

February 1997

EXE  
YEARS

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Uncovered

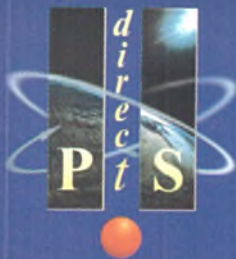
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## News & Views

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For Business Applications

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### FORMULA ONE 4.0

The International Spreadsheet!

International language support has been added to the latest version 4.0 of Visual Component's Formula One. Libraries for French, Italian, German & Spanish are in the current release, with Portuguese & Japanese planned. Other new features include:

- **Uniform Data Transfer**, which enables Formula One to be placed on a PowerBuilder DataWindow as an OLE 2 Presentation Style
  - **HTML Write** - Data from Formula One spreadsheets can be saved in HTML format, providing additional support for Internet and Intranet applications
  - **Internet File Format** - Version 4.0 includes support for the optimized and compressed file format of Formula One/NET. Files written in the native Formula One file format (.VTS) on average are about one-tenth the size of a similar Microsoft Excel file
  - **Print Preview** - Enhanced printing support including print preview
- Formula One must be the most comprehensive spreadsheet component available. Call us for more details. £180 + VAT or get it as part of the Visual Developer's Suite OCX at £216 + VAT

### FIRST IMPRESSION 2.1

The International Chart Component

This update features the same internationalisation and uniform data transfer features as Formula One 4.0, making the ideal companion. Priced the same as Formula One, but you might as well get them both (plus the word processor & spell-checker) in the Visual Developer's Suite OCX at £216 + VAT

### IBM NET.DATA

Build Dynamic Web Sites

IBM's Net.Data is finally due to be released at the end of February, and is a effective tool for building interactive web sites:

- **Native Access** to DB2. Or use ODBC or DDCS
- **Native Web Server** APIs improve performance (ISAPI, NSAPI, ICAP)
- **Macro Language** can call both compiled & interpreted languages, supports HTML variable substitution & cookies
- **DB2 Support** includes "hot" connections, all DB2 data types, invoke DB2 stored procedures
- **Java Support** with libraries of Java applets & JavaScripts, and a JDBC class library for DB2 access

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# Soap Flakes



## Cross compilation

I found the following mid-1980s story on the Web: 'Cray president John Rollwagen phoned Seymour [Cray] and told him that Apple had just purchased a Cray that would be used in designing the next Macintosh. Seymour thought for a bit, and replied that that seemed reasonable, since he was using a Macintosh to design the next Cray!'

Are computers fast enough these days that this nice story can be generalised to all kinds of software design and development? Several years ago cross-compilation was a hot topic, today Java is on everybody's lips... Back in the iron age of computing all systems were incompatible, then microprocessors and other standard hardware parts arrived. Operating systems soon followed suit. There was some brief talk of standard application frameworks with Taligent and now we are entering the decade of the portable application environment with Java and JavaOS taking the lead.

Will we see the day where any shrink-wrap – sorry, web-wrap – application will work on any platform? In light of all our past experience and trying to make the best bet on the future, should developers really place all their eggs in one basket? And if so which one? NT? Java? ...

David Mery

## Why Rhapsody may be music to your ears

The announcement that Apple has bought NeXT in a deal worth \$400 million slipped out quietly at the end of December last year. Although many people seem to have written Apple (and, for that matter, NeXT) off in the Great Platform Wars, the significance of this deal can't be understated. For one thing, it trumps the months of speculation that Apple was on the verge of reaching a deal with Jean-Louis Gassée's Be and planning to move to BeOS

as its next generation platform. BeOS enthusiasts, who I suspect were waiting for this kind of official endorsement of the new OS as a precursor to being taken seriously by the world at large, must be silently cursing a lost opportunity: after all, who is going to want to buy into a minority PowerPC OS like BeOS when IBM and Apple, the major players in the PowerPC marketplace, will shortly both have industrial-strength offerings of their own?

Secondly, this deal brings Apple co-founder Steve Jobs back to the company he was kicked out of by the man he originally chose to help him save it – John Sculley. Although Jobs is undoubtedly blessed with the kind of vision most CEO's would kill for, NeXTStep was never a huge commercial success. It was always a case of 'great OS, shame the hardware costs so much'. Not that NeXT hardware was in any way underpowered or substandard: NeXTStation machines still stand up well against today's competition, and in their day were far ahead of everyone else. Too far ahead, as it turned out, because no-one was willing to pay the kind of price NeXT was asking.

What really marked NeXTStep (the OS) out was the same kind of breathtaking innovation in the user interface which had characterised the original Macintosh when it first emerged. It is this user interface technology, and I suspect the component-based software model which goes alongside it, that Apple wants most for its current systems. Other NeXT specialities, such as Display PostScript, are more likely to make it into the new platform. Core Apple technologies such as QuickDraw, QuickTime, and Cyberdog will definitely be there, according to an open letter by Apple's Ellen Hancock.

The death of MacOS as a long-term platform was foreseen some time ago by many in the industry, when Copland, the much-vaunted MacOS 8, failed to materialise after almost as long in development as Windows 95. I'm frankly surprised that anyone

thought that migrating an ancient 16-bit, co-operatively tasked OS to a multitasking 32-bit world would ever work (well, it worked for Microsoft, but then by some divine miracle it always *does*, doesn't it? And truth be told, Windows 95 is as much a stopgap product for the future 'Cairo' NT as MacOS will now become for Rhapsody). Had MacOS for PowerPC followed the Windows NT route from the start, ie build a new industrial strength OS and support old applications in an emulated environment built on top of it, rather than writing a natty 680x0 emulator and then using it to run part of the OS itself, things might have worked out better. As it is now, those who write for the Mac have to ask themselves whether it is worthwhile ploughing much more time and money into following the upcoming 'mini-revisions' of MacOS, or waiting for Rhapsody instead.

Developers eager to prepare for the coming Rhapsody will, we are told, be catered for by an early technology preview release sometime later this year. What will be most interesting from the view of Mac developers is just how far the new 'Open' Apple goes down the road to true openness, ie how much of the non-proprietary flavour of Unix will be retained. Java support is a dead cert, so the Java camp will be happy, but those writing code in C++ and Pascal may be disappointed, because Apple seems ready to embrace Objective C, an OO version of C little known outside the NeXT developer community, as the standard native language for Rhapsody APIs. In any event, expect a slew of Objective C books shortly.

That Apple, as an alternative to Windows or Unix, will continue to be a viable platform is definitely a good thing. That NeXT's innovative technology will also be developed further is equally good. The question we have to ask ourselves now is: will Rhapsody really turn out to be 'insanely great' for developers?

Neil Hewitt

# Mayhem!

## A new approach to software maintenance

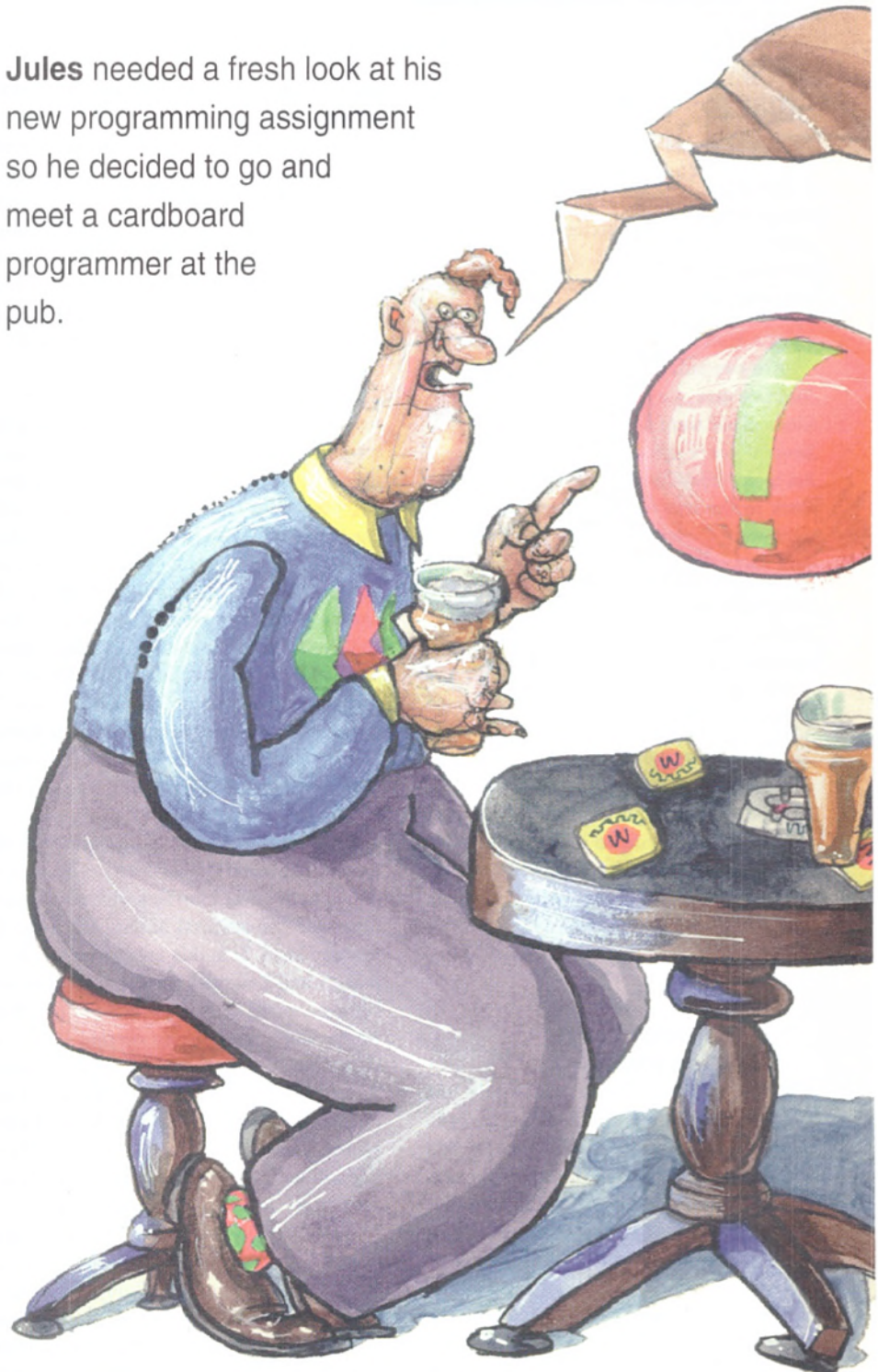
**W**hen I'm deciding how I'm going to solve a particular problem, I make heavy use of a group of friends, whom I refer to as my 'cardboard programmers'. The idea is that they don't know much about programming, and don't particularly care, but their job is to listen to me describing a problem or solution, and make me explain every tiny detail. That way, if I've made some silly assumptions, or failed to see a difficulty, they force me to look at it.

Being a cardboard programmer is a tough job. CPs have to be interested in the subject. They have to have an eye for detail. Knowing a little about programming in general is an advantage, but of course they can't be so interested that they want to become programmers, because real programmers will make the same mistakes that I do. The danger of making use of a cardboard programmer is that, if the problem you present him with starts to look interesting, the cardboard programmer becomes a real programmer, and is, consequently, ruined.

I'm telling you this, because my story starts in a pub, in front of a cardboard programmer. My customer (who was not in the pub) was selling a product which consisted of a suite of perhaps twenty programs, all sharing information through files. 'This program is version 5.3', he explained to me, 'this is 25.3, and this is 8.7a, but it includes customisations for this client. We can't keep all these programs working together.'

I explained to my CP 'This is called versioning. Everybody suffers from it. Where you make more than one product, all the products evolve at different speeds, and every time you make a change to one, you've got to change all the others to keep them working together. Trouble is, you

**Jules** needed a fresh look at his new programming assignment so he decided to go and meet a cardboard programmer at the pub.



then spend all your time changing things, and no time doing any real work. Not only that, you're bound to get the changes wrong, and the products stop working together anyway.'

'But if you have to change them, then change them you must!' said the CP. 'What can you do about that?'

'The core of this problem seems to be the files' I went on. 'If we could change all the file formats so that any version of any program could read any file produced by anything else, then most of this client's problems would go away by themselves.'

'That's easy!' said the CP. 'Just put the version number of the program writing the file into every file, and then any program that reads the file knows what to expect.'

'Ah, no, that won't work. Any program could read an

earlier version of the file, but it couldn't read a later version. That's backward compatibility. We need forward compatibility as well - we need any program to read a file generated by a later version, no matter what exotic stuff has been added or taken out. Imagine that one program version changes its file format: all the programs that talk to it need to be changed, and we're back to the same old problem.'

The CP thought for a while. Summoning the vast reserves of his programming experience he opined 'Well, you can't do it, can you?'

'Actually, yes you can. I've done it before. All I need to do is figure out how to do it in this case.'

It was too late. The CP had done the one thing that no CP should ever do: *he'd formed an opinion of his own*, and now he was going to defend it. 'When I was on a course learning Basic, we were told that you don't write a line of code until you've designed the program. Once it's designed, that's what you write. If you want something else, you've got to design a new program.'

'Haven't you ever heard of maintenance?'

'Yessir. That's bug fixing. That's not changing the design.'

Between you and me, the advice he'd received on his course was the same codswallop that they teach on all programming courses. Anyone who truly believes it can't have written a line of production code in his life. Make a note: if someone tells you with a straight face that the design must be finished before the coding starts, get your money back right away.

But the CP was having none of this. 'If that's true, why don't big programs like word processors do this? Every time you buy a new version of one of these programs, you have to use special filters to read in files from old versions. If you want to give me a file, I have to

upgrade too. If you have two word processors, and you upgrade one of them, you have to wait for the second to be upgraded before you can read files from the new version of the first into the second. Why don't they make those files forward and backward compatible?'

'Well, that's because...'

'It's true with hardware too. Look at my laser printer. Two years old, and it's broken down with a memory fault. Can I get new parts? Nope! Can I get a service manual? Not a chance. Can I buy memory chips someplace else? Doh! They've scrubbed the numbers off them. Even the importers can't fix it. Why? Because just like with the software, they don't want to fix the old stuff. They're not interested in the old stuff. They just want to sell me new stuff.'

'Yes, of course they...'

'What you should tell your client is: forget about the file problems. There *are* no problems: Ship the software with the problems still in.'

'But then the software won't work.'

'Sure it won't. That's how he can sell a fixed version six months later.'

'But the fixed software will have other problems.'

'That's right. Now you're catching on.'

'But .. but .. the whole point is that we want to make this software better!'

'Why?'

'So we can sell the new versions.'

'What's the point? You can keep selling the software without making it any better. Make life easy for yourself!'

How can somebody who is not a programmer be this cynical? I took a slurp of beer. The CP saw his opportunity.

'It seems to me' he said, slowly (so that I'd understand), 'that you don't want to make your software forward and backward compatible. It seems to me that you want to make quite sure it's neither. What you need is some way of making sure that you've got just enough versioning problems so that the software doesn't work quite right, but not so many that the product drowns in them.'

My best cardboard programmer has figured out how the software industry works. He's no use to me as a CP any more. I guess he's going to have to make his money some other way. ■

*Jules is still a programmer who works more hours than is healthy. Other idealists can contact him at [jules@cix.compulink.co.uk](mailto:jules@cix.compulink.co.uk). Last week, the cardboard programmer secured a position as senior development manager at an international software company.*



# LOOXfantastic!

# 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.

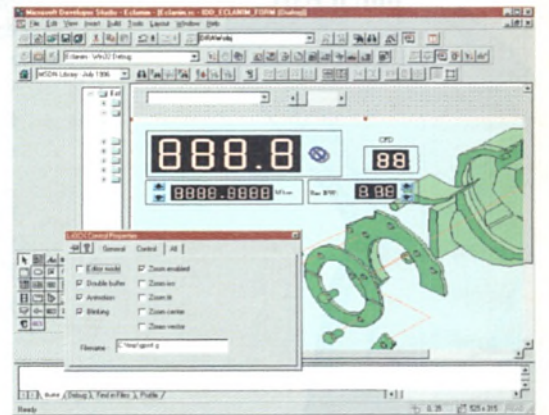
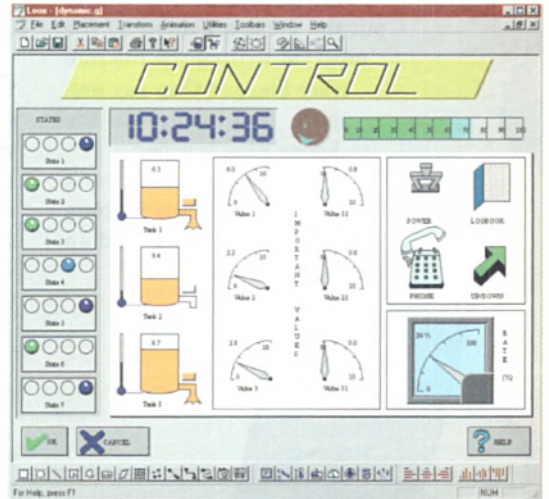
## Includes:

### 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 functionality
- 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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## SuperCede Java edition ships

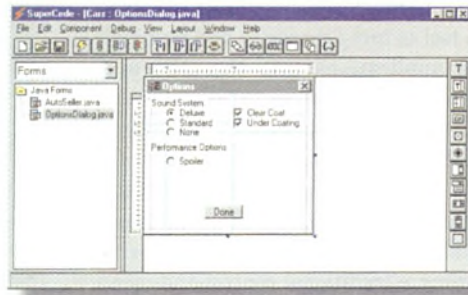
We revealed in July of last year that Asymetrix was to produce its own Java development environment based around the SuperCede virtual machine implementation, and in January the product, SuperCede Java Edition, shipped. SuperCede has a number of advantages over other Java development systems, in particular the ability to modify the source of a program while it is running and have that change reflected immediately, without needing to stop and re-compile – a feature dubbed ‘interactive compilation’. In common with one or two of its rivals, SuperCede will also compile either to Java bytecodes or to native machine code.

Within the design environment there is full support for all standard AWT controls, as well as Netscape’s Internet Foundation Classes (IFC) which are included in the package. The application skeleton code is auto-generated, with developers adding in code in the ‘event-handler’ fashion. Additional code can also be inserted into the source tree as required – the code generator will leave alone any code added in by the developer.

Object-Design’s ObjectStore PSE for Java is bundled with SuperCede as well, so objects built with the system can be made persistent automatically. Other bundled stuff includes Que’s online Java Quick Reference, and an interactive tutorial from MindQ publishing.

UK pricing details were unavailable at the time of writing, but SuperCede should be available from various resellers as you read this.

Asymetrix: URL: <http://www.asymetrix.com>



## Apple buys NeXT, goes into Rhapsody

In a surprise move, Apple has agreed to acquire Steve Jobs’ NeXT Software, designers of the NeXTStep operating system and associated NeXTCube and NeXTStation hardware. Following the acquisition, which brings Jobs back to the company he founded with Steve Wozniak in 1976, technologies from OpenStep/NeXTStep including the much-lauded user interface will become part of Apple’s next-generation operating system, code-named Rhapsody.

The announcement of a ‘two-track’ operating system strategy means that the MacOS will continue to be developed and enhanced with the technologies formerly gathered together under the umbrella of ‘Copland’ as MacOS 8 in a series of incremental releases. In the meantime, the Rhapsody project, an all-new but backwards-compatible microkernel OS for PowerPC featuring Apple’s premium technologies such as Cyberdog and QuickTime together with a blend of the Mac and NeXTStep user interfaces, will move ahead towards an early preview around the summer, and an initial developer release by the beginning of 1998.

All this makes things a little difficult for Mac developers, who are expected to continue developing for what many people believe is an underpowered OS while simultaneously preparing for a new system which will bring in a large amount of unfamiliar Unix-derived technology such as Display PostScript. It has been suggested that by the time MacOS has been patched to ‘modern’ standards, Rhapsody will be available, designed from the ground up as a MacOS replacement, and will quickly see off its older cousin.

Developer uncertainty is added to by the announcement that the Rhapsody API set will be based around NeXT’s OpenStep. While it’s possible to develop to OpenStep with traditional C++, Pascal or Java, and indeed the Windows NT version of OpenStep is designed primarily to work with C++, the native language of OpenStep is Objective C, a rarely-seen object-oriented version of C which is supported only by OpenStep development tools and the GNU C compiler at present. In an open letter to developers, Apple’s Ellen Hancock stated that ‘Objective C is the native language and will offer some advantages over other languages’, while stressing that Apple would provide support for a variety of development languages.

Apple: URL: <http://www.apple.com>

## European Developer Days focus on new tools

The latest wave of Microsoft developer tools will be previewed at a series of Developer Days to be held at various locations around the world during March. In the UK and Ireland these will be in London, Birmingham, Edinburgh and Dublin. The intention is to show the new products to developers and provide a series of tracked sessions going into the specifics of using the various tools and the new features of each. As a special treat, each will open with a keynote from Bill Gates himself – although only by the miracle of video rather than in person.

Tools to be covered include Visual Basic 5.0, Visual InterDev 1.0, Visual C++ 5.0, Visual J++ 1.1, and Visual FoxPro 5.0.

For more information, or to reserve a place, call Microsoft on 01734 270001

Information can be found on the Web at <http://www.microsoft.com/devdays>



From Hitachi software comes **Appgallery**, a plug-and-play RAD tool for assembling applications from OLE2 components. Appgallery provides a graphical tool to construct glue code with a point-and-click interface, eliminating the need to actually write any code. 01628 585335

The **FutureSplash** multimedia plugin for Web browsers has been acquired by Macromedia, and will now become part of the Shockwave family as Macromedia **Flash**. Presentations work with vector graphics, and can import from tools such as FreeHand. 01344 458600

Multilingual support for **Delphi** programmers comes in the form of **Innoview Multilanguage**, a set of VCL components for supporting multiple languages in a single executable. It even allows for users to switch between languages on the fly. Grey Matter: 01364 654100

**TopLevel Forms** designer is a custom forms construction toolkit which builds data-aware forms for use with Microsoft Office, Exchange, and other leading office applications. It does not require any VBA or macro language coding. Point your browser at <http://www.toplevel.co.uk>

Version 2.0 of **QuickTime VR** adds a C API, as requested by developers, to integrate with the other QTML technologies, QuickTime and QuickDraw. The new SDK – with the C API – will be available on both MacOS and Windows 95/NT platforms. URL <http://www.apple.com>

# N

## NEWS

Version-control tools are relatively thick on the ground, but into the fray comes **Versions 2.0** from StarBase. Available on **Windows 95** and **NT**, Versions features visual differencing, audit logs, and 'an advanced project repository'. Price £75. Call Contemporary on 01344 873434

The ActiveX control market is about to be swelled by the release of **Input Pro**, a series of formatted edit controls on steroids, and a **memo** control that can handle over **64K** of data at a time. All controls are supplied as 16-bit VBX, 32-bit ActiveX, and DLL. Price £99. Call QBS on 0181 956 8010

The **Apiary Developer Suite** is a set of ActiveX controls which encapsulate **NetWare** administration APIs for use with C++, PowerBuilder, Visual Basic, and **Delphi**. 16-bit and 32-bit versions are provided. Price: £189. <http://www.apiary.com>

From VideoSoft come **VSData** and **VSRports**, respectively a small-footprint multi-format database engine and an **Access**-compatible reporting tool built as ActiveX controls. Reports may also be output as **HTML** documents without extra programming. Cost: £145. 0181 956 8010

**Data warehousing** the easy way is what **SmartMart** from Information Builders promises. The tool includes facilities for data extraction, transformation, reporting, and 'data mart' management. Integration with legacy data sources including **SAP R/3** is promised. 0181 982 4700

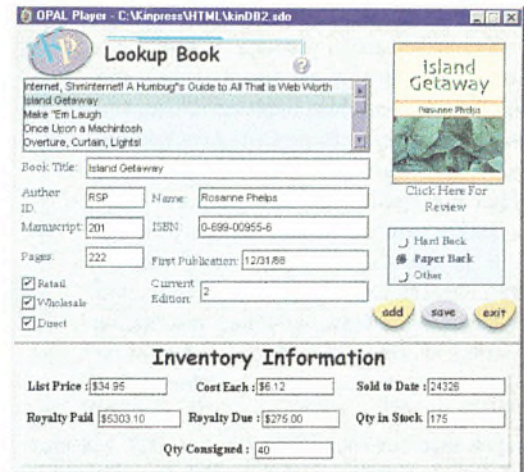
## Beyond the screen-scraper

From Computer Associates comes Opal, a tool to bring character and terminal-based applications into the GUI age. Although this in itself is nothing new – after all, the screen-scraper has been around since the early days of Windows – what CA claims makes Opal special is its interface-building capabilities. While traditional screen-scrappers limit the developer to designing a traditional control-and-menu GUI dialog interface, Opal allows for the creation of far more individual, Web-page like interfaces, with rich graphical controls and multimedia elements including video and audio.

The product has no scripting or programming language, relying instead on simple point-and-click to get the job done.

Client support is limited to Windows 95 and NT 4.0 at the moment, while the interface to character-mode applications can talk to AS/400, VAX, Unisys, and a variety of Unix platforms, as well as WinHLLAPI-compliant products. Application service is provided by CA's Open-Ingres/Desktop which comes as standard with interfaces for industry-standard databases from Oracle, Informix, and Sybase.

