

August 1995

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# EXE

The Software Developers' Magazine

## Windows 95 What developers (really) think

**PNG**  
the patent-free  
graphics file  
format

**Unravelling  
the Domain  
Name Service**

**Dave Jewell's  
DIY Delphi  
components**

**C++ code  
analysis with  
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**Why YOU need  
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What did you do in the  
Windows<sup>®</sup> 95 Beta, Daddy?

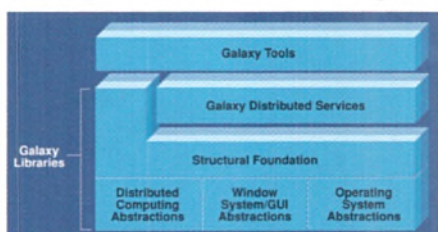




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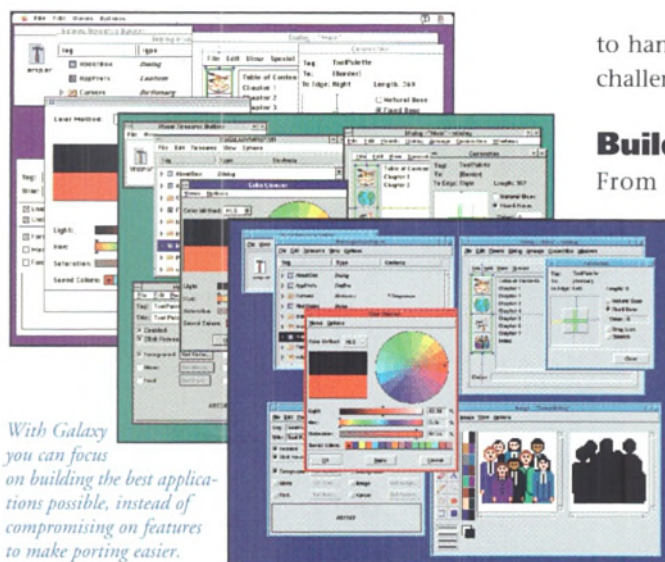
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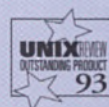
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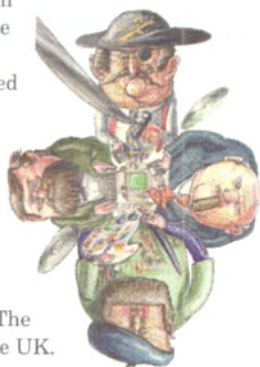
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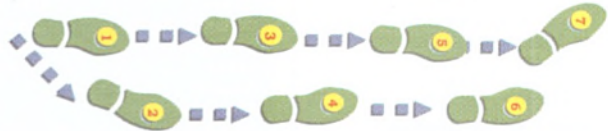
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## News & Views

### IBM VisualAge C++

If you think that Visual Basic & Delphi represent the state of the art in visual development tools, then you haven't seen IBM's VisualAge. You design the GUI portions visually, as is usual these days, but you can also build the non-visual portions visually as well. They call it "visual construction from parts" and so far it has only been available in the expensive Smalltalk variant.

IBM have now combined this technology with the robust tools from C Set++ to produce the first of a new generation of C++ compilers, at a sensible price. The first version is for OS/2 (of course!), but a Win32 version is due in 6-9 months. Future platforms include Power Mac, Solaris, AIX and OS/2 Warp for Power PC.

The core of this cross-platform portability is Open Class, an enhanced version of the class library in C Set++. This provides over 400 classes covering user interface, database access, collections, data types and exceptions. Taligent will influence future enhancements.

A few other highlights include: Data Access Builder maps DB/2 tables to C++ classes, generating C++ & SQL code; Direct-to-SOM for generating CORBA-compliant objects; Project Smarts; new Browser (no need to compile); and advanced Debugger & Performance Analyser.

How much do you think IBM are asking for this technological powerhouse? After all, it is probably the most sophisticated C++ development system ever produced and won 2 out of 4 awards at Object World Boston '95? £1000 perhaps. At least £500? No. It can be yours for only £266 + VAT (CD-ROM + printed docs). Call us now before they change their mind!

### SpeedPascal/2

A 32-bit Borland Pascal for OS/2? Not quite, but this is as close as you'll get. The Pascal Magazine said: "If Borland were to produce a Borland Pascal for OS/2, I do not think that it could be very different from (or even much better than) Speed."

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With Borland leaving OWL behind in the Win16 world in favour of VCL & Delphi, SpeedPascal/2 is the only way of porting your OWL apps to a 32-bit operating system. And SpeedSoft are working on a Windows version of the compiler as well. Call us now to order your copy (CD-ROM, online docs). Only £79 + VAT until the end of July, then £100 + VAT.

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# SoapFlakes

## Knobs for nerds

**T**HE EARLY YEARS of personal computing were the days when the hobbyist ruled, when GUIs were what ice cream did in the sun and Bill Gates still hadn't made his first million. Some of the ancients in the industry lust after those uncomplicated days. I don't. Perhaps it is a sign of old-age, but I've grown tired of writing yet another comparison routine or another hash table lookup. I'd much rather rise to the challenge of getting OLE to work without crashing or writing a multi-threaded RPC application.

What has happened is that the challenges remain high and interesting in the programming sphere, but somehow the fun has gone out of the industry, which is why the ancients are uneasy. It might also be a sign of an industry growing up, or something to do with the unquenchable thirst of the larger companies to eat the smaller ones. However, fun comes from believing you are innovating and that what you are doing will change the world. That is rarely happening in the run-of-the-mill grind of corporate programming, much less in the rarefied arena of Silicon Valley.

The only people doing the kind of stuff that can be classed as *fun* is the Internet crowd, who are just trying to put a pretty face on a network that has been working for years in the universities. It is cited as a panacea for all, but it is just a hang-out for some university boffins and students that would prefer to heal the world rather than program for commercial gain. These guys have been creating incomprehensible programs for years, for example, the pride and joy of the Internet community: HTML and the World Wide Web, is just another excuse for using a separate editor and formatter that everyone else in the world condemned to its grave long ago. When was the last time you typed `<b>` and `</b>` around a word to embolden it?

While the PC programming community can look and laugh at these guys, they are actually laughing at themselves. The Internet crowd are making programs for their own kind, making more 'Knobs for nerds', and because of that having fun doing it. They have found what is so precious in the programming of the 90s, by doing programs for themselves rather than some vague user

community. Perhaps the unwashed masses of the PC community should wake up and listen.

*Jeffrey Goldberg, Product Marketing Engineer at Cisco Systems Europe.*

## Malpractice insurance

**S**INCE SOFTWARE development began, there has always been something slightly tongue in cheek about the whole thing, as if it was all part of an elaborate joke. For years, the users of microcomputers, and indeed bigger machines, have been used to software crashing on a daily basis - a simple press of the reset button leading to a temporary resumption of operations. Wordprocessors process words in eccentric ways, such as causing valid text to disappear inexplicably and deleted text to appear equally inexplicably (the source of at least one famous embarrassing incident reported in the Internet RISKS forum). A mere glance at stationary cars next to me on the M25 reveals puzzled salesman wondering where Glasgow has gone as they pore over the output of their route planning software. Our programming languages yearly become more complex and consequently less well-defined as Fortran 90, Ada 95 and C++ amply testify. As a result, programmers verifiably commit the same mistakes with roughly the same frequency as 10 years ago. And we call this engineering.

The question is, will the public at large accept this sorry state of affairs? In the last few years, the amount of software in consumer electronic appliances has been doubling every 18-24 months. There are already many thousands of lines of code in cars, mobile phones, medical scanners, aircraft, fire alarms, televisions, VCRs and even electric razors. It is only a matter of time before the electric toothbrush with a free C compiler appears. Against this backdrop, the error density in software has been roughly constant over the last 15 years according to NASA statistics. This leads to the inevitable conclusion that the number of errors in consumer electronic appliances will also double every 18-24 months. Do we see evidence of this increase? We certainly do. In September last year, a latest technology fly-by-wire Airbus A340 exhibited behaviour normally associated with word-processors, by calculating its fuel incorrectly, replacing vital



information on the pilots' command screens with reassuring 'Please Wait...' messages during a Full Emergency landing and turning right instead of left as commanded. These were all software problems. It's not that they did a bad job, the problem is that nobody knows how to do a really good job.

It would be nice if there was adequate guidance for programmers working on products affecting the public at large. Unfortunately, this has been slow coming, and there are as yet no international standards, although several initiatives are in draft. The British Computer Society issued a 10-point policy statement on the 8th June 1993 recommending that software engineers involved in high-integrity or safety-critical work have professional qualifications equivalent to Chartered Engineering Status. Since then, professional indemnity insurance has been made available to BCS Chartered Engineers, to cover potential problems. This is the first time I had ever heard of such a possibility. These initiatives are most welcome as legal interest in software failure has been growing, and there have been several recent successful cases against the suppliers of failed systems. This is an important step as evidenced by the leader in the September 1994 edition of *Technology Magazine*, *Director's Journal*, which concluded that it was time to sue. As a result, it would not surprise me at all if some form of malpractice insurance became the rule in the not too distant future. The problem is trying to decide what limits are reasonable. As the manager of the Australian Commonwealth Bank said in February 1988, the morning after a software *enhancement* had doubled all debits and credits for 12 hours, 'the effects of software errors are limited only by the imagination'.

*Dr. Les Hatton, Director of Research and Engineering at Programming Research Ltd. Author of 'Safer C: developing software in high-integrity and safety-critical systems', published by McGraw-Hill.*



# Mayhem!

It seems that no amount of publicity or legislation can turn back the tide, and now CDs represent a major contribution to software piracy. **Jules** thinks the threat can be neutralised by changing what software is, provided the pirates don't win first.

How long have publishers been complaining about software piracy? All that talk about how piracy was costing the industry trillions of pounds every year, when it was costing no such thing. I have to admit that, even at the beginning, I thought most of this was wrong. Lots of pirated software was used for testing purposes before buying, and for small, transient jobs. There's not much functional difference between my borrowing a friend's computer for an evening, and borrowing a disk or two. As far as the publishers were concerned, there was a world of difference.

There are two problems, I think. The first is the problem of perception. The trouble with software is that it doesn't look like much. You get a disk or two, perhaps a book, and that's about it. There's none of the sense of quality that you get by slamming a car door, or eating food off bone china plates. You put the disk in the hole, make it all work, and the old familiar screen does something you really wanted it to do all along. After the novelty has worn off, you're left with a feeling of comfort - if the programmers have done their job right, that is. To steal, or borrow software appeared as if you weren't stealing very much. You'd duplicate

a disk or two (as the legitimate owner was supposed to do for himself), and perhaps photocopy a page or two out of the manual to get you started. When a program required a big fat book, the value of the software seemed greater, and it was a lot more trouble to steal, but on-line help, which we were all exhorted to write, reduced the size of the books and made piracy easier.

The second problem is one of value. Software does cost a lot to create. It seems to me ideal to rent, or to borrow software, just as is done with books and videos. But the people who write software have to make a living out of doing so, and to create a formalised lending structure would reduce the profit dramatically. Book and video libraries work because the cost of reproduction is more than the cost of origination.

So, in the absence of any short-use system, and not wanting to spend hundreds of pounds on a 35p floppy disk, the final users had no alternative other than to steal. They weren't wicked, and they won't go to hell for it. While the publishers wailed about lost profits and damage to the industry, most of the people who were stealing were saying to themselves 'but that's not what I'm doing - surely they don't mean me? I wouldn't have paid for this anyway!'

Recently, the wailing seems to have died down. I think there's two reasons for that. Firstly, software has become bigger, and 25 disks is much more trouble to duplicate than two. Prices haven't risen in line, which means the buying public thinks that it's getting far more value for money out of the new software than the old. I suppose it is, but at the expense of drastically reduced profits for the publishers. Second, as business users have increasingly bought (or stolen) all the software they want, the publishers can make fewer sales to them, and other markets have to be developed. The other markets are the Dixon's computers, where the software comes bundled, and not only can you not find all the files you need to copy, there's no point because there's no-one else who needs a stolen copy because they've got their own

bundled software anyway. This too has hampered the profits of the publishers.

