVM was essential to providing any sort of security. It also serves to support portability across a wide range of hardware platforms. I can elect to develop my Java software on the platform of my choice, and you can run it on the platform of your choice.

This idea is attractive in itself, so it is not surprising that those responsible for compilers for other languages have investigated the possibilities of compiling into byte-code for running on the JVM. There has been some success in implementing this, most notably for the Ada language. With the quantity of C and C++ code that exists it should come as no surprise that work has gone into producing suitable byte-code generators to back-end C/C++ compilers.

What may surprise some of you, however, is that the current JVM specification makes generation of efficient byte-code from C or C++ technically impossible. I may seem to be out on a limb in making that statement but I trust the judgement of Derek Jones of Knowledge Software Ltd (one of the most experienced developers of standard-conforming C compilers in the world), when he says that the specification needs some essential tweaking before C can be compiled to efficient byte-code.

Some of you may be delighted by this but I see it as a huge disadvantage for computing in general. I believe we need to separate the process of application programming from that of hardware and operating system development. In other words we should apply our own programming rules of lowering dependencies to the wider world of computer technology. The ideal would be for application developers to ship their products in a fully portable form as byte-code or something similar. Users could run the byte-code on a JVM or purchase a byte-code to native code optimising compiler if they need the extra performance. Those that wish to develop new hardware platforms would benefit because they would no longer suffer from a lack of software. Of course certain companies might feel such a development would threaten their power base. But wouldn't that be beneficial by increasing the potential for competition at all levels?

There are many vested interests involved in this. I can imagine that those who have leapt on the Java bandwagon might resent changes to the JVM that made it more useful to programmers in other languages. I don't need to waste your time by listing the arguments that will be wheeled out. Those that maintain that C/C++ needs a specific type of Von Neumann architecture may be right (I do not think they are, but I am not an authority on such things) but the JVM is within a tiny step from meeting the requirements. Many current languages already compile to C as an intermediate language and thereby side-step problems of code generation. For example you can run Fortran-90 on any machine for which you have an ISO C compiler because the Numerical Algorithms Group Fortran-90 compiler generates ISO C source code supported by calls to its specialist library (available as C source).

The JVM already provides a layer between the developer and the underlying hardware. C can provide a layer between the language of your choice and the code generators for your hardware. Now if we could mend the gap so that there were code generators for efficient byte-code from C source we would have a real chance for breaking the current mould.

Remember that one of the principles of software development is to isolate change and so empower people to make changes.

A serious book?

When I noticed a book called *Dynamics of Software Development* (ISBN 1-55615-823-8,

£22.99) in the Microsoft Press list, I asked for a review copy because I have generally been impressed by its past catalogue. When it actually arrived the front cover reduced me to a giggling heap. The author (Jim McCarthy) is described as 'Head Coach, Microsoft Visual C++'. Fine, but the brief description of the book is ' "Don't Flip the Bozo Bit" and 53 More Rules for Delivering Great Software on Time'.

All I can say is that Microsoft employees' definition of *Great Software* must be substantially different from mine. A pretty basic requirement from my side of the fence is that it is substantially bug free. Completely bug-free may be asking too much but I should not have to waste time searching for bugs in my code when the problem is being caused by the compiler. A great product should also have a long lifetime. I remain supremely unimpressed by four-monthly delivery of subscription versions. Great software should be right first time and any bugs should be fixed immediately. The very last thing I want is to be faced with a new crop of bugs three times a year.

Now as to the book, read it. Doing so will not do you any harm and provides an interesting insight into one of Microsoft's development teams. Not the purpose of the book, but... On the other hand the price is a bit steep for a book that you read only once and then give away.

Humble apologies

When I wrote the column published in the January issue *(Tropic of Cancer)* I was still seriously jet-lagged by my return from Hawaii. The result was that I switched a couple of names. Steve Rumsby is normally head of the UK delegation to WG21. Sean Corfield is also a long term member of the UK delegation and it was he that was elected as secretary to ANSI X3J16. Plus, I believe he has his ancestral roots in Northern Ireland so it would have been more appropriate to refer to him as British rather than English. Sorry for the errors.

Last month's problem

In what context is the following line well-formed and what does it do?

```
A & A(A);
```

Let me first affirm that I would suspect the motives of anyone writing such code. It is rather akin to a COBOL programmer trying to improve his job security by deciding to use only totally unintelligible identifiers composed of 1, I, 0 and O. To decide whether this code might be well formed, we have to decide whether it is a declaration or rather something else.

If `A` is a typename then anything of the form `A & fn(A)` would be a function prototype – it cannot declare a reference because references must be initialised with the assignment syntax. The only question is whether a function can have the same name as a type. If you think the answer is 'yes' because of constructor names you are mistaken. Constructors are not functions, because they have no return value. Indeed, strictly speaking they do not have names. The use of the class name is a pure lexical convenience. Whatever else the problem line is, it is not a constructor. Nor can it be any kind of member function of a class `A`.

However anywhere else, it is a perfectly legal function prototype as long as `A` is a typename. At the completion of the declaration (ie after the closing parenthesis) the typename will be hidden. If the typename is that of a `struct`, `class` or `union` (but not `enum`, I wonder why) it can still be used in conjunction with the C mechanism of prefixing the name with the relevant keyword (`struct` and `class` being interchangeable).

This fix was necessary (even though of questionable desirability) to support legacy code written by C programmers who would insist on using the same name for variables and for tags. For some reason I know not of, C makes use of a separate namespace for tags. Anyway the following minimalist code should compile and run:

```
struct A;
A & A(A);
main (){
    return 0;
}
```

So one possible meaning for `A & A(A);` is a prototype of function `A` that takes a parameter of type `A` by value and returns a reference to an `A`.

It might cross your mind that the `&` could represent an AND operation. Now if this were the case `A(A)` looks like a function call. Then `A` would evaluate to some kind of function pointer. Even my contorted mind has failed to produce any code that will correctly get past a compiler. The nearest I have got is:

```
int A ();
main(){
    int x = (int)A & A (A);
    return 0;
}
```

Which squeaks past a C compiler because the first line defines a function with an unspecified number of parameters. C++ compilers will accept that line, but complain about the third line because they treat the first line as the definition of a function that takes no parameters.

However there is another way we can interpret `A(A)`: it could be an invocation of a preprocessor macro. The following should work:

```
#define A(x) (x+x)
int main(){
    int A=7;
    return A&A(A);
}
```

Before dismissing the above, note that in order to allow our tools to do sensible things efficiently we often open the door for silly code. It is the task of an engineering discipline to constrain the work of its exponents so that they do not do dangerously silly things. You would not think much of a bridge that was built so that it was only just wide enough, could only just support the maximum load you might place on it etc so why accept code that only just works?

This month's problem

Assuming that the array boundaries have not been transgressed the following code would always work in C:

```
s[i] = s[j];
```

Is this still true in C++?

And while we're on the subject of subscripting: in C `x[y]` always evaluates to the same as `y[x]`. Is it possible to maintain this symmetry in C++?

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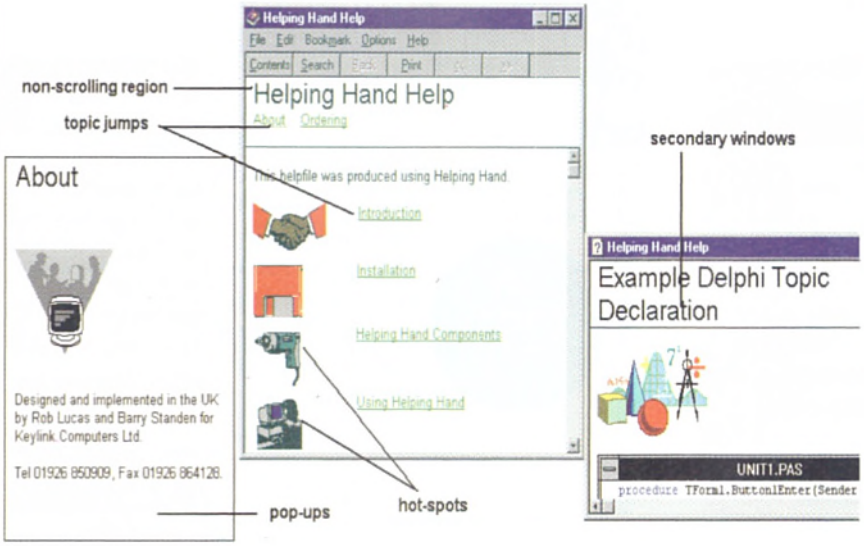

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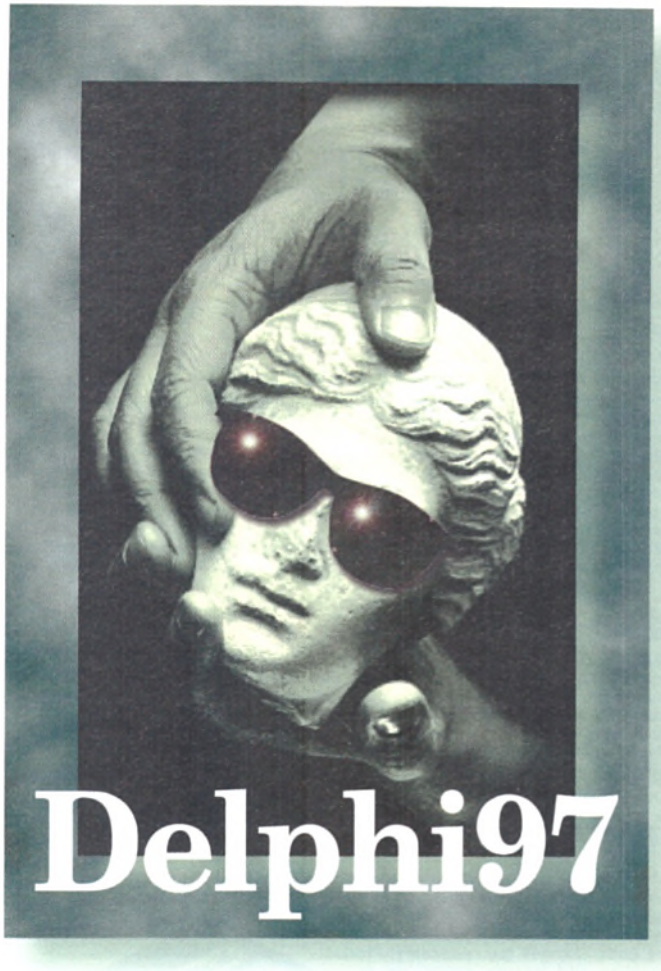

Its architect may have defected to Redmond, but the latest version of Delphi has a few new tricks to show the Visual Basic crew. **Dave Jewell** inspects the pillars...

This month, I'm going to take a look at the most significant new features in Delphi97. There's something for everyone, with enhancements to the IDE, package support for creating tiny executables, new Windows 95-style components such as the *coolbar*, and some exciting new ActiveX capabilities. Will Microsoft be quaking in its corporate boots, or can it justify its quiet confidence in the upcoming Visual C++ version 5.0? Stay tuned...

Package support

A very common source of complaint about previous versions of Delphi is the size of the executable files they produce. Both Delphi 1.0 and 2.0 statically link the entire VCL library into the EXE file, leading to program files never less than 150 KB in size on the 16-bit system, and somewhat more on Delphi 2.0. These file sizes actually compare very favourably with other development systems, particularly when taking account of large run-time libraries like the OWL, MFC and Visual Basic DLLs. Nevertheless, corporate customers and those developing application suites have been demanding the option to farm the VCL code out into a centralised DLL.

With the new support for packages, Delphi97 lets you do exactly that. For example, consider that cute THRDDEMO program that came with Delphi 2.0 – the one which uses threads to implement three separate sorting algorithms in parallel. Without package support, its compiled EXE file weighs in at 188 KB. Click on a checkbox in the *project options* dialog, rebuild the project and – lo – the executable has shrunk to a remarkable 13.5 KB. Plus, aside from the usual Win32 API imports, this EXE depends on just one DLL, VCL30.DLL. Savings in code size are even more marked in the case of database applications, because of the amount of code pulled in by VCL's data-aware controls. The FISHFACT demo program comes down from 467 KB to a mere 16 KB. Of course, it requires the presence of VCLDB30.DLL (which contains the data-aware components) as well as the standard VCL30.DLL.

The size of these DLLs needs to be taken into account when deciding whether to use packages. In the beta version of the code I was using, VCL30.DLL was around 1.1 MB with another 550 KB being needed for VCLDB30.DLL. Of course, the real benefit comes when you want to run several Delphi applications simultaneously, all sharing the same set of libraries.

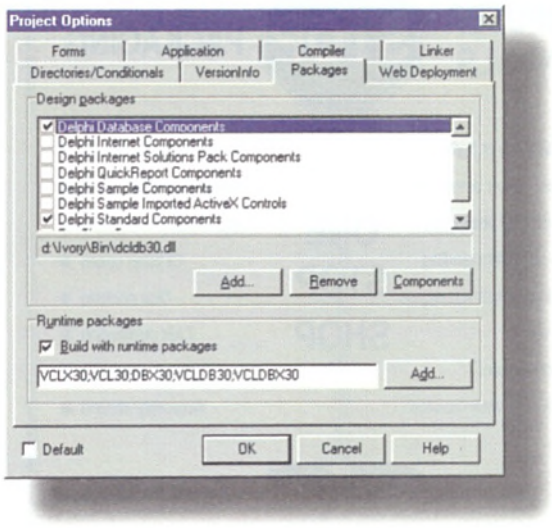

Figure 1 – The new 'Packages' page in the Project Options dialog box. As you check and un-check packages in the list-box, the IDE's component palette is instantly updated to show the currently available components. Rather cute, eh?

Figure 2 – Hold the cursor over a variable in the new Delphi97 debugger and (voila) a pop-up window appears to show you the current value of the variable. Hmmm... now where have we seen that before?

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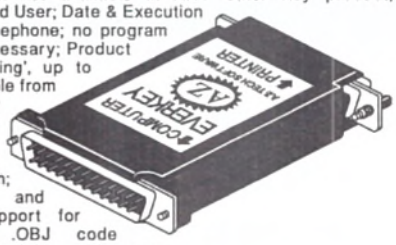

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From the above, you'll have inferred that there are quite a few of these package DLLs in existence. The exact number hasn't been cast in concrete at the time of writing, but the beta version under review contains no less than 19 different packages, arranged so as to group similar functionality into the same DLL. Internet controls are in one package, QuickReport components in another, and so forth. You can edit the contents of a particular package and move components between packages, so as to configure the DLLs to your exact requirements (see Figure 1). However, it goes without saying that if you take units out of the standard packages, other applications which reference them might get a nasty surprise.

It remains to be seen how Borland will tackle this point. There's currently talk of adding versioning and/or functionality querying mechanisms to the package support code – so a program could tell at run-time what's in a given package – but this doesn't particularly help an application if the units it needs can't be found. Much as I like package support in principle, I'm not entirely sure that Borland has thought through the full implications of deploying application(s) which make use of it. My advice to you is this: if you intend to use packages in your application(s), then take care to install your packages into the same directory as the program's that need them. That way, other applications won't get screwed up if you're using non-standard packages, and likewise you're protected from whatever non-standard packages might be in the Windows and/or system directories.

That said, there are other advantages to using packages besides smaller executables. Linking under Delphi has always been fast, but it is now even zippier because only the code unique to the application needs to be processed on each link. If you find bugs in your own packages or (horrors!) in the VCL library, then you can ship your customers a single, updated DLL rather than replacing all affected applications. Interestingly, the Delphi97 IDE is itself compiled to use packages, so Borland must be pretty confident about the new technology.