Call CA on 01753 577733 URL: <http://www.cai.com>



## Go go DVD – with Microsoft

Microsoft has become one of the first companies to announce its support for the upcoming DVD-ROM data variant of the DVD (Digital Video Disc or Digital Versatile Disc, depending on who you talk to) video and audio disc standard. It seems to be generally assumed that DVD-ROM will succeed CD-ROM as the dominant medium for software distribution and multimedia products, as the new discs – which are the same physical size and shape as the existing CD – will hold upwards of 4 GB of information, rising to tens of gigabytes within a few years.

Microsoft's support for DVD on Windows platforms will be in the shape of a class driver built on the forthcoming Win32 Driver Model, the much-vaunted 'common' driver standard for both Windows 95 and NT. Class drivers will define basic device classes such as 'streaming input' which will include DVD-ROM, CD-ROM, hard disks, and video devices. These will be backed up by 'minidrivers' written for specific manufacturers' equipment, the idea being that the majority of the device service code is contained in the class driver, making the task of implementing a driver for a new piece of equipment relatively trivial.

A new file system format is under development for DVD-ROM drives, on Windows at least. The Universal Disc Format (UDF) will be provided as an installable file system for both Windows 95 and NT. There will be significant integration with the ActiveMovie API to play back the MPEG 2.0-encoded video which DVD is expected to carry. A developers kit for building DVD minidrivers and video applications is expected to be part of the Win32 Driver Model SDK, when it arrives.

Microsoft: 01734 270001 URL: <http://www.microsoft.com>

## The great white whale of Java

Hot on the heels of its latest Optima++ release, Sybase has made available a preview version of its Java offering, currently known as Starbuck. It blends the Optima++ interface with a new Java backend, includes support for JavaBeans, and provides database connectivity services through JDBC.

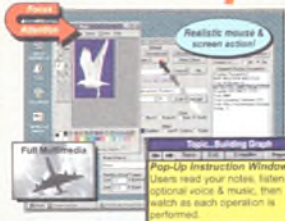
Hopping on the currently fashionable rule-based development bandwagon, the product includes the NetImpact Dynamo application server which can run and manage Java 'servlets', removing as much as possible of the processing burden from the client, which, in the Sybase model, should become 'ultra-thin'. The debugger has remote debugging capabilities for this purpose.

A variety of wizards and templates will be provided, as will tools to manage Java-enabled Web sites. Plus, because Starbuck and Optima++ share the same interface and most of the same tools, users with both will be able to develop C++ and Java simultaneously.

Sybase is not the first of the major tools vendors to move towards an integrated development environment for multiple languages – Borland's Delphi 2.0 and C++ Builder share the same interface, as do Microsoft's Visual C++ and Visual J++. Starbuck is one of the first major Java product on the Windows platform to provide support for JavaBeans and ActiveX, however, and the first to allow the developer to work with ODBC (under Optima++) and JDBC (under Starbuck) side-by-side.

Download Starbuck at the Sybase Web site, URL <http://www.sybase.com>

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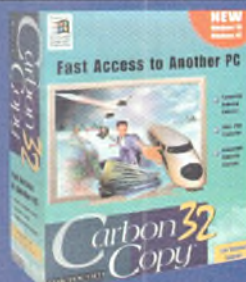


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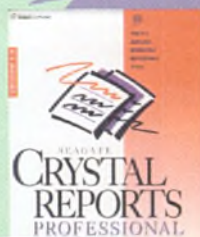
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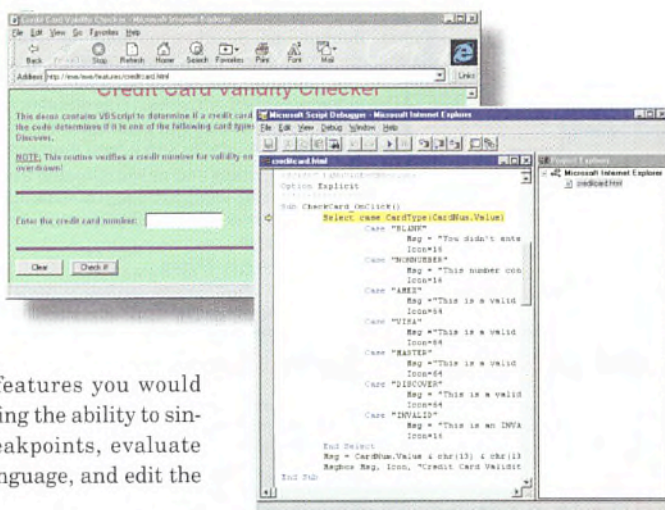


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# NEWS

## Say goodbye to bugs on the Web

Web developers who have to program extensively in either JavaScript or VBScript will be glad to hear about an extension to Internet Explorer from Microsoft. The Script Debugger add-on provides a traditional debugging environment for both scripting languages from within IE itself.



The tool has the normal features you would expect of such a package, including the ability to single-step through code, set breakpoints, evaluate expressions using the source language, and edit the code at debug time.

A hierarchical source tree display shows a list of the HTML files and frames involved in the current execution environment. Used in conjunction with other Microsoft Web tools such as FrontPage 97 or Visual InterDev, the debugger can track changes to a site on the fly and amend its display accordingly. The debugger can cope with both JScript or VBScript in a single HTML document, although as Microsoft's JScript implementation is not entirely compatible with the Netscape JavaScript language the debugger may not be able to cope with pages written specifically for the Netscape browser.

The debugger requires version 3.0 or later of Internet Explorer running on either Windows 95, or Windows NT 4.0 on Intel.

► *The debugger can be downloaded, free of charge, from the Microsoft Web site, at <http://www.microsoft.com/workshop/prog/scriptIE/>*

## QARun tests distributed client/server

Version 4.1 of QARun, the software testing tool from Compuware, incorporates a number of improvements designed to make it easier to test client/server software in an automated fashion. The major new feature is an integrated test asset repository which stores testing scripts, results and other data together for centralised management and maintenance.

This provides the individual developer with the power to manage the testing process from his or her workstation across multiple operating environments or operating systems. Compuware claims that its repository implementation is superior to earlier efforts which generally consisted of symbolic links to files held across the network, and that the true centralised nature of its repository brings significant advantages to the developer. This includes facilities for collaborative testing, custom reporting, and reusability of test data across the whole range of QACenter applications which will all, in time, be based around the repository. Compuware also claims version management is made significantly easier when all revisions of the testing scripts and data are held under central control.

Outside the repository, version 4.1 brings full object-level support for Windows 95 and NT, a number of Wizards to aid test script development, and a Web browser interface for remote use.

► *Pricing and availability information from Compuware on 01753 774000*

## Real-time modelling with Telelogic Tau

Developers working with the SDT and ITEX tools from Telelogic will welcome the arrival of Tau, an umbrella environment for both tools which itself incorporates a number of new features designed to assist in the modelling process. The SDT Object Model Editor is an OMT/UML compliant system which bridges the gap between the analysis and design functions of the SDT design and ITEX testing tools. It supports class and instance diagrams in both OMT and UML style.

Also forming part of Tau is the Organiser, which aids in the categorisation and management of object model diagrams. The Organiser sports a user-customisable interface. A link handling tool, Implink, is provided to track requirements from analysis to code in both directions. The idea here is that the effects of changes at the specification level on the resulting code can be seen quickly and easily. Tau additionally supports data modelling in ASN.1 or CORBA/IDL.

Both SDT and ITEX are tools traditionally aimed at the real-time and embedded development areas, and consequently Tau will be one of the first model-based development tools to be available in that sector.

Although no UK pricing was available at the time of writing, more information on Tau can be obtained from the Telelogic Web site.

► *Telelogic: 00 46 40174764* ► *URL: <http://www.telelogic.se>*

Interested in building 3D models and worlds? The **RealiMation Space Time Editor** is a complete toolset for 3D rendering. The resulting files are said to be small and fast to view over the Web with the free RealiView viewer. Cost: £349. Call 01332 294441

Developers who need to add mapping functions to applications built in Visual Basic need look no further than **MapServer 3/32**, a 32-bit OCX for creating and viewing digital maps. Pan, zoom and labelling facilities are all incorporated. GeoSoft: 0113 234 4000

**WebDeploy** is an installer built specifically for the Internet. Users download a small executable which then supervises the download of necessary files from the Net, saving time over traditional single-file packages which often contain unneeded files. Price: £129. 0181 956 8010

Apple has launched a MacOS runtime kit for **Java** which includes the Mac JDK, API documentation, and an Apple-written **appletviewer**, the source code for which is included in the kit. The kit allows for Java methods to be called **direct** from Mac binary code and vice-versa.

Sun's just-in-time **Java** compiler and development kit for **Solaris** have been released. Performance increases of up to 50% are being quoted. The kit can be downloaded from <http://www.sun.com/workshop/java/jit>

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## BoundsChecker Professional

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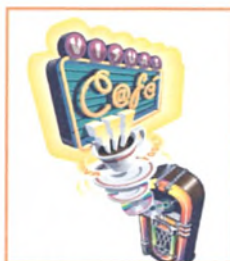
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VTOOLS D



Vireo Software

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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](mailto:editorial@dotexe.demon.co.uk). Your letter will be considered for inclusion unless it is marked 'not for publication'. Letters may be edited.



## Plus points

Dear Editor,  
Chris Cant asks 'Why is the ++ there in J++?'. Well, it's a little known fact that actually all the programmers at Microsoft are really developing code on Unix Version 6 using the `ed` editor. So, they took the C++ development environment and said

`g/C++/S//J++/g`

True? Well, not really. But my Beta version of J++ still had some C++ stuff in its help files, so it's not too far from the mark.

Incidentally, Collinson's theorem about Java states: Java will only become useful when the number of useful applications in the world written in Java exceeds the number of books that have been written about the language. I predict we'll get there, perhaps by 2001?

Peter Collinson  
[pc@hillside.co.uk](mailto:pc@hillside.co.uk)

*According to the book, 2001's HAL was built on January 12, 1997. Maybe HAL's code will be rewritten in Java. - Ed*

## Java static class variables

Dear Editor,  
In last month's Java tricks and tips article I suggested a couple of ways to reduce the number of classes in an applet. One idea was to use static class variables to hold information about a set of class instances. I would now like to recommend against using this technique, as static class variables are shared between multiple instances of an applet, possibly even if they are on different web pages. So a better solution may be to have one collection class and a separate class for each type in the collection. This is how `GridBagForm` now works; there's a separate `GBFComponent` for each component.

About some other points raised in the article: note that the JDK 1.1 should support tabbing between fields. In addition version

1.1 of the JDK adds support for JAR files so having a lot of classes is less of a problem. But the question remains: when will most users have JDK 1.1 browsers?

And sorry to those who have shown interest in the `HelpIndex` applet, all the source is not available for free.

Chris Cant  
[chris@phdcc.com](mailto:chris@phdcc.com)

## The electric ant

Dear Editor,  
Peter Cochrane's comparisons (The Electric Ant, December 1996) between programming and life systems are unconvincing.

- He says that living things, unlike man-made programs, are 'fit for purpose'. It's the other way round: Living things are not designed for a purpose, or designed at all. Variants of life come into being by chance, and survive if they are fit, not for purpose, but for survival.
- He says 'nature generat[es] unbelievably complex behaviour from incredibly simple programming', and instances ants. He justifies neither 'unbelievably complex behaviour' (how do you measure the complexity of behaviour?) nor 'incredibly simple programming' (where is the program in an ant?). He says that ants' 'phenomenally' complex behaviour was simulated in 400 lines of code. Does this mean that the behaviour of NT - which is complex, but not phenomenally complex - could be simulated in fewer than 400 lines?
- He disparages the number of lines of code produced by humans, and the number of bytes of storage they occupy, implying that nature would manage with less. But the DNA 'program' that controls humans is one billion 6-bit characters long - a lot larger than the largest human programmed system to which he refers; and the DNA program resides, in duplicate, in every cell in the human body. (Luckily nature, like computer engineers, concentrates on miniaturising the hardware.)

- He dismisses as unsuccessful attempts to use 'software building blocks' (so much for object classes), and proposes, as an 'alternative', 'genetic mutation and exchange', along the lines of nature. But he doesn't explain what he means by that.
- He implies that because nature has evolved complex organisms, programmers ought to emulate nature in generating programs. Of course in practice no programmer would be so irrational. At the most a programmer, having decided on the best method of generating programs, might notice an amusing simile between this method and the evolution of life. The article is full of these similes ('software that writes itself in a similar manner to the evolutionary process of life'; the sexual reproduction of programs); unfortunately these similes are, except at a poetic level, practically meaningless.

Alan Leadbetter  
Tunstall, Stoke-on-Trent

## Poetry lessons

Dear Editor,  
I was surprised to discover a poem lurking in last month's Object Lessons. Evidently poetry is no longer to be just the preserve of the *London Review of Books*. Well done for bringing some art back into the science of software development.

June Westin  
Coventry

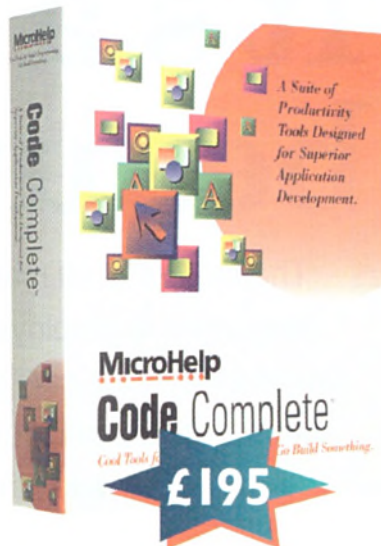
*Poems are effectively not very common in EXE, but this is actually the second consecutive month that we are featuring some, in this issue from no less than the golden-throated Verity Stob. If you do occasion to write poems on any subject related to software development, do not hesitate to send them for publication (we have some signed copies of the Java Programming Language to give away). - Ed*

## Cool Tools for Visual Programming

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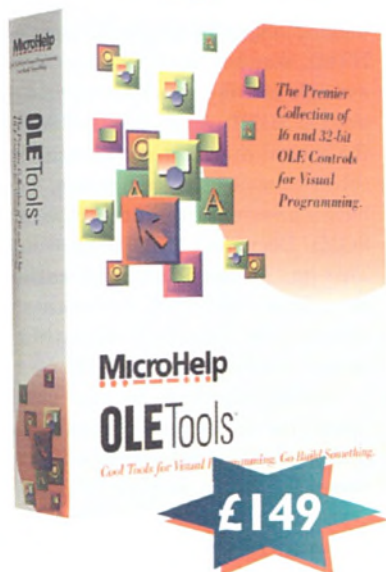
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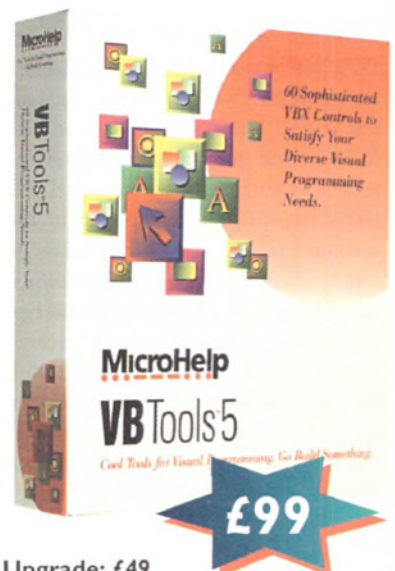
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# SGML

## It's a beautiful day

The mother of all markup languages is employed in almost every area computer

programs are, and yet many people don't know what it is.

**Adrian Orlowski** explains why it deserves top marks...

**B**efore HTML (HyperText Markup Language, natch), and before HTML made people aware of SGML (Standard Generalized Markup Language), the worst preconception one would have encountered about SGML might have been the assumption of those who, having delved into the depths of IBM's mainframe DCF/Script text processing and met GML, imagined they were three-quarters to knowing SGML. But now there is the Web, and HTML, and genuine misconceptions promoted by such pat (pun intended) formulations as: 'SGML, a superset of the Web language HTML, is a cross-platform formatting language much used for frequently-revised critical documents such as academic reports...'. If true, that would make me the Archbishop of Canterbury. But this is an age of virtual reality – HTML is a 'programming skill' to add pad-out every software developer's résumé – and of oxymorons given credence by poor puns. Who, exactly, is fooling who by calling marking-up text with HTML 'coding'?

SGML and HTML are connected, by the epithet 'markup language' at least, but as languages they are significantly different. Proprietary extensions notwithstanding, there is a distinct set of tag names which can be identified as belonging to HTML. But despite the HTML-like feel of typical SGML documents, you will search in vain in the SGML standard for tag names: there are

none. SGML is as much a markup design language as a markup language.

HTML, on the other hand, is a speciality language for hypertext – a particular way of encoding hypertext for use on computers that relies upon HTTP (HyperText Transfer Protocol) for document integration. The 'general' in SGML means that the markup is conceptually abstract with respect to all the different ways that the text might be processed: it's not specific to page composition, or cross-referencing, or indexing, etc. Not being process-oriented, it describes the data, not what a program should do with it.

By contrast, most markup in text processing is *procedural* markup (eg formatting codes): that is, oriented maximally towards processing, with all the problems that brings. An advance over this is *generic* markup, so called because it uses descriptive identifiers (for instance `topic`) in place of formatting codes. It is possible to get your word processor to output generic markup, but only insofar as using abstract styles such as 'emphasised' instead of marking text as italic. In the real world, however, generic markup is still usually specific to one application, and can intrude in an ugly way on format conversion, usually leading to a need for custom 'filter' programs.

<@\_@>

SGML builds on the insights of generic markup, but makes it computationally rig-

orous, with a data model that is inherently hierarchic. The same mechanism for marking up isolated words is used to nest larger text aggregates, so documents are structured from top to bottom. The language has the power to define sets of generic identifiers for use in marking up data content, and, more importantly, to specify constraints on their use within documents. It is these features that make it a significant advance over other languages devised for markup.

SGML makes it possible to create custom tagging languages for specific purposes – the HTML standard as defined by W3C is an example of this – which are termed *applications* of SGML. Applications of SGML have the special characteristic of being in themselves computationally rigorous, since they have a precise specification in the form of an SGML Document Type Definition (DTD). This has an important implication – the compliance of SGML documents can be enforced by a generic validating SGML parser that interprets the DTD.

In addition, you do not need to manually inspect the text of a conformant document to find out what markup there is, since the parser knows this from the DTD. Note, however, that SGML itself does not define any semantics for document data, nor, incidentally, for generic identifiers or attributes. What a document's tags mean is up to the application. For example, an application might define an element (effectively a docu-



ment logical component marked by tags) called **DATE**, which requires sub-elements **DAY**, **MONTH** and **YEAR**. An SGML parser can verify that an instance of **DATE** actually does contain these sub-components, but it cannot check to see if they contain sensible data, or any data at all.

Document semantic constraints therefore have to be handled by application processes. But, unlike in other areas of computing, there is a formal means to designate content that cannot be directly processed as being of a special type which may require a subsidiary program to be spawned. SGML expects binary data such as audio or video, and text in special notations like TeX or C, to be handled this way. This idea is unremarkable in bespoke systems implementations, but it is a measure of the industry that it has taken the Web, and Web browsers in particular, to make it acceptable in the mass market, where the kitchen-sink-with-bells approach has become the norm.

We can now pin down some of the confusion about SGML and HTML: many of the features of HTML that have become de facto standards have at various times reposed only in certain vendors' Web browsers. In parallel with this development, the W3C has been defining a standardised HTML based on this 'HTML du jour' (the latest version being HTML 3.2), couched in a formal SGML DTD. So, HTML 3.2 conformant documents are *eo ipso* valid SGML documents, but many 'HTML du jour' pages, particularly those produced by Web authoring tools, are not, since they lack the rigour SGML requires.

However, some organisations have embarked on using HTML du jour (sometimes with even more proprietary enhancements) as their base data storage format, tying them to a particular product. Where SGML represents a proven way for owners of text data – often more valuable than the executables used to process it – out of the tyranny of programs over data, the situation is a case (as the Who song puts it) of 'meet the new boss, same as the old boss'.

### The draftsman's contract

If you do want to take advantage of SGML, what does it take to draft your own markup language with it? As you can probably imagine, designing a DTD requires both quite intimate knowledge of SGML syntax, and experience of how it works in practice.

Unfortunately, many publicly available DTDs are behemoths. The groups responsible for many of the DTDs that are publicly available have often had an eye to migrating all sorts of documentation to SGML, and so bring all manner of document objects and contingent structures on board. The task is fundamentally one of analysis, not programming.

Simple, practical DTDs for everyday documents are few and far between, partly because widely available SGML-aware software (shrink-wrapped, cheap, yet adequately functional) has been lacking to date. This has made the acquisition of SGML skills in one's leisure time an activity for ardent masochists only (see *alt.sex.sgml*).

But things are changing: there are rumours that Microsoft, having reinvented itself after discovering the Web, now recognises that SGML might be an opportunity. As far as the SGML mass-market goes, though, it currently trails a long way behind WordPerfect, which has integrated core-level SGML support into WordPerfect 7. With it, you can

```

<!--      demo-ltr.dtd
Didactic DTD for simple correspondence application.
**SGML Declaration requires NAMELEN 16**
$Id: demo-ltr.dtd, v1.1 1996/02/07 14:21:00 adrian Exp $
-->

<!ENTITY % textual "#PCDATA | emph | strong | crossref" >

<!--      ELEMENT  MIN  CONTENT          +(EXCEPTIONS) -->
<!--      =====  ==  =====          ===== -->
<!ELEMENT demo-ltr  o  o  ((to? & date), Dear, body, Yours, Encs?, RSVP?)
                               +(advise) >

    <!-- Main components -->

<!ELEMENT to        -  o  (#PCDATA)          --Retain newlines in data-->
<!ELEMENT date      -  o  (#PCDATA) >
<!ELEMENT Dear      -  o  (#PCDATA)          --"Dear" to be generated -->
<!ELEMENT body      -  o  (para, (para | picture | list)*) >
<!ELEMENT Yours     -  o  (#PCDATA)          --"Yours " to be generated -->
<!ELEMENT Encs      -  o  (item*) >
<!ELEMENT RSVP      -  o  (#PCDATA)          --Keep lines; use monospaced font-->

<!ELEMENT advise    -  -  (#PCDATA)          -(advise) >

    <!-- Components of Body element -->

<!ELEMENT para      -  o  (%textual;)+ >
<!ELEMENT list      -  o  (item)+ >
<!ELEMENT item      -  o  (%textual;)+ >
<!ELEMENT picture   o  o  (graphic, title?) >
<!ELEMENT graphic   -  o  EMPTY >
<!ELEMENT title     -  o  (#PCDATA | bold)+ >
<!ELEMENT (emph, strong)
              -  -  (#PCDATA) >
<!ELEMENT crossref  -  o  EMPTY >

    <!-- Attributes -->

<!--      ELEMENT  NAME  VALUE  DEFAULT  -->
<!--      =====  ==  =====  =====  -->
<!ATTLIST demo-ltr  from  (Adrian | Alison | Eleonora | Bethia)  #REQUIRED
                    version CDATA  #FIXED "1.1"
                    date  NUMBERS  #FIXED "96 02 07" >

<!ATTLIST list      show-as  (letters | numbers | bullets | plain)  bullets >

<!ATTLIST graphic   name     ENTITY  #REQUIRED >
<!ATTLIST picture   id       ID      #IMPLIED >

<!ATTLIST Yours     closing  (sincerely | faithfully)  #CONREF >

<!ATTLIST crossref  refs     IDREFS  #REQUIRED >

    <!-- Notations -->

<!NOTATION wpg PUBLIC "-//Corel//NOTATION WordPerfect Graphic//EN">
<!NOTATION eps PUBLIC "+//ISBN 0-201-18127-4::Adobe//NOTATION PostScript Language Ref. Manual//EN">

    <!-- Character entity sets -->

<!ENTITY % ISOnum PUBLIC "ISO 8879:1986//ENTITIES Numeric and Special Graphic//EN">
<!ENTITY % ISOpub PUBLIC "ISO 8879:1986//ENTITIES Publishing//EN">
<!ENTITY % ISObox PUBLIC "ISO 8879:1986//ENTITIES Box and Line Drawing//EN">
%ISOnum;%ISOpub;%ISObox;
<!>

```

Listing 1 – A complete DTD for a simple type of document called *demo-ltr*.

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learn enough to handle real world DTDs and SGML documents in a point-and-click environment conducive to experimentation. (If nothing else, you will at some stage have a need for an SGML document viewer). Of course, as it's a wordprocessor, you can only do formatting with it, but it can provide a good practical introduction to the basics of SGML, like how output is driven by start and end tags, and can be influenced by attributes, ancestral contexts (whether or not an element is within a certain parent element), and positional ordering of elements (eg not indenting the first paragraph in a sequence).

A smart SGML text editor is not essential, but it is handy to have a tool that can interpret DTDs and handle the syntactic niceties of SGML markup. There are a few features (*sic*) of SGML which can seem like 'gotchas', especially where the problem is related to the DTD and whether some text should be interpreted as markup or data. (For reference: beware the 'mixed content problem', and don't forget that altering the tag omission features of a DTD can have the effect of turning what was document data into markup *and vice versa*. Yes, ouch).

When you are confident with the basics of handling SGML documents, you can move on to more sophisticated tools like the public domain Perl/SGMLSpM or SGMLc, or (if you can afford it) Omnimark. All of these are built over an SGML parser because, although you can roll your sleeves up, develop a BNF grammar for some document markup, run it past lex and yacc, code up the functional bits in C/C++, and then hack it some more to get it to work on the unusual features of SGML markup which were put there to make life easier for people, it is much quicker to piggy-back processing programs over a generic SGML parser which can hand you the parsing records.