But recently, something new has been happening: CDs. Actually, they're not new at all, but they are starting to have an effect. On the face of it, they're a great idea. They can contain buckets of information, and the information can be a mix of all kinds of things. They don't forget if you leave them by the loudspeakers, you can't accidentally erase a file, the mass duplication costs are tiny and the single duplication costs are huge. The great beauty of a CD from the user's point of view is that you can use it the way you use a video recorder; you put the CD in the hole, and use it, and when you take it out



you can't use it any more. All you need the hard disk for is an operating system, some initialisation files, and your own, private data.

Unfortunately, this is going to benefit the 'pirates' as well. Passing a CD around between friends shouldn't contravene a licence, because all the time one person is using the disk another person can't. It's an ideal medium for a library to hold, since the CDs can't pick up viruses. All the ways in which copyright material is cir-



culated now will be directly applicable to software. And therein lies the problem; with no requirement at all for every user to buy his own CD, not even a legal or moral one, the software publishers are going to find it even harder to wring the costs of development from a jaundiced public.

There's only one way for a programming firm to stay in business in such a climate. They must take the route that all other copyright producers do, when making books, sound recordings, or videos. They must spend the money on development, and then attack a huge mass-market. They will need television advertising, just as happens with music videos, and they'll need

a steady supply  
of new ideas,  
and new  
things to  
do. In  
short,

software publishing will be done the way music publishing and film-making is done now.

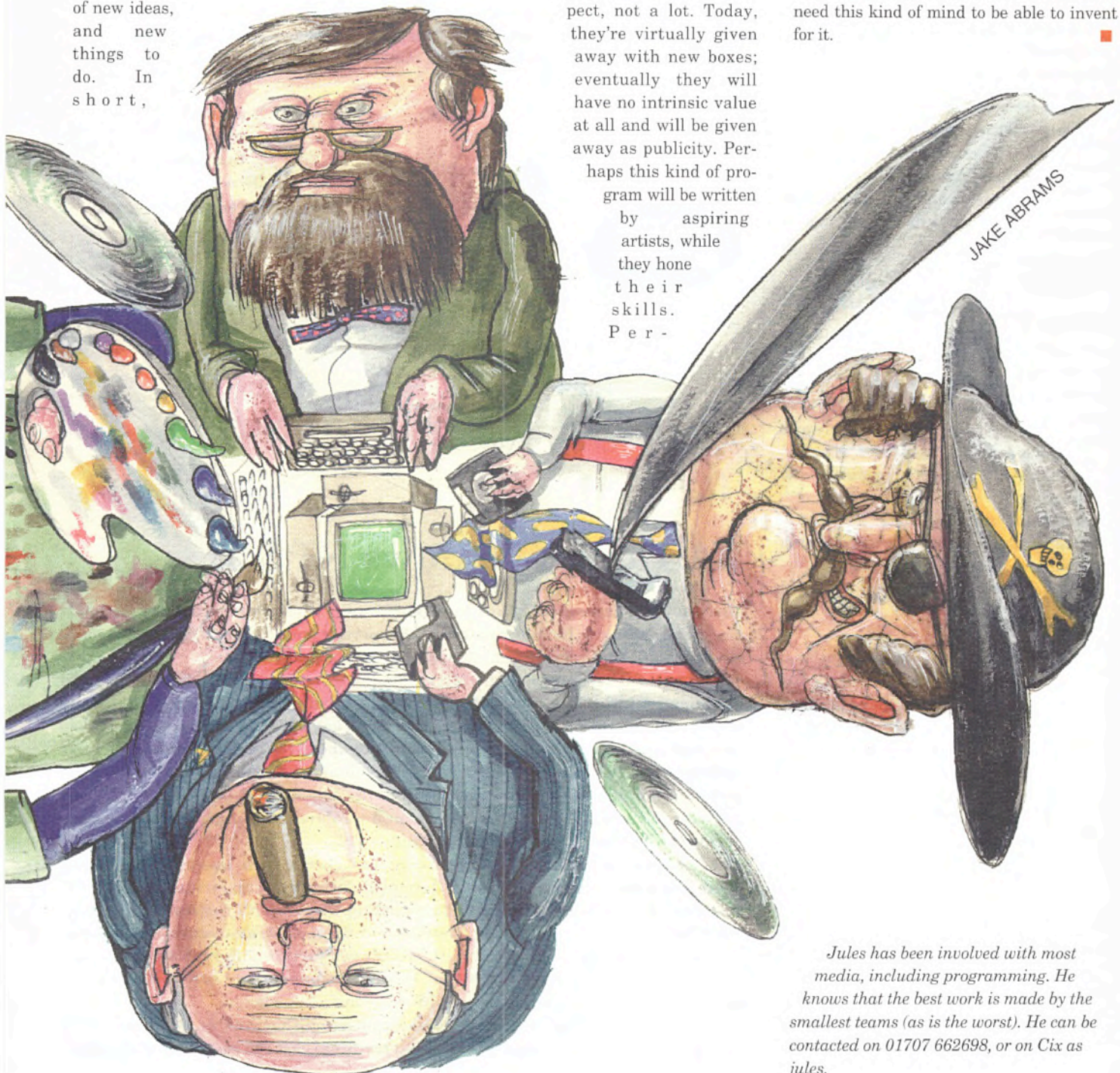
Programs, in the future, will not be created by programmers and mathematicians. Or rather, they will be, but the people will not be engineers, they will be artists. There will be no such thing as a stand-alone program, instead a program will be part of a larger multi-media experience, just the same way that recording artists now have to be stage performers and film actors. Using a program - any program - will be primarily a creative experience.

So, what will happen to the old faithful spreadsheets and wordprocessors? From now on, I suspect, not a lot. Today, they're virtually given away with new boxes; eventually they will have no intrinsic value at all and will be given away as publicity. Perhaps this kind of program will be written by aspiring artists, while they hone their skills. Per -

haps, once again, vertical markets will be exploited by dedicated amateurs, instead of professional programmers.

The whole of this vision is dependent on one thing: decent development tools and operating systems. Perhaps those tools will be created by publishing companies for their contracted artists to use; perhaps they'll be made by the machine companies to give their boxes an edge in the market, as happens with synthesiser manufacturers now. Sooner or later dedicated tools companies will take up the challenge.

But, one thing is sure: the people who make programs will soon be hippies again, as they used to be. Software is about to take its place among the mass media, and we'll need this kind of mind to be able to invent for it. ■



*Jules has been involved with most media, including programming. He knows that the best work is made by the smallest teams (as is the worst). He can be contacted on 01707 662698, or on Cix as Jules.*



## VB User Group conference

The Visual Basic User Group is holding its first annual conference on 3rd and 4th October 1995 at the London Arena, Limeharbour in the Docklands. The two-day VB bonanza features speakers from the USA and Europe (including Microsoft experts), seminars, Q & A sessions and tool demonstrations. Notes from every seminar and a conference CD-ROM are available. A new UK journal for VB users is to be launched too. To attend the conference, contact the Conference Hotline on 01291 629729.

## Through the rOOf

IT research and advisory firm ButlerBloor expects the OO market to grow by between 50% and 60% next year and then double in size during each of the following four years as the industry migrates towards client/server. It sees the major reason for this as being the need for a GUI rather than a character-based interface. Another vital factor is Microsoft's becoming a big player in the OO arena with OLE 2.0. For further information ring 01908 373311.

## Trade show comes to UK

Comdex, the US computer trade show, is coming to the UK for the first time next April at Earl's Court, London. Although a business-oriented event, Comdex/UK is targeted at technology specialists, including software developers, as well as executives. A conference will also form part of Comdex/UK, with technical issues such as networking, multimedia, open systems and online services featuring strongly. Companies interested in exhibiting should ring 0181 7418899.

## Branded with an X

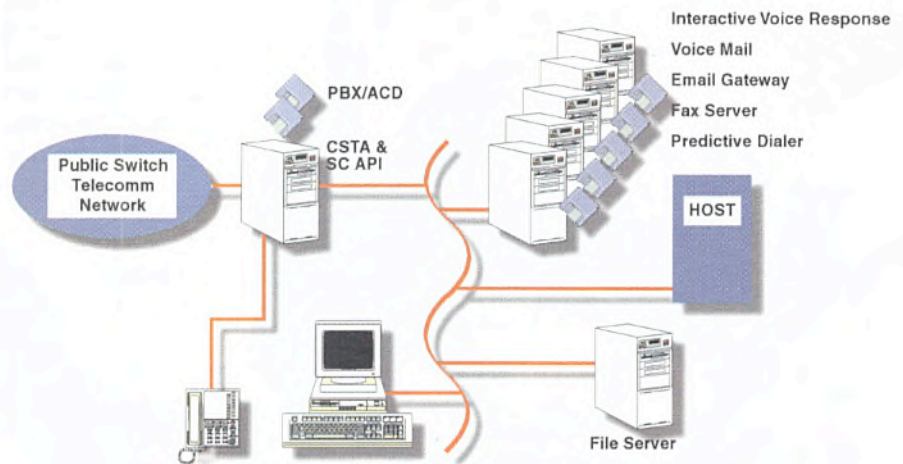
X/Open, the independent international organisation devoted to open systems, has initiated a 'branding' programme for products conforming to the Common Desktop Environment (CDE) specifications. Products that carry the CDE brand will provide users with a common development environment and look-and-feel. CDE contains the following specifications: X Windows version 11.5, including file formats, application conventions and the XLib API, the Motif Toolkit API, and various XCDE-specific requirements. By applying the brand, the vendor warrants that the branded product fully conforms to the X/Open specification. To order a copy on CD-ROM, ring 01734 508311 or mail XoPubs@xopen.org. Check out the Web site at <http://www.xopen.org> for general X/Open information.

## Client/Server telephony model

A new business model for developing computer telephony systems (including technologies such as interactive voice response, voice and fax messaging, and fax on demand) was discussed at Europe's first Signal Computing Systems Architecture (SCSA) conference held in Nice last month.

Telecommunications equipment is usually based around dedicated proprietary systems with hardware and software built into an integrated package. The SCSA business model, which covers both hardware and software considerations, is designed to allay the inefficient use of resources that this often entails. The open Client/Server architecture allows telephony applications to be developed independently of the hardware platform being used. Interoperability is another goal of the model, both at a software level (e.g. between Novell's TSAPI and Microsoft's TAPI) and at a hardware level (e.g. between SCSA and MVP).

The business model builds on SCSA itself, a multi-layered PC hardware and software architecture introduced in 1993 for building call processing systems with multiple technologies, including voice, fax, speech recognition, video and text-to-speech. 'The SCSA client server [business] model is analogous to the file server model for general office applications', said Sam Liss, Channel Programmer Manager for Dialogic Corporation, the company behind SCSA. SCSA is now supported by over 270 computer and telephony companies. For more details, including copies of the SCSA White Paper, contact Dialogic Telecom Europe on 00 32 2725 0890.



## BA(Hons) Windows NT 3.5?

Microsoft has announced plans to expand its Certified Professional Program. It cites two reasons: to include new areas of expertise and to smooth the path to more advanced product-related qualifications.

The revised structure of the Microsoft Certified Product Specialist (MCPS) qualification, which becomes effective in the third quarter of 1995, doubles the options for operating system exams, identifies key areas of technical specialisation, and provides a direct link to the more advanced Microsoft Certified Systems Engineer (MCSE) and Certified Solution Developer (MCS D) certifications. To aid potential qualification holders (wearers of the Windows 95 logo?) Microsoft has introduced its Online Institute (MOLI), an interactive training 'resource' accessible via the Microsoft Network under Windows 95.

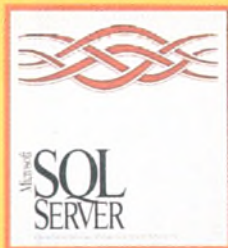
To become an MCPS, a candidate may now choose from one of the following operating system exams: Windows 3.1; Implementing and supporting Windows NT Workstation 3.5; Implementing and supporting Windows NT Server 3.5; Windows for Workgroups 3.11; Operating Systems and Services Architecture I; Operating Systems and Services Architecture II. MCPSs can further differentiate their qualifications with areas of specialisation, helping customers find suitable employees as well as themselves gaining recognition for their knowledge.

A published list of recommended exam combinations is available from Microsoft. The exams themselves (without training) cost £65 each. Call 0345 001000 for details.