IDE enhancements

The IDE itself has received something of a facelift. One of the most entertaining aspects of the computer industry is how fashion conscious it is: the style that was 'in' a year or so ago becomes all of a sudden very dated, and everyone scrambles frantically to give their applications the latest 'look'. When it moved from Delphi 1.0 to Delphi 2.0, Borland discreetly removed the increasingly old-fashioned looking Borland glyphs from its *OK*, *Cancel* and *Help* buttons. Now, the Delphi97 component palette and SpeedBar have been revamped with cute Internet Explorer-style buttons which 'pop up' invitingly as the mouse moves across. You'll wonder how you ever coped without them...

Figure 3 – Another new feature is code templates, which automatically complete constructions you type in the code editor window. The associated code completion and parameter experts mean you spend far less time looking at the on-line help.

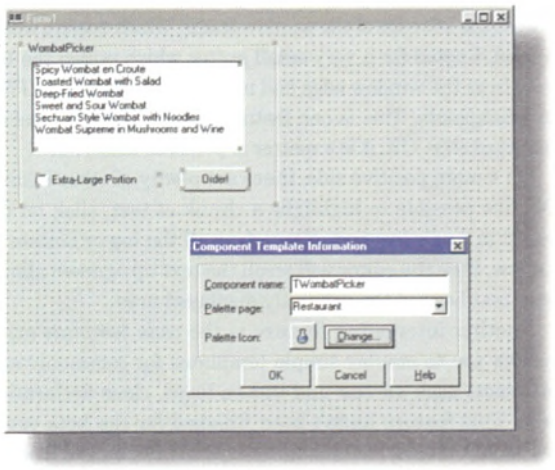

Figure 4 – You can think of component templates almost as mini-forms within a form. Delphi97 allows you to select an arbitrary group of components and add them to the component palette as a new template. When you paste the template into a project, you get a new set of components with all properties and event handlers as they were at the time the template was created.

```
IVCLComObject = interface
 ['{E07892A0-F52F-11CF-BD2F-0020AF0E5B81}']
 function GetTypeInfoCount(out Count: Integer): Integer; stdcall;
 function GetTypeInfo(Index, LocaleID: Integer; out TypeInfo): Integer; stdcall;
 function GetIDsOfNames(const IID: TGUID; Names: Pointer;
 NameCount, LocaleID: Integer; DispIDs: Pointer): Integer; stdcall;
 function Invoke(DispID: Integer; const IID: TGUID; LocaleID: Integer;
 Flags: Word; var Params; VarResult, ExcepInfo, ArgErr: Pointer): Integer; stdcall;
 function SafeCallException(ExceptObject: TObject;
 ExceptAddr: Pointer): Integer;
 procedure FreeOnRelease;
end;
```

Listing 1 – A COM interface definition taken from the VCL library code.

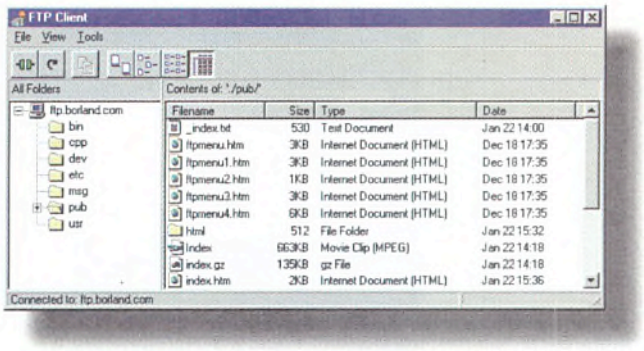

Figure 5 – Here we are logged on to Borland's FTP site, courtesy of the FTP Client demo program, and the Net Manage Internet tools which were previously shipped with Delphi 2.01.

The code editor window now sports a 'gutter' on the left hand side, which you can click to insert breakpoints within your code. Unfortunately, you can't configure the gutter's colour to match the main code display area, and as a result it looks as if the code has somehow 'slipped' over to the right. (Figure 2 shows the debugger which has a similar display.) If you turn the gutter off altogether, then each code line is hard up against the left edge of the window frame, which doesn't work either. In the end, I opted for a very small gutter which pulled the text slightly away from the window edge and made do with using the *F5* key to toggle breakpoints. This is one feature which I thought was definitely a backward step. OK, it is a matter of personal taste, but...

On a more positive side, there are plenty of other additions to the IDE. It's possible to highlight a chunk of text, click on it and then drag it to a new location. If you drag off the top or bottom of the code window, then the editor will scroll the text up or down allowing you to move text beyond the currently displayed area.

Another interesting feature is the *code template expert*, which enables you to employ simple templates for commonly encountered constructs such as `for` and `while` loops, class declarations and so forth. This feature hadn't been finished for the beta version under review, but I understand that in the final release, you'll be able to start typing in a statement and Delphi will complete it for you. For example, type `if` and a pop-up list-box will appear, allowing you to select from a number of different possible `if` statement constructions (see Figure 3).

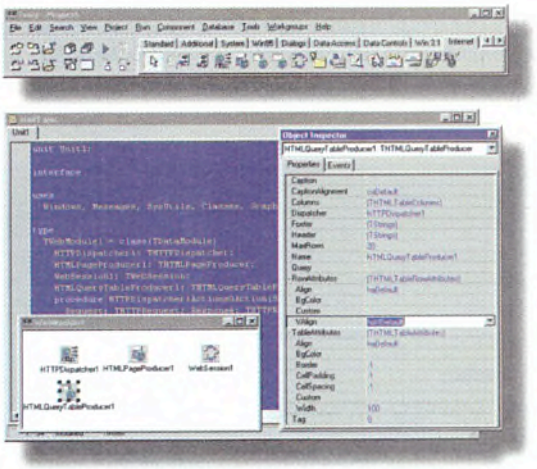

Figure 6 – Delphi97's new WebServer technology makes it possible to use the same RAD-based approach to create powerful, client-side DLLs which communicate with the Web Server using ISAPI or NSAPI.

You will supposedly be able to customise the expert with templates of your own.

In a similar vein, the *code completion expert* and *code parameter expert* features function much like the new code completion facilities in Visual Basic 5.0. The code completion expert knows all about the properties, events and methods associated with a given variable. Thus, if you type in an identifier followed by a dot, a pop-up list will give you a useful list of possibilities to choose from. Similarly, the code parameter expert displays a little tip window as you type, with information about the parameters expected by different methods, procedures and functions. As I mentioned last month in the VB5 review, I anticipated that other development systems would soon begin to sport these features but I really didn't expect it to happen *this* quickly!

If you look at the *Project Options* dialog (see Figure 1), you'll see that it sports several new tab pages, including *VersionInfo*, which contains a simple fill-in form for setting up a version resource for your project, and even allows you to add custom keys. This is sure to encourage those of us who haven't previously bothered with version resources to include them in future projects. [Embarrassed cough]. The *Project Options* dialog even has a *Web Deployment* page, from which you can specify how you want to deploy your application (as files only, CAB file or INF file). Code signing is supported using the SHA1 and MD5 algorithms, and you can specify a credentials file and private key information.

Component templates

In addition to code templates, Delphi97 introduces the idea of component templates. Delphi 2.0 brought in support for form inheritance – deriving a new form from an existing one. Component templates take things a step further. Just select a group of related components, click *Create Component Template* in the *Component* menu, and you get a dialog which asks for the name of the new template. Fill this in, tell Delphi97 which component palette page you want to use for the template, specify an optional bitmap for the template and the job's done – the component group appears on the palette as a single reusable control.

Once you've pasted a component template onto a new form, you can rearrange individual controls in the usual way (see Figure 4). If you named the controls in the template before saving it, these names will persist when pasting the template, unless there's a clash with the existing controls on the form, in which case they will be automatically renamed. Perhaps best of all, the event handlers associated with template controls are saved as part of the template. Provided that you write components' event handlers so as to be independent from other controls not in the group, you can effectively think of component templates as independent reusable plug-in blocks for providing some or all of the user interface functionality associated with a form.

So the Delphi developer now has reusable components, component templates, and form inheritance – it's really an embarrassment of (reusable) riches!

Components galore

Borland hasn't been idle on the subject of components, either. The 'splitter' control makes a welcome debut on the component palette's *Additional* page. Something very much like this control appeared in Delphi 2.0's RESXPLOR (Resource Explorer) demo program. If you wanted a splitter, you had to pull the source out of RESXPLOR for yourself, but now it's sitting waiting for you on the increasingly crowded palette.

Another control which really should have made it last time round is the long-awaited animation component, now found on the *Win95* page. It's rather cute, and can even play AVI files at design time so as to give you a better feel for how the form will look. It is fairly picky about which AVI files it will work with, though: previously, when I

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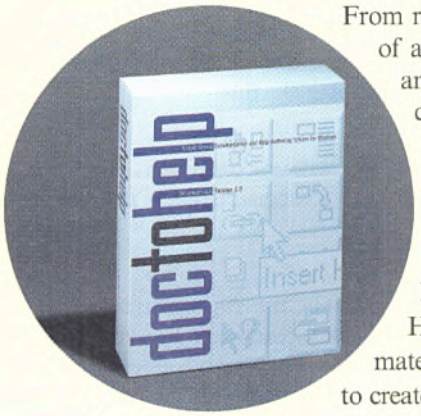

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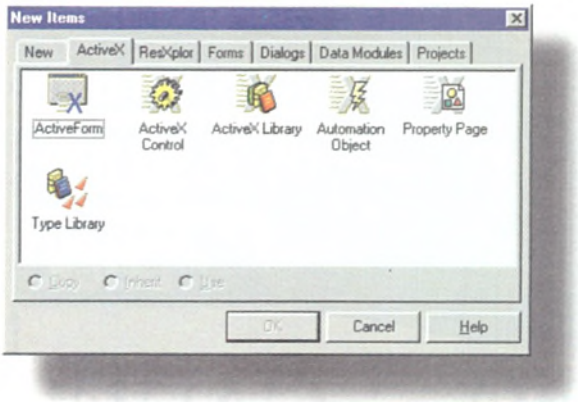

Figure 7 – Here's the ActiveX page of the new items dialog showing some of the new project types you can create with Delphi97. At time of writing, not all the implied functionality was available but ActiveX control creation works a treat.

wanted some good animations to use with it, I was forced to use Resource Workshop to pull the Windows Explorer's animations (file move, copy, search etc) out of Microsoft's executables. You don't have to resort to such nefarious activities any more, since the AVIs are now officially redistributable (and are bundled with VB5).

Incidentally, the control is implemented as part of COMCTL32.DLL, alongside the new VCL wrapper components for the toolbar and the so-called 'coolbar' (also known as the 'rebar'). The coolbar, available only if you've installed Internet Explorer 3.0 or later, allows you to place controls in easy-access 'bars' which can slide over one another or stack horizontally. The coolbar's internal implementation limits you to exactly one control per band, but if you add a toolbar to the band, or use one of Delphi's other 'container' controls such as a panel, group-box or whatever, then you can produce some really cute (and in some cases totally bizarre!) effects. Needless to say, the control's VCL wrapper makes it *so* much easier to program than if you were using the barefoot API. Now if only the shrink-wrap were to include a VCL wrapper for the new hierarchical combo-box, then life would be complete...

The *Dialogs* page of the palette includes `OpenPictureDialog` and `SavePictureDialog` components for ...errrm... well, opening and saving pictures. The selling point of these dialogs is of course the presence of an image box which lets you preview one or more graphics before clicking the fateful *OK* button.

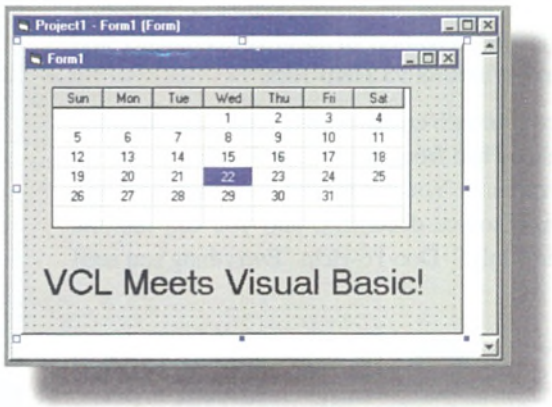

Figure 8 – A marriage made in Redmond – or possibly Scotts Valley. The native Delphi VCL component, TCalendar, converted into an OCX file courtesy of "One-Step" ActiveX control development.

In keeping with today's Internet emphasis, Delphi97 includes a new set of components for *Internet-enabling* your applications, although if you managed to track down a copy of Delphi 2.01, you will already have seen these. The Internet client-side controls include HTML, FTP, HTTP, and low-level socket support. In addition to the usual VCL code, source is provided for much of the Internet stuff, at least as regards to the VCL wrapper layer. You also get a number of sample applications, which I was able to compile and use to access Borland's Web and FTP sites (see Figure 5).

However, Delphi97's Web orientation goes a long way beyond this. On the server side, you have the option of creating 'WebServer Application' projects. A WebServer is a DLL that binds directly to a Web server through an ISAPI or NSAPI interface. You can add components from the *Internet* page of the component palette (such as `TWebSession`, `THTMLPageProducer`, `THTTPDispatcher`, and so forth), or non-visual components such as a `DataSource`, `Query` and `Table`. As the name suggests, components like `THTMLPageProducer` are capable of creating HTML on-the-fly. To make things happen, you use an `HTTPDispatcher` component to set up one or more action items, each of which is associated with a particular URI (Uniform Resource Identifiers, of which URLs are a subset). Each action item then has an associated event handler which you create on the *Events* page of the object inspector in the usual way. Whenever a URI gets passed onto the DLL from the Web server, it's compared with each of the URIs 'registered' in the `THTTPDispatcher` component. If a match is found, then the corresponding event handler is triggered. Each handler is passed an object which encapsulates the client request, another object which allows the handler to form a response, and a `Boolean` flag which enables the handler to indicate whether or not it wishes to handle the request.

ActiveX and all that...

Yes, I've saved what's possibly the best bit until last. One of the most significant features of Delphi97 is the support for all things ActiveX. Borland's stated aim is to turn Delphi97 into 'the enterprise component foundry', by which I think it means that you can use it to create heaps of ActiveX components!

In order to support COM, Borland has added a new keyword, `interface`, to the language. In addition, Delphi now recognises a GUID as part of an interface definition. As an example, Listing 1 contains an interface definition taken from the VCL library code.

Having defined an interface, you can declare a class that implements it using a simple extension of the existing `class` keyword. Thus, you might do something like this:

```
type
 TMyComObject = class (TBaseComObject,
                       IVCLComObject, IAPIComObject)
 ...
end;
```

In this hypothetical example, the `TMyComObject` class has been declared as deriving from `TBaseComObject`. In addition, the class declaration states that this class implements two previously declared interfaces, `IVCLComObject` and `IAPIComObject`. You can have any number of comma-separated class names following the ancestor type name.

Although it's certainly possible to create ActiveX controls from scratch, a far easier approach is to use an existing VCL control – and this is where things get rather exciting. If you click *ActiveX Control* in the *New Project* dialog (see Figure 7), you get presented with a list of your existing (registered) VCL controls. Select one of those, fill in a few other minor details, and Delphi97 will create a new project for you, automatically generating all the necessary wrapper code. Liter-

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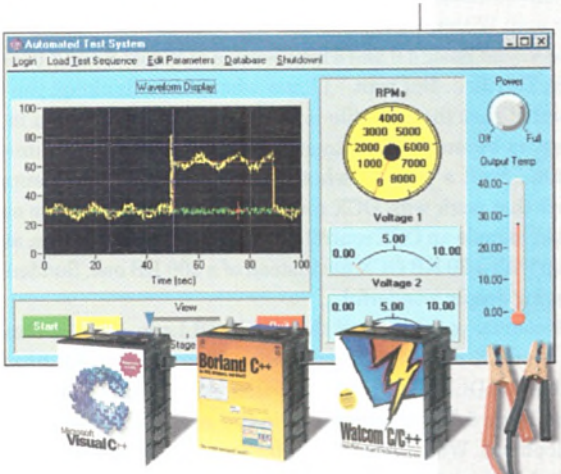

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CIRCLE NO. 137

ally all you have to do is build the project, rename the resulting DLL file with an OCX extension and suddenly you have a shiny new ActiveX control, complete with a generated type library (TLB file). Borland refers to this as 'one-step' ActiveX control development, and it's easy to see why.