## SGML documents

Now we can get technical. An SGML document comprises at least three logical parts. In the order in which they must be presented to an SGML parser, these are:

- 1. An SGML declaration.** The function of this part is rather like a command-line response file for a compiler: it sets various feature switches for parsing, and describes the concrete syntax of the parts which follow, indicating how markup text should be distinguished from data text.
- 2. A document type definition.** This is a set of declarations which has the function both of pre-declaring markup objects (rather like C/C++ header files) and defining those objects (rather like including C/C++ source).
- 3. A document instance.** This is what is normally understood as *the* document. But in SGML it is just an instance of a type of SGML document which has been defined in the DTD.

These logical parts may each consist of more than one text object (ie file), and can usually be submitted for processing as separate files, or concatenated into a single run unit. In fact, there can be more than one DTD, and one or more *Link Process Definitions* (LPDs), which specify additional markup that can be attached for specific processing circumstances, like preparing paper or electronic versions). The SGML declaration itself may be omitted, in which case the processing program will use the reference concrete syntax described in ISO 8879.

What does concrete syntax mean? Why are things separated between a DTD and an SGML declaration? SGML does not actually define what the 'on-the-ground' syntax of SGML documents should be (ie how tags are

formatted etc). ISO 8879 instead contains only an abstract syntax, which consists of slots like **STAGO** (start-tag open), **ETAGO** (end-tag open) and **TAGC** (tag close). It is up to an SGML application to fill in



those slots with characters that will fulfil those roles, to produce a concrete syntax which will then apply to markup both in the DTD and instances of that document type.

For example, the most common mapping in SGML documents of **STAGO** is to the character **<**, **ETAGO** to the characters **</** and **TAGC** to the character **>**. This is part of ISO 8879's illustrative 'reference concrete syntax', on which most SGML applications are fairly closely modelled. This is why most SGML documents so closely resemble HTML text. But in fact, someone devising a new SGML application could specify that an open-tag should start with **{>**, that an end-tag should begin with **{<** and that tags should close with **}**. So the following text cannot possibly be HTML (in any guise), but could be valid SGML:

```
{>para}
This example of SGML text uses a variant
concrete syntax.
{<para}
```

However, this is so rare that sightings are worth reporting immediately to Usenet's *comp.text.sgml*.

SGML divides its markup constructs into four kinds: tags, references, processing instructions, and declarations. *Tags* you should be familiar with from HTML; what they designate goes by the SGML name of *elements*. All tags have the primary property of a name, but they can also have subsidiary properties called *attributes*, for specifying additional information about a particular element instance.

References, though mainly used in HTML for inserting characters into the document which could be misconstrued as markup, are used much more extensively in SGML both in DTDs and document instances. Their referents, called *entities*, can range in size from single characters to whole SGML (sub-)documents, and can contain either markup or data or both. This is how SGML documents incorporate binary data such as graphics. Entities in fact step down from the logical abstraction of most markup to specify the physical organisation of SGML documents.

A note about names: while element names refer to classes, entity names always designate a particular objects. (Individual elements can be given unique names via the ID attribute, provided it is part of their declared list of possible attributes).

```
<!DOCTYPE demo-ltr SYSTEM "c:\adrian\demo-ltr.dtd" [
<!ENTITY suggest SYSTEM "c:\adrian\flowpic.wpg" NDATA wpg>
]>
<demo-ltr Adrian>
<date>7 February 1996

<dear>Peter
<body>
<para>
Thank you for your kind reply to my query about
Armageddon&trade;. Here is my suggestion for an
enhancement you might consider for a future drop:

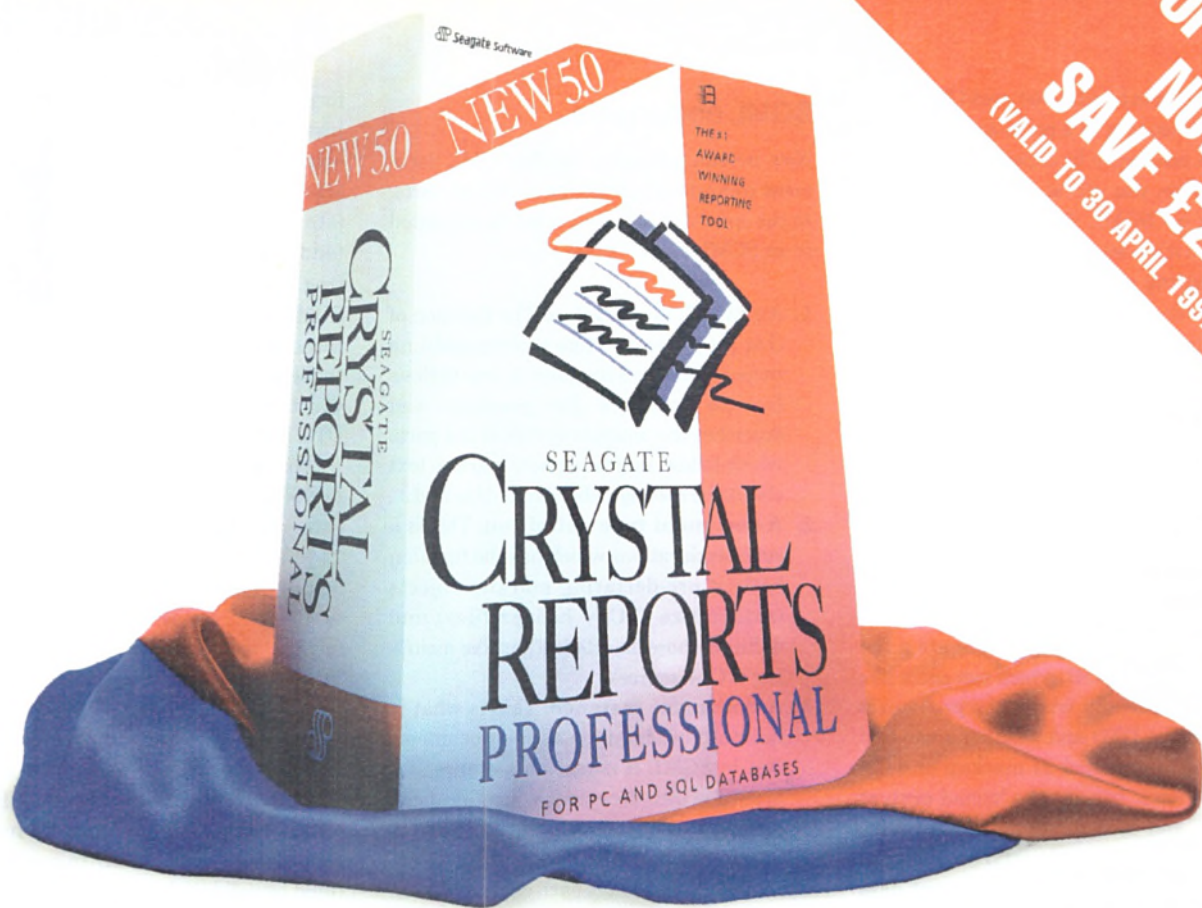
<picture id="Flow1"><graphic name='suggest'>
<title/Suggested enhancement to Armageddon./</>

<para>All the best for the forthcoming full product release.

<Yours sincerely>

<Encs><item><crossref refs="Flow1">
</demo-ltr>
```

Listing 2 – A document instance which uses the *demo-ltr* DTD.



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Processing instructions are merely a way of encoding process or application-specific data into a document. Beginners find this comforting, but in practice there is rarely any need for them. In particular, since SGML documents often have to be rendered in several different ways, specific processing instructions can hinder document portability and reuse. HTML du jour, being essentially processing instructions anyway, would seem to need no generalised syntax. But having looked at the output from Microsoft FrontPage, perhaps an equivalent SGML syntax should have been included. This is the difference it would have made:

```
<?VERMEER
  BOT=Include
  U-Include="hrule.htm"
  TAG="BODY">
<!--That was a processing instruction.
This is a comment. Processing instructions
are output by an SGML parser; comments
are eaten and no application gets
to see them-->
```

Before elements or entities can be used in markup, they have to be declared. There is a class of SGML statements concerned with declaring elements, attributes, entities, and other markup items. Most (but not all) such declarations occur in the DTD part of the SGML document. If the content of an element or entity needs special handling by a

processing program, this is where formal notation names for these classes of content are declared.

### Down to the details...

Now if you've savoured the last few paragraphs, you should be able to identify the common SGML markup declarations in a DTD and guess what they are doing. Try Listing 1. This is a complete DTD, designed for didactic purposes, for a simple type of document called `demo-ltr`. One not much more complicated is doing sterling service *chez nous* as a correspondence application in WordPerfect. A few points might clarify some aspects of it:

1. The declarations have been segregated into groups for clarity, but are considered to come into effect simultaneously. The exception to this rule is that entities have to be declared before they can be used.
2. At the top of the DTD a 'parameter entity' called `textual` has been declared. This can be used only in a DTD.
3. Elements are declared as taking either parsable character data (`#PCDATA`) or element content, which is specified in a similar way to regular expressions.
4. An exception to the regular expression syntax is the `&` connector in the declara-

tion of the `DEMO-LTR` element. This means the connected elements can occur in any order within the data.



5. The notation `+ (...)` in the document element means that an `ADVISE` element can be placed anywhere in the content of a `DEMO-LTR` element. Since this implies that such elements can contain themselves, there is a corresponding notation `- (...)` to override this behaviour (see the `ADVISE` element declaration for further detail).
6. Notice that `ITEMS` can occur in both `LISTS` and `ENCS` components.
7. Attributes all have names. They can have various types of value, and a default can be specified. (Refer to an SGML reference for details). The `#CONREF` designation in the `YOURS` attribute list is special: such elements either have an end-tag and element content, or a start-tag only and attribute content, but *not* both.
8. The declarations of the notations demonstrate the recommended alternative to system identifiers. Public identifiers mean SGML documents do not have to be edited for a different environment. An application will typically map public iden-

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CLICK  
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tifiers to system ones using a side file.

9. The DTD includes three sets of commonly used glyphs defined in ISO 8879. These are declared collectively as entities, and then loaded using

the parameter entity variation of entity reference syntax.

10. Finally note that SGML comments extend from the first – characters to the next – characters. However, the syntax of SGML requires that in many places a comment is shrouded in a declaration, hence `<!--comment-->`. The null declaration `<!>` is equivalent to a comment without content.

An example document instance which uses this `demo-1tr` DTD is shown in Listing 2. This is the text of the SGML document instance in its entirety; nothing is missing (the graphic of course refers to an external file). Notice the following:

1. The first thing is the `DOCTYPE` declaration, specifying a document type. This must be present. Here it has a system-specific reference to the definition.
2. The `DOCTYPE` declaration itself contains, nested between [ and ], an entity declara-

## References

*The SGML Handbook* by Charles F Goldfarb, the inventor of SGML. Contains the full text of ISO 8879, plus useful introductory material.

*Developing SGML DTDs: From text to model to markup* by Eve Maler and Jeanne el Andaloussi.

Robin Cover's site at <http://www.sil.org/sgml/sgml.html> contains what is probably the Web's most extensive coverage of SGML resources, FAQs, bibliographies, software lists, DTDs, applications, and information on SGML technical topics.

<http://www.w3.org/pub/WWW/MarkUp/SGML/> is another useful starting point – it describes W3C's interest in SGML. HTML 3.2 itself is described at

<http://www.w3.org/pub/WWW/MarkUp/Wilbur/>

<http://www.sil.org/sgml/general.html#overview> has several pointers to the well-liked 'Gentle Introduction to SGML' in various formats. This was written as part of TEI: an application of SGML for the humanities, particularly literary works.

<http://www.jclark.com/sp/index.htm> is the home of James Clark's public domain SGML parser `nsgmls`, the basis of many SGML implementations – information, portations, and sources. See also <http://www.jclark.com/dsssl/> for details of DSSSL and SaDE, James' DSSSL Engine. Then write to the PM's office to recommend him for an OBE.

<http://www.uottawa.ca/~dmeggins/SGMLSpm/sgmlspm.html> is David Meggins' perl class library for writing SGML processing programs in perl. Needs `nsgmls` and `perl5`.

<http://www.omnimark.com/resources/white/decl> has a comprehensive description of the SGML declaration, by the producers of what devotees consider the most effective SGML and general text processing tool. See also <http://www.omnimark.com/resources/white/cma/> for a discussion of the content model algebra used to specify structure.

<http://www.dircon.co.uk/sgml> is the home of SGMLC, a Windows-based C++-like programming language for processing SGML documents. Currently only a 'Lite' version is available.

<http://navycals.dt.navy.mil/mid/mid.html> presents attractively an application of both SGML and HyTime by the US Navy for portable interactive hypermedia training documents. Demo software and documentation can be downloaded.

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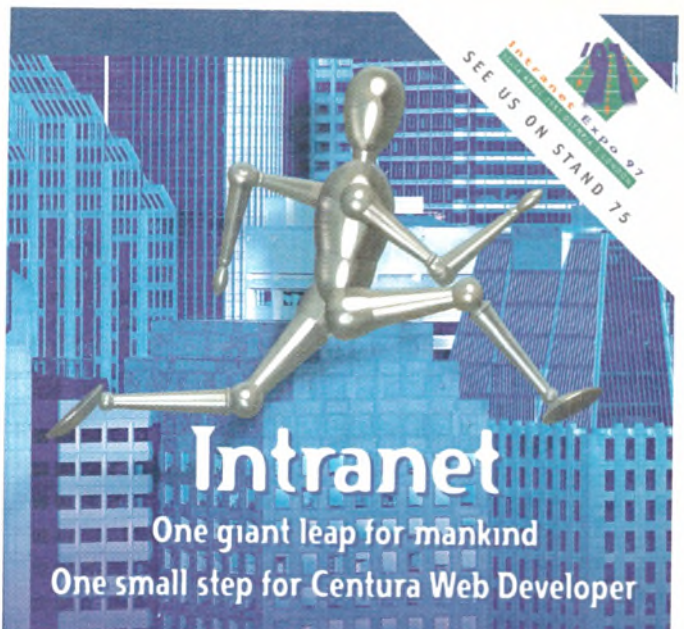
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tion. Users' entities are declared in this construct. This entity (a graphic) has a unique name, a system identifier, a designation as non-SGML data (it is non-parsable), and a notation type name (`wpg`).

3. In the document instance the first element must bear the DTD name. An attribute specifies authorship. As this was declared as drawing on a list of unique values, the tag can include the value without mentioning the attribute name.
4. The majority of elements in the document have their end-tags omitted. This is possible because the element ends are inferred by the parser from start-tags, in conjunction with the content models in the element declarations.
5. The `DEAR` element content omits the word 'Dear' – this will be inserted by the processing program.
6. The `YOURS` element seems to have no content at all! The 'Yours' is implied, as in the `DEAR` element, and the closing text derives from the tag's attribute.
7. The example shows two typical uses of entities. SGML text is included as shown for the trade-mark entity in the first `PARA` element (this comes from the

*Numeric and Special Graphics* entity set). Non-SGML data entities have to be included by mentioning them in an attribute: see the `GRAPHIC` element.

8. `<title/` is not a mistake. It has a special form of `TAGC` (tag-close) which allows a corresponding end-tag to be reduced to a single solidus character. The characters `</>` immediately following the `TITLE` element's end-tag are themselves a minimized end-tag. This terminates the `PICTURE` element, since according to the DTD the `GRAPHIC` element is not permitted content and so cannot have an end-tag.
9. The enclosures element `ENCS` cross-references the graphic, using the unique ID attribute value 'Flow1', so that when processed it will be replaced by the content of the `TITLE` element subordinate to the `PICTURE` element.


What Listing 2 cannot tell you is how it was created or processed. In WordPerfect, you typically select the DTD you want to use, select a layout specification, pick the next document element you want to insert from a panel of valid options, type the data, and WordPerfect formats the text, automatically generating additional matter such as the letterhead, and for the `DEAR` and `YOURS` elements. Never was word processing so easy...


This brief run-through of an SGML document has perhaps indicated there is more to SGML than you thought, but it has really only scratched the surface. Besides attributes, many other aspects of SGML have been glossed over, including content models, identifiers, entity attributes, treatment of line-ends, markup minimization, and Link Process Definitions; also more recent developments such as `DSSSL` (for document transformation and layout), `HyTime` (for hyper/multimedia), and architectural forms, which suggest how semantic islands represented by individual DTDs and their document instances can be linked up to make for more effective usage of text on computers. As these are all applications of SGML, a knowledge of SGML in outline at least will be a prerequisite for understanding future directions in text processing. ■

*Adrian Orlowski learned C without a debugger, wrote applications, then went on to systems programming in Cobol. Subsequently his employer let him do TeX and Postscript in exchange for text processing filters, until he discovered SGML as the way to get the most results from the least effort. He is now an independent SGML consultant and trainer. He can be reached at [adrian@solero.demon.co.uk](mailto:adrian@solero.demon.co.uk).*

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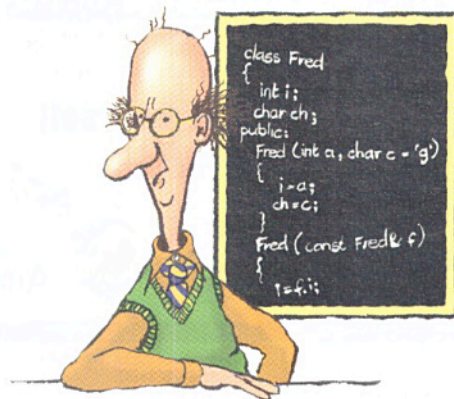
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# Just what is a language, anyway?

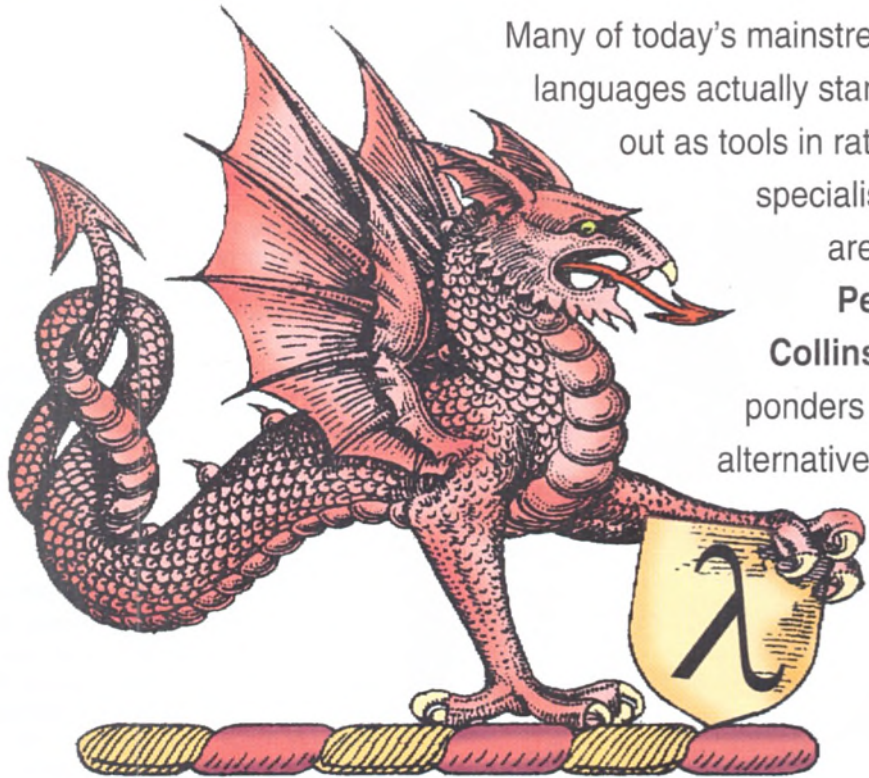
I think I've been using what might be termed 'alternative' programming languages all my working life. It just happens that some of these languages have mysteriously become mainstream. In most cases, the transition from underground existence to widespread use only happened because the language fulfilled some need of the moment, rather than because it had any intrinsic worth.

Of course, advocates of any particular language will always expound on its positive aspects and neglect to mention its weaker points. If you use a programming language on a regular basis, it becomes something that you are close to, perhaps too close. Computer people seem to become desperately partisan about things that they like or dislike. It used to be the case that 'one never discusses politics or religion over dinner'. Nowadays we need to add 'your favourite text editor', 'your programming language' and even 'your most hated operating system' to the list of taboos.

## What's a computer language?

I think of a computer language as a form of input that is intended to be used as part of some automated process or other. By this definition, a letter to your bank manager asking for that overdraft written in Word is not expressed in a computer language, but the macro definition that inserts the bank's address from your address book is.

Over the years, I've worked primarily as a systems programmer and have created a good number of custom languages for automatic input. For example, I've talked in these pages about the use of program configuration files and the design of networking protocols. In fact, I tend to treat the task of coding these little languages in much the same way as I would create a compiler for a 'regular' programming language. My programs parse the input text into tokens, and usually perform some syntactic analysis to check that the input is correct. They generally compile some internal state and then execute the task they have been instructed to do. I don't think that I am in any way unique in following these steps. If you take some large body of code, like your handy Unix source code tree, then you will find this sequence happening again and again.



Many of today's mainstream languages actually started out as tools in rather specialised areas. Peter Collinson ponders the alternatives...

This somewhat formal approach may seem obvious to you, especially if you are used to coding this way. The modularity, extensibility, clarity of coding and all the other free side effects this model provides are easily seen. However, I think that the wisdom of this approach only becomes obvious after considerable hindsight.

Thirty years ago in October, some poor person started to teach me programming in Fortran IV. I went on to dabble a little in Cobol and did some Basic. For my Ph.D, I did much assembler programming for the DEC PDP-8, which I like to call the first RISC machine. None of these languages were described by a formal grammar: the compilers or assemblers were written using a 'hack it and see' approach. Say we are compiling Basic statements. We look at the first letter on the input line and find it is an 'L', so there's a good chance that we have a LET statement. We check to see if we're right and call the piece of code that parses assignment statements.

Of course, all these languages were fairly mature (or perhaps middle-aged) when I started to use them and the lessons about formal grammars were being learnt. Algol

had demonstrated that computer languages could be properly specified using a formal grammar and that there were tangible benefits in defining a language in this way. At that time, however, it was very much an alternative language, at least in the US, because it was perceived as some funny European thing. As it happened, Algol never did make it big time in the US, except perhaps with the Burroughs Corporation who used it as a high-level assembly language substitute for their revolutionary stack-based machines.

Algol was well used on this side of the water, at least in academia. Many computer science departments were filled with the happy sounds of mechanical teletype devices generating Algol code on paper tape. It seemed to be the way Algol programs were written. Much later, I was lucky enough to inherit one of these machines. At the time, it was one of the few output devices for Unix systems that could do both upper and lower case.

These early languages, alternative or otherwise, had one other thing in common: they all hid the machine from the programmer. Programs' code dealt with variables, arrays

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and records (in Cobol and PL/1), and wasn't allowed particularly good access to the architecture of the machine. For example, it was hard to deal with characters in most of the scientific languages, and data structures (like linked lists) had to be created using pointers derived from array indexes. This always felt somewhat artificial to me.

These difficulties meant that at the time there was something of a void in our toolset: we needed a language that would be good for creating programs that did more than simply crunch numbers. In short, a systems implementation language. It was clear that assembly language programming had considerable limitations: even on a basic level, a human can only hold some finite number of lines of code in his head. I always thought that much assembly language programming was long-winded and tedious. Into this void fell BCPL, written (I think) as a PhD project by Martin Richards at Cambridge [Richards' home page is at <http://www.cl.cam.uk/users/mr/> - Ed].

## BCPL

BCPL was interesting in many respects. It was the first language that I came across that had all the program control structures (`while`, `switch` and the like) that you commonly need. In fact, it had all the ones that we are used to seeing in C today. Not surprising, since BCPL was the principal seed of the C language.

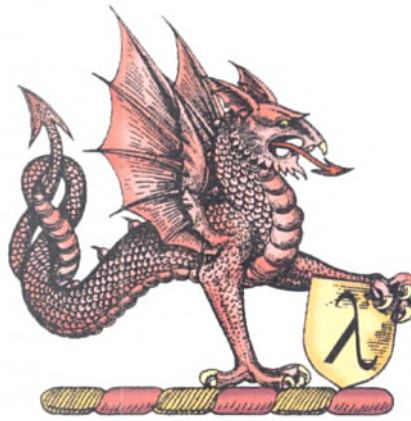
BCPL is a typeless language: variables are simply boxes that can hold a number, and that number can be an integer, a character or a pointer. In addition to the normal integer arithmetic operators, the language contained a full set of bitwise logical operators, which meant the end of trying to work with bits using the standard arithmetic operations. Better still, the code that came out of BCPL could be matched closely with the machine, so most of these integer operations went at machine speed.

Pointers were a new addition to the programmer's toolkit. Suddenly, you could create complex data structures with real addresses, rather than constructing them from array indexes. And because variables are typeless, it was easy to program pointer arithmetic: pointers are just numbers, so you can perform your address computation with the flexibility available in assembly language. BCPL introduced operators to obtain and use addresses as pointers, named L-value and R-value, after the evaluation modes used on each side of an assignment statement. Incidentally, I think that it's interesting that a strong point is made in the hype about Java that it doesn't support pointers.

BCPL allowed for extensions to the language functionality by way of routines with

well-known interfaces, ie what we now call APIs. For example, there were assembler routines for performing floating point computations, although I think that in my working life I have rarely written a program that needed floating point numbers for more than just calculating percentages.