# Build better applications. Add performance, functionality & versatility

## SQL Server



Microsoft SQL Server 6.0 is a scalable high performance database management system designed specifically for distributed client-server computing. Its powerful management tools, built-in data replication, and open system architecture provide a superior platform for delivering cost-effective information solutions for organisations of all sizes.

## Visual FoxPro version 3.0



Easy enough to be Visual, powerful enough to be Foxpro Microsoft Visual FoxPro combines a visual development environment with new tools for creating solutions that include the Microsoft Office and BackOffice families. Its flexible targeting puts existing Xbase code to work in Windows, Windows NT and Windows 95. Visual FoxPro increases

developers productivity with the addition of Rapid Application Development features such as dragging and dropping visual classes onto forms. Call for pricing and upgrade information.

## PowerBuilder Desktop for Windows 4.0

A powerful Windows desktop application development environment with an integrated client/server architecture which includes powerful object-oriented programming tools. With PowerBuilder Desktop you can easily create robust Windows applications that incorporate data from most desktop databases. The Watcom SQL database is included for development and deployment out of the box. The PowerBuilder family includes the new PowerBuilder Component pack. Competitive upgrade for most desktop database users £189



## Watcom C/C++ version 10.5

Watcom C/C++ delivers a professional, cross-platform 16-bit and 32-bit development system that produces the fastest executables for the widest range of platforms. Using the same integrated development environment, you can target all platforms including Windows NT,

Windows 95, Windows 3.x, OS/2 Warp,

extended DOS and more. New features include: Blue Sky's Visual Programmer, Windows 95 Ready, MFC 3.0 for Win32 and direct support for popular revision control packages



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## Soft-ICE Windows



Debugs Windows executables and DLLs with the capability

of setting, breakpoints on I/O ports, interrupts and Windows messages as well as source lines and memory addresses. Exploring Windows internals and the ability to debug Virtual Device Drivers (VxDs) makes Soft-ICE the ultimate Windows debugger. The new Windows 95 version is ideal for Windows 95 VxD developers. £295 each

## VTOLSD from Vireo Software



A C library and C++ Class library of functions for developing Windows or Windows 95 Device Drivers. The Quick VxD code generator automatically writes the VxD skeleton, custom header files and libraries automate segment management and expose VMM functions to C & C++ programmers. Debug and final release libraries are included. Combine with Nu-Mega's Soft-ICE/W, to get the complete VxD build and test solution.

## MKS Source Integrity

MKS Source Integrity is the most comprehensive configuration management solution for client/server, cross-platform development with powerful new features:

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  - Visual differencing & visual merging
  - Seamless integration in Visual C++, Visual Basic, Borland C++, PowerBuilder, File Manager
- Call for multi-license prices - single user £315



## Codewright Fusion

Codewright Fusion is a drop-in replacement for the Visual C++ editor. It adds the power of a stand-alone programmer's editor to the convenience of the workbench. Codewright Fusion, available for both 16 and 32 bit versions of Visual C++, provides a host of features never before available under Visual C++.



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## PK Zip Libraries for NT

PKWARE's Data Compression Libraries are now available for Windows NT, allowing developers to incorporate PK Zip data compression technology easily into their applications. The library, which is already available for MS-DOS, OS/2, Windows and many Unix systems, consists of compression routines, an explosion/extraction routine and an error checking routine. Compression formats are portable across supported platforms; there are no runtime royalties. Ring User Interface Technologies on 01223 302041 for details.

## Telephony for Windows 95

Rhetorex, supplier of computer telephony components, has announced the release of Windows 95 device drivers. These new drivers will be supplied as part of an OEM starter kit which also includes a copy of Windows 95 and membership of the Microsoft Developer Network. Also provided is the opportunity to join the Microsoft Solution Developers Group at a discounted rate. The Microsoft Network (MSN) will feature the Rhetorex Guide to TAPI (Telephony Applications Programming Interface) which will be available to all users. Free technical support is available to system developers. For more information call Jim Taylor on 01344 301066. Prices will be available soon.

## Pocket Emacs

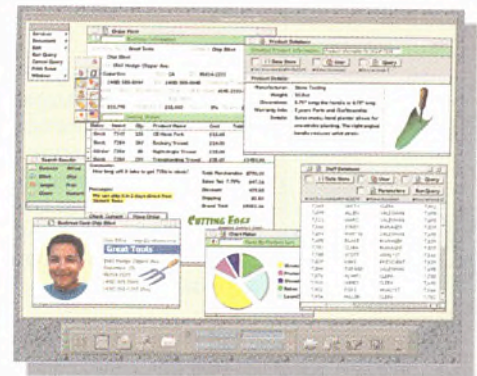
GNU Emacs, the freeware screen editor available for UNIX systems and other platforms, has been neatly summarised in a fold-up reference card published by US company Specialized Systems Consultants. The compact reference has been revised to include versions 18 and 19 of Emacs, and describes the editor's core functionality, including cutting and pasting, multiple buffers and file handling. There's a separate section on programming support. It's available directly from SSC for \$4.50 - ring 001 206 7827733 if you're interested.

## Methodology merger

Development tool provider Interactive Development Environments has published a technical white paper discussing the convergence of the two most popular object-oriented analysis/design methodologies - Booch, and Rumbaugh's Object Modelling Technique (OMT). The white paper presents approaches to blending OMT and Booch, also drawing on Jacobson's Use Cases technique. Better still, it doesn't cost anything - ring 01483 31272 for a copy.

# Taligent delivers the goods

Taligent has shipped the V1.0 'reference release' of the CommonPoint C++ application development environment to its investors IBM, Apple and Hewlett-Packard. IBM will be the first to bring this technology to market, with an AIX release scheduled for 28th July and an OS/2 version on its way. Apple and HP have promised releases for their operating systems in the autumn, with the MacOS port awaiting multi-threading and other advanced features due in V8.0. Taligent also intends to provide Common-



Point for other 32-bit multi-threaded OSs such as Windows NT and Windows 95.

Taligent's goal is to establish CommonPoint as the object-oriented standard for a new wave of task-centred enterprise applications, said Joe Guglielmi, chairman and CEO of Taligent. CommonPoint 1.0 is targeted at experienced C++ developers building distributed, multi-platform, object-oriented applications, but with the emphasis on pre-built software functionality in the form of frameworks (collections of related classes that serve one function). These frameworks fit into two categories: application frameworks and system services frameworks.

Application-level features of the CommonPoint system include a compound document structure, a 'saveless' document storage model, extensible application components, integral 2D and 3D graphics, multimedia and internationalisation. At the system services level, version 1.0 supports database connectivity, shared document collaboration, transport-independent communications, a platform-independent object model, and other foundation services. The idea is that developers will be able quickly to create portable business applications.

Taligent is currently building a family of development tools for use with CommonPoint, featuring cpConstructor - a GUI builder - and a C++ compiler, among others. For more information on Taligent and its products, explore the Web page located at <http://www.taligent.com>.

# Template Toolkit

The working prototype of the ANSI C++ Standard Template Library is being developed by Hewlett-Packard. However, HP's implementation makes heavy use of C++'s template feature and relies on (indeed is often the cause of) recent language extensions which many compilers do not yet support. Now a version of the STL is available which will compile without a state-of-the-art language implementation. OO specialist ObjectSpace has released STL<ToolKit>, a commercial version which actually compiles with Microsoft Visual C++. The MS compiler is unable to compile the HP code due to its incomplete implementation of templates.

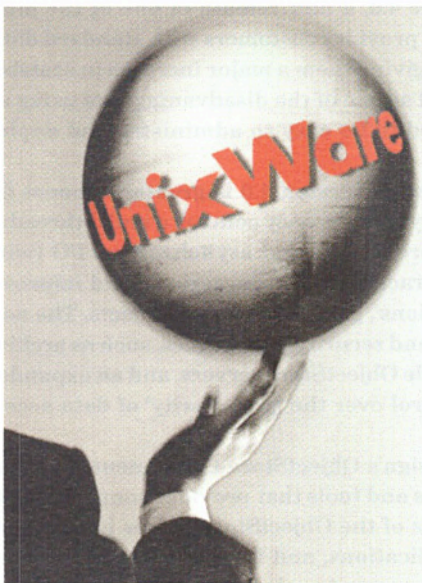
In addition to 'aggressively' tracking the ANSI standard, supplying a full templatised ANSI string class with support for international strings, STL<ToolKit> comes complete with special 'helper algorithms' designed to make it easy to use. Along with utilities such as 64-bit time and date, and time zones, STL<ToolKit> provides a set of cross-platform thread, mutex and monitor classes for multi-threaded development which allow you to add locking to your own objects as well as STL containers. Another interesting non-ANSI feature is 'dynamic allocators'. An allocator is an encapsulation of memory-model-specific allocation/deallocation primitives and data types. Dynamic allocators allow association of different types of allocator with containers, on an object-by-object basis. For example, you could add a custom allocator that grabs storage from an object database instead of the heap.

The library comes with full source, extensive examples and a user guide. It is royalty-free, and is available for Borland, GNU, IBM, Microsoft and SunSoft compilers, as well as various Cfront implementations. It's even capable of analysing which parts of your compiler are compliant with the C++ language specification and configuring itself appropriately.

If you're interested in the STL and generic programming, bytewave has an excellent STL Web site at [http://weber.u.washington.edu/~bytewave/bytewave\\_stl.html](http://weber.u.washington.edu/~bytewave/bytewave_stl.html). STL<ToolKit> costs £159 from Power Software, tel. 01224 622201.



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## ObjectReuser

ObjectReuser, Hitachi Europe's tool for managing software reuse, has been upgraded to version 1.1. The new version provides two new 'prospectors' to help developers find relevant code in a corporate library. The Search Prospector provides text and keyword searching facilities through documentation and source code; the Datasheet Prospector displays the key features of a component in summary form, describing the functionality, interface and relationships of the object. The product starts at £7,500 for a five-user license and currently runs on UNIX workstations and networks, with a PC version due November. Contact Hitachi on 01628 585335.

## WorkShop for PowerPC

SunSoft, Sun Microsystems' software subsidiary, has promised its WorkShop development product suite for the PowerPC edition of its Solaris operating system. Solaris (Power PC Edition) is the latest incarnation of SunSoft's multi-threaded Unix implementation. SunSoft WorkShop comprises ANSI-compliant C and C++ compilers, productivity tools, code management tools, and ProWorks/iMPact, a tool that enables developers to make full use of Solaris's multi-threaded kernel. An Early Access version will begin shipping at the end of the summer - call 01494 472900 for details.

## Magic 6

Magic Software Enterprises has shipped Magic Version 6, a major new release of its flagship cross-platform development product that combines a new Windows front end with its existing table-driven RAD methodology. Bruce Lomasky used Magic to win the 1995 EXE Software Developers' Challenge - proving that it does the trick. Pricing starts at £2,250 for a single developer version. Phone 01344 303045 for more information.

## Cadre's ObjectTeam/ProDev

Cadre Technologies has released ObjectTeam/ProDev, not a manifestation of its CASE diagramming tool ObjectTeam, but a set of debugging and static analysis tools for C and C++. At the moment it's only available for Solaris and HP/UX, but ports to other platforms are planned. ObjectTeam/ProDev includes a source debugger, a static code analyser, a C++ class browser, a testing tool, a performance analyser and compilers for C and C++. The product was jointly developed with Silicon Graphics. Cadre can be reached on 01344 300003.

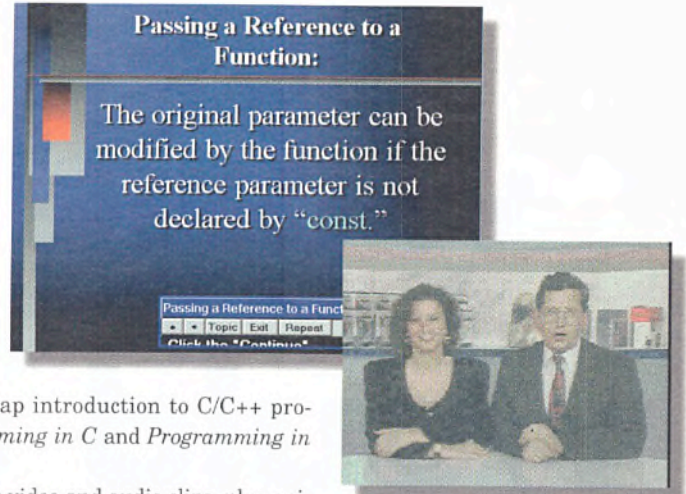
## CD-ROM++

A new range of interactive software training CD-ROMs has been launched by training video specialist Burgess Video Group. Two of the twelve titles in the range of CD-ROMs may be of interest to programmers looking for a quick and cheap introduction to C/C++ programming: *Programming in C* and *Programming in C++*.