At random, I selected the `TCalendar` component (from the *Samples* page of the component palette), put it through the 'ActiveX sausage-machine' and watched a 200 KB OCX file squirt out the other end. Within minutes, I had the calendar component working inside Visual Basic 4.0 and a beta version of Visual Basic 5.0 (see Figure 8). Terrific... But wait – I know what you're thinking: you're disappointed that the OCX file is so large. The reason it's so large, of course, is because it has to contain the entire VCL framework. Hmmm...'wait a minute, what about the new packages support – doesn't that work with OCX controls?', I hear you cry. Sure enough, you can compile an OCX control project so as to use packages, and you end up with a 20 KB OCX file instead of a 200 KB one. Suddenly, life is looking deeply wonderful...

Of course, you still need those VCL DLLs in just the same way that an OCX control authored with Visual Basic 5.0 needs the VBRUN500.DLL library. It's clear that between them, Delphi97 and Visual Basic 5.0 now represent the two simplest routes for ActiveX development. Which one you prefer is a matter of personal choice. Inevitably though, the marketplace in Delphi VCL components is going to become even more buoyant once developers realise that they're effectively killing two birds with one stone.

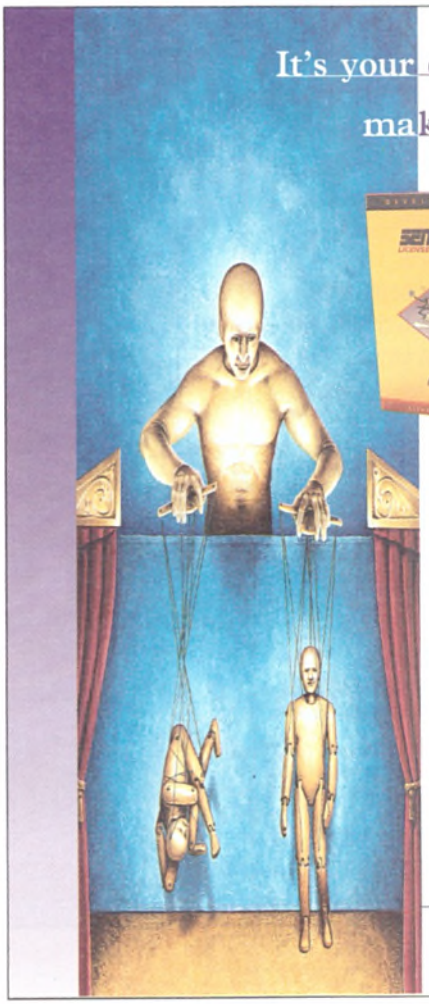
But that isn't the end of the story. Delphi97 also has a feature called *ActiveForms*. This wasn't finished in the beta code, but the idea is that you can turn any Delphi form into an ActiveX document which can then be used inside Internet Explorer, or other ActiveX enabled applications. This obviously represents an approach for deploying Delphi applications over the Internet – the same feature boasted by Visual Basic 5.0.

97 reasons

Although Delphi has always been a great product (I think), there's been considerable resistance to the uptake of Delphi, particularly in the US. Sales of Delphi 2.0 were frankly disappointing, although the Delphi marketplace in Britain and Europe was far more active. Delphi97 goes a long way towards breaking down this corporate resistance through the new features it provides. The package support means that companies creating a suite of applications/utilities can benefit from greater maintainability, lower distribution costs and reduced disk space requirements. The ActiveX support means that you can now develop complex VCL components with impunity, knowing that your work can quickly be turned into an industry standard ActiveX control. The new CAB, INF and code-signing features, ActiveForms support and the WebServer facilities also make Delphi a serious contender for server-side and client-side development, and for deploying applications over the Web.

So, has the best got even better? In my opinion, it certainly has. But at what price, I hear you ask. Well, at the time of writing, final pricing and release date has not been fixed, but Borland has indicated that pricing will be similar to the C++ Builder range, ie £69 (standard edition), £249 (professional edition upgrade), £399 (professional edition), £1299 (client/server edition). You can get more information from the Borland information centre on (0990) 561281. ■

Dave Jewell is a freelance consultant, programmer and technical author. You can contact him as DSJewell@aol.com, 102354.1572@compuserve.com or DaveJewell@msn.com.



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CIRCLE NO. 151

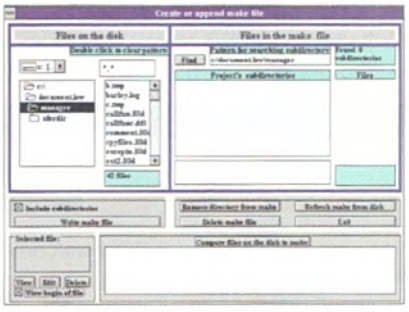
THE YEAR 2000 FOR C/C++ AND COBOL

All programmers can write programs but it takes a special type to analyse, change and reuse code. The constant work overload has pushed analysis and maintenance into the background. The Year 2000 has changed all this.

Legacy Systems Workbench(LSW) minimises the detailed knowledge required for code analysis. LSW scans the C/C++ and COBOL code in minutes into a hierarchical Hypertext facility. From the Hypertext database via multiple documentation paths, a structure of 'Concept Segregation' with 'Interconnecting Threads' is created.

LSW's metrics are implemented at Program level AND System level. LSW automatically captures and documents all aspects of the application in its scanning operation. Fan-In/Fan-Out model provide clear views of program flow even if it is unstructured. The function vs data battle is over. Other tools do not encompass all aspects of process, data, internal and external interfaces and the user interface.

The LSW Y2K (Year 2000) module has been specifically written to interface with the Hypertext database and provide the users with addresses of code to be changed. The results can be implemented and tested within LSW itself.



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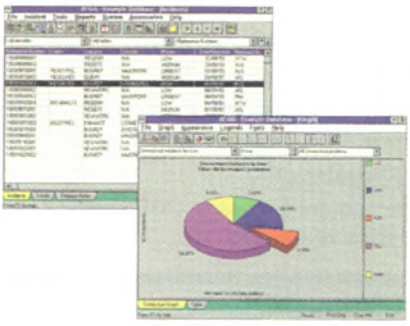

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CIRCLE NO. 139

ImageGear 6.0

Looking for a change of image? Your worries may be over as **Philip Harris** looks at a product which claims to help.

To paraphrase an old saying, the great thing about graphics file formats is that there are so many of them. And as anyone who has developed graphic import and export filters will tell you, the great thing about the specifications is that they are not always entirely accurate. Add to this the fact that other people's implementations don't always produce 100%-conformant image files and you've got yourself a real problem, particularly if you are facing down an approaching deadline. Enter ImageGear, one of several libraries which aim to hide the complexities of image file formats and let you get on with the rest of your application.

The library comes in two flavours, Standard and Pro Gold, both available in VBX, and 16-bit and 32-bit DLL and OCX (ActiveX) versions. The Pro Gold edition has the advantages of better optimisation, a number of more advanced features, and availability on a range of non-Intel platforms including NT/MIPS [although Microsoft has abandoned this – Ed], NT/ALPHA, Mac and AIX. Unlike many other libraries, neither version includes source code. For the record, the two packages I tested were the 16-bit Standard DLL and Pro Gold 32-bit ActiveX kits.

The first thing you'll notice when you open the ImageGear box is the documentation. You actually get one of those old style black-chemicals-on-dead-tree manuals. What's more, it covers the entire package, a welcome change from the standard slim 'Getting Started' pamphlet composed mostly of references to the online help. The online help is of course available, but the manual goes to some trouble to tell you everything you need to know. In some cases it could actually be said to go a little too far: I would have assumed that anyone forking out $2000 for an image library would already have grasped the concept of the `WM_PAINT` message.

Installing the library is simple enough, once you've digested the license agreement (see *Licensed to...?*). Once installed the 16-bit DLL version takes up about 8 MB of disk space, including the sample applications which are supplied as both source and executables. The DLL itself is 820 KB. The

Gill Button - "Yellow Pinky"

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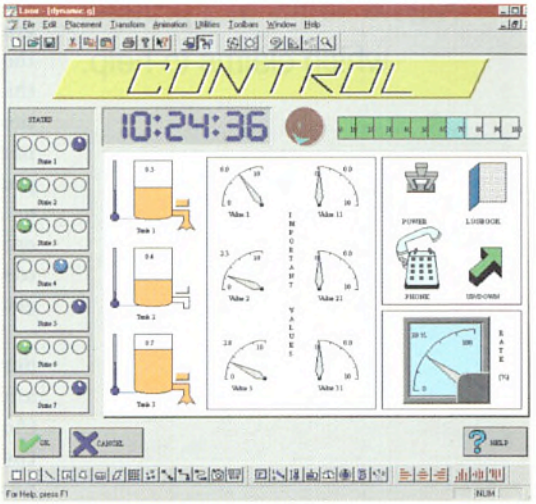
LOOXWin

LOOXWin is a complete graphical development tool, based on Win32, that can dramatically ease the development of your animated interactive interfaces. LOOXWin is ideal for creating applications in Command and Control, Network Monitoring, Simulation, Process Control, GIS etc. LOOXWin comprises LOOXMaker and LOOXLib.



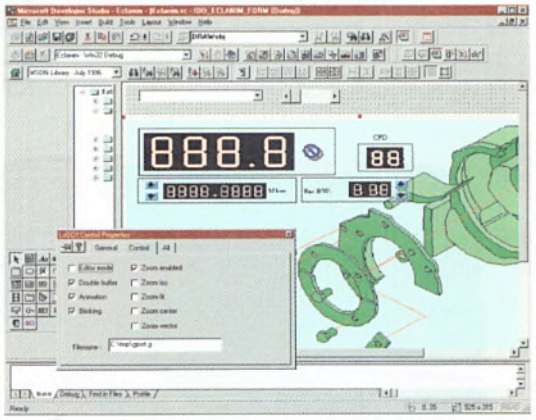
Includes:

LOOXMaker

LOOXMaker is a graphic editor with a rich set of vector and dynamic objects that makes it easy to design very sophisticated graphical interfaces.

LOOXLib

LOOXLib is an object oriented DLL which allows the creation and control of the graphical objects designed in LOOXMaker. LOOXLib automatically handles all the difficulties normally associated with programming in Win32, including refreshing and drawing optimisation.



Key Features

- Fully supports Vector graphics, with editable resource funtionality
- Integrates with standard Windows developer tools such as MicroSoft Visual C++
- Application wizards are available to facilitate generation of common program types
- Supports OLE, OCX and MFC standards
- LOOXWin uses OLE to export graphic objects to several types of external applications. (Word Processors, Spreadsheets etc.)
- The LOOX development environment is also available on UNIX platforms

SYSTEM REQUIREMENTS	
Platform	Windows NT Windows 95
Memory	16 MB
Disk	15 MB
Compiler	Visual C/C++ Borland C/C++

For more information on LOOXWin contact Scientific Computers on 01293-403636

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CIRCLE NO. 140

Original image

Converted to monochrome using halftone dithering

Image converted to 256 colours using Median Cut colour reduction.

Image converted to 256 colours using Octree colour reduction.

Image converted to 16 colours using Image Gear's diffusion colour reduction technique.

Image converted to 16 colours using Paint Shop Pro's error diffusion colour reduction technique.

Figure 1 – Colour reduction techniques.

ActiveX version is slightly smaller, with a 7 MB installation and a 750 KB control. The 32-bit libraries support multi-threading and include long filename support.

Basic features

The core functionality of an image library is of course being able to deal with a variety of image formats and ImageGear has this covered admirably. The current version reads over 45 formats and writes over 30 (see Table 1), although as ImageGear is aimed firmly at bitmaps there are few vector formats in the list. Those vector formats which are supported are restricted to the bitmap portion of the format only. Windows Metafile images, for example, are converted into a bitmap before use, discarding the vector information. The library supports GIF and LZW TIFF, but since portions of these are patented technology you will need to contact Unisys to arrange a licence before they can be used (see *Patent nonsense*).

ImageGear can load and save images, rectangular portions of images and embedded raw Group 3 and 4 fax data from anywhere in memory or on disk. You can even supply a call-back function for implementing a progress indicator. Once loaded, images are stored internally as standard Windows Device Independent Bitmaps (DIBs) referenced by `HIGEAR` handles. There are a couple of functions that provide direct access to the DIB information, but ImageGear's range of functions is so extensive that you probably won't need them. There are even functions for accessing rows, columns and rectangles of pixels in addition to the more usual single-pixel access routines. For some reason, though, only the single-pixel routines are available in the 32-bit ActiveX version of the library.

A range of display functions are available from basic drawing of the bitmap or a rectangular portion of it in a window to dithering and contrast settings. Display settings are controlled by calling the appropriate *set* function before calling the display function. For example the following code will draw the image so that it fills the entire client area of the window:

```
/* Get paintable rectangle of window: */
   GetClientRect ( hWnd, &rClientRect );

/* Copy to Images Device Rect, going to
   display image to whole window:    */
   rDevRect.top    =  rClientRect.top;
   rDevRect.left   =  rClientRect.left;
   rDevRect.bottom =  rClientRect.bottom;
   rDevRect.right  =  rClientRect.right;

/* Set Rect in which to display image: */
   IG_device_rect_set ( hIGear,
                        &rDevRect);
/* Tell ImageGear to display this image
   in its Dev Rect. */
IG_display_image ( hIGear,
                   psPaintStruc.hdc );
```

The downside to using the DIB format is that the ImageGear display functions are slower than the standard Windows `BitBlt` for Device-Dependent Bitmaps (DDBs). It is possible to obtain a DDB from an ImageGear handle, but the DDB display functions are very basic. The slow drawing of images is particularly apparent in the sample programs which all use the DIB technique, and for your own applications you will almost certainly want to use some form of DDB buffering for faster updates. That's not a failing of the library though, just an unfortunate side effect of device independence under Windows.

Colouring in

ImageGear supports several colour reduction techniques including median-cut and octree and can be instructed to reduce an image as it is loaded, as it is displayed or as a one-off operation which affects an image held in memory. Figure 1 shows an image dithered using a selection of ImageGear's dithering options. The 256 colour reduction is excellent, but the 16-colour diffusion does not come off well compared to similar functions in Paint Shop Pro. The set of image processing operations is as comprehensive as the rest

of the package, covering everything from contrast (five functions!) and gamma correction to special effects such as blur, emboss, chromakey and watermark.

ImageGear's printing support comes in two forms. The first sends the image directly to the printer and leaves it to worry about dithering while the second function handles dithering the image before it is printed. The second technique is slower but will give better results on black and white printers. While neither of the functions provide much flexibility they do save you a small amount of programming. For scanning, ImageGear supports a partial implementation of version 1.5 of the TWAIN standard (which apparently stands for Technology Without An Interesting Name). Only one of the three data transfer modes is handled, and the library does not support the TWAIN 1.6 standard (released in February 1996). It should still be compatible with the vast majority of scanners on the market, though, and future versions will support the standard fully.

A feature too far?

By version 6.0 of a library like this you would expect the designers to be running out of ideas for new functionality. Apart from yet more image formats what can you do to make the upgrade worth its while? Well, AccuSoft has answered this question with 'Advanced GUI' features. The most useful of these is an *overview window* which displays a miniature of the image being displayed, with the currently visible area highlighted and changeable by clicking in the overview. Functions are also provided to support pan and zoom by modifying the area of the image which will be drawn by the display functions. A *thumbnail browser* is a window containing thumbnail versions of a series of images (as in Corel Mosaic). The last and least useful of the GUI functions is a palette editor for editing an image's palette: it does the job, but the edit window is very badly designed and uses a common palette dialog box to actually change colours. I would much rather have seen something along the lines of the palette editors used in packages like CorelDraw.