BCPL encouraged you to divide your code into small routines, again something to which we are used today. The language was stack-based (C inherited this too) so you could pass values into routines as parameters, and return single value results to the calling code.



Individual procedures were kept local to a particular source file. To access program-wide data, routines communicated via a shared array of variables called the *global vector*. Entries in the global vector were allocated rather like TCP/IP service numbers: there were certain well-known values used by the standard library routines, with the remainder available for allocation by the programmer. If your program spanned several source files, then you would store your global data at some chosen point in the global vector.

In reality, the global vector mostly contained addresses of routines, which were used to call routines that were not local to a particular source file. Programmers made considerable use of this notion to implement a kind of what has become known as object-oriented programming. The idea was that you could easily customise the standard routines by replacing their entry points in the global vector with the addresses of your custom functions.

BCPL was novel in other respects. First, the entire source code from a single file was parsed into a tree in memory, which was then traversed to generate code. Second, the language was portable. The compiler itself was written in BCPL (another novel aspect at the time) and compiled the code tree into an internal language called *OCODE* [Although it's only an interpreter, LISP was written in itself much earlier - Ed]. The language implemented a simple stack machine which could be easily mapped onto most architectures. You could actually interpret OCODE on the fly, but it was mostly com-

plied into something that would run directly on the machine. It was usual to compile binary directly from the OCODE and then run a linker phase to generate the executable. Since the only communication between program modules was the global vector, linking was a very simple step.

To port the language to another machine, you had to first write a program that would convert OCODE into something that would run on your machine and then implement the standard I/O library used by the compiler. I did this once for Unix and the PDP-11 - not from scratch, but based on a PDP-11 port that a colleague did for another PDP-11 operating system. In actual fact, BCPL on the PDP-11 was rather messy. The language didn't do too well on byte-oriented machines because it used the notion of the machine 'word' as its basic unit of storage. There was a very strong assumption that every instruction that a programmer used would fit into one word on the target architecture. In addition, because pointers and integers were interchangeable, adding one to a pointer meant that it should point to the next word in memory. Not true on the PDP-11: since it addressed its memory in bytes, you needed to add two to move a pointer on to the next word. The solution was to define a BCPL pointer as a machine address divided by two (ie right-shifted one place). Whenever code accessed memory through a pointer, it was necessary to multiply the pointer by two (with a left-shift) to get the actual machine address. Consequently, BCPL programs on the PDP-11 spent a lot of time just messing around with pointers.

BCPL, too, was an alternative language: it never became very widespread. Perhaps its greatest contribution to computing was its very strong influence on C. C started life as an attempt to create a typed BCPL, a language that would overcome all the problems of pointer scaling by giving a type to the object that the pointer addressed. Adding one to a pointer would automatically generate the correct numerical increment because the language knew what type of object the pointer was addressing.

## C and Unix

At the start, C was an alternative language, but it was certainly the best high level assembly language that was ever created. On the PDP-11, if you looked at the code that it produced, you were hard pushed to create better code by hand.

One of the language's most significant differences from BCPL is the presence of structures, gained from both Pascal and informal uses of data areas in BCPL itself. Structures were added because Ken Thompson wanted to cleanly address data areas

# FEATURES



that were used to communicate with hardware devices. In assembler, it was easy to specify data areas with named offsets, and he simply moved this notion to C—in fact, creating a very good systems implementation language.

C was originally indivisible from Unix, with the entire system designed to allow you to create applications that concentrated on the task at hand. I must say that in my recent dabbings with NT and Windows, I am astounded at the amount of simple baggage that you need to implement when you create a Windows application. The problem is that you generally have to support a proportion of what on Unix is standard operating system functionality within your application code (and we wonder why our brand new multi-gigabyte disks are full).

Unix was supplied with a great many little alternative languages, some more useful than others. Even the command line interpreter on Unix is a powerful programming language in its own right, although it didn't start out that way. The Version 6 Unix shell had a set of control statements that were actually programs residing in the machine's

/bin directory. Control statements like `if` or `goto`, which needed to jump to some new point in the command file used the `seek` call to move the read pointer over the file selecting the code that was to be executed next.

The Version 7 shell, normally referred to as *the Bourne shell*, was a complete rewrite creating a fully functional programming language, with a fairly full set of constructs supporting variable handling, automatic string processing and control statements. Steve Bourne, the author of the shell, was British and had been at Cambridge, where he was heavily influenced by the structured programming doctrine prevalent at the time. He was an Algol 68 freak, and the 'funny' syntax like `fi` and `esac` derives from that language.

However, it's interesting that the Bourne shell language is not parsable, that is, you cannot write a formal grammar for it, because it's written in the 'read a token, do an action' way that I described above. It's probably well known that the shell was written in C, but it was a C heavily overlaid with preprocessor macro definitions that effectively created a new programming language with a very Algol 68 flavour. The definitions pretty much encrypt the code, making it very hard to understand and modify. As a result, only the brave or foolhardy ever dabbled with it, and the shell has not changed too

much, it becoming a case of 'all bugs are now features'. When David Korn used the Bourne Shell as the basis for his ideas of what a shell should do, he worked with a decrypted version that exploded all the Algol 68 mark-up into something approaching regular C.

The C preprocessor gave rise to an alternative language that I have recently started to make great use of: the `m4` macro processor. I devoted my June 1992 column to the language, and nowadays find it just the right tool for coding HTML pages.

Actually, the full explosion of 'little languages' on Unix didn't really happen until Version 7 was released. Version 7 came with several 'super-tools' that constitute alternative languages. For example, `awk` and `sed`. Perhaps the most notable of these was `awk`, designed to process text for that small one-off job of dragging some information from a set of text files. It's possible to write very large programs in `awk`. I note that there are now commercially available `awk` compilers, so perhaps it is moving into the mainstream.

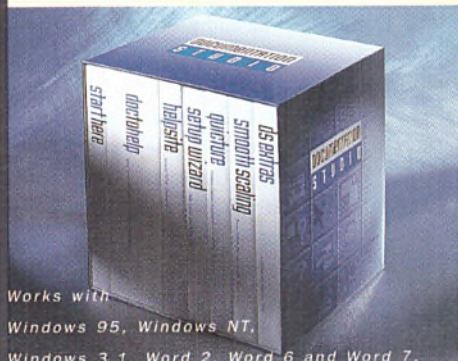
In turn, and several years later, these Unix languages gave rise to Perl, which was an attempt to combine all the good features of C, the shell, and the Unix toolkit into one programming language. Early Perl felt very 'hacky' to me: it was rather idiosyncratic and often counter-intuitive. When O'Reilly posed

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a camel on the cover of its Perl book, they did it with good reason. Perl's creator, Larry Wall, has since altered many things in Perl in versions up to the modern Perl 5, and I think that this has probably had a negative effect on the spread of the language. However, Perl is in widespread use amongst system administrators and has turned out to be just the tool for creating CGI scripts on (Unix) Web servers, largely because it's very simple in Perl to translate the argument format that the CGI script sees. Overall though, it's still probably enough of a geek to count as an alternative language.

We've seen the rise of other 'standalone' alternative scripting languages in the Unix environment: Tcl and its GUI-generating extension Tk is a good example of this. Tcl was designed as an embeddable language, intended to be placed into other programs to permit extensibility, in a similar way to Lisp in the Emacs editor. It hasn't really fulfilled its designer's intention, because it has actually appeared in very few other programs. However, Tcl has been added into some bits of hardware as a scripting language, for example, the Netblazer TCP/IP connection box that

I used to run TCP/IP over ISDN has Tcl embedded into it for writing tailoring scripts.

## Some sort of summary

As I said in my diatribe about the general non-extensibility of the Windows GUI world in *EXE* in December of 1996, Unix represents the pinnacle of operating systems whose basic 'unit of currency' is the text file. Text processing tools in the form of little languages abound on the system, tied together with common ground such as regular expression processing. The syntax of C permeates the arithmetic and control structures of many of these languages giving them a common feel. This similarity supplies the C-aware user with the ability to quickly learn how to use the facilities of the system. I think that it's been proved that many developers find the environment is one that they enjoy using.

However, Unix has failed to generate many incentives to get ordinary mortals to learn how to use it properly. Naive users see the system as unfriendly and difficult to get into. They have had this belief reinforced by the media, where non-technical technical journalists often failed to see the reasoning behind many of the features. To understand a solution, you need to comprehend the problem. Unix failed to communicate the problems that it was solving, and for me, continues to solve.

I don't need to buy new tools, new versions, repositories, upgrades and service packs to this and that – I just put the tools together in a different way and get the job done.

Sadly, Unix has never actually extended the hand of friendship to novices. For example, had there been an early adoption of a consistent regular expression syntax, plus some tools to explain and debug regular expressions, this essential part of Unix culture would perhaps have been more accessible. Occasional users can find things hard going: they are not really provided with enough aid to allow them to expand their knowledge as part of some task that they are attempting.

All this created a void, and into that void has leapt Mr. Gates who, by very definition, has given the people what they want, or at least, what they think that they want, or maybe only what they think they want right now. Whichever, the people have voted with their feet in favour of his product range. Personally though, on NT and Windows, I deeply miss the ability to automate my work, a capability that is supplied for free with all these alternative Unix languages. ■

*Peter Collinson is a freelance consultant specialising in Unix. He can be reached on 01227 761824, as [pc@hillside.co.uk](mailto:pc@hillside.co.uk), or on the Web at <http://www.hillside.co.uk>.*

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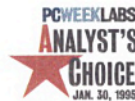
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NO LIMITS

Object references are sometimes a little more complicated than they might seem. Delphi guru **Brian Long** shows you how it's done.

# Delphi internals

**E**ven when you're using a RAD tool, there are many situations where a knowledge of what is going on behind the scenes can be useful. In the first of this series, we'll explore the details of how Delphi actually implements class and object references.

## Class references

When we see a common declaration such as `Button1: TButton;` we tend to think of `Button1` as a button object, but in reality `Button1` is an *object reference*: a reference to a button object. It is effectively a pointer to the object, albeit without the problems of pointer dereference notation (ie no `^` symbol requirement, as is normally the case in Pascal). Because objects are referred to in this way, we can end up with many different object references that all refer to the same object.

The usage of object references is commonplace in Delphi, and so we won't be looking at it in any detail, but it is interesting to examine the details of the structure an object reference points to. An object reference is itself implemented as a pointer to a *class reference*, which is immediately followed by the object's data items. Class references are

sometimes referred to as *meta-classes* (the Delphi help files refer to them several times as *object-type references*). They are defined with the following syntax: `class of <object type>`. Normal types of class allow operations to be performed on class instances (ie objects) via object references. Class reference types, on the other hand, allow operations to be performed on classes themselves. The VCL/RTL predefines several class references, among which the following can come in handy:

```
TClass = class of TObject;
TFormClass = class of TForm;
TComponentClass = class of
    TComponent;
TControlClass = class of
    TControl;
THintWindowClass = class of
    THintWindow;
```

`TComponentClass` above is a class reference type that can reference the `TComponent` class and any class inherited from it. So, we could write:

```
var
    AClassRef: TComponentClass;
...
AClassRef := TButton;
```

We can obtain an appropriate class reference for every object through its `ClassType` method, but since the return type is defined as `TClass`, a typecast can prove necessary. For example, in an event handler we might write:

```
AClassRef := TComponentClass(Sender.ClassType);
```

without knowing at compile time what class it represents. Once we have obtained a class reference, we can use it to create an object of the referenced type, put it on the right-hand side of an `is` or an `as` operation, or call a *class method*. Class methods are methods that operate on a class, not on a class instance, and are marked syntactically by the word `class` preceding their declaration and definition. They are as close as we get in Delphi to the equivalent of C++ static member functions. As an example, take the `TObject` method `InheritsFrom`. The online help tells us that this is declared as:

```
class function InheritsFrom(AClass: TClass): Boolean;
```

This tells us that it is a class method and therefore means that we can call `InheritsFrom` for a class reference, for example:

```
var
    AClass: Tclass;
Begin
    if AClass.InheritsFrom(TControl) then ...
```

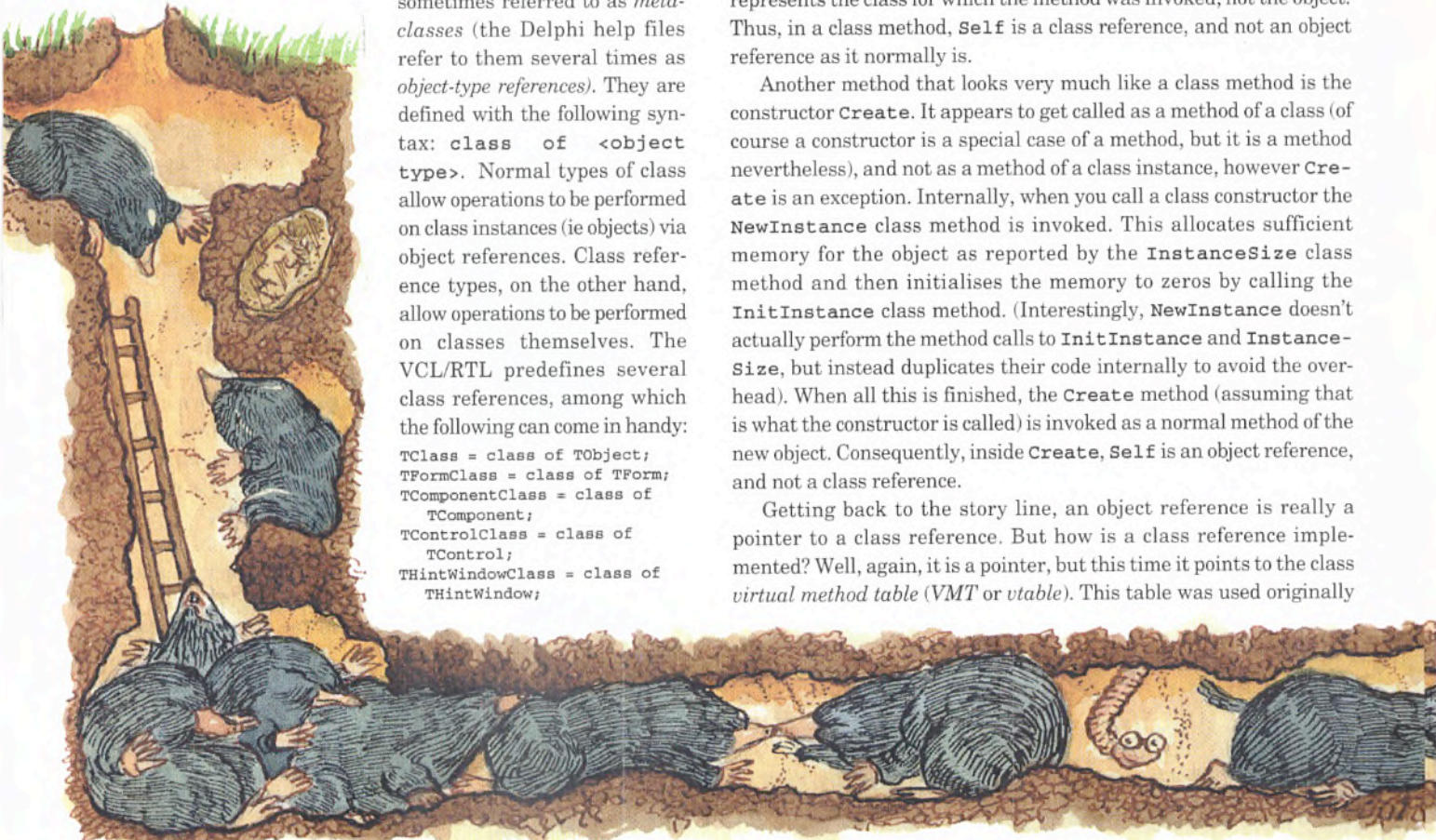
Note that we can call class methods from object instances (ie when using an object reference) in the same way as normal methods, like:

```
var
    AnObject: TObject;
begin
    if AnObject.InheritsFrom(TControl) then ...
```

An important difference in the body of class methods is that `Self` represents the class for which the method was invoked, not the object. Thus, in a class method, `Self` is a class reference, and not an object reference as it normally is.

Another method that looks very much like a class method is the constructor `Create`. It appears to get called as a method of a class (of course a constructor is a special case of a method, but it is a method nevertheless), and not as a method of a class instance, however `Create` is an exception. Internally, when you call a class constructor the `NewInstance` class method is invoked. This allocates sufficient memory for the object as reported by the `InstanceSize` class method and then initialises the memory to zeros by calling the `InitInstance` class method. (Interestingly, `NewInstance` doesn't actually perform the method calls to `InitInstance` and `InstanceSize`, but instead duplicates their code internally to avoid the overhead). When all this is finished, the `Create` method (assuming that is what the constructor is called) is invoked as a normal method of the new object. Consequently, inside `Create`, `Self` is an object reference, and not a class reference.

Getting back to the story line, an object reference is really a pointer to a class reference. But how is a class reference implemented? Well, again, it is a pointer, but this time it points to the class *virtual method table* (VMT or *vtable*). This table was used originally



Method Name	Method Type	Purpose
ClassType	Instance method	Return class reference for object's type
ClassName	Class method	Return class name
ClassParent	Class method	Return class reference of ancestor class
ClassInfo	Class method	Return point to run-time type information
InstanceSize	Class method	Return number of bytes of data each instance requires
InheritsFrom	Class method	Identify if a given class appears in class's ancestry
MethodAddress	Class method	Return address of published method, given name
MethodName	Class method	Return name of published method, given address
FieldAddress	Instance method	Return address of published field given name

Table 1 - Methods provided by TObject for extracting class information.

Constant Name	Delphi 2	Delphi 1	Use
VtAutoTable	-52	N/A	Pointer to OLE automation entries
VtInitTable	-48	N/A	Information for long string finalising
VtTypeInfo	-44	-32	RTTI table pointer
VtFieldTable	-40	-30	Pointer to published data fields
VtMethodTable	-36	-28	Pointer to published methods
VtDynamicTable	-32	-26	Pointer to dynamic dispatch table
VtClassName	-28	-24	Pointer to class name as short string
VtInstanceSize	-24	-22	Size, in bytes, of instance
VtParent	-20	-20	Ancestor class reference
VtDefaultHandler	-16	-16	Pointer to default message handler
VtNewInstance	-12	-12	Pointer to new instance routine
VtFreeInstance	-8	-8	Pointer to kill instance routine
VtDestroy	-4	-4	Pointer to destructor
ClVTable	0	N/A	Virtual method addresses
VtVectors	N/A	0	Virtual method addresses

Table 2 - Virtual Method Table field constants and their Delphi 1 and 2 offsets.

for implementing *late binding* (or *polymorphism*) in Object Pascal, but it has several other indirect uses. Situated immediately before the VMT are several pointers to various pieces of internal information, such as the run-time type information, the class name, the parent class, and the OLE automation entries.

So a class reference is really a VMT pointer, and an object reference is a class reference pointer, or a pointer to a VMT pointer - perhaps a VMT pointer pointer?

## Generalised form creation

OK, that's the theory. Let's look at a useful application of class references. Many Delphi users want to create some arbitrary form at run-time, and their code usually looks something like this:

```
var
  WhichForm: Byte;
  Form: TForm;
...
case WhichForm of
  1: Form := TForm1.Create(Application);
  2: Form := TForm2.Create(Application);
  3: Form := TForm3.Create(Application);
end;
```

This is somewhat clumsy. If we use class references to avoid different statements for different form types, we can use a more general approach as in the next code excerpt. Notice that I have opted to replace the literal numbers with an enumerated type.

```
type
  TForm = (fForm1, fForm2, fForm3);
const
  FormList: array[TForms] of TFormClass = (TForm1, TForm2,
  TForm3);
var
  WhichForm: TForms;
...
Form := FormList[WhichForm].Create(Application);
```

## Object methods

Any object in Delphi (ie an instance of any descendent of TObject) has a number of methods available for extracting information about its class, as shown in Table 1. Some of these are class methods, and so can be called via any class reference, but they can all be called via an object reference. These methods tend to operate by making use of the VMT, or more particularly the data preceding it (mentioned above). To see how these routines work, and how objects are laid out in memory we can use the TObjInfo unit that accompanies this article.

The principle behind the unit is to try and make the reader more aware of what goes on behind the scenes in any Delphi application. It includes routines that mimic all the TObject methods listed above, implementing in Pascal what Borland has coded in assembler. Bearing in mind that some of these methods can be called from object references as well as class references, the functionality is split between two functions. One of them takes an object reference parameter (and has a name beginning with the prefix OR), the other takes a class reference (and has a name beginning with CR). The declarations are therefore of the form:

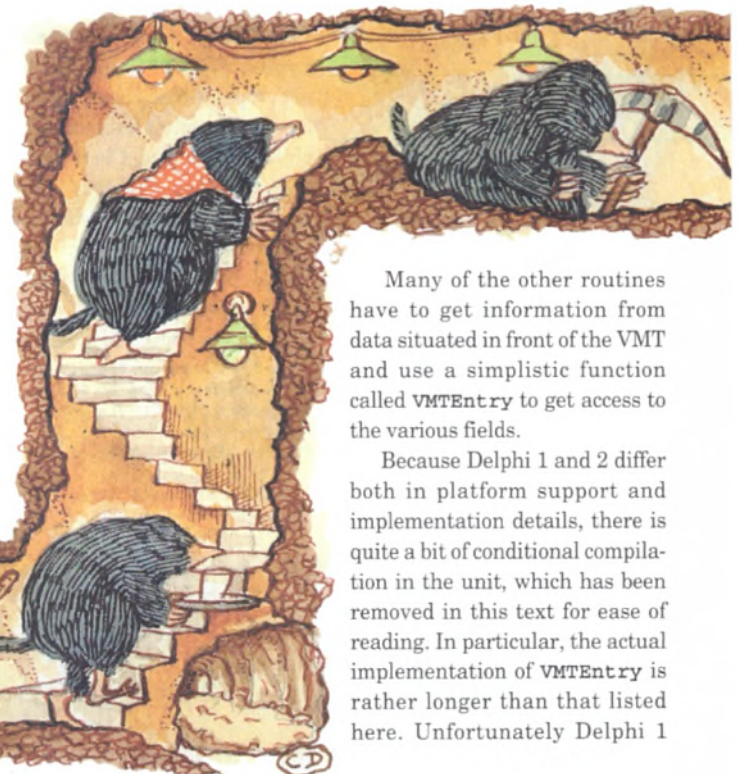
```
{ function TObject.ClassType: TClass; }
function ORClassType(O: TObject): TClass;

{ class function TObject.ClassName: ShortString; }
...

```

Given the fact that an object reference is a pointer to a class reference, the implementation of ORClassType, which takes an object reference and returns a class reference, should not be a surprise:

```
function ORClassType(O: TObject): TClass;
begin
  Result := nil;
  if Assigned(O) then
    Result := TClass(Pointer(O)^);
end;
```



Many of the other routines have to get information from data situated in front of the VMT and use a simplistic function called VMTEntry to get access to the various fields.

Because Delphi 1 and 2 differ both in platform support and implementation details, there is quite a bit of conditional compilation in the unit, which has been removed in this text for ease of reading. In particular, the actual implementation of VMTEntry is rather longer than that listed here. Unfortunately Delphi 1

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requires different actions for the different fields as some are **near** pointers (16-bit, no segment) and some are **far** pointers (32-bit, segment and offset).

```
function VMTEntry(C: TClass; Entry: Integer): Pointer;
begin
  Result := nil;
  if Assigned(C) then
    Result := Pointer((PChar(C) + Entry)^);
end;
```

Access to the individual fields is performed with the aid of a number of supplied constants that have been collected from various source files in Delphi 1 and 2. These are shown in Table 2.

Here's the re-implementation of the **InheritsFrom** function so you can see how **VMTEntry** is used.

```
function CRInheritsFrom(C, Target: TClass): Boolean;
begin
  while Assigned(C) and (C <> Target) do
    C := CRClassParent(C);
  Result := C = Target;
end;

function ORInheritsFrom(O: TObject; Target: TClass): Boolean;
begin
  Result := CRInheritsFrom(ORClassType(O), Target);
end;
```

Let's now look at some real-life applications of these routines.

## Common ancestry

Another common problem is with programs with several forms which do similar jobs, each with a method of the same name to do the appropriate processing. Given the code earlier on, which leaves you with an object reference for the form called **Form**, calling the method should look like this:

```
if Form is TForm1 then
  TForm1(Form).DoProcessing(ParamValue)
else if Form is TForm2 then
  TForm2(Form).DoProcessing(ParamValue)
```

Unfortunately, you still have to check the actual type of the object and perform a typecast, and this gets longer as you use more forms. This is because each method, although similarly named, has been

added independently to each class. There is no common ancestor (eg **TForm**) shared between the forms, and so polymorphism cannot be employed.

In Delphi 2 we can get around this by taking advantage of form inheritance. You create a placeholder form with the virtual (and possibly abstract) method **DoProcessing** and inherit your other forms from it, overriding the method in each case. If you want compatibility with Delphi 1, however, this is out of the question.

Instead, we can use the **MethodAddress** class method to change the logic above (or the **ORMethodAddress** or **CRMMethodAddress** functions from the **ObjInfo** unit). **MethodAddress** takes a string argument and returns a pointer to a **published** method of that name, if one exists, otherwise it returns **nil**. So as long as we remember to put the method in the **published** section of our form classes, then **MethodAddress** will be able to find it.