Each CD contains video and audio clips, plus animations to steer you through assorted language topics. *Programming in C* covers control structures, relational operators, logical operators, conditionals, data types, formatted output via `printf`, arrays, strings and pointers, plus a variety of practical programming tips. *Programming in C++* deals with more advanced features such as stream input and output, default function arguments, variable declarations and scope, macro vs. inline functions, the `const` qualifier, overloaded functions, references, classes and member functions.

Also of use might be *Visual Basic 3.0*, an overview of the VB programming environment covering properties, forms, buttons, VB program structure, dynamic vs. static variables, tool-boxes and more.

The CD-ROMs cost only £39.95 each, or £79.95 for any three - at this price don't expect to see Bjarne Stroustrup explaining the design and evolution of C++. However, with around six hours of multimedia training material on each CD-ROM, the series may well be a viable alternative to expensive training courses. For further information ring 01874 611633.



## Persistent Objects

Object Design has announced ObjectStore 4.0, a new release of one of the most mature commercial OODBMSs. Version 4.0 provides customers with standard database requirements such as security, while giving them a major increase in scalability and performance - the latter often cited as one of the disadvantages of using an object database. The database is designed to be easy to administer and deploy across multiple client/server systems.

An important enhancement shipping with version 4.0 is greater support for large-scale applications. This is provided by concurrency control, a multi-threaded architecture enabling symmetric multi-processing and asynchronous I/O (with inter-thread locking to serialise client interactions with the server), and improvements to ObjectStore's support for 'collections', groups of related objects. The new version also includes increased reliability and security capabilities, such as archive logging, distributed backups across multiple ObjectStore servers, and an expanded security model that gives users more control over the 'granularity' of data access privileges.

ObjectStore is at the core of Object Design's ObjectStore Component Architecture (OCA), an open framework of products and tools that provides connectivity to legacy systems and RDBMSs. OCA consists of the ObjectStore server itself, client software for C++, SQL and Smalltalk applications, and ObjectStore Gateway, an interoperability tool enabling transparent access to relational databases residing on Unix and PC platforms. The client software and Gateway will be available in the second half of 1995.

ObjectStore 4.0 is available directly from Object Design, priced from £3,300. It's offered initially for Solaris, Windows NT and HP Unix, with versions for OS/2, Win32s and other Unix implementations imminent. Object Design can be contacted on 01793 486111.



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# Letters

We welcome short letters on any subject that is relevant to software development.

Please write to: The Editor, EXE Magazine, St. Giles House, 50 Poland Street, London W1V 4AX or email [editorial@dotexe.demon.co.uk](mailto:editorial@dotexe.demon.co.uk) Unless your letter is marked 'not for publication', it will be considered for inclusion. Letters may be edited.



## Balls to Jules

Dear Sir,

I just read Jules' item on robots (*Mayhem*, EXE July '95) with great interest. I may be wrong, but I don't think Jules has ever ridden a unicycle himself. My suspicion is aroused because I'm learning myself (have been for over two years), and some of the things he suggests aren't quite that easy. You'll be amazed at the amount of force required just to go forward after that 'lean forwards'. Most of the energy (I found) was spent pushing the backward-pedal to stop the forward pedal shooting away. 'Stopping would have the same little jiggle' - huh!

As for load carrying, and dynamic suspension, again I think that this is a tall order. Balance is very critical on a unicycle, particularly because in addition to coping with changes, you have to make sure you make the right correction, otherwise Splat! To be able to cope with someone putting on a heavy load, you're going to have to be very accurate in your predictions, and particularly with weight changes.

The biggest problem, in this varied world, is going to be people. When you're unicycling along, and someone steps out in front, a person can stop, put down his legs, and all is well. A uni-robot would have to reverse direction, if it had enough room. But what if it tripped? It can't pick itself (or its load) back up. In addition to 'beep, beep', and 'oops', it'll have to have 'heeeelp!'.

So, the instant suggestion is that it will need retractable legs so it can stop. But the main idea that I think is essential, and will change some of the problems, is to use a ball, not a wheel. Turning on a unicycle is a matter of twisting, losing balance, and then twisting again while moving the wheel under yourself to restore the balance. With a ball, you can 'just' rotate it in any direction required - just a bit of complex math needed.

So, good luck, I'll buy the 100,000th one of the production line. But you're crackers.

Matthew Jones  
CIX

*I think you're taking this too seriously. I wrote it because it's funny, not because it's a viable machine.*

*You may be amused to know that I've just had some mail from a robot engineer. He raised a lot of objections, none of which I was unable to field, but missed the big clincher. You led with it.*

*You need enormous power to make this work, and this applies in power supply, power conversion, and even maintaining the friction with the ground.*

*The balance issue isn't as tough as you think. There's a huge body of math dealing with reactive control systems. Coping with a new load, or a skip across the ground, or any of the other unpredictable effects is tough, but not necessarily impossible...*

*You're not the first person to suggest using a ball, but there's a terrible problem with getting the power in, and you do need some method of making the vehicle rotate. On a unicycle, you do this by waving your arms around, the same way a cat rights itself. On a robot, you can have a flywheel doing the same job. Great place to put the batteries. :-)*

Jules May

## Anders: A tweak too far?

Dear Sir,

So Anders Hejlsberg says he is planning to add garbage collection to Object Pascal as implemented in Delphi (*The Delphi Man*, EXE June '95). I trust he can be dissuaded from this course. I have noticed that one thing that distinguishes languages and development systems that get the job done from those that get the job done *properly* is the presence of garbage collection in the former. However well-written the garbage collector is, there is *always* an unacceptable performance overhead. This is why industrial-quality systems are always written in C and C++, and probably why Eiffel - to take one example of a 'trendy' language - isn't going anywhere.

If Mr Hejlsberg pollutes Delphi with this over-rated technique, he will reduce it to the

same level as all those Basic variants they call 'Visual Programming Environments', and he will have lost a great opportunity to improve not only Borland's fortunes, but also the standard of so-called 'corporate' programming.

S. J. Fish  
Dorset

## Linux

Dear Sir,

OK, EXE Magazine has its Unix coverage - but what about Linux? This must be the most exciting Unix variant for years: the price is right, the take-up is huge (especially with the interest in the Internet) and what has EXE done about it? Diddley squat. I suppose, as usual, the commercial pressures from your advertising department prevent you from featuring it.

Yours in disappointment

Dennis Smith  
Hull

*Mr Smith is quite wrong to suggest that advertising pressures have dictated our coverage of Linux or, for that matter, anything else. He may rest assured that EXE's editorial dept is entirely free from such pressures - we write about whatever we feel is of interest and value to our readers.*

*However, I take his point about Linux coverage, and promise to look into the matter. If anybody out there is brim full of Linux knowledge, and would consider writing an article for us, please do get in touch: our contact details are on the Contents page - Ed.*

## Name game

Dear Sir,

Will Watts seeks an alternative name for the Information Super Highway (*SoapFlakes*, EXE June '95). He fails to mention either of the obvious and generally adopted solutions: 1) omit the word 'Super' and 2) 'infobahn'? This last has the added merit of being witty... nearly.

Ken Paisley  
Internet address supplied



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# Beta Times

The final release of Windows 95 should be on the shelves in less than a month – but some developers have been using betas for more than a year. **David Mery** asked them how they got on.



Windows 95 is the largest commercial beta ever. Starting with Beta 2 aka 'M8' aka 'build 347', more than 400,000 beta copies of the operating system were sold to developers worldwide: it was much more than a sneak preview or a standard beta test procedure. By now most of you will already have received the pre-release version and the most fortunate, members of the 'a beta a week' club, will be working on release numbers greater than 900. M8 was build 347 and the pre-release is 490.

EXE interviewed developers who have had exposure to Windows 95 in order to learn the opinions of the people that will make it a success... or not (see box 'Interviewees'). To our surprise, this very large beta programme seems to have missed out (accidentally?) some big names. Jack Grimes, Director of Technology Evaluation at Taligent, told us: 'We are not yet working with Win96 [sic]. We only received the beta release a few weeks ago. We have done prototyping on Windows NT and hope the work will carry over, but haven't done any real work yet.' Taligent has announced that it will release a version of CommonPoint, its framework based development environment, for Windows 95 and Windows NT.

## Main issues

The most common problem with which the developers we interviewed were faced with was the differences in the Win32 API between Windows 95 and Windows NT. Two other issues concern most developers. Dave Harris points out that 'we've been concerned about various 16-bit third party DLLs we've been using. It has proved hard to get hold of 32-bit versions' and David Morgan had some problems with the 'headers supplied by Microsoft which would not compile'.

Apart from these general issues, most comments are related directly to the type of applications developed, or to the history of the company. For instance, Matthew Jones states the main issues as being: '... the mammoth task of supporting OLE, and all the other modern extras.

Our main application started with Windows 2.0, so it's not the easiest thing to convert (being raw API). We are therefore going to do a major refurbishment for Win32, to start with a new shell (probably MFC), and then move the old operational code into that.' Laurence Shafe is confronted with different problems: 'We already have a 32-bit, multitasking AM code base developed for OS/2. We do not have a Windows 3.1 product so our main issue was the conversion of AM from OS/2 to 32-bit Windows.'

Harris finds problems elsewhere: 'You need to pay more attention to the application framework. MFC is the problem. At the same time [we moved to Windows 95], we decided to discard our old, in-house, tried and tested class library in favour of MFC and VC++. This issue swamped everything else as it meant we were doing a complete rewrite anyway.'

## Specific features

Taking advantage of some specific features means losing in terms of portability. All respondents have gone that way: most applications will run on both Windows 95 and NT, but definitely not on Windows 3.1 with Win32s. The subset is just too limited. The exception is Clarion Works which will also work on Win32s but without the IDE. Win32s performance is also an issue.

The implementation of Windows 95 specific features goes from none ('At present, we have gone for compatibility for the August launch simply because we do not view the user base being great before 1996' says Toms) to just what is supported by both Windows 95 and NT ('nothing that wasn't in NT already' according to Pietrek), to many. Support of the registry is the first feature to be implemented by most developers: it is needed for the Windows 95 logo scheme. Other features of interest include new controls, OLE2, multi-threading, file properties and long file names.

When their application(s) run on NT, some take advantage of its specific features. Beame, for instance, insists on 'security features of Win-



### 1982

VisiCorp demonstrates *VisiOn*, a GUI for the IBM PC, at the Comdex. Bill Gates is attending.

### 1983

Microsoft starts working on *Interface Manager* (later renamed *Windows*).  
VisiCorp releases *VisiOn*.  
Microsoft announces *Windows*.

### 1985

*Windows 1.01* released with automatic tiling, popup windows, a system menu composed of three lines (the 'three slice toaster') and the MS-DOS Executive to launch programs.

### 1987

*MS-OS/2 1.0* announced.  
Pre-emptive multi-tasking OS

targeted at the Intel 286 processor.  
*OS/2 Presentation Manager* announced.

*Windows 2.0* ships with overlapping windows and support for EMS.

### 1988

*Windows/386* released  
Uses the virtual 86 mode of the 386  
At this occasion *Windows 2.0* is renamed *Windows/286*.

*MS-OS/2 1.0* released without a GUI  
Microsoft Press publishes *Inside OS/2* written by Gordon Letwin with a foreword by Bill Gates (Chapter 3 is titled 'The OS/2 Religion').

*MS-OS/2 1.1*  
Introducing *Presentation Manager*.

### 1989

*MS-OS/2 1.2* is introduced. It adds support for the HPFS file system,





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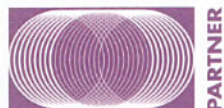
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dows NT (not there in Windows 95) and file properties'. Zwicker also points out 'NT services and NT event manager'.