And the list of functions goes on. Clipboard support, colour space conversion, saving and loading of palette files and more. In total the library provides over 200 application-callable functions. Thankfully, the DLL version of the library offsets its huge size with a sensible naming convention. Each function has several portions to its name, for example `IG_display_dither_mode_set` is a function which belongs to the dither section of the display group and which sets the dither mode. This convention makes for some very long names but after a while each group of functions can be found very easily, even if you can't remember the exact name. The ActiveX version is more confusing but there are less functions and with a bit of experience that won't be a problem.

The help file supplied with the package is virtually an identical electronic copy of the manual, covering all of the functions, complete with code examples. Both versions of the package include a variety of samples ranging from simple file viewers to thumbnail browsers although most of them are very basic. Each one comes with full source, in C for the DLL version and Visual Basic for the ActiveX library. Unfortunately, the samples are very poor in places, particularly in the ActiveX version (which has fewer as well). Some have menu options which are permanently disabled or simply do nothing.

Interestingly, tucked away among the samples for the 16-bit DLL version of the software is a set of C++ classes which encap-

ImageGear supports the following formats:

Amiga ILBM (IFF)	Mac Paint (MAC)
ASCII (TXT)	Microsoft Paint (MSP)
ATT	NCR
Brooktrout (301 or BRK)	PC Paintbrush (PCX)
CALS Raster Type 1 (CAL)	Photoshop (PSD)
CCITT G3	PICT (PCT)
CCITT G4	Portable Anymap File Format (PNM)
CIF ABIC (CIF)	Portable Bitmap File Format (PBM)
DCX	Portable Graymap File Format (PGM)
Dicom	Portable Network Graphics (PNG)
Dr Halo (CUT)	Portable Pixmap File Format (PPM)
Encapsulated Postscript (EPS)	Run Length Encoded data stream (RLE)
Gem Paint (IMG)	SGI Image File Format (SGI)
GIF	Sun Raster (RAS)
GX2	Targa (TGA)
IBM IOCA (ICA)	TIFF 6.0 (TIF)
IBM IOCA ABIC	Windows Bitmap
IBM MO:DCA	Windows Clipboard (CLP)
ImageGear Format (IGF)	Windows Icon (ICO)
IMNET (IMT)	Windows Metafile (WMF)
JBIG	WordPerfect Graphics (WPG)
JPEG-JFIF (JPG)	X PixMap (XPM)
Kodak Photo CD (PCD)	X Window Bitmaps (XBM)
Kofax Group 4 (KFX)	X Window Dump (XWD)
Laser Data (LV)	Xerox (IMG)

Table 1 – Image formats supported by ImageGear .

Load	PCX	TIFF	JPEG	TGA	
16-bit DLL	1.9	0.9	1.6	0.5	
32-bit ActiveX	0.4	0.5	1.2	0.4	
Paint Shop Pro	1.4	0.7	0.9	0.5	
Save	**PCX**	**TIF**	**JPEG**	**TGA**	
16-bit DLL	2.5	1.5	4.2	0.3	
32-bit ActiveX	1.1	0.9	3.0	0.3	
Paint Shop Pro	1.3	1.6	1.6	1.1	
Image Processing	**Emboss**		**Blur**	**Dither to 16 Colours**	**Pixels**
16 bit DLL	4.5		4.4	1.6	4
32 bit ActiveX	1.8		2.1	1.2	0.5
Paint Shop Pro	2.3		4.6	1.5	0.5

Table 2 – Timing of various functions. The test image was 560x486 pixels at 24-bit. All times are in seconds.

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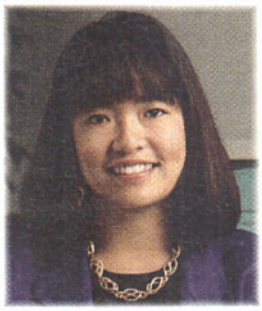

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Patent nonsense

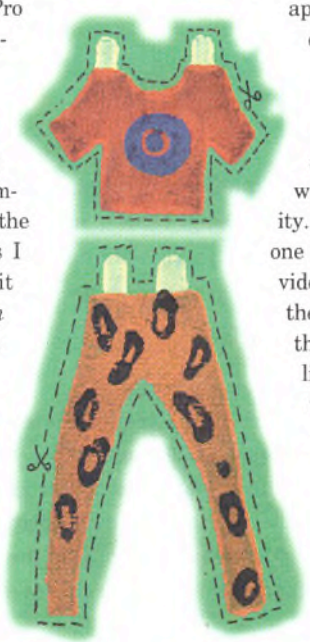
At the end of 1994 CompuServe announced that the compression technique used in its GIF image format was patented by Unisys and that developers using the format would be required to pay a royalty (See *EXE* May '95, *Patent grief in GIF city*). The same patent also applies to the LZW variety of TIFF files. Despite the best efforts of developers everywhere, which have included the creation of a replacement format (the Portable Network Graphics or PNG format), GIF and LZW TIFF are still unavoidable. GIF is the de facto standard for 256 colour graphics on the Internet, and TIFF is prevalent in desktop publishing and design environments. Very few graphics applications can afford to ignore either format, and that means negotiating a licence with Unisys.

Like other libraries, ImageGear's GIF and LZW TIFF support code is supplied encrypted, with AccuSoft supplying a decryption key once you have obtained a licence from Unisys. At the time of writing, royalties are around 0.45% for GIF and 0.65% for TIFF, on top of the $1000 initial fee. These rates do vary so you will need to check with Unisys for your specific application. Emailing StarrMT@po4.bb.unisys.com with details of your application and your fax number should get you the appropriate licensing details.

sulate the library and a similar set of classes designed for MFC users. It would be nice to see more made of this: in particular there are no similar classes with the ActiveX version.

Gold teeth

The Pro Gold edition of the package is around twice the price of the Standard version, but what exactly do you get for your money? Well, for a start the Pro Gold version is faster, (AccuSoft claims) by 2 to 8 times for black and white images and 2 to 4 times for colour images. It additionally sports optimised image display, zooming and panning. To compare the speeds of the two versions I loaded and saved the 24-bit image from *Colour reduction techniques* with both versions of the software and version 4 of Paint Shop Pro. I also compared the speed of several of the image processing functions, again using Paint Shop Pro as a 'real world' comparison. The results are shown in Table 2.



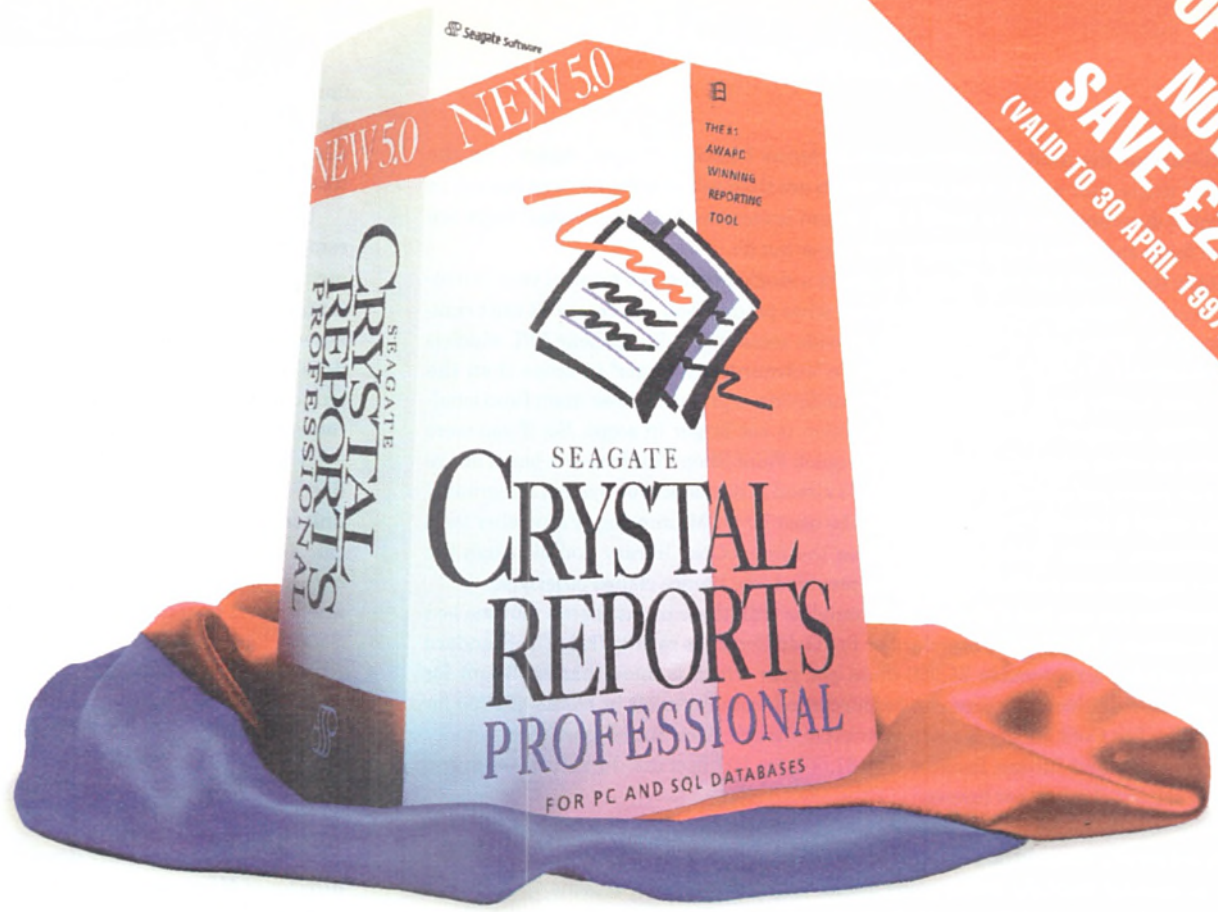
As expected, the Standard version of the library is slower than both the Pro Gold version and Paint Shop Pro, although some of the difference may be due to the 16-bit nature of the DLL. Better news, however, is that the Pro Gold version holds its own against Paint Shop Pro, even surpassing it in several tests, with only JPEG compression letting it down.

In addition, the Pro Gold version adds a number of functions such as 1/100th of a degree rotation of images, anti-aliased display and auto-deskew. There not as many extra functions as you might expect, so I think the Standard version is the one that most people will go for. Beware though: while using the ActiveX version, it became clear that not all of the functionality of the DLL version was available. A quick email to AccuSoft confirmed that the ActiveX versions do not contain all of the facilities of the DLLs. Worth knowing if you're planning on going with the newer technology, although apparently only a small number of functions are missing from the controls.

Two things are critical in an image library. Firstly speed, which AccuSoft has well covered. Secondly reliability. Any library, and particularly one where source code is not provided needs to be able to read all the files you and your customers throw at it. Both versions of the library managed to load every uncorrupted image I tried, and safely handled those which were corrupted. If you should come across an image that the library doesn't load, AccuSoft guarantees that it will fix the problem for you. I did have occasional problems with the sample programs crashing and the ActiveX version of the library does seem to lack some error handling. For example, calling the `Emboss` function without setting the direction of the emboss frequently caused a general protection fault. If everything was properly initialised before use everything worked fine though.

Six and not out

Although this is version 6 of ImageGear, it is in fact an entirely new product. AccuSoft's



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Licensed to...?

ImageGear has the most restrictive licensing terms I have ever seen. Apart from the standard single-user-only license terms (which are themselves stressed very heavily in the licence document) and the usual LZW patent issues (see *Patent nonsense*) there are several fairly significant limitations on what you can do.

Firstly the library can only be used to create a single product: no reuse of your investment here. Secondly there are limitations on what product you can create. It can't compete with the ImageGear product itself or provide access to the ImageGear API, which is understandable. Your product must also be 'substantially larger' in scope than the ImageGear library itself. In case you were wondering, a product whose main functionality is image manipulation or format conversion is not larger in scope. So, if you were planning on using this library to knock up a quick Paint Shop Pro clone or a batch image converter you're out of luck. If your product is aimed at developers or 'system integrators' you can forget it as well. Your product can't be used for OEM licensing or any other form of distribution which involves sub-licensing the ImageGear library and although the manual suggests you can use the samples provided, the licence claims otherwise.

Assuming you can find a product that complies with those terms there's still one last issue to consider. Neither the Standard or Pro Gold library is royalty free. The Standard library includes a reasonable 25,000 units per year which is more than sufficient for most people. Additional licences can be purchased from AccuSoft in blocks of 5000 for $1,000. The Pro Gold library is more restrictive though. Your initial purchase includes just 50 licences and further licences cost $1,000 for 100 licences. In both cases larger blocks work out cheaper per licence.

While royalty based licensing is not unreasonable there are other image libraries which are royalty free and don't have such restrictive licensing agreements so you might want to consider carefully before going ahead with ImageGear. Particularly if you are going to use the Pro Gold version: 50 licences could easily be eaten up by a beta test.

previous image library, the AccuSoft Image Format Library (IFL), was licensed from Snowbound Software. In May of 1996 a court case between AccuSoft and Snowbound resulted in the rights to the IFL being returned to Snowbound, which now markets it as its own product. As a result AccuSoft has released a completely new library with a new API. Whether this new code is licensed from a third party or written in house isn't clear (although development has apparently taken two years) but the new API means anyone who has been using the original AccuSoft library will need to spend some time with the transition guide in the manual to get their code up and running. In addition, if you are upgrading from version 5 you may want to check out Snowbound Software's version first.

AccuSoft has covered the functionality which would be required by most graphics programs (and then some) but there are one or two gaps. Functions which operate on an area of an image will only work on rectangular regions: elliptical and irregular regions would be very useful. There are still a few image processing operations which are not covered, too. For example, the diffusion colour reduction function cannot reduce to 256 colours, and the auto-deskew functions imply that some sort of OCR functionality could be added. Although it's not really the fault of the library itself, the speed of the display functions leaves something to be desired. An intelligent DDB buffering system would ease that somewhat.

ImageGear is an excellent package, very comprehensive and undoubtedly useful for anyone who is developing graphics applications but given the restrictions in the license agreement it is most suited to a consultant developing custom applications which will be used by a relatively small number of customers. The library's performance is very good but the difference between the Standard and Pro Gold versions is marginal unless your application is really speed critical. Anyone who plans on taking the world by storm with a new graphics program might want to enquire as to whether AccuSoft will actually let you release it using its library before splashing out and if you're planning on using the ActiveX versions check to make sure the functionality you need really is included. ■

Philip Harris is a software developer and director of Microtrope Ltd, a Windows software development company based in Oxfordshire. He can be contacted by email at piharris@microtrope.com or on the web at http://www.microtrope.com. Our colour reduction supermodel was Mark Harris.

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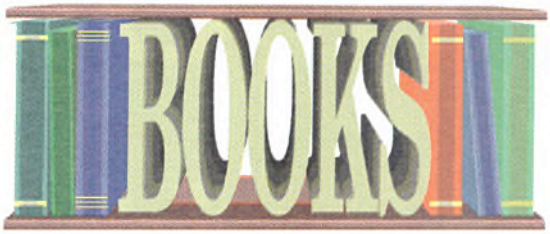
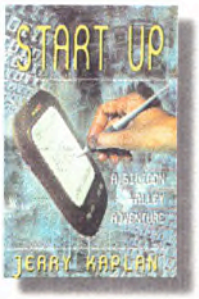


Start Up reviewed by **Will Watts**



Start Up is the incredibly true story of how author Jerry Kaplan, using huge amounts of time, energy and not-his-own money, built the GO Corporation – the company that never quite made pen computers, remember? – from a mere wild, exciting all-American techno dream into nothing at all. Oops, I've gone and given away the plot. What a clumsy clogs.