Incidentally, you should note that the untitled section of a form class that is maintained by Delphi, which includes object reference declarations for all of the form's components and all the event handler method declarations, is a **published** section. Thus, **MethodAddress** will work for event handlers added at design time with no additional effort.

To call a method with **MethodAddress**, you need to typecast the returned pointer to an appropriate procedural type. If the routine is an event handler method, use the **event** property type, otherwise you will need to define your own type.

```
type
  TProcessingProc = procedure (I: Integer) of object;
var
  Proc: TProcessingProc;
...
@Proc := Form.MethodAddress('DoProcessing');
if Assigned(Proc) then
  Proc(ParamValue);
```

The same approach can be used for **published** data fields in a class. An important difference between **public** and **published** class sections is that a **published** section can only have object references as data fields. If you need to gain access to an object reference data field that is common to a number of forms, for example, but which does not appear in any common ancestor, then you can use the **FieldAddress** method. Note that this is a normal method, not a class method, since fields are instance-specific.

```
var
  Btn: TButton;
...
Btn := TButton(FieldAddress('Button1')^);
if Assigned(Btn) then
  Btn.Caption := 'Hello';
```

**FieldAddress** returns the address of the specified data field. If you want to get the object reference, you dereference the returned pointer. You can also ensure that the typecast used, to make the object reference useful, is a safe one by using the **as** operator.

```
var
  Btn: TButton;
...
Btn := TObject(FieldAddress('Button1')^) as TButton;
Btn.Caption := 'Hello';
```

Again, the **ObjInfo** unit from earlier allows the alternative:  
**Btn := TObject(ORFieldAddress(Self, 'Button1')^) as TButton;**  
 Similar problems can occur with common data fields and methods with common properties that are not from a shared ancestor. To get rid of the complications of nested **if..then..else** statements, we will need to use functionality in the **TypInfo** unit. We'll come back to that unit next month. ■

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

Given the following class definition and variable declarations then the internal layout of things goes something like that in Figure 1b.

```
TMyObj = class
public
  FData: Integer;
  FData2: Integer;
  procedure AMethod; virtual;
end;

var
  MyObj: TMyObj;
  MyObjClass: TClass;

and the following statements

MyObj := TMyObj.Create;
MyObjClass := TMyObj;
```

```
procedure TMyObj.AMethod;
begin
  { Blah blah }
end;
```

Figure 1a – The internals of class and object references.

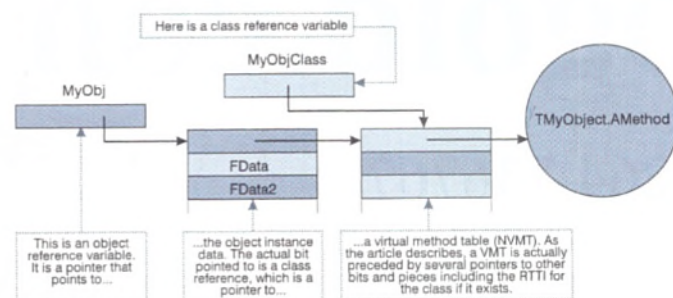


Figure 1b – The internals of class and object references.

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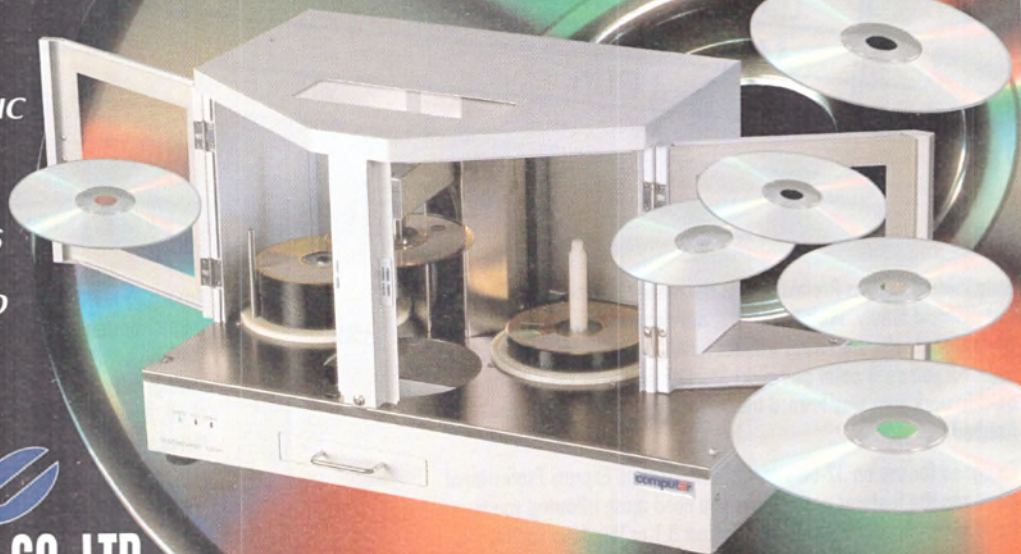
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**INNOVATION AT ITS BEST**

 CIRCLE NO. 069



IBM's new scripting language brings the power of Java to the typing-impaired via the simple low-wordage syntax of Rexx. It's so easy **Mike Ingram** learnt it in the time it took him to find the 'n' key.

Once upon a time, there was a language called Rexx, and its scripts lived contentedly in the computers of many programmers, and in the computer of its master, an IBM engineer called Mike Cowlshaw. Rexx was a good language, and grew exceptionally adept in practically all electronic environments.

Well, that was a while ago, and now Mike Cowlshaw is an IBM fellow at the Hursley laboratories, and his new creation aims to bring the joy of Rexx back to the overperked world of Java. NetRexx is a language that has a syntax mostly derived from Rexx, but semantics closely mirroring Java. The system consists of a compiler (written in NetRexx: cursed be the language that can't compile itself) that converts NetRexx code into Java for compilation with the standard Java Development Kit (JDK) tools. As a result, NetRexx will work on practically every platform under the (wait for it) sun.

The NetRexx package, which comprises the NetRexx utility and compiler classes and complete HTML documentation, is downloadable from the Hursley Web site. It's distributed in the form of a 538 KB zip file for PC users, and a 749 KB tarred+compressed file for other systems. The package comes under IBM's standard licensing terms for employee-written software, but this imposes surprisingly few restrictions on usage, arguably fewer than the JDK's licence.

The installation procedure itself is pretty painless, and the documentation goes out of its way to hold your hand throughout. Under NT, it consisted of unzipping the downloaded file, and uncompressing the NetRexx classes and tools into the JDK directory structure. Following the pattern set by version 1.1 of the JDK, the classes are kept permanently stored within two zip files to reduce space requirements and avoid cluttering up the directory structure.

For a language which promises to help you shirk typing duty, NetRexx's compiler (being itself a Java application) is a bit of a mouthful to invoke. A mere 'Hello, World!' program, with code weighing in at a princely 17 characters (these being say 'Hello, World! '), requires you to type:

```
java COM.ibm.netrexx.process.NetRexxC hello
java hello
```

The first line compiles the `hello.nrx` source file into `hello.java`, automatically runs the Java compiler to produce the `hello.class` output file, and deletes the intermediate file (the `-keep` option preserves it). The second (really?) runs our application, which has magically sprouted the class definition and main method befitting a Java creation. You can of course condense most of the verbiage into a shell script (or – shudders – batch file), and for the Rexx-endowed the system includes a rather nifty script which does just this (and then some).

### What's it look like?

Listing 1 shows the source code of the Spectrum example application. The first thing to notice is that, despite implicit references to several standard Java classes within the code, the program does not have any `import` instructions. This is because NetRexx automatically knows how to access both its own classes and the contents of the standard Java packages. (In fact, if you examine the generated Java code in Listing 2, it refers to all external classes through absolute names, thus eliminating the need to import entire packages).



# NetRexx

```
/* This draws a spectrum in a frame window on the screen, using
   and off-screen image to hold the current picture */

options binary          -- optional, for speed
class Spectrum extends Frame -- a window object

    shadow=Image          -- where we'll build the image

method main(s=String[]) static
    frame=Spectrum("My Spectrum" Rexx(s)) -- make a titled frame
    frame.resize(200,200)                -- size it
    frame.show                          -- and make it visible

method Spectrum(s=String)
    super(s) -- pass the title to the superclass

/* Update is called when the display content needs updating */
method update(g=Graphics)
    shadow=createImage(size.width, size.height) -- make new image
    d=shadow.getGraphics                      -- context for graphics
    maxx=size.width-1
    maxy=size.height-1
    loop y=0 to maxy
        col=Color.getHSBColor(y/maxy, 1, 1) -- select a colour
        d.setColor(col)                    -- set it
        d.drawRect(0, y, maxx, y)         -- and fill a slice
    end y
    paint(g)                                -- paint to screen

/* Paint is called when the window needs to be redrawn, either by
   update or when a window is uncovered */
method paint(g=Graphics)
    if shadow=null then update(g)          -- (no image yet)
    g.drawImage(shadow, 0, 0, this)       -- copy to screen

/* We need a handleEvent method to ensure Close works properly */
method handleEvent(e=Event) returns boolean
    if e.id=Event.WINDOW_DESTROY then exit -- exit on close
    return super.handleEvent(e)         -- otherwise take default action
```

Listing 1 – The Spectrum.nrx example application.

NetRexx's syntax may seem somewhat loose to people used to more 'delimiter-happy' programming languages. If you examine the class and method definitions in the code, you may be slightly jarred by the abandonment of braces and terminating semicolons in favour of the almighty carriage return. Having come to NetRexx from Java myself, I have occasionally mourned the reliance on this 'invisible syntax'. When a calculation gets too complicated to fit cleanly on one line, I don't feel right having to split it up into five successive ones just to make them fit nicely on my monitor. Perhaps IBM has more invested in widescreen technology than we realise...

On to the other major differences that Java programmers will notice: in NetRexx, as in many other scripting languages, you don't have to declare or type most variables before they are used. Ordinarily, variables take on and retain the type of the first value assigned to them, but you can conversely declare their type without assigning a value, as in the case of `shadow` here. NetRexx's type system is worth a mention at this point: variables that are not assigned a specific type (either a class or one of Java's fundamental types) default to the system type `Rexx`. In the case of numeric variables, this means computations are performed using Rexx's custom routines instead of a



JVM's native arithmetical operations. While this will guarantee the accuracy of the calculations, it does reduce the performance. The compiler can be forced to use Java's native types with the `options binary` compiler option (and, in this particular case, is).

NetRexx's syntax contains numerous other small peculiarities: NetRexx class and variable names (though *not* external variable or class references) are case-insensitive – yes, it's a feature, but *lo*, it's annoying. Comment delimiters are slightly different from Java, too: 'to-end-of-line' comments are indicated by `--` instead of `//`, and in keeping with the carriage-return-cult parsing mentioned above, return-type specifications and qualifiers like `static` have to come after the argument list in method definitions.

The rest of the example code in Listing 1 just deals with setting up an AWT frame, drawing a spectrum of colour bars inside it, and updating the screen when necessary. As you can see, native Java classes and methods can be used pretty much transparently, and a few quibbles aside, I can't say that NetRexx often gets in the way of everything you want to do. In addition, coding in NetRexx as opposed to pure Java doesn't seem to give you a big performance hit, since the syntax was specifically designed to make translation straightforward. There are of course some exceptions: the documentation lists a common problem area: the compiler is not picking up on exceptions that Java requires to be caught, and thus generates Java code that the JDK will return as invalid.

But, despite the easier-Java-than-Java blurb that NetRexx has gathered around itself, making your code easier to read isn't where its strength lies. One of the things that has made languages like Perl, Tcl and Rexx itself so good at what they do is their support for things at a higher level than, say, bog-standard array structures. Native associated arrays are just one feature which can prove invaluable, but the essence of NetRexx's strength is in exactly *what* it can save you having to deal with manually. It's in the tedious stuff like event handlers, where even the modern visual tools only go so far, where NetRexx can save you time. Adding event handlers to components in many of today's RAD tools for Java is at best a case of taking your hands off the keyboard and making multiple mouse clicks (and it can get very frustrating if you don't know where the particular menu item you need is located). Surely a language that enables you to do the same thing quicker with a cut-and-pasted three-line method in a vanilla-flavour text editor is worth a look.

## Carved in stone

Unfortunately, there are currently no integrated development environments available for NetRexx. I am sure there are Java developers out there who are content to stick with the basic command-line JDK tools, but for how long? It won't be long before NetRexx's offer of simpler, smaller, easier to maintain code won't be able to compete with the drummers-drumming flashiness of source debugging and project management features. In addition, I do not think it is possible to customise any of the current raft of Java tools even as far as getting them to use a different Java compiler, let alone to integrate with an intermediate processor. Even in the case of IBM itself, there has been no apparent desire to add NetRexx support to the VisualAge range of development environments. In the end, without better support from tools of this kind, NetRexx could find itself being left behind in the wash of the Java flood. ■

*Additional information on NetRexx, the NetRexx mailing list and the new NetRexx 1.0 toolkit (released 3<sup>rd</sup> Jan) are available at <http://www2.hursley.ibm.com>. Mike Cowlshaw's book on the language, *The NetRexx language*, was published in January by Prentice Hall, ISBN 0-138-06332-X. EurOS/2 has a NetRexx page at <http://www.moorestephens.com/euros2/technic/netrex.htm>.*

```

/* Options: Binary Crossref Logo Trace2 Verbose3 */
public class Spectrum extends java.awt.Frame {

    protected java.awt.Image shadow;
    private static final java.lang.String $0="Spectrum.nrx";

    public static void main(java.lang.String $s){
        Spectrum $frame;
        $frame=new Spectrum(((new netrex.lang.Rexx("My Spectrum")).
            OpCblank(null,new netrex.lang.Rexx($s)).toString()));
        $frame.resize(((int)200),((int)200));
        $frame.show();
        return;
    }

    public Spectrum(java.lang.String $s){
        super($s);
        return;
    }

    public void update(java.awt.Graphics $g){
        java.awt.Graphics $d;
        int $maxx; int $maxy; int $y=0;
        java.awt.Color $col=null;
        shadow=createImage(size().width,size().height);
        $d=shadow.getGraphics();
        $maxx=size().width-(byte)1; $maxy=size().height-(byte)1;
        {
            int $t=$maxy; $y=(byte)0;
            $l:for(;;$y++){
                if($y>$t) break;
                $col=java.awt.Color.getHSBColor(((float)$y)/
                    ((float)$maxy),((float)1),((float)1));
                $d.setColor($col);
                $d.drawRect(((int)0),$y,$maxx,$y);
            }
        }
        paint($g);
        return;
    }

    public void paint(java.awt.Graphics $g) {
        if (shadow==null){
            update($g);
        }
        $g.drawImage(shadow,((int)0),((int)0),
            ((java.awt.image.ImageObserver)this));

        return;
    }
    public boolean handleEvent(java.awt.Event $e){
        if ($e.id==java.awt.Event.WINDOW_DESTROY){
            System.exit(0);
        }
        return super.handleEvent($e);
    }
}

```

Listing 2 – The (cleaned up) Java code generated for Spectrum.

# EXE Company Profile

**T**he computer software industry has seen healthy increases in software sales around the world and has arguably become one of the great business success stories of recent history, according to the U.S. Department of Commerce. Continued growth is predicted across the globe, however, software piracy seriously threatens the industry's economic future. Software piracy, the illegal duplication and use of software, negatively impacts developers by reducing revenue and profit.

In a recent Business Software Alliance and Software Publishers Association joint Piracy Survey, 80 countries were surveyed in six major world regions, resulting in estimated losses of \$13.1 billion to the software publishing industry.

In 1995 piracy losses in Europe totalled more than \$4.2 billion with Eastern Europe having the highest overall piracy rates; averaging 83%. The losses due to software piracy in Asian countries exceeded \$3.9 billion, while in the United States losses were the highest of any single country, estimated at more than \$2.9 billion.

Ultimately these losses lead to lost jobs and company failures.

Fortunately, software piracy is preventable. Advances in technology have led to protection solutions that are easy to implement and transparent to the licensed customer.

Execution control based hardware keys, or dongles as they are sometimes called, provide a simple, yet effective, proactive solution to stop software piracy.

Established in 1984, Rainbow Technologies is recognised as the world's leading developer, manufacturer and supplier of software protection solutions, and a leading provider of network license management and information/communications security.

From their headquarters in Irvine, California, Rainbow directs facilities throughout the world. This publicly owned company, with stock traded on the NASDAQ exchange, has international offices in the United Kingdom, France and Germany and through a growing network of more than 45 authorised distributors, serve Rainbow customers in over 100 countries.

To offer the most complete and comprehensive support services, Rainbow employs a large engineering and technical staff. Committed to product innovation and customer satisfaction 11% of company revenues are invested in research and development.

This ensures that, with worldwide revenues for 1996 in excess of \$80 million, Rainbow customers are provided with ongoing product superiority and compatibility as new technologies emerge.

This commitment to service and quality earned the corporate headquarters in Irvine ISO 9002 certification in December 1994 with the International offices achieving certification during the following year.

Rainbow is the first software protection company to receive ISO 9002 certification - a globally recognised standard for quality - and is affirmation from an independent third party, the British Standards Institution, of their high quality of manufacturing and ability to deliver products and services.

In May 1995 Rainbow Technologies acquired Mykotronx, Inc., a leading manufacturer of high-grade encryption and decryption equipment that is used in space and other sensitive digital communication environments. Since 1979, the US government has been the primary customer for Mykotronx communications and information security technology, which have attained more National Security Agency endorsements than any other security technology supplier.

In addition to the US government, Rainbow have a large number of partners, including software publishers and developers; Autodesk, Corel, MACROMEDIA, Quark and Micro Focus.

The Internet Security Group, a business unit of Rainbow Technologies, Inc., has announced a series of cryptographic server accelerator boards designed to increase server capacity for secure transactions on the Internet.



*"The ability to control software will be fundamental in determining the distribution strategies necessary to meet new marketing channels."*

Gary Clark  
Director of Marketing (UK and Eire)  
Rainbow Technologies

## **RAINBOW U.K.**

The U.K. office is located in Chertsey, Surrey. A team of 25 staff are based here to support U.K. and Eire customers. Full support facilities are available, including software and hardware engineers to discuss and advise on any implementation issues. Production and Warehousing facilities are also located on-site to supply U.K. customer requirements quickly and efficiently.

We aim to add significant value to our customers products and services. Our investment in the U.K. shows how seriously we take our responsibility to support them now and in the future.

**RAINBOW**  
TECHNOLOGIES

# Product Profile

**T**he Sentinel software protection range, from Rainbow Technologies, Inc., offers a highly sophisticated, yet easy to implement solution to software piracy. These advanced products are available for DOS, Windows, NT, 95, OS/2, Unix, Xenix and Apple Macintosh platforms.

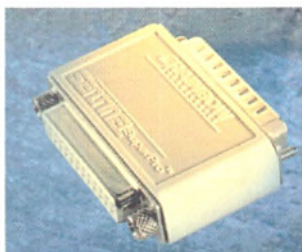
Currently available solutions include:

SentinelSuperPro	advanced protection featuring multiple algorithms and memory.
SentinelShell Software	quick and easy automatic protection.
SentinelPro	easy to implement algorithmic protection.
SentinelEve3	advanced, reliable Macintosh protection.
MicroSentinelLUX	flexible protection for UNIX/Open Systems.
NetSentinel	hardware key-based concurrent licensing.
SentinelLM	software based license management.

## SentinelSuperPro

**S**entinelSuperPro uses next generation proprietary Application Specific Integrated Circuitry (ASIC) technology to provide a highly secure, flexible and technologically advanced programmable key. It is the industry's first software protection device that combines the benefits of multiple algorithms and read/write memory in one key.

The SentinelSuperPro can be set-up to act as a time counter for leased software, or to count executions for limiting the operation of demonstration products. Additionally customer information, serial numbers, passwords and more can also be programmed into the key.



Once protection has been implemented into a software application, the developer only needs to include a programmed SentinelSuperPro with each software package purchase to assure execution control and revenue protection.

Offering 14 field-activated algorithms, memory and proprietary ASIC technology and a very high level of transparency to the end user, SentinelSuperPro provides some of the most secure and flexible protection available.

## SentinelWizard

**T**he SentinelWizard is an innovative Graphical User Interface (GUI) based software tool that makes implementing SentinelSuperPro software protection easier than ever before.

Developers simply describe their products and how they want to sell them; a custom protection



solution is then created by the SentinelWizard using this information.

The SentinelWizard helps developers to take full advantage of the SentinelSuperPro's advanced features and flexibility.

## SentinelLM

**T**he ever increasing popularity of floating software licences, means that companies' are finding themselves in the position of being able to pay only for what they need. Rather than having to buy an expensive site license or an individual license for each potential user, a floating licence can be made available to anyone on a network and is not tied to a particular PC. With a floating license model, a company's goal is to buy only the maximum number of licenses for an application that will be in concurrent use at any given time.

In order to keep track of this concurrent use of applications in an increasingly complex networked environment, license management products become a real necessity.

Providing single or multi-user access to software applications in a single user or networked multi-user environment, SentinelLM offers a floating license management solution.

The principal functions of SentinelLM include; user based licensing, component licensing, timed software and software protection.

User based licensing allows per-user floating licensing which controls the number of concurrent users for an application. People often forget that licenses are not sold to machines, but to users. Component licensing is the ability to license features or components of an application individually, simplifying licensing and distribution of the application. Timed software allows an expiration date to be added to the software in order to create evaluation or trial copies of an application. Software protection ensures that an application will only operate on an authorised, licensed computer or network, but still permitting backup copies and re-installations to be made.

End users view license management as a way to pay only for the amount of software they actually use, which enables them to save money. Users also find license management attractive because it enables them to stay legal and avoid accidental violation of their software license agreements, relieving them of worry regarding copyright infringement lawsuits.

Developers benefit in a variety of ways from integrating license management products into their applications. Users rarely keep track of how many people are legally licensed after the purchase



SentinelLM Developer's Kits are available for easy implementation.

of an application. License management software controls the use of each application, and reminds users when they need to purchase additional licenses from the developer. This approach protects intellectual property and prevents applications from being illegally copied.

In January 1997 Rainbow Technologies, Inc. signed a licensing agreement with Canadian based Corel Corporation, one of the world's leading software publishers. The agreement is for the Windows version of Rainbow's SentinelLM License Manager. This software product enables Corel to provide innovative distribution

methods to their customers, while preventing unlicensed use of their products.

"The ability to control software will be fundamental in determining the distribution strategies necessary to meet new marketing channels," says Gary Clark, Director of Marketing (UK and Eire) of Rainbow Technologies.

With this high level of sophistication it is no wonder that, in 1995, 1.9 million Sentinel keys were shipped worldwide and that in excess of 9 million Sentinel keys currently protect software for more than 20 000 companies.

## Customer Testimonials

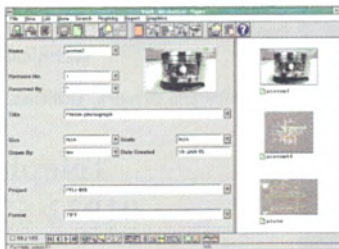
### PAFEC

PAFEC is an independent British company that primarily focuses on the sale of Electronic Document Management (EDM) systems for a wide range of platforms.

In October 1995 PAFEC became the first SentinelLM customer after financial considerations ruled out an in-house development project to replace the current software licensing product.

PAFEC purchased SentinelLM for both UNIX and PC platforms for a number of reasons. The enablement system is extremely simple to operate - the despatch of a 16-digit code is all that is required and the avoidance of alpha-characters is especially useful in supporting overseas, non-English speaking customers.

PAFEC understand and appreciate the level of technical support that is available and integration of SentinelLM into their own applications has been both rapid and easy.



*Graphical Data Searching*



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### ILT

Interactive Language Teaching Ltd (ILT) have developed an exciting new multi-media English language course for foreign students, called English Express.

The course utilises video-game technology to create a fun and stimulating learning environment, but being distributed on CD it is open to illegal copying.

Reasoning that not everyone has the budget to purchase outright a quality language teaching course, ILT decided to sell access to its software, rather than selling the software itself, by using some innovative distribution methods.

"At any one time there are more people in China learning English than there are people in the USA". With figures like those and the fact that traditional marketing and distribution takes between half and two-thirds of the retail cost of the software, it is not hard to see that the real value of the software is in the usage.

The power of interactive CD computer technology made it possible for ILT to employ a pay-as-you-use method of software distribution that has not been widely used before in consumer markets.

A uniquely programmed SentinelSuperPro key is supplied with every ILT course. The key controls access to the software by being programmed to allow the purchase of a number of sessions up to a

cumulative total of, say, 100 hours. Upon expiration of the time purchased, the SentinelSuperPro denies access to the software until re-activated by the purchase of a code supplied by ILT.

This method works just like the old coin operated electricity meters except that now the software can be recharged using a modem, the Internet or by telephoning the support line.

The SentinelSuperPro has enabled ILT to prevent piracy whilst getting high quality, deep content software out to the market at a price that is acceptable to the consumer.



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# Hiding Complexity

Not everyone tries to open faulty pieces of hardware to repair them. **Francis Glassborow** recommends what the user serviceable parts in language should be.



**R**ecently, as I was installing a new operating system on a machine, I found myself having to open up the hardware in order to overcome some problems. Of course, the normal neat box became a clutter of cables. At times we have to delve into the guts of a machine in order to fix a problem, and then their complexity comes to the surface. Many manufacturers, it seems, do not like this one bit.