### 95 better than 3.1?

When asked if there was any compelling *technical* reason to move from Windows 3.x to Windows 95, the answers were not as warm as one would have expected. Jones just says that there was *no* reason. Morgan is more moderate: 'sort of - it's more to Win32 in general. It's a more robust environment with improved functionality of the API. There's no limitation of memory size.' Beame is no more convinced: 'with a multi-threaded NFS, we have greater speed. Other than that, I see no reason to move.' Harris just found that the move was simple: 'it was relatively easy, especially given our switch to MFC'.

Toms is among the enthusiasts: 'The advantage of a flat memory model in our application is tremendous and means that our database (typically 20 MB) can be mapped directly into memory'. Shafe goes over the top: 'We regard Win 3.x as unsuitable for mission-critical client/server application because of its poor stability, lack of memory protection and unsatisfactory multithreading for communications. Windows 95 solves all these problems.'

When trying to pinpoint difficulties and positive discoveries, once again the answers were far from uniform. Perhaps because developers stress certain functions of the operating system depending on their applications. Lynch found that '[the lack] of multi-tasking and the resource handling problems were the biggest restrictions in Windows 3.x. Windows 95 deals with both reasonably well.' But Harris is of a different opinion: 'The multi-tasking is still poor; the resource limits are still there, just raised; the OS is still unstable (especially if you are working on buggy half-finished apps).'

Beame did find the resource problem solved but he encountered 'several other major problems. We have seen many users end up in MS-DOS virtual memory compatibility mode because of anti-virus programs, mapping BIOSes or other unknown reasons. When this occurs, most of the benefits of Windows 95 are lost'. Beame explains that these situations often prevent Windows 95 from using its 32-bit disk drivers to access the pagefile and instead force it to go through MS-DOS. Since

'MS-DOS is *non-re-entrant*, you can never be guaranteed that you can page memory. So if your machine is running in "MS-DOS Virtual Compatibility Mode", all VxDs are locked into memory and most of the memory allocation routines cannot be called arbitrarily as when you are in 32-bit virtual memory mode. This uses up your memory a lot faster than in 32-bit mode. It also means that you lose the ability to multi-task when an application is waiting for disk I/O to complete.'

Another issue specific to Windows 95 is thunking, that is calling a 32-bit API from a 16-bit application or vice-versa. Trevor Thomas comments: 'Slow thunking is certainly an issue in Windows 95, and 16-bit apps certainly seem to hit the system in build 347.' Shafe believes it's a short term problem: 'We run a mixture of 16-bit and 32-bit applications with no problems. Obviously intimate association, such as calling a DLL, requires both to be 32-bit. We do not recommend 32-bit to 16-bit thunking. We believe the transition to full 32-bit will be rapid and end-user driven, especially by Office 95.'

### Development platform

I had expected everybody to develop directly on the latest Windows 95 beta. Far from it. Toms is working on a Windows 95 platform but still using M7. Morgan was also working with M7 but 'the second beta has just arrived'. Harris and Zwicker have received the M8 beta. Zwicker is working mainly with 'NT Workstation/Server'. Shafe is more up-to-date, with build 501. He's using 'Windows 95 beta and Windows NT Workstation with OS/2 and Windows NT servers. No Windows 3.x in-house'. Beame has build 950 rc2 while Pietrek has build 950 r3. Beame develops: 'Windows 95 on Windows 95, Windows NT on Windows NT and Windows 3.x on Windows 3.1'. Same goes for Pietrek: 'Some of our team run NT, others run Windows 95. It helps keep things compatible across our NT and Windows 95 versions.'

Obviously the earlier the beta developers started with, the more problems it generated. Beame had the most troubles caused by the changes in betas: 'We have to support users with "The Final Beta" (build 347) and whatever the current build was. This was almost impossible. Some of our applications require

build 501 to work and thus most of our beta testers can't run the programs, because they are at 347'.



Pietrek comments: 'Things changed. We dealt with it'. Shafe is more positive: 'We had some gotchas and some missing functionality early on but since January it has been fine. We have found Windows 95 remarkably stable since beginning of 1994.'

But tracking Windows 95 betas was not the only issue as points out Harris: 'All the betas we got were good enough to use. A bigger issue was the betas of VC++, where we badly need the new stuff (eg toolbars) ASAP. I think it is shocking the way MFC has lagged behind the capabilities of the OS, for example in the area of OLE compound files.'

### The market

What will happen to the different flavours of Windows and OS/2? For once there seems to be a consensus. Windows 3.1 will disappear but it will take some time. Windows 95 will make it on workstations, at least for a few years. NT will be the big winner. And OS/2 will remain in a niche market.

Beame is of the opinion that 'NT will never replace Windows 95 for home use, since games won't run. NT will take over the corporate market.' This is further emphasised by Toms: 'We expect Windows 95 to become the "desktop Windows", with NT being positioned as server. OS/2 will become marginalised and possibly disappear in 3-5 years unless it positions itself purely against NT and ups its price/functionality. Windows 3.1 will disappear in a similar time frame. The Windows 3.1 market will continue, although ever-shrinking, just as we still find the occasional user who runs Windows 3.0 or, heaven forbid, plain ol' DOS.'

Others expect a shorter life for Windows 95. Says Lynch: 'Windows 95 and NT will move closer together and NT will possibly acquire Windows 95-style interface. One of the objectives for Windows 95 seems to be to act as a lever to increase the number of applications that run on NT. OS/2 is surely entering a critical phase. I cannot help feeling that the initiative is about to pass to Microsoft for good, and that OS/2 has missed its chance. This will be a shame, as the supremacy of Microsoft

and an upgraded Presentation Manager.

At the beginning of the year, MS had cut its Windows staff to a single person. There were about 200 developers in the OS/2 team

### ■1990

Windows 3.0 announced and ships on the same date. Features proportional system fonts, 3D

shadowing, colour icons, listboxes, buttons and palette management. The MS-DOS Executive is replaced by File Manager and Program Manager. In Standard Mode, supports Extended Memory up to 16 MB in Enhanced Mode: virtual memory.

In six weeks, 500,000 copies are shipped. OS/2 1.3 reduces RAD requirements to an official minimum of 2

MB. Features faster, improved printing and file-handling. ATM and REXX language added. End of MS involvement with OS/2.

### ■1992

Windows 3.1 introduces True Type fonts, OLE, multimedia, and better network support. Real Mode abandoned

Microsoft positions *Chicago* and *Cairo* at its Developer's Conference.

### ■1993

Win32s  
Subset of Win32 for Windows 3.1.

Windows NT 3.1  
32-bit preemptive multi-tasking O/S. Multi-platform, runs on Intel 386, MIPS and Alpha.

Windows for Workgroups 3.11  
32-bit file system and improved networking technology (peer to peer).



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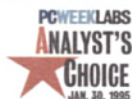
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## The following developers took part in our straw poll.

### Carl Beame, Beame & Whiteside Software

Beame & Whiteside, a subsidiary of Hummingbird Communications, is a networking company which develops multi-threaded VxD based NFS client and TCP/IP applications. Its software runs on DOS, Windows, NT, NetWare and Solaris. Carl Beame founded the company and is now its Chairman.

### Dave Harris, Serif

Serif develops and markets a range of DTP applications. Serif's flagship product, PagePlus, is a desktop publishing application. Dave Harris developed TypePlus, which wraps text around circles and spirals, and TablePlus, which formats tabular data. Both work with PagePlus.

### Matthew Jones, Banxia Software

Matthew Jones is running software development and publishing company, Banxia Software. Banxia has a Win16 application, and an NT based server for it. Apart from ensuring compatibility, no Windows 95-specific development has yet been done.

### Barry Lynch, TopSpeed Software

TopSpeed has opted for a two stage release. Clarion for Windows 1.5 which is planned for the end of August is a hybrid development system that runs as 16-bit on Windows 3.x, and 32-bit on Windows 95 and Windows NT. It contains both 16-bit and 32-bit compilers that will produce true .EXEs for all of the above platforms plus Win32s. Subject to the feature restrictions imposed by the OS, this can be done from a single block of source code. To facilitate this, Windows 95 controls have been cloned to 16-bit and normal VBXs are supported under 32-bit. OLE is not supported, nor are OCX controls. This latter restriction is claimed not to be important with the 32-bit VBXs support.

Clarion for Windows 2.0, a 32-bit only system for Windows 95 and Windows NT is planned for mid-96. It will have comprehensive support for OLE2 and OCX. Barry Lynch is the MD of TopSpeed.

### David Morgan, ISE

David Morgan works for Bertrand Meyer's company ISE. Meyer is the inventor and developer of the Eiffel language. It's a widely used object oriented computing language.

### Matt Pietrek, Nu-Mega

Nu-Mega develops the Bounds Checker and SoftIce family of products. Versions of Bounds Checker for Windows 95 and NT are in the work. Matt Pietrek is Principal Architect at Nu-Mega, he also wrote the book *Windows Internals* and is finishing a new book on Windows 95.

### Laurence Shafe, Intelligent Environments

Intelligent Environments developed Application Manager (AM) for OS/2 in 1989. AM is a client/server development tool, a Windows 95 and Windows NT version is planned to be release in August. Dr Laurence Shafe is CEO of strategy.

### Trevor Toms, RJC Microaid

RJC Microaid specialises in software for the radio industry. The application is used by the major radio stations (Capital, Classic, Virgin, etc) and media service agencies to schedule advertising on radio according to the advertiser's budget or rating requirements.

RBP was written for Windows 3 around three years ago in C++. Trevor Toms told *EXE* that RJC sees Windows 95 as an opportunity to maintain its market position. It plans to do so by making the internal operation of the software faster and more structured using multi-threaded operation in a flat memory model.

### Dave Zwicker, Gradient

Gradient specialises in DCE (Distributed Computing Environment) offerings. Gradient developed PC-DCE, an OSF DCE 'secure core' client as a Windows DLL. Dave Zwicker is VP of Marketing of Gradient.

**Thanks to all the above for taking time to answer our questions.**

may not be used for the greater good in the long term.'

Pietrek concludes that 'Windows 95 will take off, but after several years NT will start to take more and more of its market share.' And Harris: 'NT will supercede Windows 95 within a couple of years, on all but the smallest platforms.'

### Windows 95 logo

Microsoft has created the Windows 95 logo scheme. In order for an application to carry the

logo on its packaging and marketing materials, it must satisfy various requirements. It must run successfully on NT as well as on Windows 95, applications dealing with files must have both OLE 2.0 container and/or object support and OLE 2.0 drag-and-drop support.

There are six other requirements: the whole was known as 'the magnificent seven requirements' but a Plug and Play event-awareness recommendation added more recently makes this nickname look a bit silly.

On the question of whether NT support is a problem, the answer is a unanimous 'no'. For instance, Harris says: 'We expect NT to become important within the lifetime of our forthcoming products, so we ought to cope with it anyway' and Lynch: 'as running on NT is always an objective, this was not an issue' or Jones: 'it's a good thing (says an NT user).'



Beame has no problem with NT: 'since the requirements allows for operating system specific programs to not have to conform', OLE is another matter: 'but OLE compliance for every application (we ship about 40 apps) is a big problem.' This is further emphasised by Lynch: 'The extensive list of requirements for the use of the Windows 95 logo seems to be in the best interest of Microsoft rather than anyone else. Some of the requirements are not really related to the OS at all but are an enforcement of Microsoft technology standards, such as OLE and OCX. Naturally Microsoft applications comply and carry the logo. Competitive products not carrying the logo will automatically appear inferior to the buyer, even though the missing feature(s) may not be at all important to him. And possibly difficult to implement by the manufacturer or even irrelevant, eg 32-bit VBX support provided instead of OCX.'

For Pietrek the logo itself is not an issue: 'We decided "Screw the logo".'

### One for all, all for one

Windows 95 is now a few days from final release but quite a few developers are still struggling with the betas, some even with old betas. It will take time for all Windows developers to finalise their applications on the shipping Windows 95 code. For the ones still in early development phase, let's hope that all the tools which should be released soon will ease the support of all the logo programme requirements.

With the expectation that NT will soon overtake Windows 95, some tough decisions must be made. Implement all specific NT features relevant to one's application, such as security and Unicode, and run in a 'degraded' mode on Windows 95, or wait and plan enhancements in a future upgrade? ■

### 1994

#### Daytona

Beta version of NT 3.5.