Here is the moment where Kaplan, flying to San Francisco with Mitch 'Lotus 1-2-3' Kapor in the latter's private jet, first conceives the idea of building a pen computer:

'The poet Edna St. Vincent Millay wrote that "Euclid alone has looked on beauty bare." And now Mitchell and I knew exactly what she meant.'

'We were momentarily unable to speak. I saw Mitchell's eyes become glazed and teary.'

Presumably the cabin's oxygen mixture was too rich. After they have stopped blubbing and landed, Mitch encourages Kaplan to start a company to exploit their idea, but himself (I note) fairly soon quits to spend more time with his Hawaiian shirt collection. I suspect old Mitch is more savvy than he lets on.

(At this point I reached down my dog-eared copy of Robert X Cringely's superb 1992 history of Silicon Valley, *Accidental Empires*. Here are Cringely's four tips for would-be entrepreneurs: *1) Avoid stupid and unlucky people. If you are stupid or have bad luck, don't start a high-tech business. 2) Do a product that you want to do, not one that they want you to do. 3) Don't take venture funding until you have used up your own money, your mother-in-law's money and everything you can borrow. 4) Invite me to lunch.* Hey kids: see if you can spot Kaplan breaking any of the rules.)

Kaplan starts by going out and getting venture funding, which he uses to launch GO. He assembles a team of techies. They build a primitive prototype and use up all the money. The prototype is shown to Bill Gates of Microsoft, in the hope that he will ISV for them and give them some money SDFGHJ XCVBNM TYUOIP90-=#

Sorry, I was laughing so much I banged my head on the keyboard. There, that wouldn't have happened if pen computing had taken off.

Gates resists Kaplan's offer, but Kaplan gets hold of another few million from other sources. Kaplan meets a sinister organisation called 'The Research Board', whose members 'control the computer budgets for some of the largest businesses in the world'. While presenting to this Board, it all gets to be too much, and Kaplan experiences some sort of awe-of-power orgasm ('I was in heaven' he writes).

GO completes a new prototype, using pens made by a Japanese Moony-cult company. GO again involves Microsoft, trying to persuade them to write applications for GO. The Microsoft rep advises them to use Windows as the OS. The GOalies take this badly. As a result of his earth moving Research Board effort, Kaplan manages to get a contract with an outfit called State Farm – conditional on the project being partnered by either Hewlett-Packard or IBM. Kaplan & co. predictably (given Kaplan's power fetish) elect IBM. Equally predictably IBM then drags GO into a mire of technical negotiations, lawyers and general time wasting.

GO continues to spend money. They never ship anything. They raise more money. They do more prototypes. They hype pen computing. Soon everybody else in the world plans a pen computer. Apple announces the Newton. Microsoft says it will put pen support into Windows. GOalies stunned, like Beatles when Brian Epstein dies. Third party vendors switch loyalty to Microsoft. The whiney own-GOalies are outmanoeuvred by Redmond at every turn. Kaplan's hair goes grey. Kaplan's father dies of cancer, but neither Gates nor IBM are implicated. GO crawls free of IBM straight into a snare with the Death Star itself: AT&T. GO finally runs out of money and is absorbed by AT&T, which shuts it down in 1994, about fifty pages too late. Nothing is ever shipped to anybody.

The book's index includes the entry: *Kaplan, Jerry: ... personal goals of, 26-27.*

Towards the end of the saga, when all is clearly lost, Uncle Mitch Kapor reappears for another emotional set piece. This time Mitch balls out Kaplan because Kaplan has been a hopeless dope, slaps him around a bit, and demands his million bucks investment back. OK, that was wishful thinking. Mitch actually tells Kaplan that he has won, huh?, and gives him a big juicy hug. Yeah, right.

✔ **Verdict: Irritating, but some good unintentional laughs.**

Title:	*Start Up*
Author:	*Jerry Kaplan*
Publisher:	*Warner Books*
ISBN:	*0-75151-713-5*
Price:	*£7.99*
Pages:	*322*

Programming with GNU Software reviewed by **Paul Dunne**

The classic text describing and explaining the programming tools available on Unix is *The UNIX Programming Environment*, by Kernighan and Pike, published in 1984. Times have changed; that book now shows its age. In particular, since its publication, the GNU Project has produced a range of software tools that both parallel and improve on the time-honoured Unix tools. *Programming with GNU Software* is an introduction to the most important of these tools. The book is not a replacement for 'Kernighan and Pike'; but is an important supplement, for in many areas the tools have changed beyond recognition. A case in point is gdb, the GNU debugger, a far superior tool to the traditional adb and sdb.

The book starts with the assumption that one is coming to the tools with no knowledge of them; the only specific requirement is a familiarity with C. After an introduction to the philosophy behind these tools, a short chapter covers the need-to-know material on Unix, which is assumed to be the operating system on which the tools are running. Bits and pieces of the GNU software have been ported to other platforms, but Unix remains its home.

A chapter on Emacs concentrates on editing C code, and provides the basic information for getting the code typed in. Compilation and linking with the gcc command-line invocation is good but rather terse. It could have been expanded to cover gcc's options in greater detail. The chapter on the GNU C and C++ libraries can't hope to be comprehensive, however, it might have paid more attention to the enhancements made available in those libraries over those of standard Unix. It is really too slim as it stands. Chapters on gdb the GNU make; the revision control system RCS and the GNU profiler gprof, all serve as good introductions.

The included CD-ROM contains all the tools dealt within the book, with full source and compiled binaries for a variety of common Unices. The binaries have been provided by Cygnus Support, a company which sells support for much of the freely available GNU project software.

The book is a useful resource for the Unix newbie who can program, but who is unfamiliar with the tools available on a Unix system. It is also handy for someone with a Linux system who needs a good introduction to the GNU programming tools. Equipped with this book, and an introduction to the C language, one has all one needs to get started as a Unix programmer. I think, though, that there is still a need for a more advanced book to fill the gap between this and the formidable GNU manuals.

✔ **Verdict: Recommended for Unix newbies.**

Title:	*Programming with GNU Software*
Author:	*Mike Loukides & Andy Oram*
Publisher:	*O'Reilly*
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Paradox ObjectPAL	To suit	3	735	Leamington Spa	FOCUS
GROUPWARE / OFFICE SYSTEMS					
Supporting Microsoft Exchange - Core Technologies	To suit	5	1375	Cirencester	QA TRAIN
ReportSmith 2.5 Introduction	06/03/97	1	195	Leamington Spa	FOCUS
ReportSmith 2.5 Introduction	10/04/97	1	195	Leamington Spa	FOCUS
Crystal Reports	17/04/97	1	195	Leamington Spa	FOCUS
ReportSmith 2.5 Introduction	15/05/97	1	195	Leamington Spa	FOCUS
Crystal Reports	22/05/97	1	195	Leamington Spa	FOCUS
ReportSmith 2.5 Introduction	12/06/97	1	195	Leamington Spa	FOCUS
Crystal Reports	19/06/97	1	195	Leamington Spa	FOCUS
ReportSmith 2.5 Introduction	10/07/97	1	195	Leamington Spa	FOCUS
Crystal Reports	17/07/97	1	195	Leamington Spa	FOCUS
ReportSmith 2.5 Introduction	07/08/97	1	195	Leamington Spa	FOCUS
Crystal Reports	14/08/97	1	195	Leamington Spa	FOCUS
Design & Development of Workflow Systems	To suit	3	995	Cirencester	QA TRAIN
Application Programming with Microsoft Office	To suit	2	625	Cirencester	QA TRAIN
Supporting Microsoft Office 4.3	To suit	4	1145	Cirencester	QA TRAIN
Supporting Microsoft Office 95	To suit	4	1145	Cirencester	QA TRAIN
Supporting Microsoft Word	To suit	4	1145	Cirencester	QA TRAIN
Supporting Microsoft Excel	To suit	3	895	Cirencester	QA TRAIN
Supporting Microsoft Mail	To suit	4	1145	Cirencester	QA TRAIN
Microsoft Exchange Client Support	To suit	2	595	Cirencester	QA TRAIN
Microsoft Exchange Dev'ment	To suit	4	1295	Cirencester	QA TRAIN
Novell GroupWise V5 Administration	To suit	3	985	Cirencester	QA TRAIN
Supporting Lotus cc:Mail	To suit	4	1195	Cirencester	QA TRAIN
GUI DEVELOPMENT					
Borland Delphi - Database Programming	03/03/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	10/03/97	3	825	Painswick	DPR
MS Visual Basic- Advanced Programming	13/03/97	2	615	Painswick	DPR
MS Access- Fundamentals	17/03/97	5	1250	Painswick	DPR
MS Visual Basic- Introduction	17/03/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part I	07/04/97	5	1250	Painswick	DPR
Borland Delphi - Database Programming	14/04/97	5	1250	Painswick	DPR
MS Visual FoxPro- Programming Fundamentals	28/04/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part 1	19/05/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	28/05/97	3	825	Painswick	DPR
MS Visual Basic- Introduction	16/06/97	5	1250	Painswick	DPR
MS Visual FoxPro- Programming Fundamentals	23/06/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part 1	30/06/97	5	1250	Painswick	DPR
Borland Delphi - Database Programming	07/07/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	14/07/97	3	825	Painswick	DPR
Human Computer Interaction	03/2/97	4	470	Kingston on Th	KINGSTON
INTERNET					
Java - Introduction	21/04/97	5	1250	Painswick	DPR
Java - Introduction	02/06/97	5	1250	Painswick	DPR
Internet Fundamentals	To suit	3	845	Cirencester	QA TRAIN
Internetwork and Internet Security	To suit	2	650	Cirencester	QA TRAIN
Building a Microsoft Intranet using Internet Information Server	To suit	3	995	Cirencester	QA TRAIN
Building an Effective Web Site	To suit	2	650	Cirencester	QA TRAIN
Internetworking with TCP/IP	To suit	4	1245	Cirencester	QA TRAIN