There are times when the notice 'no user-serviceable parts' means just what it says. A lot of the time, however, it just seems to be an excuse used by manufacturers wanting to retain the power to keep the machine working, and therefore earn more money.

What has this got to do with programming? I will get to that in a moment. But first let me highlight another relevant irritant from everyday life: why do I have to have exactly the right controller for a specific TV? If the battery runs out on the remote in my sitting room, why can't I borrow the remote my wife uses when watching TV in bed? This is just one example of the problems caused by the lack of a standard. If you want more, just strip down an old computer and start counting the number of different and completely incompatible screws you find.

What we need is mechanisms that hide complexity in a standard fashion, while allowing easy access for the competent. Now let me relate this to programming.

Languages such as Pascal have a defined logical level at which the label 'No serviceable parts...' is placed. Obviously, when something is wrong some will ignore the notice and break in to fix the things they know they can. Unfortunately, the result can be a system held together with little more than metaphorical duct tape. Keeping the novice away from the low-level stuff is fine, but it can cause problems when the expert needs access.

C allows low-level access but causes problems for the inexperienced because everything is out in the open, rather like the radios I built as a teenage enthusiast. Most C code, even that written by experts, has its working exposed for all to see and tamper with. That is not a problem for the experienced, but it is for novices.

C++ provides better mechanisms for putting 'cases' round the working parts. Now, we still sometimes need to open up the box and get at the works, but mostly we should just be happy to use them. Unfortunately, too many of those writing about C++ and training others come from a C heritage and do not see that using exposed code is generally unnecessary and almost always undesirable. The designers of C++ have gone to considerable trouble to provide mechanisms to assist with hiding complexity, and the better programmers have developed idioms to use those mechanisms.

Let me give you an example. Why is so much C++ code still riddled with uses of arrays of `char` for dealing with strings? Certainly at some level you must map characters onto some form of machine level

code, but why do high-level users still use and teach a mechanism that is so close to the hardware? Perhaps one reason has been the desire to write portable code. However most programmers have a more immediate interest in getting their code working as quickly as possible. The problem until recently has been that you must make a choice: good programmers, conscious of the need to write portable code, have implemented their own string types based on the low-level portable elements of C++ and therefore expect trainees to learn enough to do the same.

Of course you could use the string type provided by your compiler implementor, but that locks you into a particular product. Without a standard string type, we suffer from the TV remote controller problem.

This is no longer necessary. There is a perfectly reasonable string type provided by the draft standard C++ library. Of course it is a bit like a putative generic TV remote controller in that it has mechanisms for just about every way a string might be used. However it is portable and using it hides the implementation complexity from those who have no need to see it. Indeed the use of `#include <string>` (without the `.h`) even hides the fact that it is actually a specialisation of a template class (`basic_string`). It is time that we stopped introducing C style arrays of `char` to novices struggling to write their first program. Yes, the low-level complexity will need to be understood by some, and those concerned with maintaining legacy code will need to know about legacy idioms, but modern C++ programmers should learn on a need-to-know basis, and not through retracing the historical development of the language.

Nowhere is this more visible than in the standard template library. The combination of finely-honed containers and algorithms for managing them is something that every sane programmer should be grabbing with delight. You have no need to understand the inner workings of the STL in order to use it and now that all major compilers come with a reasonable implementation it is available to everyone. Admittedly, each implementation has had to find its own solution to the current lack of support for such things as member template functions and default template parameters but the fixes being used are reasonable and allow a good degree of portability for high-level code.

I think that it is also important to understand that efficiency criteria were an important element of the design of the STL so you should gain both in the development cycle and in performance by using it.

As an example consider the following implementation of Eratosthenes' Sieve written so that it will compile with Visual C++ 4.2. However, it is written with standard parts and will compile and execute on any platform that supports the current C++ standard library and console-style applications.

```
#include <iostream>
#include <vector>
#include <math.h>
typedef vector<bool, allocator<bool> > BitArray;
int main(int argc, char ** argv) {
    if (argc==1) {
        cout << "No upper limit given" << endl;
        return 1;
    }
    long upper_limit = atol(argv[1]);
    int check_limit =
        static_cast<int>(sqrt(static_cast<double>(upper_limit))) + 1;
    BitArray numbers(upper_limit, true);
    for (int i=2; i!=check_limit; i++)
        if (numbers[i])
            for (long j=i*i; j<upper_limit; j+=i) numbers[j] = false;
    long last_prime = 2;
    long prime_count = 0;
    for (long k=2; k!=upper_limit; k++)
        if (numbers[k]) {
            last_prime = k;
            prime_count ++;
        }
    cout << "There are " << prime_count
        << " prime numbers less than " << upper_limit << endl;
    cout << "The largest is " << last_prime << "." << endl;
    return 0;
}
```

There are a number of points worth highlighting in the above code. The presence of the `typedef` is for both portability and readability. Take note that there must be a space between successive `>` closures of template arguments, otherwise the parser may get it wrong. I have used `static_cast` because I think that this is preferable by far to the mechanism inherited from C. I have in fact avoided placing any non-essential casts within my code. The first one ensures that the subsequent addition is an integer one, not a floating point one that could on very rare occasions cause a rounding error. The second one is needed to resolve an ambiguity as the C++ math library supports more than just double precision arithmetic.

The last point is my changed loop idiom. Though it is not necessary here: you need to think in terms of using `!=` in the loop continuation clause where you are iterating across all members of a container because the more traditional `<` will not work correctly for some of the STL containers.

Try running the above on your machine. My Pentium-90 based Windows NT 3.51 machine counts all the primes less than four million in under 5 seconds.

## C++ for Windows 95

If you are one of those people running Windows 95 who do not want or need a full-scale professional C++ development kit you have very little choice. Microsoft long abandoned you: its low cost entry is a 16-bit compiler without any of the powerful features of C++ such as templates (without which you cannot enjoy the power of the STL).

Unfortunately Borland's Turbo C++ 4.5 seems to misbehave on Win95 machines (although it works fine on Windows 3.1). I guess Borland will eventually produce a Turbo C++ for Win95 but until it does, your only choice for Win95 at under £100 is Symantec C++ 7.5. This has just been released (or it should have been by the time you read this) at £79. Yes, I found that price unbelievable but Paul Leathers of Silicon River (0181 316 7777) assures me it is the new price for what would have cost £375 a few months ago as C++ 7.2. Interestingly it is £50 cheaper than Symantec's all bells-and-whistles development kit for Java, Visual Café.

## Last month's problem

Under what circumstances does the following do something in C?

```
i; /* i is a variable */
```

Under the C rules, `i` is an rvalue and consequently its value is fetched. Does this matter? If `i` is `volatile` qualified, yes: the process of fetching it may destroy the original (for example if it is a memory mapped input port).

WG21/X3J16 decided to classify such a statement as an lvalue which means that it effectively does nothing and will be ignored by all but the dumbest of compilers. If for some reason you want to restore it to the previous behaviour you must use a cast, for example:

```
(void)i;
```

The second question: is either one or both of the following defective?

```
void fn1 () {
    for (int i=0; i<10; i++) {
        for (int i=i; i<10; i++) {
            cout << i << " ";
        }
        cout << endl;
    }
}

void fn2 () {
    for (int i=0; i<10; i++) {
        for (int i(i); i<10; i++) {
            cout << i << " ";
        }
        cout << endl;
    }
}
```

`fn1()` is defective, because of a subtle and little known feature of how the different forms of declarator relate to initialisation. The form that uses an `=` sign (for compatibility with C) has the identifier on the left in scope so the form `int i=i` results in `i` being initialised with a copy of itself (that is, of course, undefined behaviour – I wish compilers would spot this and issue at least a warning).

`fn2()` does exactly what the naive programmer expects: it initialises the inner `i` with the value of the outer one because the inner one is not in scope until the closing parenthesis of its declaration.

There is a great potential for unexpected consequences when using the C form of initialisation in a C++ declaration. I think that you would be well advised to discard this idiom and replace it with the explicit constructor call form that is available in C++.

## This month's problem

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

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

## ACCU Conference 1997 News

What is Embedded C++? What is a diagnostic release version? These are just a couple of the questions that will be addressed by the likes of Bill Plauger, Tom Plum and a dozen others on July 18th/19th in the Oxford Town Hall.

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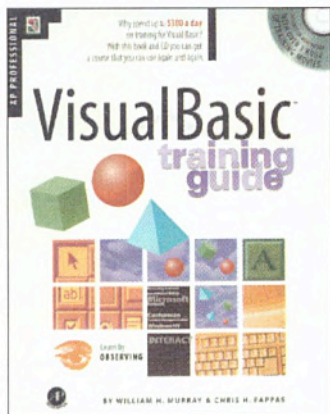
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Last month's article on the Control Creation Edition (CCE) of Visual Basic 5.0 was necessarily somewhat coy due to restrictions on what we could and couldn't talk about at the time. Happily, these restrictions have now been lifted and we can provide a much more complete picture of the new development system's capabilities.

### Going native

Just a few short months ago, Redmond's level of concern about Delphi was becoming immediately apparent from a set of benchmarks which you could download from the Microsoft Web site. These benchmarks were supposedly intended to 'prove' that an interpreted Visual Basic program actually ran faster than the equivalent native code application produced with Delphi! Those who accepted this 'evidence' probably also believe that OS/2 is the ideal scalable mission-critical platform for the nineties and that Bill Gates really is concerned with open standards, cross-platform compatibility and the future of Unix. I won't waste time commenting further on these particular benchmarks except to say that if you choose to put square wheels on a Ferrari, you really *can* make it go slower than a fully-laden Reliant Robin towing a caravan.

The point of all this? Simply that despite the apparently magical properties of their threaded p-code interpreter, Microsoft has finally got around to adding native code generation to the Professional and Enterprise editions of Visual Basic. This is probably the single most significant feature of the new release, aside from the OCX generation capabilities discussed last month. Speaking as someone who has long been a devoted Delphi

# Visual Basic

# Hawaii 5.0

As the covers finally come off the next version of Microsoft's ubiquitous RAD tool, **Dave Jewell** opens the hood and looks at some things to make you go vroom...

fan, I anticipated that Microsoft would respond to Delphi's appearance in short order and add the feature into the very next version of VB. Inexplicably, they didn't, which is especially surprising when you bear in mind that Visual Basic for DOS (remember that?) had native code compilation from the word go.

Although it's great at last to have the option to compile to something other than p-code, I was disappointed by the fact that you can't create stand-alone executables. In other words, no matter which way an application is compiled, it *always* requires the VB run-time library VBRUN500.DLL to be present. When you create a p-code application, the stub code in the EXE file fires up the interpreter inside the DLL. And when you build a native code program, the code calls library routines in the DLL in the usual way. Thus, the DLL has to be all things to all men, which may go some way towards accounting for the fact that it's now over 1.3 MB in version 5.0!

By contrast, Visual C++ will allow you to create

MFC applications which dynamically link to the MFC run-time DLLs or statically link all the MFC code into your application. Likewise, both Watcom's Optima++ (reviewed in the December issue) and Delphi 3.0 (which should be almost upon us by the time you read these words) can link their runtime libraries dynamically or stick the whole enchilada in a single file. The point is that VB is the only system mentioned which doesn't give you the choice.

Maybe you think I'm just being fickle: ever since Delphi 1.0 appeared, I've been complaining about the fact that you can't put the VCL library into DLLs. Well, now you can, so I'm upset that you can't make a stand-alone EXE with VB5! I'm not intentionally trying to be a RAD version of Victor Meldrew: what's important here is *choice*. If I'm writing a shareware application for a magazine front cover where size is important, then linking to DLLs is a reasonable decision if I know that the readers are already going to have them. Equally, if I'm writing a commercial application, then I'll almost certainly want to create a stand-alone app, unless I know that the program is going to be one of a suite of applications which can share the common run-time libraries.

The real tragedy comes when you are building OCX files: although these can be compiled as native code executables (one of

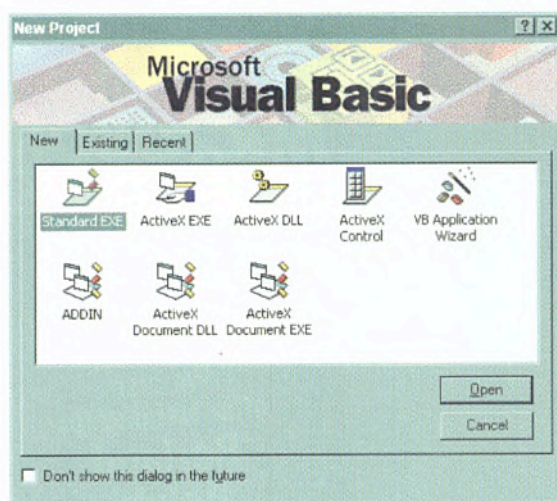


Figure 1 – When you first fire up VB5, you'll see this New Project dialog which speaks volumes about its flexibility – and Microsoft's commitment to ActiveX technology!

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the things I couldn't tell you last month), they *still* need VBRUN500.DLL. This makes it very hard to see how one might realistically deploy VB-authored OCX controls over the Web. There is no mention of these issues in the online documentation accompanying the beta release reviewed here.

Well, that's the bad news over, and here's some good news. When you compile for native code, the VB compiler will generate standard OBJ files. You can opt to include symbolic debugging information into your EXE file, and then perform debugging at the native-code level from within Visual C++. However, I imagine that most developers will initially build an application as p-code for testing and debugging purposes and then – optionally – compile the final version as a native code executable.

One interesting point, though: many people still expect a native code program to execute *a lot* faster than the equivalent interpreted code, but this just isn't so. The vast bulk of any Windows application's time is spent executing API code. Microsoft's own research indicates that an interpreted application will typically spend only 5% of its time executing p-code. Thus, if you compile to a native executable, you shouldn't expect to get more than a 5% speedup in a typical case. Native code only really comes into its own in very compute-intensive applications, such as numerical analysis, bit-twiddling and so on. If you're writing something like a bitmap manipulation program in Visual Basic then native code compilation will be like manna from heaven.

**A plethora of projects**

Another innovation in VB5 is the addition of project groups. I touched on these last month when I mentioned that you can create an ActiveX control project and, without closing it, create an ordinary EXE project from which to test the control. Both projects can be saved together as a related project group.

When you start up VB5, you now see an optional New Project dialog (see Figure 1) from where you can select a new project type or open an existing (or recent) project. As you can see from the screenshot, the design environment can now create many different types of skeleton projects including in-process OLE servers (ActiveX EXE) and out-of-process servers (ActiveX DLL), as well as projects for creating add-ons to the IDE itself. A new project type has been added in the shape of ActiveX documents, which can be thought of as forms which can display themselves within a Web browser window, enabling you to create VB5 applications

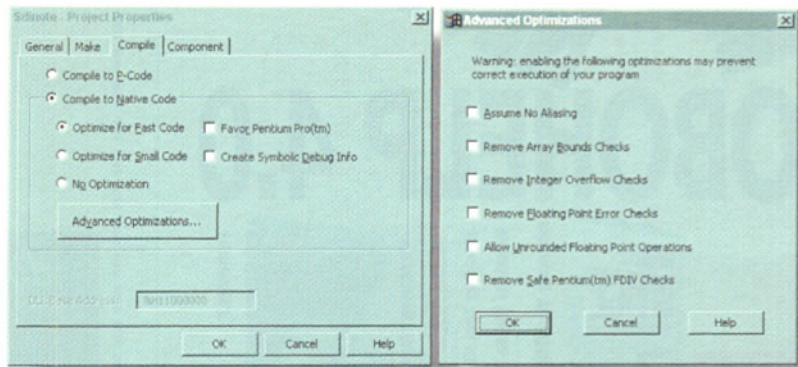


Figure 2 – Going native: applications can now be compiled as either p-code or native executables. In the latter case, you can select from a number of conventional compilation options and you can even debug a native code executable using the Visual C++ debugger.

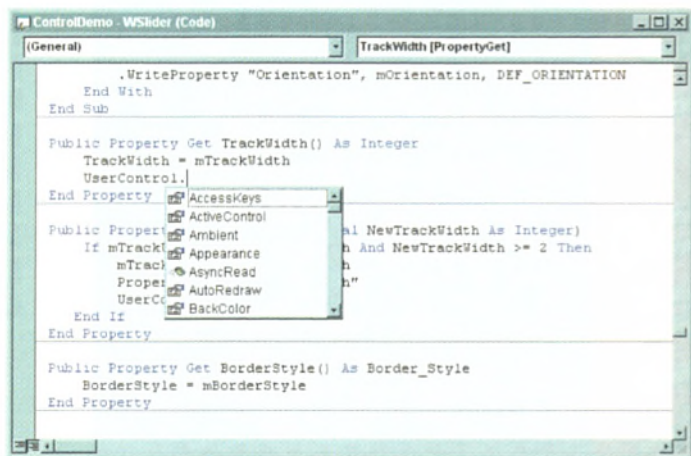


Figure 3 – The next ACC (automatic code completion) feature acts like a helping hand, remembering all the details of member names, parameter lists and so forth. It works equally well with custom types and procedures.

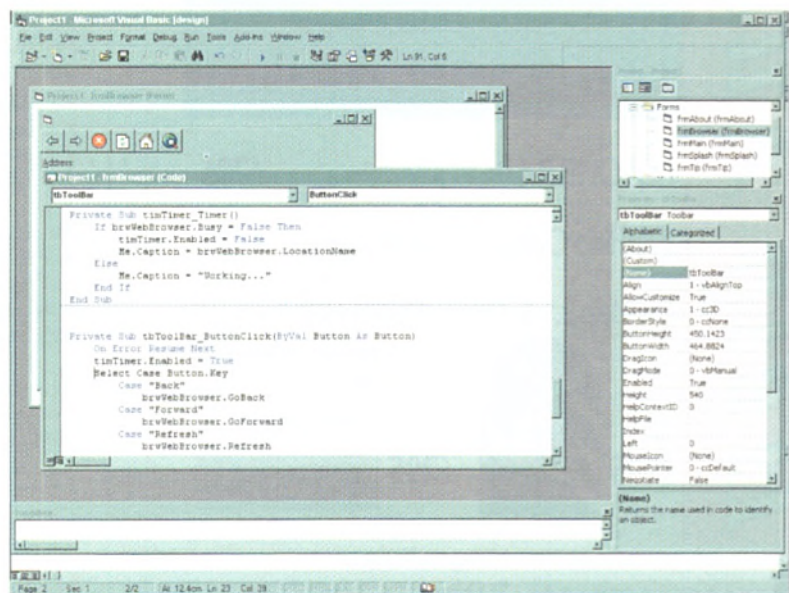


Figure 4 – Using the new application wizard, you can quickly knock up a professional looking application complete with splash screen, tip of the day and even an Internet Browser!

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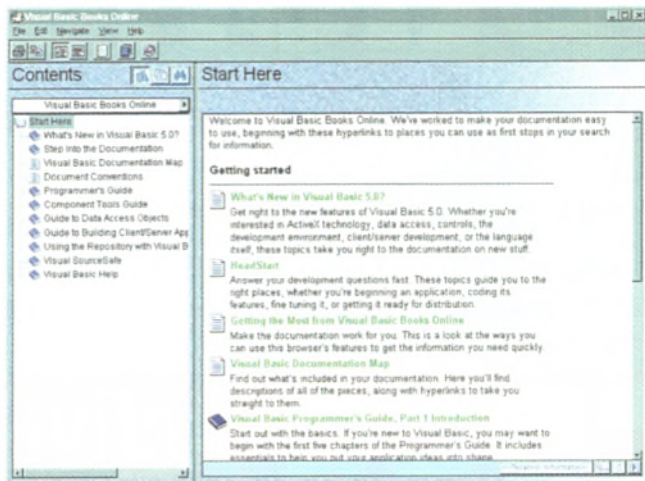


Figure 5 – The new Visual Basic Books Online software provides hierarchical, MSDN-style access to the various manuals in the documentation set. See the accompanying table for a list of what's available for each product edition.

which can be deployed over the Net. Interestingly, an ActiveX document automatically merges its window with those of the Web browser, so 'remote' users have access to the same interface functionality as if they were using the application locally. A migration wizard is on hand to help you convert existing forms into ActiveX documents. (This is only one of a number of new wizards, including a 'wizard wizard' for constructing custom wizards of your own).



Continuing on the Internet-enabling theme, the new VB application wizard is very cute. Not only can you create an application complete with splash screens and 'tip of the day' dialogs, but you can even build a complete Web browser into your application, courtesy of a new bundled browser control. In addition to the traditional MDI/SDI interface styles, the wizard can generate new 'Explorer-style' applications, which comprise a hierarchical tree view on the left and a detail content pane on the right, separated by a vertical splitter.

As you'd expect, there have been a host of enhancements to the development environment itself. One of the nicest of these is called *automatic code completion* (ACC) which works in various ways as you type within a code editor window. For example, suppose you type the name of a control followed immediately by a period. At this point, ACC knows you're going to reference one of the control's properties or methods, so it automatically pops up a list of their names. If you type the first few letters of the required member name and hit the *Tab* key, the name is entered into the editor for you. As another example, when you are assigning to some typed variable, typing the equals character

pops up a list of possible assignment values which can be selected in the same way.

Perhaps the most useful aspect of ACC is when writing method calls to subroutines and functions which take a large number of arguments. Once you've typed the function name and entered a space, ACC displays the function (together with its complete argument list) in a small pop-window below your current typing position, with the first argument in the list highlighted. As you enter successive arguments, the highlight moves along the list, keeping pace with your typing and indicating the expected type of the next argument. Handily, ACC works not just with built-in functions, but can handle user-defined types and routines, and any Windows API declarations you import into your project. If you regard this as wimpy spoon-feeding, you can always turn off ACC's capabilities from the Options dialog, but I thought it was rather clever. It certainly makes the system immediately more accessible to those who don't have an eidetic memory for parameter lists. I wouldn't be surprised to see something similar to ACC in new versions of Visual C++ or even in the odd Borland product.

### Catchy enhancements

VB5 brings many enhancements to the VB language specification, some which arise from the requirements of OXC development. For example, as we saw last month, you can define a custom event like this:

```
Event MouseDown (Button As Integer, Shift
                As Integer, X As Single, Y As Single)
```

and then raise the event like this:

```
RaiseEvent MouseDown(Button, Shift, X, Y)
```

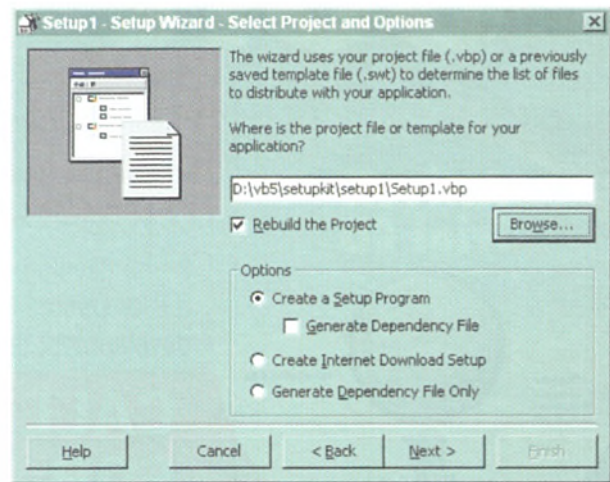


Figure 6 – The Internet theme extends even to the revamped setup wizard where you can now create a setup configuration suitable for deploying over the net.

An OCX control's 'user' normally handles events of this type – the control's code doesn't have to 'catch' the event. But, more generally, you can use a new **WithEvents** keyword to implement event handlers in your own code.

Here's how it works: you can associate one or more events with a certain class module, so events are considered to be generated by objects of that class. Within (say) a form that uses this class module, you can declare an 'event catcher' as follows:

```
Private WithEvents MyCatcher As Wombat
```

This establishes a variable, **MyCatcher**, which can receive events from the **Wombat**



Figure 7 – There are plenty of goodies for database types too. The unfortunately named APE (for Application Performance Enhancer) can be used to benchmark transactions involving several components in a complex client/server scenario.

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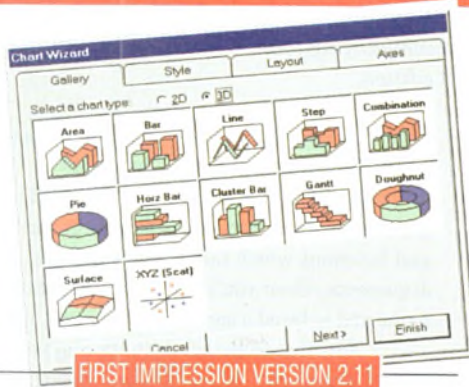


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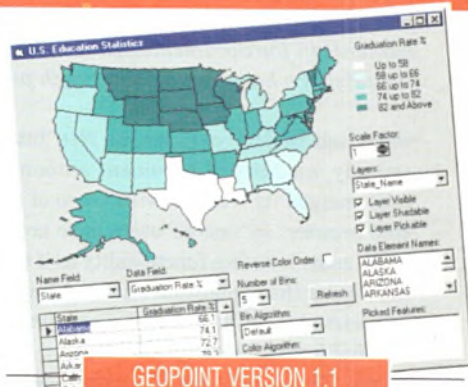
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module. Having added this sort of variable to the *Declarations* section of a form, you can then select the **MyCatcher** variable in the left-hand combo

box of the module's code window, and select from one of your custom event types in the right-hand combo. You then end up with an event catching routine for the specified event. By convention, the event procedure's name is made up of the 'event catcher' variable name and the name of the event, so if you were catching an event called **Zap**, the procedure name would be **MyCatcher\_Zap**.