#### Chicago

This first beta was sent to 20,000 beta testers. Product subsequently renamed to *Windows 95* announced.

NT 3.5 released to manufacturing. It offers many bug fixes, reduced footprint (officially 12 MB) and

improved connectivity.

Beta 2 or M7 of Windows 95

User interface improvements (recycle bin, undo for file operations...).

MS-DOS support improved (CONFIG.SYS and AUTOEXEC.BAT per session...).

Increased Device Contexts resource limits from 150 to 4000.

Integration of DriveSpace/DoubleSpace, improved CD-ROM

support, video...

TrueSpeech voice compression

### 1995

March: Beta 3 or M8 of Windows 95 Sent to 50,000 beta testers.

Beta of Windows 95 Resource Kit for M8.

Windows 95 Preview Program

Sent to some 400,000 beta testers.

Pre-release version of Windows 95

NT 3.51.

First release to support the PowerPC architecture.

Announced launch of Windows 95.

### Future

NT 4.0

NT with Windows 95 interface.

Cairo

An object oriented operating system.



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 CIRCLE NO. 242



A

# PNGO

## format primer

**C**ompuServe's Graphics Interchange Format (GIF) has been the popular standard for storing graphics images since its development in 1987. Just a few months ago, David Mery's May *EXE* cover article told the gripping story of Unisys's bombshell announcement. Unisys would enforce its LZW compression patent and demand royalties from all commercial GIF application developers. Raging anti-Unisys and anti-CompuServe flames filled the graphics newsgroups and forums on all the online services. In many a small programming house there was gnashing of teeth as developers wrestled with how to cope with GIF support in their applications in the light of the royalty demand. The Portable Network Graphics (PNG) format was only just freshly born. Was PNG ready to do battle with Unisys?

### The state of the GIF revolt

What a difference a few months make! Today the flames are gone and argument has vanished. In a June press release, CompuServe, the originator of GIF, has announced its full support for PNG and its plan to phase out GIF. Many major applications already support PNG, and many more developers have announced their forthcoming support. The only remaining question is how fast PNG will replace GIF in the thousands of image repositories on BBSs and online services around the world. Something like the historical massive conversion of files from ARC to ZIP is now beginning.

In retrospect, the need for a royalty-free GIF replacement was so compelling that PNG was destined for success as long as the PNG team did at least a passable job of creating a new format. As it turned out, the PNG team took full advantage of progress in the graphics industry since GIF's 1987 genesis, and made PNG a 'better GIF than GIF'. PNG supports the palette-based graphics that made GIF famous, but compresses better than GIF, and adds true colour support lacking in GIF. PNG adds critically needed features such as full alpha channel support (transparency) and gamma (linearity adjustment).


The main on-line discussion of GIF and PNG you are likely to see now is 'where can I get PNG source code?' Glad you asked; you have come to the right place. The PNG team's reference source code is in beta as I write, and version 1.0 will be ready as you read this or soon after. Using the PNG team's free reference source to add PNG support to your applications is covered a bit later in this article, along with information on where to find the source code.

You read about the Unisys LZW patent, the death of GIF and the new PNG graphics format. Now that PNG is finished and the reference code is here ready for you to use, **Tim Wegner** gives the inside scoop.





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## PNG and GIF Compared

The single most important difference between PNG and GIF is the kind of image compression used. GIF uses LZW (Liv, Zempel, Welch) compression. This compression is the problem with GIF since Unisys holds the US patent on LZW and is charging royalties for any commercial application that uses LZW. PNG uses the deflate/inflate algorithm that is also widely used in the PKZIP, ZIP, UNZIP and GZIP programs. While there is never any guarantee of freedom from patent infringement, a number of extensive patent investigations by the Free Software Foundation, CompuServe and others have not turned up any problems with inflate/deflate. Both LZW and deflate are lossless compression algorithms which restore the exact uncompressed original upon decompression. Deflate generally results in somewhat smaller files.

PNG supports the same kind of palette-based graphics as GIF. With this method of storing images, a colour number is used to look up the colour to be displayed in a table (the palette). One of the reasons for the popularity of GIF is that its capability to display palette-based images coincided with the widespread acceptance of Super VGA video which featured this kind of graphics format.

Today virtually all video graphics adapters come with true colour capabilities as well as palette-based colour. True colour stores the red, green, and blue information directly in the frame buffer for each pixel. This approach allows a much larger number of colours to be displayed at once on the screen, 16,777,216 for 24-bit true colour. The JPEG format supports true colour, but does so with a lossy form of compression that has limitations for critical work. PNG supports true colour with lossless compression for a colour depth of up to 48 bits, yielding 281,474,976,710,660 simultaneous colours. This is a greater colour depth than is commonly available in video hardware today. This is a good thing, since a new format should have some room for future technology.

PNG also goes beyond GIF by supporting a full alpha channel (general transparency masks) and image gamma indication, allowing contrast correction for different input and output devices.

Several GIF features were intentionally left out of PNG. The GIF format supports multiple images, but most decoders display only the first image. The GIF89a revision contains some rarely used graphic control extensions and plain text extensions. The PNG designers were concerned that PNG should be kept architecturally clean and free from exotic features that would be unlikely to be used by most decoders. Multiple image

support will be added in a meta-PNG format in the future.

PNG maintains the essential features that made GIF popular, abandons several unpopular GIF features that compromise universal support, and extends GIF with true colour, alpha channels, and gamma.

## Signature and chunk format

Now that you have a good idea about why the PNG format was created, and how it compares to the older GIF format, let's have a closer look at just how the PNG format is structured. We'll touch on the high points here, but recommend that you get a copy of the PNG format from one of the sites listed in the box, curl up in an easy chair, and have a good read. The basic story is this: a PNG file consists of a 'signature' followed by a series of 'chunks'.

The eight-byte PNG signature is shown in Figure 1. The signature allows an application to identify a PNG file by checking the first few characters. This signature is designed to handle various kinds of transmission errors by including white space and newline characters as well as upper ASCII characters in the signature. When files are sent accidentally using an ASCII protocol rather than binary, the error will show itself in incorrect transmission of some of the signature characters.

The remainder of a PNG file is a series of 'chunks'. A chunk is a named bundle of information. Every chunk contains a length, a name, some data items, and a CRC value, as shown in Figure 2. The length facilitates skipping chunks, and the CRC (cyclical redundancy check) value gives a thorough method of verifying the integrity of a chunk. The chunk name tells an application what kind of data is in the chunk.

Once a chunk is defined, the definition will not change. Either your application

recognises a chunk or it doesn't. If a chunk is recognised, then the application can read and process the information if it wishes. If a chunk is not

recognised, then the chunk is simply skipped. This approach avoids the evils of format versions. I wish I had a pound note for every time I heard the complaint that some GIF viewer couldn't recognise a file created by my Fractint application. Forward compatibility had been designed into GIF by the original format authors, only to be broken by many a brain-dead GIF application that searched for 'GIF87a' but couldn't accept the later 'GIF89a' signature. PNG files have no versions, and there is no version number in the signature. Chunks are guaranteed to be fixed once defined. Later decoders will understand more chunks, but earlier decoders will not break when they encounter later chunks.

Chunk names have attributes that are encoded into the name using the case of letters (actually whether the fifth bit of each byte is 0 or 1). Figure 3 shows this convention. Now you know why PNG chunk names have funny capitalisation. From this naming convention you can tell if a chunk is required to render an image or ancillary (optional), whether the chunk is part of the public specification or private, and whether editors can safely save the chunk if the image has been edited. Check out Figure 4 to see a list of all the chunks that are defined as of Draft 10 of the PNG specification.

## Critical chunks

Critical chunks are essential for the display of an image. All decoders must be able to deal with them. The PNG specification



The first eight bytes of a PNG file always contain the following values:

(decimal)	137	80	78	71	13	10	26	10
(hex)	89	50	4e	47	0d	0a	1a	0a
(ASCII C notation)	\211	P	N	G	\r	\n	\032	\n

Figure 1- The PNG signature

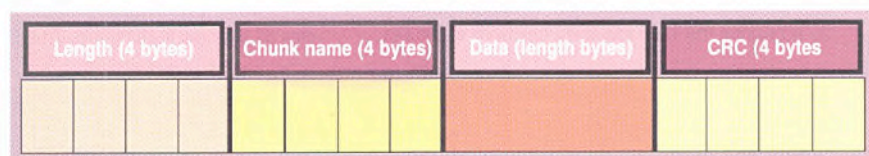


Figure 2 - PNG chunk structure



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Chunk Name			
Byte 1	Byte 2	Byte 3	Byte 4
If upper case, chunk is critical.	If upper case, chunk is public.	Must be upper case.	If upper case, chunk is not safe to copy.
If lower case, chunk is ancillary.	If lower case, chunk is private.		If lower case, chunk is safe to copy.

Figure 3 - PNG chunk naming convention

defines four critical chunks: `ihdr` (Image Header), `plte` (Palette), `idat` (Image Data), and `iemd` (Image Trailer).

The `ihdr` chunk specifies the main details about the image, such as its dimensions and colour characteristics. Figure 5 shows the structure of this chunk. The image dimensions are four bytes long rather than two bytes as in GIF. These bytes do not assume that an unsigned representation is available, so the maximum size is  $2^{31}-1$ , or 2,147,483,647, more than two thousand million pixels wide or high. A byte is provided to specify alternative compression schemes in the future, although at the present time only deflate/inflate is supported. Similarly, a byte

is provided to specify filtering algorithms that can be applied prior to compression to further enhance the degree of compression. At present only filter type 0 (adaptive filtering with five basic filter types) is defined. The filters recalculate pixel values before compression based on nearby pixels in a reversible way. A very aggressive encoder could try all the different filters, and use the one that provided best compression, while a less ambitious encode can use no filter at all. The PNG team is currently developing heuristics to efficiently estimate which filters are likely to be the most effective.

The `plte` chunk is the colour palette, which is required for palette-mapped images but is not used for true colour images. A palette can contain up to 256 three-byte red, green, blue triplets, exactly the same as with GIF.

The `idat` chunk contains the compressed image data. Each pixel row of data is prepended with a one byte integer that indicates which (if any) filter is to be applied to that row. For large images multiple `idat` chunks can be used consecutively. The contents of these chunks is assumed to be concatenated together.

Finally, the `iemd` chunk marks the end of the PNG image. This chunk is a simple empty chunk with no data. The `iemd` chunk is effectively a PNG end-of-file marker.

### Other chunks

Ancillary chunks add useful information related to the image but are not required to render the image. These chunks allow such things as the image gamma (linearity), transparency information, background colour, application data, and comments to be stored in PNG files.

The special purpose chunks include three chunks specifically for preserving information when converting GIF files that use some of the special GIF89a extensions. The `frac` chunk has been reserved by the Fractint authors for use in a future fractal data format.

One of the great features of PNG is its extensibility. If you have some other infor-

mation you wish to store in your PNG files, you can create your own chunks. Make sure that the third character of the chunk name is in



lower case. This will tell PNG applications that your chunk is a private chunk. If you want other applications to share your chunk, then you should register the chunk name with the PNG team and make it a public chunk.

### The reference implementation

The PNG team has created a portable reference implementation in the C language that you can use to quickly and easily add PNG support to your own applications. Yes we know, *real* programmers always code in low level assembly language directly from a format specification. If you are the author of a professional high-performance graphics application, you may want to do just that. But even the most macho programmer would be well advised to at least prototype his application using the reference implementation. You can use your prototype as a bench program to compare the results of your high powered, hand-coded, assembler implementation. The reference code comes with a very permissive license, which lets you use the code freely even in commercial applications. You will likely find that basing your application's PNG support on Libpng will more than meet your requirements.

The PNG reference implementation is divided into two libraries, Libpng and Zlib. Libpng handles all the details of reading and writing various PNG chunks, and the Zlib library provides support for inflate/deflate compression. A later *EXE* article will deal with Zlib, which is useful for other compression purposes besides PNG. Libpng calls Zlib functions, so if you are using high-level Libpng calls, you needn't worry about Zlib beyond making sure that it compiles properly in your computing environment. Makefiles are provided for compilers under various flavours of UNIX, Borland C/C++, Microsoft C/C++, and Turbo C. For example, if you are using Microsoft C, copy `MAKEFILE.MSC` to `MAKEFILE` and type `nmake test`. The makefile will compile the modules, build a library and run several simple test programs to make sure all is well.