COURSE	DATE	DAYS	£	LOCATION	COMPANY
Internetworking with Microsoft TCP/IP using Windows NT	To suit	4	1245	Cirencester	QA TRAIN
Internet Design and Migration	To suit	3	995	Cirencester	QA TRAIN
Netscape Enterprise Server for Windows NT	To suit	3	995	Cirencester	QA TRAIN
Netscape Enterprise Server for UNIX	To suit	3	995	Cirencester	QA TRAIN
Netscape Mail Server for Windows	To suit	2	695	Cirencester	QA TRAIN
Netscape Mail Server for UNIX	To suit	2	695	Cirencester	QA TRAIN
JAVA for 'Sun Java Programmer' Certification (Hands-On)	08/04/97	4	1190	Bristol	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	08/04/97	4	1190	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	03/06/97	4	1190	London	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	03/06/97	4	1190	Manchester	TRIREME
JAVA with OO Design (Hands-On)	17/06/97	4	1190	Bristol	TRIREME
JAVA with OO Design (Hands-On)	17/06/97	4	1190	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	22/07/97	4	1190	Edinburgh	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	22/07/97	4	1190	Manchester	TRIREME
LANGUAGES					
Borland Delphi - Database Programming	03/03/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	10/03/97	3	825	Painswick	DPR
MS Visual Basic- Advanced Programming	13/03/97	2	615	Painswick	DPR
MS Access- Fundamentals	17/03/97	5	1250	Painswick	DPR
MS Visual Basic- Introduction	17/03/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part I	07/04/97	5	1250	Painswick	DPR
Borland Delphi - Database Programming	14/04/97	5	1250	Painswick	DPR
Java - Introduction	21/04/97	5	1250	Painswick	DPR
MS Visual FoxPro- Programming Fundamentals	28/04/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part 1	19/05/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	28/05/97	3	825	Painswick	DPR
Java - Introduction	02/06/97	5	1250	Painswick	DPR
MS Visual Basic- Introduction	16/06/97	5	1250	Painswick	DPR
MS Visual FoxPro- Programming Fundamentals	23/06/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part 1	30/06/97	5	1250	Painswick	DPR
Borland Delphi - Database Programming	07/07/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	14/07/97	3	825	Painswick	DPR
Delphi 2.0	To suit	5	1200	Leamington Spa	FOCUS
Delphi 2.0 Introduction	To suit	3	735	Leamington Spa	FOCUS
Delphi 2.0 Advanced	To suit	3	735	Leamington Spa	FOCUS
Paradox ObjectPAL	To suit	3	735	Leamington Spa	FOCUS
C Primer	To suit	2	550	Cirencester	QA TRAIN
C Programming	To suit	4	1135	Cirencester	QA TRAIN
Advanced C	To suit	4	1195	Cirencester	QA TRAIN
C++ for non-C Programmers	To suit	5	1195	Cirencester	QA TRAIN
C++ for C Programmers	To suit	4	1135	Cirencester	QA TRAIN
Advanced C++ Develpmnt Techniques	To suit	4	1195	Cirencester	QA TRAIN
Java Programming	To suit	4	1175	Cirencester	QA TRAIN
Advanced Java Develpmnt	To suit	5	1395	Cirencester	QA TRAIN
JAVA for 'Sun Java Programmer' Certification (Hands-On)	08/04/97	4	1190	Bristol	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	08/04/97	4	1190	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	03/06/97	4	1190	London	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	03/06/97	4	1190	Manchester	TRIREME
JAVA with OO Design (Hands-On)	17/06/97	4	1190	Bristol	TRIREME
JAVA with OO Design (Hands-On)	17/06/97	4	1190	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	22/07/97	4	1190	Edinburgh	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	22/07/97	4	1190	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	19/08/97	4	1190	London	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	19/08/97	4	1190	Manchester	TRIREME
C++ with OO Design (Hands-on)	22/04/97	4	1350	Manchester	TRIREME
C++ with OO Design (Hands-on)	22/04/97	4	1350	London	TRIREME
MANAGEMENT					
Management Intro. to OT - General	26/03/97	fi	85	London	TRIREME
Management Intro. to Java/Internet/Intranet	26/03/97	fi	85	London	TRIREME
Management Intro. to OT - General	26/03/97	fi	85	Manchester	TRIREME
Management Intro. to Java/Internet/Intranet	26/03/97	fi	85	Manchester	TRIREME
Management Intro. to OT - General	26/06/97	fi	85	London	TRIREME
Management Intro. to Java/Internet/Intranet	26/06/97	fi	85	London	TRIREME
Management Intro. to OT - General	26/06/97	fi	85	Bristol	TRIREME
Management Intro. to Java/Internet/Intranet	26/06/97	fi	85	Bristol	TRIREME
Management Intro. to OT - General	16/07/97	fi	85	Edinburgh	TRIREME
Management Intro. to Java/Internet/Intranet	16/07/97	fi	85	Edinburgh	TRIREME
Management Intro. to OT - General	16/07/97	fi	85	Manchester	TRIREME
Management Intro. to Java/Internet/Intranet	16/07/97	fi	85	Manchester	TRIREME
MULTIMEDIA					
Distributed Multimedia	17/2/97	4	470	Kingston on Th	KINGSTON
NETWARE					
NetWare 3 Support and Administration	To suit	4	1245	Cirencester	QA TRAIN
NetWare 4 Support and Administration	To suit	5	1395	Cirencester	QA TRAIN
NetWare 4.x Administration	To suit	5	1695	Cirencester	QA TRAIN
NetWare 4.x Advanced Administration	To suit	3	1095	Cirencester	QA TRAIN
NetWare 4.x Design/Implementation	To suit	3	985	Cirencester	QA TRAIN
NetWare Service and Support	To suit	5	1695	Cirencester	QA TRAIN
Networking Technologies	To suit	3	995	Cirencester	QA TRAIN
NetWare NFS Services	To suit	4	1315	Cirencester	QA TRAIN
NetWare TCP/IP Transport	To suit	2	875	Cirencester	QA TRAIN
NetWare Web Server Management	To suit	2	765	Cirencester	QA TRAIN
NetWare for SAA	To suit	3	1315	Cirencester	QA TRAIN
Advanced Networks	3/3/97	4	470	Kingston on Th	KINGSTON
NETWORKS					
Introduction to Data Comms	To suit	2	730	Cirencester	QA TRAIN
Enterprise-wide Comms and Networking	To suit	4	1295	Cirencester	QA TRAIN
Understanding ATM	To suit	2	730	Cirencester	QA TRAIN
Network Primer	To suit	1	295	Cirencester	QA TRAIN
Local Area Network Implementation and Management	To suit	4	1295	Cirencester	QA TRAIN
Microsoft Windows NT SNA Server Implementation & Support	To suit	3	1095	Cirencester	QA TRAIN
OO TECHNOLOGY					
Borland Delphi - Database Programming	03/03/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	10/03/97	3	825	Painswick	DPR
MS Visual Basic- Advanced Programming	13/03/97	2	615	Painswick	DPR
MS Access- Fundamentals	17/03/97	5	1250	Painswick	DPR
MS Visual Basic - Introduction	17/03/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part I	07/04/97	5	1250	Painswick	DPR
Borland Delphi - Database Programming	14/04/97	5	1250	Painswick	DPR
MS Visual FoxPro- Programming Fundamentals	28/04/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part 1	19/05/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	28/05/97	3	825	Painswick	DPR
MS Visual Basic- Introduction	16/06/97	5	1250	Painswick	DPR
MS Visual FoxPro- Programming Fundamentals	23/06/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part 1	30/06/97	5	1250	Painswick	DPR
Borland Delphi - Database Programming	07/07/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	14/07/97	3	825	Painswick	DPR
OO Design and Analysis	20/1/97	4	470	Kingston on Th	KINGSTON
OO Primer	To suit	1	295	Cirencester	QA TRAIN
OO Software Development	To suit	3	965	Cirencester	QA TRAIN
Overview of the Unified Modelling Language	To suit	1	295	Cirencester	QA TRAIN
Moving to the Unified Modelling Language	To suit	2	675	Cirencester	QA TRAIN
OO Analysis & Design using the Unified Modelling Language	To suit	5	1395	Cirencester	QA TRAIN
OO Analysis & Design using Rumbaugh's OMT	To suit	5	1395	Cirencester	QA TRAIN
Detailed Design using Rumbaugh's OMT	To suit	3	995	Cirencester	QA TRAIN
OO Analysis & Design using the Booch Method	To suit	4	1195	Cirencester	QA TRAIN
OO Design Patterns	To suit	2	675	Cirencester	QA TRAIN
OO Analysis & Design with UML	11/03/97	4	1250	London	TRIREME
OO Analysis & Design with UML	11/03/97	4	1250	Manchester	TRIREME
OO Analysis & Design with UML	13/05/97	4	1250	London	TRIREME
OO Analysis & Design with UML	13/05/97	4	1250	Bristol	TRIREME
OO Analysis & Design with UML	08/07/97	4	1250	Edinburgh	TRIREME
OO Analysis & Design with UML	08/07/97	4	1250	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	08/04/97	4	1190	Bristol	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	08/04/97	4	1190	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	03/06/97	4	1190	London	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	03/06/97	4	1190	Manchester	TRIREME
JAVA with OO Design (Hands-On)	17/06/97	4	1190	Bristol	TRIREME
JAVA with OO Design (Hands-On)	17/06/97	4	1190	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	22/07/97	4	1190	Edinburgh	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	22/07/97	4	1190	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	19/08/97	4	1190	London	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	19/08/97	4	1190	Manchester	TRIREME
Advanced Object Design Patterns	25/03/97	1	390	London	TRIREME
Advanced Object Design Patterns	25/03/97	1	390	Manchester	TRIREME
C++ with OO Design (Hands-on)	22/04/97	4	1350	Manchester	TRIREME
C++ with OO Design (Hands-on)	22/04/97	4	1350	London	TRIREME
Management Introduction to OT - General	26/03/97	fi	85	TRIREME	
Management Intro to Java/Internet/Intranet	26/03/97	fi	85	TRIREME	
Management Intro. to OT - General	26/03/97	fi	85	TRIREME	
Management Intro to Java/Internet/Intranet	26/03/97	fi	85	TRIREME	
Management Intro to OT - General	26/06/97	fi	85	TRIREME	
Management Intro. to Java/Internet/Intranet	26/06/97	fi	85	TRIREME	
Management Intro. to OT - General	26/06/97	fi	85	TRIREME	
Management Intro. to Java/Internet/Intranet	26/06/97	fi	85	TRIREME	
Management Intro. to OT - General	16/07/97	fi	85	TRIREME	
Management Intro. to Java/Internet/Intranet	16/07/97	fi	85	TRIREME	
Management Intro. to OT - General	16/07/97	fi	85	TRIREME	
Management Intro. to Java/Internet/Intranet	16/07/97	fi	85	TRIREME	
OS/2					
Supporting OS/2 Version 3 Warp	To suit	4	1145	Cirencester	QA TRAIN
Supporting OS/2 LAN Server 4	To suit	4	1195	Cirencester	QA TRAIN
PC SUPPORT					
PC Fundamentals	To suit	3	795	Cirencester	QA TRAIN
PC Support	To suit	4	1145	Cirencester	QA TRAIN
Advanced PC Support	To suit	4	1195	Cirencester	QA TRAIN
Compaq Technical Certification for Desktops and Notebooks	To suit	2	570	Cirencester	QA TRAIN
Compaq Technical Certification for Servers	To suit	3	850	Cirencester	QA TRAIN
Compaq/NetWare Advanced Performance Integration	To suit	3	850	Cirencester	QA TRAIN
Compaq Server Technologies	To suit	2	570	Cirencester	QA TRAIN
Compaq Insight Manager	To suit	2	570	Cirencester	QA TRAIN
Compaq/Windows NT Advanced Performance Integration	To suit	2	570	Cirencester	QA TRAIN
PROGRAMMING					
Borland Delphi - Database Programming	03/03/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	10/03/97	3	825	Painswick	DPR
MS Visual Basic- Advanced Programming	13/03/97	2	615	Painswick	DPR

COURSE	DATE	DAYS	£	LOCATION	COMPANY
MS Access- Fundamentals	17/03/97	5	1250	Painswick	DPR
MS Visual Basic- Introduction	17/03/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part I	07/04/97	5	1250	Painswick	DPR
Borland Delphi - Database Programming	14/04/97	5	1250	Painswick	DPR
Java - Introduction	21/04/97	5	1250	Painswick	DPR
MS Visual FoxPro- Programming Fundamentals	28/04/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part 1	19/05/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	28/05/97	3	825	Painswick	DPR
Java - Introduction	02/06/97	5	1250	Painswick	DPR
MS Visual Basic- Introduction	16/06/97	5	1250	Painswick	DPR
MS Visual FoxPro- Programming Fundamentals	23/06/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part 1	30/06/97	5	1250	Painswick	DPR
Borland Delphi - Database Programming	07/07/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	14/07/97	3	825	Painswick	DPR
Delphi 2.0 Introduction	03/03/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Advanced	10/03/97	3	735	Leamington Spa	FOCUS
Paradox ObjectPAL	17/03/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Intensive	24/03/97	5	1200	Leamington Spa	FOCUS
Delphi 2.0 Introduction	07/04/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Advanced	14/04/97	3	735	Leamington Spa	FOCUS
Paradox ObjectPAL	21/04/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Intensive	28/04/97	5	1200	Leamington Spa	FOCUS
Delphi 2.0 Introduction	12/05/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Advanced	19/05/97	3	735	Leamington Spa	FOCUS
Paradox ObjectPAL	19/05/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Intensive	26/05/97	5	1200	Leamington Spa	FOCUS
Delphi 2.0 Introduction	09/06/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Advanced	16/06/97	3	735	Leamington Spa	FOCUS
Paradox ObjectPAL	16/06/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Intensive	23/06/97	5	1200	Leamington Spa	FOCUS
Delphi 2.0 Introduction	07/07/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Advanced	14/07/97	3	735	Leamington Spa	FOCUS
Paradox ObjectPAL	14/07/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Intensive	21/07/97	5	1200	Leamington Spa	FOCUS
Delphi 2.0 Introduction	04/08/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Advanced	11/08/97	3	735	Leamington Spa	FOCUS
Paradox ObjectPAL	11/08/97	3	735	Leamington Spa	FOCUS
Delphi 2.0 Intensive	18/08/97	5	1200	Leamington Spa	FOCUS
Client/Server Applications	To suit	2	590	Leamington Spa	FOCUS
C++ OO Programming	To suit	4	700	Kingston on Th	KINGSTON
Programming in Java	To suit	4	700	Kingston on Th	KINGSTON
Applications Programming with X and Motif	To suit	5	875	Kingston on Th	KINGSTON
C Programming	To suit	4	700	Kingston on Th	KINGSTON
Image Processing & Analysis	To suit	3	525	Kingston on Th	KINGSTON
Ada Programming	To suit	5	875	Kingston on Th	KINGSTON
Application Develpmnt using Delphi 2.0 C/S	17/03/97	5	1320	London	PYGMALION
Application Develpmnt using Delphi 2.0 C/S	21/04/97	5	1320	London	PYGMALION
Application Develpmnt using Delphi 2.0 C/S	19/05/97	5	1320	London	PYGMALION
Developing applications using Access 2.0	02/04/97	3	760	London	PYGMALION
Programming in Access 2.0	09/04/97	3	760	London	PYGMALION
Programming with Access for Windows 95	10/03/97	5	1195	London	PYGMALION
Programming with Access for Windows 95	14/04/97	5	1195	London	PYGMALION
Programming with Access for Windows 95	06/05/97	5	1195	London	PYGMALION
Programming with Access for Windows 95	03/03/97	5	1195	Manchester	PYGMALION
Client/Server Develpmnt using VB & SQL Server	03/03/97	3	950	London	PYGMALION
Client/Server Develpmnt using VB & SQL Server	02/04/97	3	950	London	PYGMALION
Client/Server Develpmnt using VB & SQL Server	06/05/97	3	950	London	PYGMALION
Client/Server Develpmnt using VB & SQL Server	24/03/97	3	950	Manchester	PYGMALION
App Develpmnt using Excel 95 & VB for Apps	To suit	5	1195	At Your Site	PYGMALION
Mastering Internet development with ActiveX Technologies	07/04/97	5	1195	London	PYGMALION
ActiveX development using VB 5.0	21/04/97	5	1195	Manchester	PYGMALION
ActiveX development using VB 5.0	17/03/97	5	1195	London	PYGMALION
ActiveX development using VB 5.0	28/04/97	5	1195	London	PYGMALION
Advanced Programming in VB 4.0	07/04/97	5	1195	London	PYGMALION
Advanced Programming in VB 4.0	28/04/97	5	1195	London	PYGMALION
Advanced Programming in VB 4.0	19/05/97	5	1195	London	PYGMALION
Fundamentals of Microsoft VB 4.0	24/03/97	3	795	London	PYGMALION
Fundamentals of Microsoft VB 4.0	23/04/97	3	795	London	PYGMALION
Fundamentals of Microsoft VB 4.0	27/05/97	3	795	London	PYGMALION
Fundamentals of VB 5.0	21/04/97	5	795	London	PYGMALION
Fundamentals of VB 5.0	27/05/97	5	795	London	PYGMALION
Fundamentals of VB 5.0	14/04/97	5	795	Manchester	PYGMALION
Programming intuitive user interfaces in VB 4.0	To suit	2	595	At Your Site	PYGMALION
Upgrading from VB 4.0 to 5.0	24/03/97	3	795	London	PYGMALION
Upgrading from VB 4.0 to 5.0	28/04/97	3	795	London	PYGMALION
Fundamentals of Programming MFC library apps	03/03/97	5	1395	London	PYGMALION
Fundamentals of Programming MFC library apps	28/04/97	5	1395	London	PYGMALION
Implementing OLE 2 in MFC apps	17/03/97	5	1395	London	PYGMALION
Intermediate Windows based Progrmng using MFC libraries	10/03/97	5	1395	London	PYGMALION
Intermediate Windows based Progrmng using MFC libraries	12/05/97	5	1395	London	PYGMALION
Intro to Visual C++ and OO Programming	01/04/97	5	1395	London	PYGMALION
Intro to Visual C++ and OO Programming	27/05/97	5	1395	London	PYGMALION
Programming in MS C++	To suit	5	1395	At Your Site	PYGMALION
Programming in Windows NT 3.5 using C++	To suit	4	1195	At Your Site	PYGMALION