Enumerated types have been enhanced so that you can make explicit assignments to the individual members of the type. Previously, enumerated types were always greater than or equal to zero, and were assigned consecutively by the compiler. Now, you can have disjoint constant values and use negative numbers for invalid values. For example:

```
Public Enum StatusCode
    Initialised ' takes the default value zero
    Busy ' takes the value 1
    Idle = 30 ' explicitly set to 30
    Searching ' takes the value 31
    Invalid = -1 ' indicates an error condition
End Enum
```

In keeping with its increasing level of COM integration, VB5 now supports polymorphism. Not by multiple inheritance, you'll be relieved to hear (!) but in true Java style through the use of interfaces. Class modules specify that they implement a particular interface through the new **Implements** keyword.

Previous versions of VB implemented optional routine parameters, but only if those parameters were of type **VARIANT**. In VB5, optional parameters can be properly typed. The **Debug** object has gained its own **Assert** method, allowing you to incorporate debugging checks which don't appear in your project's final executable.

One other nice language enhancement concerns the new **GlobalMultiUse** specifier which can be applied to a class module. With **GlobalMultiUse** enabled, you can call methods of a particular class without having to first create an instance of that class. This might seem a bit odd, but if you think about it, it's roughly equivalent to the use of static member functions in C++. I say 'roughly' because there is a difference: in C++, a static member function does not have an implicit **this** pointer, and attempting to access **this** will produce a compiler error. With VB5, a **GlobalMultiUse** class module

does have an associated object instance – the object is created 'behind the scenes' when the first reference to one of the class's methods occurs. Sneaky, eh?

**Don't call me, I'll call you...**

Up until now, it wasn't possible to call Windows API routines which required a callback function pointer. For example, **EnumWindows** and **EnumFonts** are examples of routines which repeatedly execute an application-supplied callback function in order to perform the required enumeration. This just wasn't possible in previous ver-

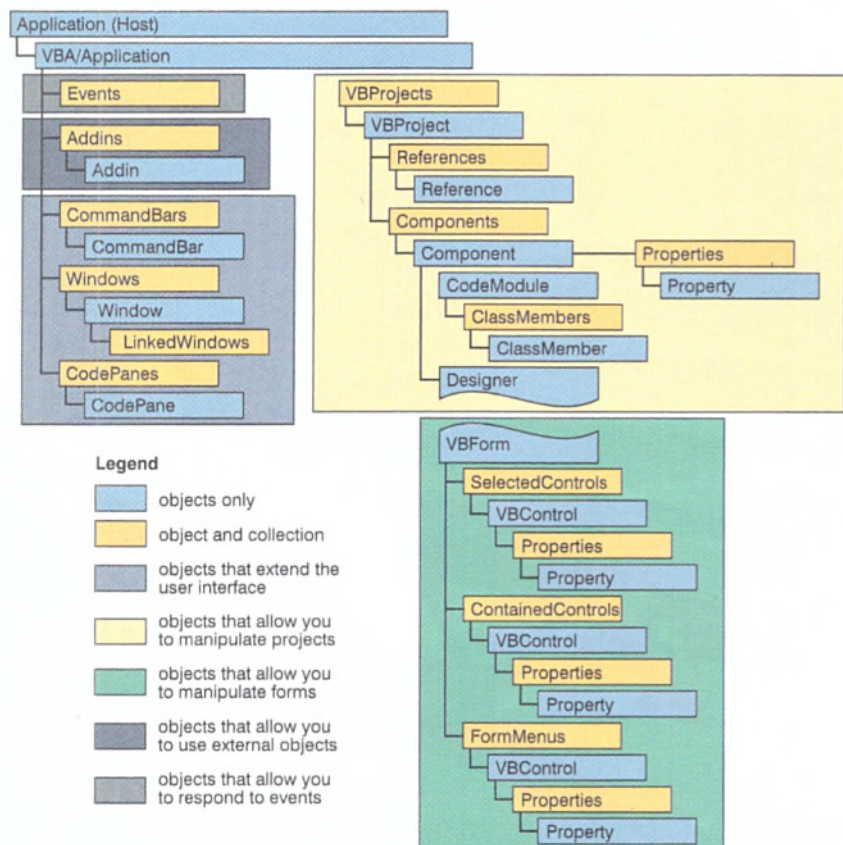


Figure 8 – Taken from Microsoft's on-line documentation, this illustration shows the rich set of object classes that make up the new extensibility architecture used to implement custom add-ons within the VB5 IDE.

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Title	Supplied with
Programmers Guide	S, P, E
Using ActiveX Controls	P, E
Building Internet Applications	P, E
Creating ActiveX Components	P, E
Extending the Visual Basic Environment with Add-Ins	P, E
Accessing DLLs and the Windows API	P, E
Guide to Data Access Objects	P, E
Crystal Reports for Visual Basic: User's Manual	P, E
Building Client/Server Applications with Visual Basic	E
Visual SourceSafe User's Guide	E

Table 1 - A (tentative) list of the manuals supplied with the various editions of Visual Basic 5.0. The letters SPE indicate the Standard, Professional and Enterprise.

sions of Visual Basic without using some add-on such as a third party DLL or VBX control - a klunky approach.

With VB5, you can pass the address of a callback function by using the new `AddressOf` keyword. Thus, to call `EnumWindows`, you might simply do this:

```
Err = EnumWindows (AddressOf  
MyWindowEnumerator, 0)
```

Seasoned API developers will realise that there's actually a fair bit going on behind the scenes here - the function address that *actually* gets passed to the `EnumWindows` API call is the address of a stub which must take care of re-establishing the VB run-time environment (including the stack and data segments) before calling the user-supplied function. It's a very useful addition for those who do much API coding from Visual Basic, and as a bonus it makes possible to pass VB function addresses to third-party and custom DLLs. Thus, you could (for example) pass the address of a progress indicator routine to some DLL performing a lengthy file copying or archiving operation.

A lot of work has gone into the business of creating VB add-ons, and there's a whole raft of new objects which provide access to the IDE's user interface. (See Figure 8 for a hierarchy diagram.) You can use these to manipulate projects, forms, source code and extend the IDE's user interface in various ways.

VB5 incorporates a number of goodies to keep the database aficionados happy including a connection designer for building stand-alone connection objects which incorporate stored procedure or user-defined queries as method calls. A new interactive SQL debugger allows you to debug Transact-SQL code from within VB, and a number of enhancements have been made to the RDO (Remote Data Objects) library for enhanced cursor support and stand-alone query connection and result set objects.

The documentation supplied with VB5 is truly exemplary. In the beta package under review, no printed manuals were available, but much of the final documentation was already present in electronic form via the *Visual Basic Books Online* browser software which runs from the CD. The manuals that will be included with the shipping versions are shown in Table 1.

### Two words to the wise

As you'll have no doubt gathered, the big changes to VB5 can be summed up in two words: Internet and ActiveX. Visual Basic is now a great system for developing OCX controls, OLE servers and ActiveX documents as well as regular client-side Windows applications. Native code generation is a big plus point and we'll undoubtedly be performing some more detailed benchmarks once the final shipping product is available. The language enhancements go a long way towards overcoming those irritating little niggles that often used to get in your way, and the new automatic code completion stuff will surely be aped by many other development systems before the year is out. The documentation is superb - although it needs to be, because VB5 is a much more complex product than its predecessors. The only real fly in the ointment is the continued requirement for the aforementioned `VBRUN500.DLL`. I guess we may have to wait until VB6 for truly stand-alone executables. In the meantime, be sure to think carefully about deployment issues.

Unfortunately, no pricing information for VB5 was available at the time of going to press, though I'd expect prices to be pretty much in line with the existing VB4 product. Hopefully, firm prices should be available by the time you read these lines.

*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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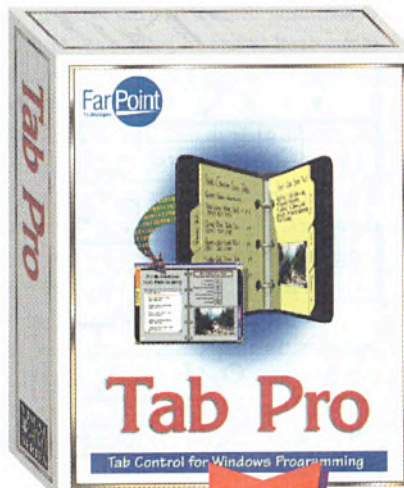
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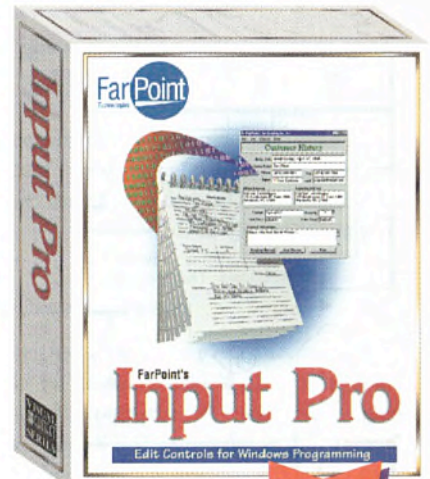
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# Internet Foundation Classes

With every major Java power readying its weaponry in the battle for the 'Net, Netscape is going back to the fundamental elements. **Chris Cant** performs some alchemy...

**N**etscape's Internet Foundation Classes (IFC) aim to provide a base Java API, extending Sun's core Java Development Kit (JDK) classes. The current offering is billed as a GUI IFC, since it mainly improves on the JDK's limited Abstract Window Toolkit (AWT), with other IFC packages to come, some Netscape-specific. Even today, however, IFC is facing several rivals, including Sun's own Java Workshop visual classes.

This review covers the 'Barium' release of October 15 1996. This had substantial changes from the previous 'Cesium' version, but Netscape claims that there should be no further major alterations before the final release (available for download from <http://developer.netscape.com/library/ifc/>, and due to ship with Navigator 4.0). In addition to class changes, the Barium release has better documentation and a few examples.

Netscape is in a good position to push its frameworks, including IFC, as de facto standards by including them with its browsers, and since IFC is written entirely in Java, it is browser independent. However, the big question is whether other browsers will support the classes: the complete download is over 500 KB, and no-one will want to have to download those just to run a single application. Somewhat limply, Netscape suggests that users will be able to get the classes on disk from someone else.

## Naming conventions

As if Sun's reorganisation of the JDK in version 1.1 wasn't enough, the IFC naming convention seems to have been specifically designed to confuse. Among the breaks with tradition are the `paint` routine, replaced with `draw` and `drawView`, and `getFocus` becoming `resumeFocus`. Even the applet method `getParameter` becomes `parameterNamed`.

IFC does follow previous naming conventions in some places, however. For example, its replacement for the JDK's AWT `Graphics` class comes in the shape of `netscape_beta.application.Graphics`. Note though, that if you've imported both packages, you'll have to write both class names out in full to make use of them.

While it avoids having to name the classes eponymously, (ie as Netscape Foundation Classes), having 'Internet' in the title doesn't seem quite appropriate. Netscape describes IFC as being intended to provide a series of frameworks, but I think 'function areas' would be a more applicable term.

## Overview

Table 1 shows a broad summary of the areas of functionality provided by IFC, which are divided between two packages: `netscape.util` and `netscape.application`. (Note that in the beta versions these followed the form of `netscape_beta.util`). The `application` package is by far the larger, consisting effectively of extensions to `java.applet` and `java.awt`.

Many of the classes, including the display and event objects, are based around the abstract `View` class. I should point out straight away that IFC does not support a document/view style architecture, although you could certainly build a companion document class if you so wished. IFC views only represent an area on the screen able to receive events.

The user interface components supplied include `Button`, `ColorWell`, `PopUp`, `ContainerView`, `ListView` and `TextView`, as well as

composite components like `ColorChooser`. In IFC, the window component is just an interface, which is implemented by two distinct window classes, `InternalWindow` and `ExternalWindow`, both of which are derived from `View`. An `InternalWindow` lives within the area of its parent, be it a program or an applet. It must be rectangular, but numerous visual styles can be used: it can be transparent, display title bars, resize handles etc. `ExternalWindows`, on the other hand, live outside the area of the Java program, and look like the windows of the native operating system. Each external window can contain sub-windows by creating its own `RootView`.

IFC uses each `RootView` as the basis of a hierarchy (z-order) of views within a program, which keeps track of the display order of internal windows. The primary `RootView`

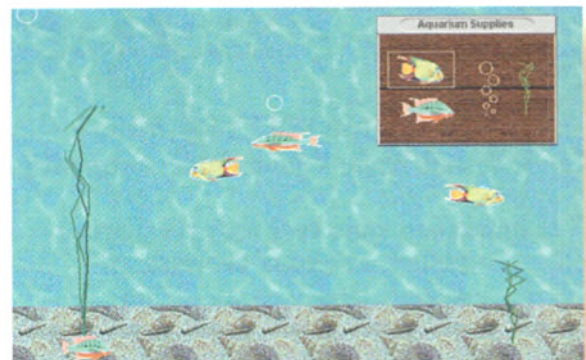


Figure 1 - The aquarium example applet.

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of your program represents the area that it has been given to work in. In addition, you can specify a 'layer number' for each window, such as `DEFAULT_LAYER`, `PALETTE_LAYER`, `POPUP_LAYER`, or `DRAG_LAYER`. So, for example, you could set a floating palette's layer number higher than a document window, to make sure it always appears on top.

Views support resizing nicely. You can decide whether the width should stay the same when resized, or – if fixed – which margin should move. Unlike some other systems (like Win32 and X), IFC is restricted to an image model based on pixels.

The actual rendering of views is performed by the `drawView` method, although you normally call `draw`, which calls `drawView` and then paints the sub-views. You can override the methods used to draw the standard components, for example to derive oval-shaped buttons from the `Button` class by making the view transparent and overriding `drawViewInterior` to render only the oval. Views have in-built (optional) support for drawing to off-screen buffers to avoid flicker while painting.

The abstract `Border` class is used by components to draw their surrounds. Five borders are provided as standard, though you may roll your own by implementing or overriding the primitive methods. The `ScrollGroup` class makes it easy to create scrollable components (or groups of components).

One thing that may surprise experienced AWT programmers is the necessity to set up the Graphics context each time you use it. For example, the `drawView` method must set the font every time it is called.

```
// GrayView.java By Ned Etoode
// Copyright 1995, 1996 Netscape Communications Corp.
// All rights reserved.
import netscape_beta.application.*;
import netscape_beta.util.*;

/** The most common way to draw to the screen is to
 * subclass View and override the primitive drawing
 * method, drawView(). In this simple example we just
 * fill our bounds with a solid shade of gray.
 */
public class GrayView extends View {
    int value;

    public GrayView(int x, int y, int width, int height) {
        super(x, y, width, height);
    }

    public void setValue(int value) {
        this.value = value;
        draw();
    }

    public int value() {
        return value;
    }

    public void drawView(Graphics g) {
        g.setColor(new Color(value, value, value));
        g.fillRect(0, 0, width(), height());
    }
}
```

Listing 1 – The source code of the `GrayView` applet. Note that the `_beta` suffix on package names will be dropped in the release version of IFC.

Framework	Description
Drawing/event framework	The basic framework for directing events to interface objects and allowing those objects to draw themselves to the screen.
Fundamental application controls	Basic GUI application controls, such as buttons, sliders, and text fields.
Composite controls	More complex interface controls, such as the <code>ColorChooser</code> and <code>FontChooser</code> .
Multi-font text object	An object that can display multi-font text as well as embedded images.
Windowing framework	Brings a traditional-style windowing environment to Java applications, as well as tools for placing IFC components within 'native' windows.
Animation framework	Animation functions, including buffered drawing and transparency.
Drag-and-drop framework	Support for dragging and dropping items within an application.
Timers framework	Allows concurrent behaviour without the need to spawn threads.
Object persistence framework	Enables objects to save their essential state to secondary store, allowing them to be reconstituted at a later time.
Localisation framework	Support for multiple localised versions of application resources.

Table 1 – Overview of IFC function areas.

### Events and Targets

Every IFC application has a main thread that receives mouse and keyboard AWT events, which are directed to the appropriate object in the view hierarchy. The event system has some nice touches here. If your `mouseDown` handler returns false, then the system does not harass you with `mouseDragged` or `mouseUp` events. By default, mouse tracking events are coalesced so only the most recent `MOUSE_DRAGGED` or `MOUSE_MOVED` event is sent, allowing a view to keep up to date with the user's actions. You can request auto-scrolling events, for example for when the user continues a drag operation outside a component's window.

Note that, as in AWT, applications are not made aware of any `paint` events generated by the underlying operating system, since the core Java classes ensure that `draw` is called automatically.

IFC components that wish to receive object-specific commands do so by implementing the `Target` interface. So, for example, when a button with a target interface is pressed, the system calls its `performCommand` method. Unfortunately, the command is currently passed as a string (eg the button's name), which is far from ideal: surely in the interests of efficiency, an integer identifier would serve much better.

Netscape says that this interface will be altered to use class reflection once JDK 1.1 is widely available. Reflection allows you to determine the (public) fields, methods and constructors of other classes. I presume this means that a command named `CUT` will automatically invoke the method `OnCUT`.

It is not normal for commands to be passed as events, but there is a specific `CommandEvent` to do just that. For commands which may apply to more than one class of object (eg `CUT`), the framework can identify the first object (from the current object, or the first in the reverse view hierarchy) that can handle it. This is done through the `ExtendedTarget` interface. There are 14 standard commands marked out in the interface that your object may want to respond to, for example `ExtendedTarget.CUT`. I attempted, somewhat briefly, to implement cut and paste functionality on a `TextField` component using this technique, but failed. So, there's a clipboard facility available, but an undocumented one.

IFC makes it simple to avoid having multiple threads in your program if it only needs to perform some single simple action regularly, by creating a `Timer` object which calls your `Target performCommand` at some defined rate.

If you want to add events to an application's event queue, you can use the `EventLoop` class instance returned by a call to `eventLoop`. Exceptions in your code are caught in the event loop, and event processing continues.

Your application can incorporate drag-and-drop functionality by implementing the `DragSource` and `DragDestination` interfaces within source and destination classes respectively. The dragging itself is handled by a `DragSession` object created by the source's `mouseDragged` method.

### Look and feel

IFC only enables you to set the order in which the user can tab through components for `TextField` controls. As a result, setting up tabbing for other components is cumbersome, and quite limited in flexibility. This is disappointing: I think it is important to give people the option of using the keyboard to deal with



things like radio buttons and so forth. According to the documentation, hitting the *Return* key is supposed to be equivalent to pressing *Tab*, but I found this not to be the case.

Various other aspects of the components are subtly naff: in text components, for example, *shift+left cursor* does not select the previous character, and the *home* and *end* keys do not work. Thankfully, you can at least select character ranges with the mouse. Text view controls seem to have all sorts of glitches and inconsistencies: when you type a lot of text into one, you would expect it to scroll the new text into the view, and preferably sprout a scroll bar, but it does neither. Worse still, not all of the view area is cleared to the background colour when you do a deletion. Text views are supposed to be able to

read and interpret HTML, but the display is disastrous. Implementing a text field (especially one with multiple fonts and HTML display capabilities) is no easy job, but Netscape will have its work cut out getting this ready for release.

Another disappointing omission is the absence of support for the likes of toolbars and tooltips, which nowadays most users probably expect.

The Constructor GUI tool used internally by Netscape is not part of the SDK, although IDE vendors may well produce something similar. Interestingly, the documentation seems to allude to some resource format, but there is no actual evidence of its existence, nor the promised localisation framework for application resources.

## Public utilities

IFC's *util* package provides, alongside improved versions of the *Vector* and *HashTable* and utility classes like *Sort*, a new *Archiver* class. This can encode a graph of objects (ie a root object and all the other objects it relies upon) for storage in an *Archive*. Archives do not have to be read serially, so they could be viewed as simple databases for storing classes and their version information.

To be archivable, an object must implement the *Codable* interface, and must provide a constructor that takes no arguments. Most of the IFC classes seem to support this:

```
// PushMe.java By Ned Etcode
// Copyright 1995, 1996 Netscape Communications Corp.

import netscape_beta.application.*;
import netscape_beta.util.*;

/** In this example we create several user interface elements & place
 * them on the root view. We set ourselves as the target of these
 * elements so that as the user interacts with them we receive the
 * corresponding commands.
 */
public class PushMe extends Application implements Target {
    Button button;
    Slider slider;
    TextField textField;
    TextField statusField;
    GrayView grayView;

    /** This method gets called to initialize an application. We'll take
     * this opportunity to set up the View hierarchy.
     */
    public void init() {
        super.init();

        // Change the color of the root view to be the standard
        // application lightGray.

        rootView().setColor(Color.lightGray);

        // Set up a TextField which will display status messages. The
        // setBuffered(true) call will prevent it from flickering when
        // someone drags the slider. After setting it up we add it as a
        // subview of the root view so it will be displayed on the screen.

        statusField = new TextField(24, 24, 256, 24);
        statusField.setBorder(null);
        statusField.setEditable(false);
        statusField.setBackground(Color.lightGray);
        statusField.setFont(Font.fontNamed("Courier", Font.PLAIN, 12));
        statusField.setBuffered(true);
        statusField.setStringValue("Hello World");
        rootView().addSubview(statusField);

        // Create a button with the text "Push Me" on it. We set ourselves
        // as the target of the button, so that we'll receive a
        // performCommand() message (see the Target interface) with the
        // command "buttonWasPressed" whenever the button is pressed.

        button = new Button(24, 54, 64, 24);
        button.setTitle("Push Me");
        button.setTarget(this);
        button.setCommand("buttonWasPressed");
        rootView().addSubview(button);

        // Make a Slider and tell it to send us the command
        // "sliderWasMoved" whenever the slider changes.

        slider = new Slider(24, 96, 64, 24);
        slider.setTarget(this);
        slider.setCommand("sliderWasMoved");
        slider.setBuffered(true);
        rootView().addSubview(slider);

        // Make a TextField which the user can edit. The API to set the
        // target and command will improve in a future release.

        textField = new TextField(24, 128, 64, 24);

        textField.setCommand("textWasEntered");
        textField.setTarget(this);
        rootView().addSubview(textField);

        // GrayView is a custom View subclass which just draws solid gray
        // rectangle. We change the shade of gray it displays in the
        // sliderWasMoved() method below.

        grayView = new GrayView(128, 64, 128, 128);
        rootView().addSubview(grayView);
    }

    /** This is the sole method of the Target interface. Since java
     * doesn't have a way to do callbacks, this ugly little bit of code
     * needs to exist. The convention we recommend is to simply invoke
     * the method with the same name as the command.
     */
    public void performCommand(String command, Object arg) {
        if (command.equals("buttonWasPressed"))
            buttonWasPressed(arg);
        else if (command.equals("sliderWasMoved"))
            sliderWasMoved(arg);
        else if (command.equals("textWasEntered"))
            textWasEntered(arg);
    }

    /** This method is invoked when the button is pressed.
     */
    public void buttonWasPressed(Object arg) {
        showStatus("Button Was Pressed!");
    }

    /** This method is invoked when the slider moves. We set the shade
     * of gray displayed in the GrayView from the value of the slider.
     */
    public void sliderWasMoved(Object arg) {
        grayView.setValue(slider.value());
        showStatus("Slider Was Moved! value = " + slider.value());
    }

    /** This method is invoked when the user hits return in the TF.
     */
    public void textWasEntered(Object arg) {
        showStatus("Text Was Entered! value = \"" +
            textField.stringValue() + "\"");
    }

    /** We call showStatus() from several places to update the text
     * displayed in the status field.
     */
    public void showStatus(String status) {
        statusField.setStringValue(status);
    }

    // This method allows PushMe to run as a stand alone application.
    public static void main(String args[]) {
        PushMe app;
        ExternalWindow mainWindow;
        Size size;

        app = new PushMe();
        mainWindow = new ExternalWindow();
        app.setMainRootView(mainWindow.rootView());
        size = mainWindow.windowSizeForContentSize(320, 200);
        mainWindow.setSize(size.width, size.height);
        mainWindow.show();
    }
}
```

Listing 2 - The source of IFC's PushMe example applet.



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perhaps Netscape intend to use their archive as a resource format for laying out windows.

Note that the JDK 1.1 supports 'light-weight' object persistence. By default, this saves all non-transient and non-static fields in a class to an `ObjectOutputStream`, which can be overridden with custom `readObject` and `writeObject` methods. For some programs this automatic persistence mechanism may be much simpler to use than IFC's more flexible options.

## Applets

Figure 2 shows the `PushMe` example applet. Unlike a normal applet, an IFC applet's main entry point is in the IFC `NetscapeApplet` class, which starts up IFC and then calls your main class. The HTML code that starts the applet must call `NetscapeApplet` with the name of your class specified in the `ApplicationClass` applet parameter. For example, the `PushMe` applet is started by:

```
<APPLET CODE="NetscapeApplet"
  WIDTH=320 HEIGHT=200>
  <PARAM NAME="ApplicationClass"
    VALUE="PushMe">
</APPLET>
```

`NetscapeApplet` exists to provide the `classForName` method – if IFC is installed as part of the system classes, placing this function inside the `Foundation` applet would

mean the user classes would not be found. Here's its source:

```
import netscape_beta.application.*;
import netscape_beta.util.*;
public class NetscapeApplet
  extends FoundationApplet {
  public Class classForName
    (String className)
    throws ClassNotFoundException {
    return Class.forName(className);
  }
}
```

As you can see from the `PushMe` applet's code in Listing 2, the main `PushMe` class extends `Application` instead of `Applet`. As usual, it implements the `Target` interface so that it can perform commands – a nice feature of Java is that you can normally avoid having to write message loops.