Once you have Zlib working with your environment, you can tackle getting Libpng to compile. This should also be a relatively simple matter for most environments. In this case also the makefiles will cause all the modules to be compiled, a library built and a test program compiled and run.

#### Ancillary

bKGD	Background color
cHRM	Primary chromaticities and white point
gAMA	Gamma correction
hIST	Image histogram
pHYs	Physical pixel dimensions
sBIT	Significant bits
tEXt	Textual data
tIME	Image last-modification time
tRNS	Transparency
zTXt	Compressed textual data

#### Special Purpose

gIFg	GIF graphic control extension
gIFt	GIF plain text extension
gIFx	GIF application extension
fRAC	Fractal image parameters

Figure 4 - PNG ancillary and special purpose chunks



## A simple PNG writing app

A simple PNG demo program is shown in Figure 6. This program uses Libpng function calls to write a 640x480 PNG file with an interesting Moiré pattern. This listing shows the main steps involved in writing a PNG file. The reference library treats file reading in a very similar way.

Libpng has two important structures, both defined in PNG.H. One is `png_struct`, which maintains all the details about the PNG file needed for the Libpng routines, and `png_info`, which contains the user-settable information that closely follows the header and chunk information from the PNG specification.

Most of the work of writing the PNG file is accomplished by the function `write_png_file`. The first order of business is to initialise the structures and setup the I/O.

```
/* demowrite.c - an example of writing a file using libpng */

#include "png.h"

#define WIDTH 640
#define HEIGHT 480
static png_byte cbuf[WIDTH];

/* this function does all the work of writing the image */
void
write_png_file(FILE * fp, int width, int height,
               int depth, int interlace, int gray, png_color * palette)
{
    static png_info info;
    static png_struct png;
    static png_color ppalette[256];
    int x, y, pass, number_passes;

    if (setjmp(png.jmpbuf))
        return;

    /* initialise the PNG structures */
    png_write_init(&png);
    png_info_init(&info);
    png_init_io(&png, fp);

    /* fill in the png_info values */
    info.width = width;
    info.height = height;
    if (depth > 8)
    {
        info.bit_depth = 8;
        info.color_type = PNG_COLOR_TYPE_RGB;
    }
    else if (gray)
    {
        info.bit_depth = depth;
        info.color_type = PNG_COLOR_TYPE_GRAY;
    }
    else
    {
        info.bit_depth = depth;
        info.color_type = PNG_COLOR_TYPE_PALETTE;
        info.palette = ppalette;
        info.num_palette = (1 << depth);
        info.valid |= PNG_INFO_PLTE;
        for (x = 0; x < (1 << depth); x++)
        {
            ppalette[x].red = palette[x].red;
            ppalette[x].green = palette[x].green;
            ppalette[x].blue = palette[x].blue;
        }
    }

    if (interlace)
        info.interlace_type = 1;
    else
        info.interlace_type = 0;

    png_write_info(&png, &info);

    /* turn on interlace handling */
    if (interlace)
        number_passes = png_set_interlace_handling(&png);
    else
```

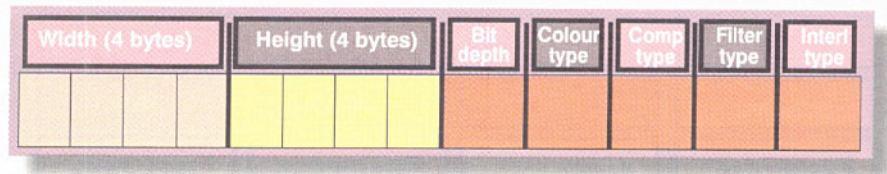


Figure 5 - IHDR chunk structure

This is accomplished by the lines

```
/* initialise the PNG structures */
png_write_init(&png);
png_info_init(&info);
png_init_io(&png, fp);
```

Next, various values for the PNG\_INFO structure are filled in, such as the image dimensions, bit depth, interlacing, and palette colours. When all the information is filled in, the call

```
png_write_info(&png, &info);
```

writes the information to the IHDR chunk and any other chunks, and updates the `png_info` structure. You will find it instructive to look in the Libpng source to see what `png_write_info()` does. You will find this function in the file PNGWRITE.C. The function `png_write_info()` calls many functions with names like `png_write_gAMA()`, one for each chunk. If you want to see how a chunk length, data, and CRC is written, look in any of these functions.

```
number_passes = 1;

/* write the image number_passes times;
 * interlacing details taken care of internally
 */
for (pass = 0; pass < number_passes; pass++)
    for (y = 0; y < height; y++)
    {
        for (x = 0; x < width; x++)
            cbuf[x] = (y * y + x * x) % 256; /* moire pattern */
        /* cbuf[x] = (y+x)%256; /* diagonal shaded bars */
        png_write_row(&png, cbuf);
        printf("writing row %3d\r", y);
    }

png_write_end(&png, NULL);
png_write_destroy(&png);
printf("Done\n");
fclose(fp);

/* make an interesting palette for our image demo */
void
set_palette(png_color * palbuf)
{
    int x, y;
    for (x = 0; x < 256; x++)
    {
        y = x & 255;
        if (x & 256)
            y = 255 - y;
        palbuf[x].red = y;
        palbuf[x].green = y * y / 255;
        y = (x >> 1) & 255;
        if (x & 512)
            y = 255 - y;
        palbuf[x].blue = y;
    }
}

/* write a png file */
void
main(int argc, char *argv[])
{
    static char name[] =
        {"test.png"};
    static png_color palette[256];
    FILE *fp;
    int screenwidth = WIDTH;
    int screenheight = HEIGHT;
    int depth = 8; /* 256 colours */
    int interlace = 0; /* use interlacing */
    int gray = 0; /* not grayscale */

    set_palette(palette); /* set up colour palette */
    if (fp = fopen(name, "wb"))
    {
        write_png_file(fp, screenwidth, screenheight,
                      depth, interlace, gray, palette);
        fclose(fp);
    }
}
```

Figure 6 - A simple PNG demo program



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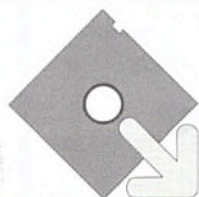
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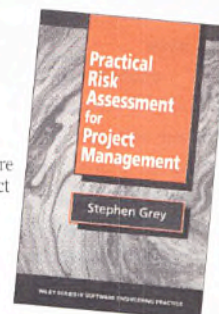
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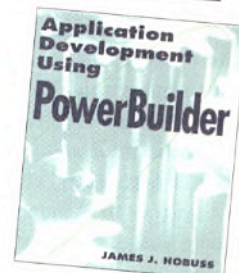


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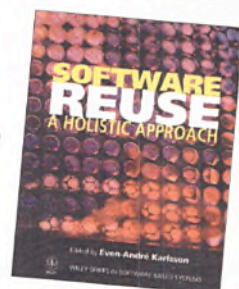
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Next, the interlace handling is set up with the lines

```
/* turn on interlace handling */
if (interlace)
    number_passes =
        png_set_interlace_handling(&png);
else
    number_passes = 1;
```

The PNG format supports a seven step interlacing scheme for progressively displaying images. Until recently, interlaced images were not popular, but they have found new life with the advent of World Wide Web browsers because they let you see an approximation of an image quickly. PNG's scheme is more complex than GIF's, and harder to program. However the extra complexity allows the initial pass of the image to be displayed much more quickly. If you use the Libpng function `png_write_rows()` to write the pixel data, the interlacing complexities are handled transparently. This requires allocating a pixel array in memory large enough for the whole image. If you don't wish to allocate that much memory all at once, you can use `png_write_row()` instead, which writes just a single row. You have to write the image number passes (ie seven) times, but if you called `png_set_interlace_handling()` first, you won't have to worry about which pixels to write. This is the approach that I used in writing the DEMOWRITE.C file for this arti-

## Where to find more information

The following FTP and WWW sites provide many examples of PNG code and images.

<ftp://ftp.uu.net/graphics/png/> - Official PNG spec and code site

<http://sunsite.unc.edu/boutell/png.html> - PNG specification in HTML format

<http://www.group42.com/> - Guy Schalnat's PNG home page

[http://quest.jpl.nasa.gov/info-ZIP/people/greg/greg\\_png.html](http://quest.jpl.nasa.gov/info-ZIP/people/greg/greg_png.html) - Greg Roell's PNG home page

cle. This one-row-at-a-time strategy is illustrated in the demowrite.c code by the lines in the `for` loop just after the comment :

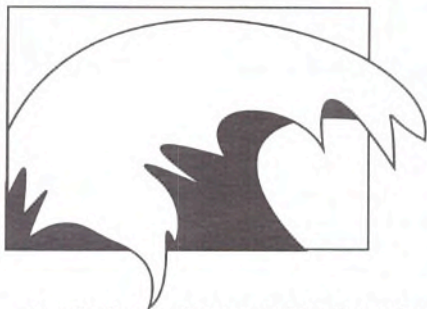
```
/* write the image number_passes times...
To actually turn on interlacing, change the
value of the variable interlace in main() from
0 to 1. That's about it. All that is left is to
write the IEND chunk and deallocate the
Libpng and Zlib memory.
```

You can compile and link DEMOWRITE.C with Libpng and Zlib to get the DEMPPNG executable. The Microsoft C command line to do this is just:

```
cl /AL demowrite.c libpng.lib zlib.zlib
When you run DEMOWRITE.EXE, the PNG
file 640x480 TEST.PNG file is created. You
can view this file with any of the dozens of
graphics file viewers that now support PNG.
You should look at the file LIBPNG.TXT for a
```

more detailed discussion of how to use the Libpng library functions. Two other files worthy of study are PNGTEST.C, which reads and then writes a small PNG logo image and compares the results, and EXAMPLE.C, which is a template for building PNG readers and writers.

*Timothy Wegner is a member of the Stone Soup Group and a developer of the famous Fractint fractal program. Readers who wish a copy of the code described in this article should send a blank, formatted disk with a self-addressed, pre-paid mailer to our address, as given on the contents page. Mark your envelopes PNG.ZIP. Wired readers can pick up PNG.ZIP from exe/files on CIX or ftp.exe.co.uk.*



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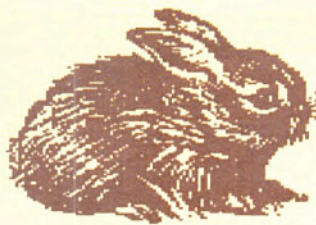
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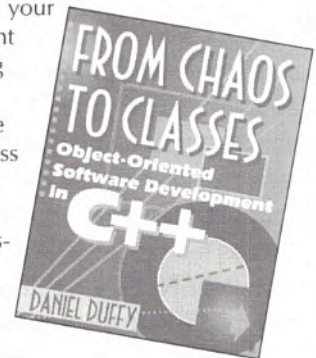
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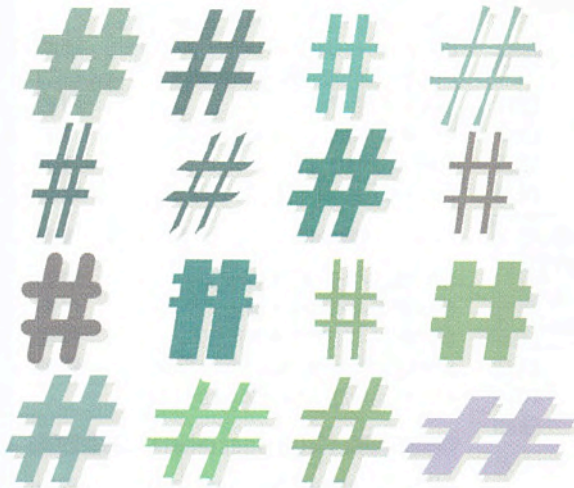
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# Service #included

One of the simplest directives is commonly used as though it had a higher level of functionality.

**Crosbie Fitch** shows how the associated pitfalls can be systematically removed.



The `#include` directive is deceptively innocent. Neophyte C++ programmers may think of it as something that just saves retyping or pasting the same block of source code over and over again. Of course the real advantage of `#include` is that any changes can be made in just one place, rather than

requiring modifications to every declaration.