COURSE	DATE	DAYS	£	LOCATION	COMPANY
Mastering Visual J++	14/04/97	5	1395	London	PYGMALION
Mastering Visual J++	12/05/97	5	1395	London	PYGMALION
User interface design for Windows 95	To suit	2	595	London	PYGMALION
Application development using Word	To suit	3	795	London	PYGMALION
OS/2 Presentation Manager	To suit	5	1495	Cirencester	QA TRAIN
OO Analysis & Design with UML	11/03/97	4	1250	London	TRIREME
OO Analysis & Design with UML	11/03/97	4	1250	Manchester	TRIREME
OO Analysis & Design with UML	13/05/97	4	1250	London	TRIREME
OO Analysis & Design with UML	13/05/97	4	1250	Bristol	TRIREME
OO Analysis & Design with UML	08/07/97	4	1250	Edinburgh	TRIREME
OO Analysis & Design with UML	08/07/97	4	1250	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	08/04/97	4	1190	Bristol	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	08/04/97	4	1190	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	03/06/97	4	1190	London	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	03/06/97	4	1190	Manchester	TRIREME
JAVA with OO Design (Hands-On)	17/06/97	4	1190	Bristol	TRIREME
JAVA with OO Design (Hands-On)	17/06/97	4	1190	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	22/07/97	4	1190	Edinburgh	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	22/07/97	4	1190	Manchester	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	19/08/97	4	1190	London	TRIREME
JAVA for 'Sun Java Programmer' Certification (Hands-On)	19/08/97	4	1190	Manchester	TRIREME
Advanced Object Design Patterns	25/03/97	1	390	London	TRIREME
Advanced Object Design Patterns	25/03/97	1	390	Manchester	TRIREME
C++ with OO Design (Hands-on)	22/04/97	4	1350	Manchester	TRIREME
C++ with OO Design (Hands-on)	22/04/97	4	1350	London	TRIREME
PROJECT MANAGEMENT					
Project Management	13/1/97	4	470	Kingston on Th	KINGSTON
Project Management Skills	To suit	4	1150	Cirencester	QA TRAIN
Managing Client/Server S'ware Dev Projects	To suit	3	995	Cirencester	QA TRAIN
OO Project Management	To suit	2	675	Cirencester	QA TRAIN
SYSTEMS ANALYSIS					
SSADM4+ : Advanced Data Modelling	To suit	2	250	Kingston on Th	KINGSTON
SSADM4+ : Behaviour & Process Modelling	To suit	2	250	Kingston on Th	KINGSTON
SSADM4+ : Function Modelling	To suit	2	250	Kingston on Th	KINGSTON
SSADM4+ : Intro to Structured Systs Analys & Design Method	To suit	4	500	Kingston on Th	KINGSTON
OO Analysis & Design with UML	11/03/97	4	1250	London	TRIREME
OO Analysis & Design with UML	11/03/97	4	1250	Manchester	TRIREME
OO Analysis & Design with UML	13/05/97	4	1250	London	TRIREME
OO Analysis & Design with UML	13/05/97	4	1250	Bristol	TRIREME
OO Analysis & Design with UML	08/07/97	4	1250	Edinburgh	TRIREME
OO Analysis & Design with UML	08/07/97	4	1250	Manchester	TRIREME
Advanced Object Design Patterns	25/03/97	1	390	London	TRIREME
Advanced Object Design Patterns	25/03/97	1	390	Manchester	TRIREME
SYSTEMS MANAGEMENT					
Core technologies of Exchange Server	17/03/97	5	1450	London	PYGMALION
Core technologies of Exchange Server	28/04/97	5	1450	London	PYGMALION
Core technologies of Exchange Server	27/05/97	5	1450	London	PYGMALION
Core technologies of Exchange Server	28/04/97	5	1450	London	PYGMALION
Core technologies of Exchange Server	27/05/97	5	1450	London	PYGMALION
Exchange server Multisite & Internet environments	01/04/97	3	1095	London	PYGMALION
Exchange server Multisite & Internet environments	06/05/97	3	1095	London	PYGMALION
Fundamentals of Exchange	To suit	3	1095	London	PYGMALION
Implementing & supporting Proxy Server	10/03/97	2	695	London	PYGMALION
Implementing & supporting Proxy Server	12/05/97	2	695	London	PYGMALION
Installing Internet inofmation Server 2.0	01/05/97	1	330	London	PYGMALION
Supporting Internet inofmation Server	12/03/97	3	995	London	PYGMALION
Supporting Internet inofmation Server	14/05/97	3	995	London	PYGMALION
Implementing Mail 3.5	To suit	5	1360	At Your Site	PYGMALION
Migrating to Win 95 using Systems Managementt Server 1.1	To suit	2	690	At Your Site	PYGMALION
Planning a Systems Management Server Site	To suit	2	695	At Your Site	PYGMALION
Supporting a Systems Mangmt Server 1.2	24/03/97	5	1450	London	PYGMALION
Supporting a Systems Management Server 1.2	28/04/97	5	1450	London	PYGMALION
Windows & MS DOS of support professionals	To suit	3	895	At Your Site	PYGMALION
Supporting Windows 95	01/04/97	5	1295	London	PYGMALION
Supporting Windows 95	21/04/97	5	1295	London	PYGMALION
Supporting Windows 95	27/05/97	5	1295	London	PYGMALION
Windows 95 Technical Overview	10/03/97	1	330	London	PYGMALION
Windows 95 Technical Overview	25/04/97	1	330	London	PYGMALION
Windows 95 Technical Overview	30/05/97	1	330	London	PYGMALION
Accelerated Training of NT 3.51 w/stn & server	To suit	5	1450	At Your Site	PYGMALION
Administering Windows NT 4.0 - final	05/03/97	3	995	London	PYGMALION
Administering Windows NT 4.0 - final	02/04/97	3	995	London	PYGMALION
Administering Windows NT 4.0 - final	06/05/97	3	995	London	PYGMALION
Advanced troubleshooting NT Server 4.0	21/03/97	1	330	London	PYGMALION
Advanced troubleshooting NT Server 4.0	18/04/97	1	330	London	PYGMALION
Advanced troubleshooting NT Server 4.0	23/05/97	1	330	London	PYGMALION
Capacity planning of your NT 4.0 Server network	19/03/97	2	695	London	PYGMALION
Capacity planning of your NT 4.0 Server network	16/04/97	2	695	London	PYGMALION
Capacity planning of your NT 4.0 Server network	12/05/97	2	695	London	PYGMALION
Capacity planning with NT 4.0 Server	18/03/97	1	330	London	PYGMALION
Capacity planning with NT 4.0 Server	15/04/97	1	330	London	PYGMALION
Capacity planning with NT 4.0 Server	20/05/97	1	330	London	PYGMALION
Implementing directory services / NT Server 4.0	17/03/97	1	330	London	PYGMALION
Implementing directory services / NT Server 4.0	19/05/97	1	330	London	PYGMALION

COURSE	DATE	DAYS	£	LOCATION	COMPANY
Integrating NT Server 4.0 with Netware Networks	To suit	1	330	At Your Site	PYGMALION
Inter-Networking with TCP/IP using NT	03/03/97	4	1295	London	PYGMALION
Inter-Networking with TCP/IP using NT	03/03/97	4	1295	London	PYGMALION
Inter-Networking with TCP/IP using NT	21/04/97	4	1295	London	PYGMALION
Inter-Networking with TCP/IP using NT	27/05/97	4	1295	London	PYGMALION
SNA Server of Windows NT	07/04/97	3	1450	London	PYGMALION
Supporting NT Server 4.0 - Enterprise Tech	17/03/97	5	1360	London	PYGMALION
Supporting NT Server 4.0 - Enterprise Tech	14/04/97	5	1360	London	PYGMALION
Supporting NT Server 4.0 - Enterprise Tech	19/05/97	5	1360	London	PYGMALION
Supporting Windows NT 3.51	03/03/97	5	1360	London	PYGMALION
Supporting Windows NT 3.51	01/04/97	5	1360	London	PYGMALION
Supporting Windows NT 3.51	06/05/97	5	1360	London	PYGMALION
Supporting NT 4.0 Core Technologies	10/03/97	5	1360	London	PYGMALION
Supporting NT 4.0 Core Technologies	24/03/97	5	1360	London	PYGMALION
Supporting NT 4.0 Core Technologies	07/04/97	5	1360	London	PYGMALION
Supporting NT 4.0 Core Technologies	12/05/97	5	1360	London	PYGMALION
Windows NT / 95 comparison overview	To suit	1	330	At Your Site	PYGMALION
Windows NT 4.0 - technical overview	04/04/97	1	330	London	PYGMALION
Windows NT 4.0 - technical overview	09/05/97	1	330	London	PYGMALION
Windows NT 4.0 Security	01/04/97	1	330	London	PYGMALION
Windows NT 4.0 Security	09/05/97	1	330	London	PYGMALION
Windows NT 4.0 Upgrade	10/03/97	2	695	London	PYGMALION
Windows NT 4.0 Upgrade	10/04/97	2	695	London	PYGMALION
Windows NT 4.0 Upgrade	12/05/97	2	695	London	PYGMALION
Windows OS's and services architecture	25/03/97	3	995	London	PYGMALION
Windows OS's and services architecture	21/04/97	3	995	London	PYGMALION
Windows OS's and services architecture	27/05/97	3	995	London	PYGMALION
Windows OS's and services architecture	01/04/97	3	995	Manchester	PYGMALION
UNIX					
Introduction to Unix	To suit	4	700	Kingston on Th	KINGSTON
Unix Networking	To suit	4	700	Kingston on Th	KINGSTON
Introduction to Unix (2-day)	To suit	2	350	Kingston on Th	KINGSTON
Advanced Unix Tools	To suit	2	350	Kingston on Th	KINGSTON
UNIX Fundamentals	To suit	4	1095	Cirencester	QA TRAIN
UNIX Systems Administration	To suit	4	1095	Cirencester	QA TRAIN
Mastering UNIX Shell Scripts	To suit	4	1095	Cirencester	QA TRAIN
UNIX Programming	To suit	5	1295	Cirencester	QA TRAIN
Motif User Interface Programming	To suit	5	1295	Cirencester	QA TRAIN
WINDOWS					
Borland Delphi - Database Programming	03/03/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	10/03/97	3	825	Painswick	DPR
MS Visual Basic- Advanced Programming	13/03/97	2	615	Painswick	DPR
MS Access- Fundamentals	17/03/97	5	1250	Painswick	DPR
MS Visual Basic- Introduction	17/03/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part I	07/04/97	5	1250	Painswick	DPR
Borland Delphi - Database Programming	14/04/97	5	1250	Painswick	DPR
Java - Introduction	21/04/97	5	1250	Painswick	DPR
MS Visual FoxPro- Programming Fundamentals	28/04/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part 1	19/05/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	28/05/97	3	825	Painswick	DPR
Java - Introduction	02/06/97	5	1250	Painswick	DPR
MS Visual Basic- Introduction	16/06/97	5	1250	Painswick	DPR
MS Visual FoxPro- Programming Fundamentals	23/06/97	5	1250	Painswick	DPR
Borland Delphi - Programming Part 1	30/06/97	5	1250	Painswick	DPR
Borland Delphi - Database Programming	07/07/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	14/07/97	3	825	Painswick	DPR
Windows Programming in C	To suit	5	1395	Cirencester	QA TRAIN
Windows Programming with Visual C++ and the MFC Library	To suit	5	1395	Cirencester	QA TRAIN
Win32 Programming Essentials	To suit	5	1395	Cirencester	QA TRAIN
Windows OLE Application Programming	To suit	5	1395	Cirencester	QA TRAIN
Windows OLE System Programming	To suit	5	1495	Cirencester	QA TRAIN
Microsoft Systems Management Server Administration	To suit	4	1295	Cirencester	QA TRAIN
Creating Web Content with ActiveX Technology	To suit	5	1375	Cirencester	QA TRAIN
Introduction to Windows 95	To suit	1	295	Cirencester	QA TRAIN
WINDOWS NT SERVER					
Borland Delphi - Database Programming	03/03/97	5	1250	Painswick	DPR
Borland Delphi - Database Programming	14/04/97	5	1250	Painswick	DPR
Borland Delphi - Advanced Programming	28/05/97	3	825	Painswick	DPR
Borland Delphi - Database Programming	07/07/97	5	1250	Painswick	DPR
Developing Windows NT Server Applications	To suit	5	1495	Cirencester	QA TRAIN
Supporting Windows NT 3.51 Servers	To suit	4	1295	Cirencester	QA TRAIN
Supporting Windows NT4.x Servers	To suit	4	1295	Cirencester	QA TRAIN
Supporting Microsoft Windows NT Server 3.51	To suit	4	1295	Cirencester	QA TRAIN
Supporting Windows NT Server 4.x - Enterprise Technologies	To suit	4	1295	Cirencester	QA TRAIN
WINDOWS SUPPORT					
Supporting Windows 95	To suit	4	1195	Cirencester	QA TRAIN
Supporting Windows 3.x	To suit	4	1245	Cirencester	QA TRAIN
Supporting Microsoft Windows 95	To suit	5	1395	Cirencester	QA TRAIN
Supporting Windows for Workgroups	To suit	3	1035	Cirencester	QA TRAIN
Supporting Microsoft Systems Management Server	To suit	5	1395	Cirencester	QA TRAIN

Focus Training & Development (UK) Ltd

Contact: Stuart Ainscow
St Albans House
Portland Street
Leamington Spa
Warwickshire CV32 5EZ
Tel: 01926 887660 Fax: 01926 887450
E-mail: 100446,327@Compuserve.com
URL: www.focus-td.com/focus

Focus Training & Development is a specialist Borland training centre and software house providing introductory to advanced courses for Developers and Managers. We write our own course materials; this allows us to tailor our courses to our customers' needs. Courses can be held at Focus or at a customer site as required.

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Kingston University
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Kingston upon Thames
Surrey KT1 2EE
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E-mail: L.David@kingston.ac.uk
URL: http://techweb.king.ac.uk/courses

Kingston University is a charity whose mission is to support all sectors of the economy by the development of individuals and organisations through quality career-oriented higher education, advanced training and research.

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URL: http://www.pygmalion.co.uk

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Painswick
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E-mail: 71760.632@Compuserve.com
URL: http://www.dp-retreat.com

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RECRUITMENT

RDBMS

UNIX/SYBASE
C.London – £32k + Benefits

We require an Analyst Programmer for the financial sector, based in Piccadilly. Working as part of a small team on development and maintenance of the in-house trading system, using Sybase and ideally Powerbuilder, under UNIX. You will assist Fund Managers in identifying system requirements and you will act as project manager for minor projects.

Ref: RC/1

UNIX/INGRES
C.London – To £28k

Our client, a prestigious software house is searching for Senior Analyst Programmers with good Ingres and UNIX skills. The ideal candidate will also have a good understanding of a recognised methodology. Formal training and the opportunity to develop you own career path, together with an excellent benefits package are some of the attractions!

Ref: PP/2

UNIX/SYBASE/POWERBUILDER
West London – To £35k

A world leader in state of the art technology, requires a number of senior development professionals with excellent user facing, interpersonal and presentation skills. You will be responsible for the development, implementation and support on a range of Client Server Systems. Experience of Sybase and/or Powerbuilder under UNIX would be ideal, although cross training from major relational databases will be provided.

Ref: KB/3

UNIX DEVELOPMENT

UNIX KERNEL
Herts – To £35K + excellent bens

Our client is seeking a highly skilled UNIX engineer with strong kernel/device driver and 'C' programming experience. The successful candidate will join a highly skilled team involved in technically varied and demanding work. This position will particularly appeal to versatile candidates who enjoy problem solving and challenge.

Ref: LC/4

C++/REAL-TIME
Herts – To £30k

Our client is predominantly a developer of software and a supplier of computer systems and associated support services for retail applications. Candidates should have experience of real-time applications and either two years of 'C'/C++ under UNIX or Visual/Borland C++ in a Windows environment, preferably using the class libraries. You must be able to work well within a team.

Ref: CP/5

C++/UNIX
Herts – To £35k

These positions will appeal to candidates interested in developing systems for the on-line video market. You must have excellent academic qualifications and at least two years C++ under UNIX development experience. Additional experience of the Apple Macintosh, Graphics or network design, whilst not essential, will be of interest. Good communications skills, both written and verbal are essential, as is the ability to keep learning the latest technologies. Excellent career opportunities on offer.

Ref: PP/6

DEVICE DRIVERS
Berks – To £35k

Exceptional projects with a leading worldwide software company. Opportunities for software engineers with a first class background in systems level and UNIX device driver development. Working within the telecommunications sector, any previous experience of this area will be of great interest.

Ref: JK/7

'C'/UNIX DEVELOPER
Berks – £22k

Rapidly expanding international company supplying state of the art Collection Systems, requires an experienced individual to program, install and support their systems - applications training will be provided. You will have a minimum of two years programming experience using 'C' in a UNIX environment. Windows NT experience would be advantageous.

Ref: KB/8

EMBEDDED C/C++
Berks/Avon – £15k - £30k

A range of Software Engineers are required with a minimum of one year's embedded 'C' programming skills to develop software for a variety of projects. Development will be under a motorola 68000 operating system on a PC host. Any UNIX skills would be advantageous. The successful applicants will be working for one of the UK's leading Software Houses which currently is expanding into the European markets.

Ref: DE/9

C++/NT/UNIX

C++/NT/UNIX
Surrey – to £40k

Our client is a leading developer of a renowned trading platform for financial institutions. The platform is widely used within the City of London and Wall Street. The continued success of the company in both the UK and US has led to a need for experienced software engineers.

WINDOWS NT
Software Engineers

Experienced developers are required with a minimum of one year's Visual C++/MFC experience. Candidates should demonstrate first rate technical knowledge and a good academic background. Any experience of developing real-time systems or using OLE would be advantageous.

UNIX
Software Engineers

Candidates must possess excellent C++ programming skills on any UNIX platform. Any communications or networking skills would be considered a plus, along with any previous experience of real-time development.
A financial background is not necessarily required as full training will be provided.