`PushMe.init` initialises the application by setting up the view hierarchy, in this case a root view with a write-only status text field, a button, a slider, an editable text field and a custom `GrayView`. Each component has its target set to be `PushMe` so `PushMe.performCommand` is called to dispatch all commands. Unfortunately, commands are passed as strings, so you have to perform all your checking the hard way. If there were some mechanism for passing commands as integers, a single switch statement could be used, cleaning things up.

`PushMe` provides a main method to run as a stand-alone application as well as an applet. In this case, the initialisation consists of creating a new instance of `PushMe`, and a new `ExternalWindow`, which is set as the root view, sized and finally shown. The meat of the code is invoked via IFC's `Application.run` method.

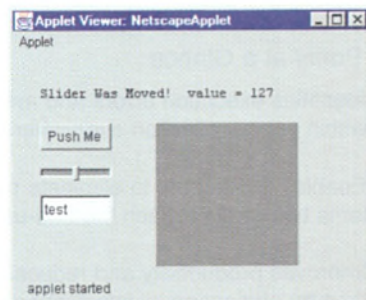


Figure 2 – The `PushMe` applet in action. The slider has been moved halfway along, making the `GreyView` box halfway between black and white.

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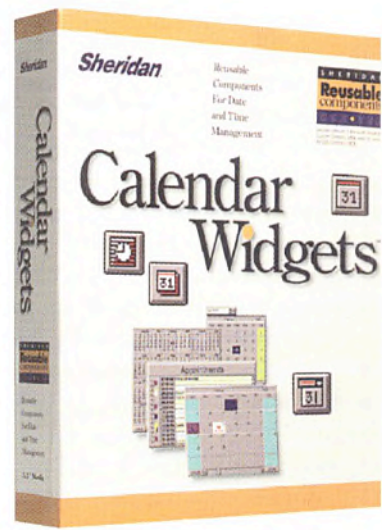
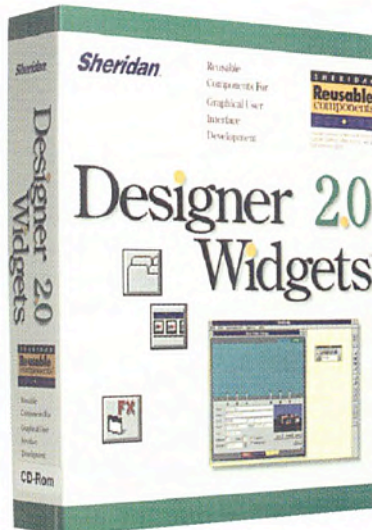
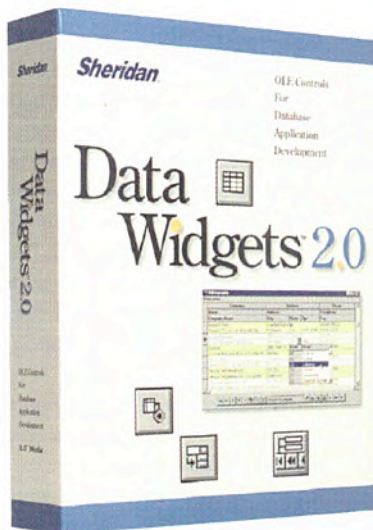
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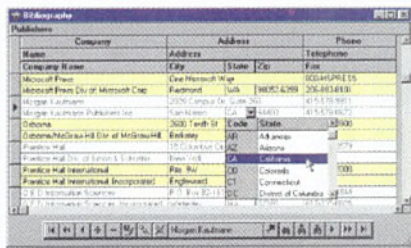
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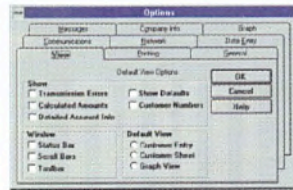
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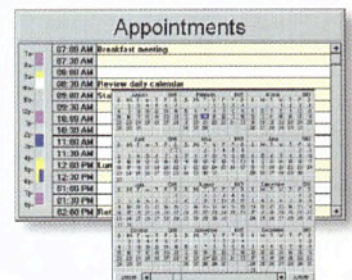
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**The IFC SDK**

The full 900 KB IFC SDK (including the support classes) is available publicly on the Web at <http://developer.netscape.com/library/ifc/>. You need to download the archive in the appropriate format and expand it (on a file system that supports long filenames) to produce the release directory structure. The CLASSPATH environment variable needs to be set as well: on NT I had to reboot to get the change recognised. [Note – the command line tools seem to work fine if you just close and restart the console – Ed]. The toolkit comes with two sets of HTML documentation: a developers guide and the class reference, with further resources (including a quiescent newsgroup) available online. It's very handy at this point to bookmark some links to relevant parts of the documentation, since it's tedious to have to search them out in the directory tree every time you want to look something up.

The kit includes five examples (complete with source) to play around with, the cutest being the aquarium applet shown in Figure 1. You can drag the aquarium supplies into the tank, then watch and relax as the fish swim, the bubbles bubble and the foliage waves. Netscape seems very fond of fishtanks!

The developers guide is reasonably comprehensive and comprehensible, an improvement over the Cesium release. However, if you want to discover all of IFC's capabilities, you have to go to the pain of tootling around the class documentation. This is the familiar format used by the JDK, but is generated by (Netscape's?) *netdoc*, rather than the more commonplace *javadoc*. The usual class hierarchy, package and global index pages are the same, but the individual class pages start with the Java code for the class's public definition, rather than the pretty listing generated by *javadoc*.

One complaint: there are numerous broken links within the class reference pages. Most of these refer to the JDK, with a few inconsistencies referring to IFC itself. This is probably due to some classes being just used internally (for example, `TextView` using `HTMLParser`). This may be corrected for the release version, but it gives a rather sloppy appearance.

**Top of the league?**

While IFC definitely improves on the raw JDK, I think it does not quite go far enough. The supplied user interface components need work: I would like to see a standard window manager to give a common look and feel to Java applications (although by all means make it so that you can use other ones). Similarly, a resource format taking care of localisation and a document/view architecture with file storage on a server would be nice.

Although it is not the perfect solution, if I knew for certain that a tidied-up IFC would be available on most browsers, then I would certainly use these classes to build on. Apparently Symantec has already opted to bundle IFC, but it is unclear if Netscape will be able to count on support from other tool vendors.

I had hoped that IFC would have been good enough to become *de rigueur*. Although I am not totally convinced, Netscape may actually have the clout to make sure this happens, especially if all my moans are tidied up for the final release. ■

*Chris Cant runs PHD Computer Consultants Ltd. You can check out various Java applets on his web site at <http://www.phdcc.com>, or email him at [chris@phdcc.com](mailto:chris@phdcc.com).*



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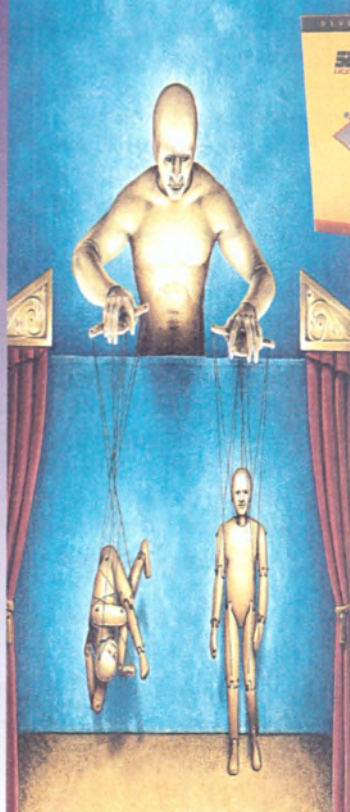


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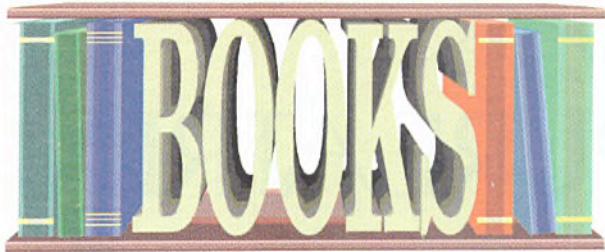
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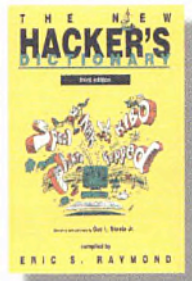
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The New Hacker's Dictionary (third edition) reviewed by David Mery



A little over eleven years ago I discovered an exhilarating file called JARGON.TXT. Since then, I have kept my printout of it: a mere 28 pages (including the cover sheet) laser-printed at 1:53:28am on a Saturday. The

third edition of its printed counterpart, the *New Hacker's Dictionary* (TNHD) corresponds to version 4.0.0 of the Jargon file, and weighs in at 547 pages. For those who have missed out on the online files and the previous books, *TNHD* is mostly a lexicon of hackish terms, originally started in the 70s as a reference to the technical slang used within such hallowed eves as the MIT, Stanford and Carnegie-Mellon AI Labs. Since then, the dictionary has grown to encompass terms outside the pure AI-scope, from development centres all over the world and the anarchy of Usenet.

This third edition of *TNHD* adds more than 100 new entries including *Dilbert*, *warez d00dz*, and *washing software: n. The process of*

*recompiling a software distribution (used more often when the recompilation is occurring from scratch) to pick up and merge together all of the various changes that have been made to the source.* Many entries present in previous versions have been updated (more than 200 according to the cover blurb), either to illustrate additional meanings or to include more etymological information. For instance, the tiny entry in my 1985 printout for *dike*: '[from "diagonal cutters"] v. To remove a module or disable it. "When in doubt, dike it out."', has been expanded to eleven lines. All British readers should check out the *Commonwealth Hackish* and *tea, ISO standard cup of entries.*

If you already have a previous edition of the book, you might still want this third edition. Probably not so much for the new terms, since many of them are simply basic slang from the BBS and micro-computing worlds, but more for the updates and enhanced etymological erudition. For instance, the origin of bug, was originally given as '*from telephone terminology, "bugs in a telephone cable", blamed for noisy lines*'. The second edition corrected this, referring to the moth found in the Harvard Mark II on September 9, 1945. The

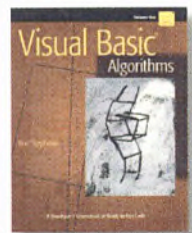
log for that date reads '*1545 Relay #70 Panel F (moth) in relay. First actual case of bug being found*'. The third edition goes even further and gives some origins which may explain the common folk etymology: '*it may well be a distorted joke among telegraph operators more than a century ago*'. The origin of this story is traced back to the use of the Vibroplex Morse keys which '*had a graphic of a beetle on them*'. For the full explanation go to the source. Don't miss out either the whole story about *kludge* and *kluge* which is slightly different depending on which side of the pond you are on.

You can check out the Jargon file online at [http://www.ccil.org/jargon/jargon\\_toc.html](http://www.ccil.org/jargon/jargon_toc.html). Downloading a text version gives you a great reference for when you want to search for a specific entry, but the book is better for picking up and reading every now and then.

✓ Verdict: compulsory reading

<b>Title:</b>	<i>The New Hacker's Dictionary - 3rd ed.</i>
<b>Author:</b>	Compiled by Eric S. Raymond
<b>Publisher:</b>	The MIT Press
<b>ISBN:</b>	0-262-68092-0
<b>Price:</b>	£13.95 (paperback), £26.95 (cloth)
<b>Pages:</b>	547

Visual Basic Algorithms reviewed by Mary Hope



'Visual Basic Algorithms! Is this an oxymoron? Is this guy serious? Surely it is only fools who try to tackle the hard-edged depths of *real* algorithms with anything but C and C++! Is this a sign of declining

standards in our society? Or, adopting a more considered tone, is this a sign that Visual Basic is coming of age? There was a time when it was synonymous with 'quick' and 'dirty' programming' but Visual Basic 4 with its growing respect for the principles of object orientation now provides the tools for a much better style. There is support for reusable class modules and even an acknowledgement in the manual that 'it's good practice to explicitly declare your variables...'

So much for Visual Basic, what about the book? If its main title was not explicit enough, its subtitled 'A Developer's Sourcebook of Ready-to-Run code'. And that is exactly what it is: a collection of algorithms, with descrip-

tions and example code in the book and on the disk in both source and executable form. The text is relaxed and explanatory, starting with a discussion of the term 'algorithm' and how algorithms can be evaluated. The usual ground is covered, going through the Big O notation and the trade-off between time and space, with a stress on the difference between average and worst-case scenarios. All this can be found in other books, but the style is readable and Visual Basic is a very non-threatening environment for introducing the concepts. For comparison, I randomly opened one of the classic algorithm books, Robert Sedgewick's *Algorithms in C++*, and was immediately aware of the different impact of the two languages. C++ books delight in pages abundant with cryptic -, &, \*, +=, ? : notations, but Visual Basic's style, particularly so in the examples given in this book, is more words than symbols.

The range of algorithms covered is conventional. Stephens starts with dynamic data structures such as lists, stacks and queues. He then throws in a useful section on recursion which includes a look at when to use it

and when to avoid it. The bulk of the book is in its coverage of trees (including balanced and decision trees), sorting, searching, hashing and network algorithms.

Having read the text I thought this book would sit quite comfortably in an academic environment; when I looked at the programs on the disc I was completely sold. From a programmer's point of view the gain is having the source code. From an educational point of view the executables are the perfect way to back up the theory. However the intended audience seems to be software developers, for whom it would be an invaluable source if their work includes some substantial processing tasks. As the author states at the start, this is not a 'teach yourself' Visual Basic book, but it would definitely move an enthusiast up a rank.

✓ Verdict: recommended

<b>Title:</b>	<i>Visual Basic Algorithms</i>
<b>Author:</b>	Rod Stephens
<b>Publisher:</b>	John Wiley
<b>ISBN:</b>	0-471-13418-X
<b>Price:</b>	£32.50
<b>Pages:</b>	327 (plus floppy disk)



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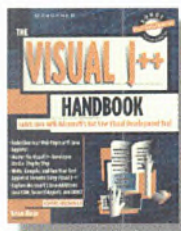
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- 099  Other

**Platform/operating system**

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- 103  UNIX
- 105  IBM AS-400
- 106  Client-server
- 107  Windows
- 199  Other

**Turnover**

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- 302  £1m-£10m
- 303  £10m-£50m
- 304  £50m-£100m
- 305  £100m-£1bn
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- 307  Public sector

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Ref: RC/1

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Ref: KB/3

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Ref: LC/4

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Ref: CP/5

### C++/UNIX

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Ref: KB/8

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Ref: DE/9

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### C++/NT/UNIX

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**Software Engineers**

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Ref:JK/10

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## PLAYING GAMES FOR A LIVING? PRINCIPAL S/W ENGINEER - PC TECHNOLOGY

THE ENVIRONMENT . . .

- ▶ International £multi-million consumer electronics Group.
- ▶ Recently established new technology centre for leisure computer peripherals - rural location near Bristol.
- ▶ Exciting, creative, 'leading-edge' designs combining market-leading functionality & aesthetics with integral, easy to use, PC interface software.
- ▶ Working closely with the World's leading leisure software houses.
- ▶ Backed by major group investment, with a commitment to an ongoing series of new product designs and global market launches.

THE ROLE . . .

- ▶ To guide the Company's strategy for PC interface development.
- ▶ Inspire & motivate a growing team of software professionals
- ▶ To lead the development of Saitek's user interface and connectivity software.

THE CANDIDATE . . .

- ▶ Currently 'Top Flight' PC/interface/peripheral software development engineer or consultant.
- ▶ Capable of setting new standards in medium/high tech consumer electronics.
- ▶ Will have a good knowledge of low level O/S interfaces including Device Drivers, HAL, TSR's etc., and ideally an awareness of Direct-X.

£Salary package, including relocation assistance if necessary will not be a barrier to attracting the ideal candidate  
Applications from highest-calibre, PC orientated electronics/software graduates with an interest in joining this expanding team would also be welcome.

Interested candidates should telephone or apply in writing to:  
Chris Slack, Morgan REM, 7-9 Kingsbury Square, Aylesbury HP20 2JA. Tel: (01296) 330930. Fax: (01296) 330940.

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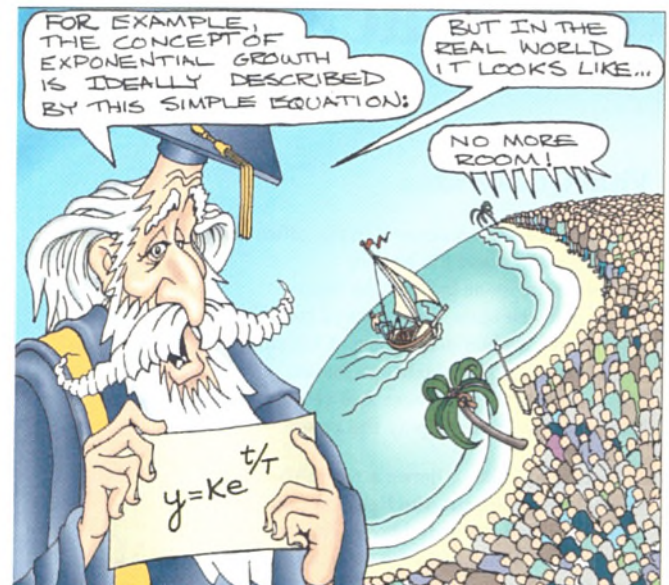
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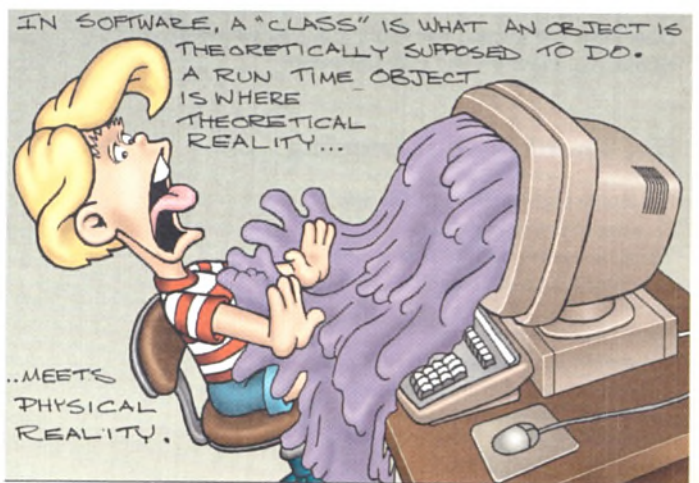
## OBJECT. LESSONS



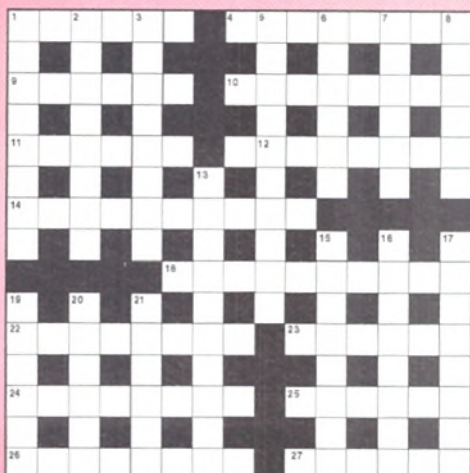
THE RELATION BETWEEN MASS AND ENERGY IS PRECISELY EXPRESSED BY A SIMPLE EQUATION:



BUT, IN THE REAL WORLD, IT LOOKS MORE LIKE THIS:



## CROSSWORD



### ACROSS

1. Get on top of the current file (6)
4. Search success level for radiation (8)
9. Endless play with 0 or 1 is just a ruse (6)
10. In short I am a hanging decoration that's stuck (8)
11. Baste broken lander ... (6)
12. ... partitioned with metal, a great deal, by Edward (8)
14. 1990s' technology before you now (10)
18. Number work may be vital for usage data (10)
22. What a computer can make well - true of false? (8)
23. Cancel a little gas by the logic circuit (6)
24. Unusual if I spy ET - it is normal ... (8)
25. ... but stops the program run with tar of a sort (6)
26. Shows on screens ... (8)
27. ... active loops (6)

### DOWN

1. Such media still seems attractive (8)
2. Ease the path of systems analysis, for instance (8)
3. Sarky sayings about ripe mags (8)
5. Not 2 output chip in electrode (10)
6. Crustacean initially in state of poverty or disgrace (6)
7. With fools I go before, and in, printer units (6)

8. Gives up profits (6)
13. Despite its name, the fastest moving consumable (10)
15. Getting together a harsh code (8)
16. Stereo wine holder on test (8)
17. Evaluates article seven ways (8)
19. Made changes on screen? (6)
20. Little micros with several fields of action (6)
21. Like a utility presumably (6)

### SOLUTION TO DECEMBER'S CROSSWORD

ACROSS: 1. MERRY 4. CHRISTMAS 9. RUBBISH 10. COMFORT 11. HEARKEN 12. CATCHER 13. RED 14. MASTERMINDS 16. INTOXICATES 20. PAD 21. DREAMER 22. EASTERN 25. EXCUSES 26. DESSERT 27. STEPSHYLY 28. YETIS

DOWN: 1. MYRRH 2. RUBHARD 3. YOICK 4. COHUNTS 5. RECYCLE 6. SOMETIMES 7. MOORHEN 8. SATIRISED 13. REINDEERS 14. MAXIMISES 15. TEA 17. TREAACLE 18. CURTESEY 19. TUESDAY 20. PRESENT 23. SISSY 24. NOTES



## The black eye of the little blue techie

Ms Verity Stob murders some well-loved poems.

### Vitai Quakerama

There's a roar and a screech in the office tonight—  
Ten frags down and 8% health,  
No decent weapons to level the fight—  
Trapped in the open, no chance of stealth.  
A scrag at his shoulder, a vore at his side  
A chainsawing ogre slashes to maim.  
Then up pops the message: 'Are you here for the ride?  
Play up! Play up! And play the game!'

Reception is locked, there's a cat in the hall  
The heating's cut out, the lights are all dim.  
He's turned off the switchboard for fear of a call  
From his wife (but she long since has giv'n up on him).  
With fierce concentration he Quakes on untired  
But looks up astonished when his boss speaks his name:  
'Now Alan I've warned you - this time you are fired!  
So play up! Play up! And play the game!'

### Not Thinking but Looping

He double clicked the old DOS app  
Treaded NT was crawling:  
'Must be 'cos it's 16-bit.' He's wrong—  
Not Thinking but Looping.

Never was a speedy app  
We should have ditched it years ago  
It's just got worse since Windows 4  
It's 32-bit that makes it slow

Oh no no no you silly folk!  
(Still NT was crawling)  
The bloody thing is written wrong  
Not Thinking but Looping.

### I saw a jolly Trek flick

I saw a jolly Trek flick  
Best so far it's reckoned  
Picard's team came jolly first  
Borg came jolly second.

Though Data is a jolly droid  
It's hard to understand  
Why jolly Data enters data  
All by jolly hand.

An RS-jolly-232  
Would jolly things much faster.  
It's not like jolly Doctor Who  
And jolly friend - The Master!

*Chorus:*  
Klingons on the starboard bow, starboard bow, starboard bow etc.

### The Naming of Parts

Today we have the Naming of Parts. Last week we had booting up with and without the F8 key depressed. And next week we shall have Special Config Secrets of the Windows 95 Gurus, and then connectivity to Sun. And outside Sun shines, and birds sing  
For today we have the Naming of Parts.

Our photo shows the printer port, and this is the port for the joystick (which in your case you have not got), and here is the power supply, and the ribbon cable for the floppies. It has both male and female connectors  
Which in your case you have not got.

[Now turn to page 30, Issue 7]

*(Freely adapted from Easy PC Magazine part-work.)*

### The black eye of the little blue techie

There's a battered H-P Inkjet down by the Ladies' loo  
And a Compaq Pentium 90 sans its case.  
There a broken-hearted techie mourns the ghost of OS/2  
And he's got his CV ready - just in case.

He was known as 'Little Blue' by the 'We-love-Windows' crew  
His faith in IBM was unconstrained.  
His workmates liked to goad, but they couldn't fault his code  
So for his C++ he was retained.

The girl who stole his heart: she wasn't very smart,  
But in her presence he'd just sit and gawp.  
He asked her which OS would she like on her PC?  
He very nearly wept when she said 'Warp'.

To make the setup clean, he dismantled her machine  
The installation took the whole weekend.  
Monday, when she got in, he was waiting by her desk  
To present his work and beg to be her Friend.

She upbraided Little Blue in the way that women do  
She said she'd asked for Warp just as a joke.  
But then she got a fright for his lips went paper white  
And he gurgled as if he was going to choke.

He grabbed the Compaq's case, and he hurled it at her face  
It missed and smashed a printer to the floor.  
She swung her handbag high and she caught him in the eye  
Then beat a hasty exit through the door.

There's a battered H-P Inkjet down by the Ladies' loo  
And a Compaq Pentium 90 sans its case.  
There a broken-hearted techie mourns the ghost of OS/2  
And he's got his CV ready - just in case.

*(VS apologises to Sir Henry Newbolt, Stevie Smith, Charles Causley, Henry Reed and J Milton Hayes.)*



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Scoring Category	Aladdin HASP	Rainbow Sentinel
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Ease of Learning	9.1	7.1
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
<b>Final Score</b>	<b>8.5</b>	<b>6.5</b>

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

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