Ref:JK/10

Logistix Recruitment Limited, Lamb House, Church Street, Chiswick Mall, London W4 2PD

Logistix

Fax: 0181 742 3061 E-mail: logistix@atlas.co.uk
Telephone: 0181 742 3060

Visual Basic Development
Kingston-upon-Thames, Surrey

The Company: Growing, established and leading software house providing IT services to its clients in a number of IT sectors.
The Position: Working with the latest technology you will be responsible for developing systems for an impressive number of clients. Training will be provided where appropriate.
The Person: For this position you will need excellent development skills using Visual Basic. Any V4 experience will be an advantage. Graduates will also be considered with Visual Basic experience. *Ref: TS-291EX*

VISUAL C++, MFC
Newbury **to £28,00**

The Company: involved in the development of advanced E-Mail and mobile communication software involving digital and satellite technology.
The Position: To play a major part of the development team working on new projects for major blue chip clients, utilising state-of-the-art technology.
The Person: You will have gained at least 6 months experience of Visual C++ with some exposure to the MFC. Any knowledge of communications would be beneficial but not essential. *Ref: JJ-292EX*

MOVE INTO FINANCE WITH 'C' & UNIX
Several Locations **£18,000 to £31,000**

The Company: Successful software development company involved in many projects within the financial sector, particularly major high street names.
The Position: To become a team player and major contributor of development on new high street banking projects. Possible opportunities for training into Oracle.
The Person: Ideally you will have 18 months experience, with at least 12 months 'C' & UNIX. **Excellent opportunity to move into finance work.** No previous experience required. *Ref: JJ-293EX*

Windows Product Development
City **from £20,000 to £35,000 + benefits**

The Company: Well known industry provider of retail sales systems that use innovative Windows Technology to great effect.
The Position: You will be developing a completely new Windows product, carrying over no previous programming code from the current Windows version.
The Person: At least one years solid Visual C++ & MFC development gained within any commercial environment. You will have control over the development phase so an ability to work within your own time schedules is a must. *Ref: DL-291EX*

London Financial Exchange
City **to £40,000 + outstanding benefits**

This Is a fantastic opportunity to join one of London's top financial exchanges are looking for a number of skilled Analyst Programmers and Software Engineers.
The Skills required include:-
Visual C++, MFC and Windows NT.
Sybase or SQL Server, Powerbuilder and UNIX.
'C' or C++ with Sybase or SQL Server.
A minimum of two years solid experience in any of these areas is required. A degree would be preferred. *Ref: DL-295EX*

VISUAL BASIC CLIENT SERVER TECHNICIANS
London **from £27,500 plus bonus**

A leading supplier of workflow and document management systems to finance and aerospace markets require experienced client server technicians to work in a motivated, innovative, client-facing environment. Skills required are: Minimum two years Visual Basic programming, good understanding of PC client server architectures and networking in either Unix or NT server environments. *Ref: JA-291EX*

C/C++ UNIX SOFTWARE ENGINEERS
North London **Salary Negotiable**

Producers of software to the oil industry require developers capable of seeing through projects in imaging, plotting or data management. Applicants will need three years scientific or technical programming experience using C/C++ or Fortran and a sound knowledge of Unix. Good prospects, good benefits package, opportunities for foreign travel, good working environment. *Ref: JA-293EX*

POWERBUILDER
Reading **up to £40,000**

The Company: Renowned PowerBuilder software developer working closely with a range of blue-chip clients on high value projects.
The position: Working closely with clients and colleagues to produce innovative solutions using PowerBuilder and relational database technology. Take a leading role in the design and development process, with a wide range of responsibilities.
The Person: Software developer with a sound understanding of Powerbuilder and a least one year working with any relational database (Oracle or Sybase preferred). *Ref: MD-228EX*

HOT ICE!
Wokingham **To £28,000 plus benefits**

The Company: British multinational designing in-circuit emulators (I.C.E. systems) used in the development of embedded systems.
The Position: Working as part of a team writing Windows software for the company's latest products. Writing Visual C++ with MFC, you will take responsibility for various parts of the Windows95 and NT products.
The Person: Graduate software engineer with at least 2 years experience programming C++ or Visual C++ for Windows. Ready to take responsibility for delivering new tools and applications. *Ref: MD-224EX*

VISION

VISION COMPUTER RECRUITMENT

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Aztec West Hotel
12 noon - 8pm

London Heathrow
Monday 10th March
Excelsior Hotel
12 noon - 8pm

Edinburgh
14th & 15th March
Holiday Inn Crowne Plaza
12 noon - 7pm Friday
9.30am - 4pm Saturday

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Recruitment Exchange Ltd, Garden House, London Road, Sunningdale, Berks SL5 0LE.
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WINDOWS in BERKS to £28K

This small UK company with subsidiaries in the USA and Europe are market leaders in Emulation Technology. They seek additional Team Members working on a New range of Products essential for the development of systems using emergent Technology in the PC, Automotive and Telecommunications markets.

For Windows positions you will need a minimum of 1 yrs post graduate experience of Windows design ideally using C/C++, plus any development tools including MFC or SDK etc. They also need an embedded software design engineer with several years experience of C and 680X0 assembler in either a Windows or Unix environment including Comms and Sun Platforms.

This company offers an excellent opportunity to expand your knowledge of Windows design in a Real Time environment working in a small friendly team of like-minded engineers.

Interested? Call James Hunt for full details of this and similar positions.

World Wide Web

We've given in and developed our own Web pages, they include:-

- **Real Time Positions**
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- **What's New (Search Engine for what's New on Web + Interesting Links)**
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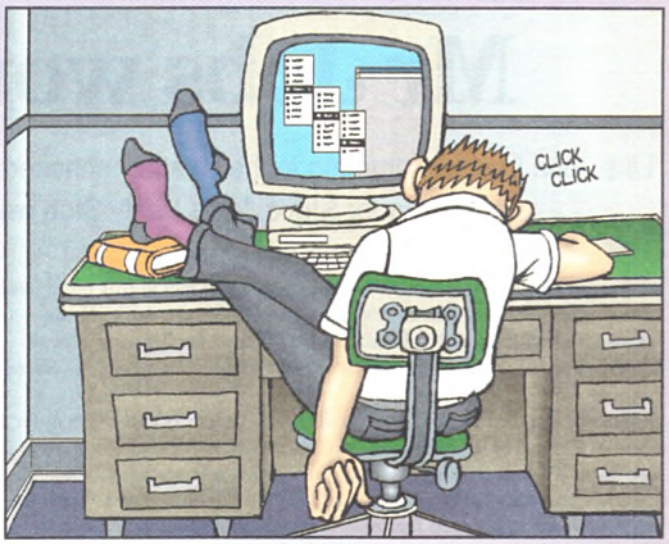
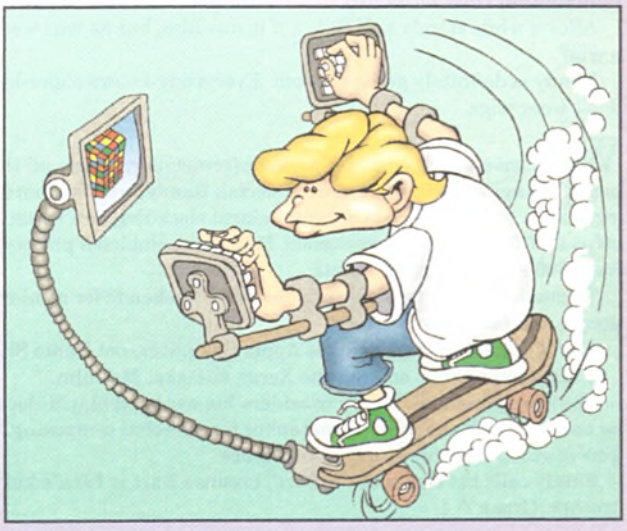
Programming used to be cool. Pure touch typing. Only 45 keys on the keyboard. A hot programmer would slam those bones like nobody's business.



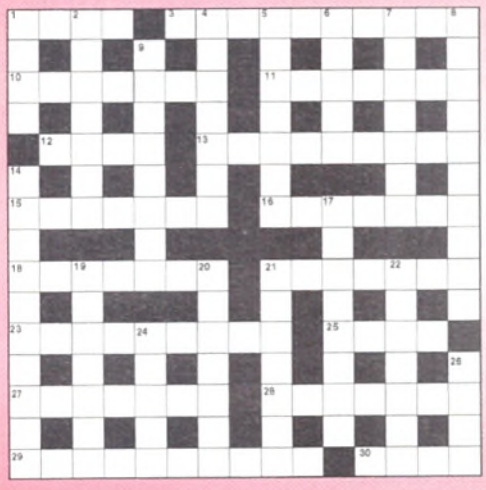
Object orientation has reduced the art of programming to nothing more than making menu choices with a mouse. Drag this method, that parameter, check here for OLE container....

After a few years of mousing around one menu after another, today's programmers typically develop shrivelled arms on one side and knotted back and shoulder muscles on the other side.

In future programming environments, body language will be used to control cursor postion while the fingers maintain continous keyboard registration. Emerging user interface technology offers the promise of making programming fun again.



CROSSWORD



ACROSS

1. Nearly all take iron from the transistor (4)
3. Suffering from too large a current (10)
10. It can digitise a printed sheet (7)
11. Electron source cover broken in 25 (7)
12. Thpeak thtrangely in program language (4)
13. Happily immerse an eprom and clear it (9)
15. Subterranean site of many a computer game (7)
16. Aquatic mammal worker may stop the leak (7)
18. How the conductor opposes the current! (7)
21. He charged frogs' legs (7)
23. Line of 25 from banking computer? (9)
25. Convert an algorithm into a source (4)
27. Opening character in one confused ending (7)
28. What n and s do (7)
29. Milliards of Tebbit's carriers! (10)
30. Top match needed at the end of programming (4)

DOWN

1. Chip cover using 18 (4)
2. Where to work on a network (7)
4. Type of package we need the latest of (7)
5. Writes down the parts of a file (7)
6. Chosen with a bit of surgery, Edward (5)
7. Jovian moon in a play in a model 3D set (7)
8. Insulator with such a constant (10)
9. Voracious creatures in once popular arcade game (8)
14. Envelope action that may be absolute or indexed (eg) (10)
17. Assign greetings to Catherine, I hear (8)
19. Graphically relating measures (7)
20. Varnish part of the os with alternating current (7)
21. Become delayed and let free in logic unit (4,3)
22. It needs two positives to be positive (3,4)
24. the first modern war-time computer (5)
26. Make no change about 30 (4)

SOLUTION TO FEBRUARY'S CROSSWORD

ACROSS: 1. MASTER 4. ACTIVITY 9. GAMBIT 10. IMMOBILE 11. ENLARD 12. ALLOTTED 14. INFORMATICS 18. STATISTICS 22. DECISION 23. NEGATE 24. TYPIFIES 25. ABORTS 26. DISPLAYS 27. CYCLES

DOWN: 1. MAGNETIC 2. SIMPLIFY 3. EPIGRAMS 5. COMPLICATE 6. ISOPOD 7. IDIOTS 8. YIELDS 13. STATIONERY 15. ASSEMBLY 16. BINAURAL 17. ASSESSES 19. EDITED 20. SCOPES 21. USEFUL

Mr Jobs works next door

'Like John Lennon returning to the Beatles' shrieked The Guardian, reporting Apple's recent acquisition of its own cofounder Steve Jobs. Verity Stob wonders how other Apple employees are coping.

Marcie screamed 'It's him!' and of course the whole hut piled over to the window; but when the man on the BMW bike took off his helmet he had frizzy blond hair, so we trooped back to our places. This sort of thing happens two or three times a day since The Second Coming.

We call it a 'hut', but it's just a 700 square feet of 80s-style open plan on Floor 2 of 4b Infinite Loop. Officially we are working on a new laptop - well that's not going to happen, but we have been together through three re-orgs now (is this a record?) so I think we must have been blurged from some company database. At any event, it's nice working together with people for five months solid. Especially I like Marcie: we have exchanged **private** PGP keys (total total mutual trust factor 10).

After a while Randy said 'What if it was him, but he was wearing a wig?'

Randy is definitely going random. Everybody knows super-heroes don't wear wigs.

We all have secret personal projects (remember, nearly all the big breakthroughs started as secret projects). Randy, who is a hardware guy, has a project which is a digital alarm clock that can be set to go off at a different time at weekends. He has assembled a prototype from $400-worth of components.

'It can be set also for three and four-day weekends for semi-retired people and part time workers.'

'For Woz's sake Randy, this is Apple Computer, not Radio Shack!'

'I hope you are not making the Xerox mistake, Malcolm.'

The Xerox mistake. Randy considers his weekend alarm clock to be on a par with the desktop metaphor for personal computing. You've got to admire the guy's confidence.

Randy calls his alarm clock 'Bart', because Bart is **Lisa's** kid brother. Groan ^ 4.

First contact! Marcie (it would be Marcie) was in the lobby of building 7, waiting to meet her friend from the Photoshop liaison division. They have two elevators there, but elevator B is broken and sits at lobby level awaiting this week's CEO's permission to call in an engineer. Since the doors to elevator B are stuck open, people go in and press buttons, then get mad when nothing happens.

Marcie was leaning on the desk, watching about four groups of people get trapped by the dead elevator, when she hears this growling noise behind her, so she turns round and it's Steve! She nearly pukes with fright and awe, and her vision is going blurry with the reality distortion field, then he says

'Why doesn't someone stick an "Out Of Service" Post-It® by the door?'

(So direct!

So brilliant!

So Steve!)

Marcie says:
'That's a great idea, sir. I'll see to it at once.'
And He nods.

When Marcie got back to the hut, I plugged my old Yamaha Amp into my Powerbook and brought up this shareware drumkit program that I pulled off the Net; then we all took off our shoes and socks and did our Steve dance.

Here is our Steve dance:

[Oooomph Crash dee-Boom-Boom Crash]

Marcie: What do artists do?

All Except Marcie: Real artists ship!

[Oooomph Crash Oooomph Crash]

Marcie: Good artists copy!

AEM: GREAT ARTISTS STEAL!

[Stomp Stomp Oooomph Stomper Stomp Oooomph]

Marcie (shrieks): ARE WE GREAT?

AEM: **INSANELY GREAT!**

Everyone: Steve Jobs is my hero, Employee number zero!

If you think this is silly, try making a dance from the sayings of Bill Gates:

- A computer on every desk and in every home.
- We believe OS/2 is the operating system for the '90s.
- The Internet is just a passing fad.

See?

Java (uh oh Chungo - it's Jarrr-varrr!) for me from now on. Marcie won't let me program in C++ any more. She says that it's masculine and spiky and aggressive and homophobic (huh?) and (strongest possible insult in Marcie's repertoire) *IBMish*. Besides which she says it always causes memory leaks sooner or later.

Marcie has a thing about memory leaks. She says that if all the memory leaks in all the C++ programs in all the world could be eliminated, then the Taiwanese shrimping otter, which apparently lives downstream of the mega-polluting biggest RAM chip factories in the world, could be saved from extinction. She says that giving up C++ is a way of being more eco-sensitivc, without having to give up Captain Crunch or whatever.

Randy says this theory sucks rocks. Although he has a point, I don't like siding with Randy, besides which Randy hasn't had an Encounter of the First Kind and he doesn't have my private PGP key. So Java it is.

Last night I woke up from a nightmare that IBM had bought Apple, and all us software people were sucked into Lotus and made to work on Notes add-ons. I couldn't sleep after this.

Tell us it ain't so Steve. Help us Steve. Save us Steve.

Steve, please don't let it be too late.

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Ease of Use	8.3	7.2
Versatility/Features	10	8.7
Compatibility	6.7	6.5
Speed of API Calls	0.9	1.2
Final Score	**8.5**	6.5

*For a full copy of the NSTL report, contact your local HASP distributor.

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INTRODUCING

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Setup Checklist

Set the Visual Design
- Application Information
- Main Window
- Features

Specify InstallShield Objects
- General Options
- Advanced Options

Specify Components and Files
- Groups and Files
- Components
- Setup Types

Select User Interface Components
- Dialog Boxes
- InstallShield Extensions

Make System File Changes
- Private INI Files
- System INI Files
- AUTOEXEC.BAT
- CONFIG.SYS

Make Registry Changes
- Keys
- Values

Specify Folders and Icons
- General Settings
- Advanced Settings

Run Disk Builder
- Disk Builder

Test the Installation
- Test Run

A+

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✓Organized!
✓Nice work!

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