But if you've been programming in C/C++ for a while, you begin to forget the essential simplicity of `#include`. You start to think of `#include "myclass.hpp"` as meaning *Hey, Compiler! Just thought I'd let you know that I'm going to be using this class of mine later on. I know how you like to be warned of such things well in advance.*

Unfortunately, thinking of `#include` in this way soon reaps unpleasant rewards: ie 'redefinition of symbol' errors, and the even less welcome '`#includes` nested too deep'. Most of you will have encountered one or both of these problems.

In C, life was pretty straightforward. You could consider `#include` to mean *Hey, Compiler! I'm going to be using some functions defined in another module without too much difficulty.* The only problems to solve were ensuring that the declarations were only seen once, and avoiding circular inclusion. It's this sort of 'use and forget' attitude that I wanted to continue when I came to C++.

## The Contrived Example

Like a proponent of multiple inheritance, I'm going to give you a contrived example that demonstrates the need for a solution. Consider the two classes listed in Figures 1 and 2. I want to be able to use the `Node` class with as little hassle as possible. I just want to say

```
#include "Node.hpp"
```

I'd like to be able to make use of the `Root*` returned by `GetRoot()`, for example by call-

ing a `Root` member function via the pointer. This won't be possible unless either I explicitly include `Root.hpp` myself, or `Node.hpp` automatically includes `Root.hpp`. The forward declaration `class Root;` is not enough on its own. One solution would be to make it the header's responsibility to ensure that any other necessary header is `#included`. However, in this case, as `Root.hpp` itself needs to include `Node.hpp` - by this very decree - you would have an example of circular inclusion.

Furthermore, you might not want to `#include` every related header, preferring to have some control over what ones are automatically included. In the `.cpp` file that defines a class's member functions, you may want to have automatic access to *all* the classes referred to in that class's header. Otherwise, you'd probably only want to expose classes needed for use by clients of the class (such as classes used by `public` or `protected` data or functions).

So what to do? When things start getting complicated there are a few approaches to resolving inclusion:

1. Have a system of multiple header files: the bare class, one that includes the bare class file and has additional `#includes` for the applications programmer's benefit, one for the class implementation file.
2. Header files don't `#include` other headers. A super-header is created that `#includes` all the headers in the correct order. Source files always include this super-header; they can't pick and choose. This could lead to a lot of unnecessary compilation; precompiled headers can be used to compensate if your compiler supports them.
3. Group interdependent classes into a single header - then header files don't need to `#include` other headers. This is effectively the same as 2 above.

```
// File: Root.hpp
#include "Node.hpp"
class Root : public Node
{
public:
    Root() : Node() {}
    void Fun() {}
};
```

Figure 1 - This `Root` class depends on...

```
// File: Node.hpp
class Root;
class Node
{
private:
    Root* m_pRoot;
public:
    Node() : m_pRoot(NULL) {}
    Root* GetRoot() const
    {return m_pRoot;}
};
```

Figure 2 - ...this `Node` class, which depends on...



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**WE HAVE MOVED**  
please note our new address



- Again, header files don't #include other headers. Forgo the idea of automating inclusion and make it the responsibility of each .cpp file to include extra headers as and when required.
- Find out the simple and elegant solution that the experts have been keeping from some of us all these years.
- Do it any old way, but whenever there are problems, bodge a solution.
- Resort to the Fitch method.

If you choose any option except the last, you have my best wishes. If you choose option 5 and succeed, please let us know. Meanwhile, it's time to present option 6...

### Assumptions

Before I present any solutions, I'd better present my working assumptions. Source filenames are suffixed by .h & .c for C header and implementation files respectively, while C++ source filenames are suffixed by .hpp and .cpp.

In a header file, the definition of your class may mean that the compiler needs to know the full definition (as opposed to just a forward declaration) of another class prior to compiling your class. This situation arises when:

- the class being defined contains a member which is an instance of another class;
- the class being defined is *derived* from another class;



```
// Replace FILENAME with filename (upper case)
// Replace Class with class name

#if !defined(FILENAME_LOCK)
// This file cannot be included recursively
#define FILENAME_LOCK

#if defined(DEFINITION)
#define FILENAME_DEFINITION
// Save DEFINITION entry state
#endif

#if defined(PRIVATE) //Ensure only one defined
#if defined(PROTECTED) // Assert
#error PROTECTED defined in
    addition to PRIVATE
#elif defined(PUBLIC) // Assert
#error PUBLIC defined in
    addition to PRIVATE
#endif
#define FILENAME_PRIVATE // Save PRIVATE
// entry state
#undef PRIVATE // Release
#elif defined(PROTECTED) // Ensure only one
// defined
#error PUBLIC defined in
    addition to PROTECTED
#endif
#define FILENAME_PROTECTED
// Save PROTECTED entry state
#undef PROTECTED // Release
#elif defined(PUBLIC)
#define FILENAME_PUBLIC // Save PUBLIC
// entry state
#undef PUBLIC // Release
#elif !defined(DEFINITION) // Default must be
// from a .cpp file
#define DEFINITION
#if defined(CPP) // Called from THE
// .cpp file
#undef CPP // A one shot parameter
#define FILENAME_CPP // Save CPP entry
// state
#define FILENAME_PRIVATE
// Save effective PRIVATE entry state
#endif
#endif

#if defined(DEFINITION) // Definition of
// class required?
#if !defined(FILENAME_DEFINED)
// Defining this class
#define FILENAME_DEFINED
// PREVENT RE-ENTRY PERMANENTLY
// HEADER PREPARATION
// Include CLibs here - Use #include <CLib.h>
// Include Libraries here - #include "Library.h"
// Include remaining base classes here -
// Include definitions of base classes,
// e.g. #include "Baseclass.h"
// Include remaining template classes,
// parameter classes to them and declarations
// here, e.g. #include "Tpl.h",
// #include "MyClass", typedef class
// Templ<MyClass> MyTC;
// Include remaining member objects here -
// Include definitions of classes used as member
```

```
// objects, e.g. #include "MemberObj.hpp"
// Declare remaining classes referenced here -
// and any typedefs etc., e.g. class CReference;
//
// HEADER PROPER:- Define class between these
// dashed lines

class Class: public Baseclass
{
private:
protected:
public:
    Class();
    ~Class();
};

//
#endif
#undef DEFINITION // Release
#endif

#if defined(FILENAME_PRIVATE)
// classes this class uses privately
// (i.e. for cpp or friend file's benefit)
#define DEFINITION
// This will include definitions of classes
// who have declared us friends
#define PRIVATE
// This will include private, prot & pub
// class references of classes who
// have declared us friends
//
// Include classes declaring us friends, between
// these dashed lines (even if included earlier)
//
#undef DEFINITION
#undef PRIVATE
#endif

#if defined(FILENAME_PRIVATE)
// defined(FILENAME_PROTECTED)
// defined(FILENAME_PUBLIC)
#define PUBLIC
#else
#define PROTECTED
#endif

//
// Include non-library base classes, between
// these dashed lines (even if included earlier)
//
#if defined(FILENAME_PUBLIC)
#undef PUBLIC
#else
#undef PROTECTED
#endif
#endif

#if defined(FILENAME_PRIVATE)
#define DEFINITION
#define PUBLIC
//
// Include classes privately referenced,
// between these dashed lines (unless included
// in header preparation)
//
#undef PUBLIC
#undef DEFINITION
#endif
```

```
#if defined(FILENAME_PRIVATE) ||
defined(FILENAME_PROTECTED)
#define DEFINITION
#define PUBLIC
//
// Include classes protectedly referenced,
// between these dashed lines (unless included
// in header preparation)
//
#undef PUBLIC
#undef DEFINITION
#endif

#if defined(FILENAME_PRIVATE)
// defined(FILENAME_PROTECTED)
// defined(FILENAME_PUBLIC)
#define DEFINITION
#define PUBLIC
//
// Include classes publicly referenced, between
// these dashed lines (unless included in
// header preparation)
//
#undef PUBLIC
#undef DEFINITION
#endif

#if defined(FILENAME_PRIVATE)
// Restore PRIVATE parameter state
#undef FILENAME_PRIVATE
#define PRIVATE
#elif defined(FILENAME_PROTECTED)
// Restore PROTECTED parameter state
#undef FILENAME_PROTECTED
#define PROTECTED
#elif defined(FILENAME_PUBLIC)
// Restore PUBLIC parameter state
#undef FILENAME_PUBLIC
#define PUBLIC
#endif

#if defined(DEFINITION) // Assert
#error DEFINITION should be undefined
    at this point
#endif

#if defined(FILENAME_CPP)
#undef FILENAME_CPP
#undef PRIVATE // Restore PRIVATE state
#endif

#if defined(FILENAME_DEFINITION)
// Restore DEFINITION state
#define DEFINITION
#undef FILENAME_DEFINITION
#endif

#undef FILENAME_LOCK
#else
#pragma message
    ("Breach of FILENAME_LOCK attempted")
#endif
// Always exits with:
// DEFINITION unchanged,
// PRIVATE/PROTECTED/PUBLIC unchanged,
// CPP undefined, FILENAME_* undefined,
// except FILENAME_DEFINED defined.
```

Figure 3 - The enhanced class header



- the header defines an `inline` function which makes use of another class.
- In a `.cpp` file, a class definition is required:
- to *define* the member functions and static data members of the class;
  - to *use* members of the class;
  - to define `friend` functions (or member functions of a `friend` class);
  - to declare instances of the class.

When I `#include` a header, I expect it to do everything I need. For example, if I'm defining a class's members, I want the header to declare the class, any base classes, and all other classes referred to in the class's definition and accessible parts of the base classes. I should only have to explicitly `#include` headers for what I need to implement the internals of the class.

If I'm defining an instance of the class, I only want declarations of classes referred to in the `public` section of the class definition.

Moreover, the header should also prevent multiple inclusion and optionally produce a warning upon circular inclusion.

I want quite a lot.

## Defining an improved `#include` mechanism

My solution is along these lines. By default the header will define the class - that is, after all, its primary purpose. The novel part is that if requested, the header will also `#include` other headers according to particular requirements. These requirements are dealt with by a simulated switch statement which `#includes` other headers on an effective access basis, ie the highest access gets everything, the lowest access gets nothing.

```
// Replace FILENAME with the
// filename (use upper case)
// Replace Class with class name

// Precompilation (include)
#include "STDAFX.H"
// Parent (include)
#define CPP
#include "FILENAME.HPP"
// C Libraries (includes)
// Libraries (includes)
// Classes not in header used
// (includes)
// Debugging (includes)
// Macro implementations
// Redefinitions (includes)
// Support
// Global definitions
// Message maps

// Class member definitions follow:

// **** private: ****

// **** protected: ****

// **** public: ****
```

Figure 4 - The corresponding code (.cpp)

If we're being `#included` by the class's implementation file, or a class or function declared a `friend`, we include the definitions of *all* classes referred to. If we're being `#included` by another `.cpp` file, we only need to include all *publicly* referred classes. If we're *deriving* from the class, what we'd like to include depends on whether the inheritance is `private`, `protected` or `public`.

How to accomplish this? The trick I have adopted is to think of `#include` as a function-like thing, which takes two arguments. The first, which means 'Do I need the class definition', is easily implemented as a `#define`. The other, which indicates what level of access is required, is essentially an enumerated constant ranging from Nil (don't give me anything) up through `public`, `protected` to `private` (I want it all!). Because enumerated constants are not a preprocessor feature, the mechanism to accomplish this is a nightmarish mess of nested `#ifs`, `#elifs` and `#endifs`. The think to keep hold of is that it is built and works - you don't need to tamper with it, except for a mechanical global search and replace when you first build the class. This is because each header file has to have unique symbols in which to save the states of the parameter symbols.

Every time you need to write a new header for a class, open the template header up (Figure 3), save it as `MyClass.hpp`, and replace all instances of `FILENAME` with `MYCLASS` and all instances of `Class` with `MyClass`. Note that if your operating system doesn't support long filenames, you should keep to the eight character limit for preprocessor symbols - that way they can be used for filenames too.

Then fill in the various sections. You can start off with the class definition itself and then `#include` the necessary base class headers, library headers, etc.

When you come to define the members, take the source template (Figure 4), save it as `MyClass.cpp`, do the same global replaces and fill it in. I like to keep my member functions organised by access and in the same order as declared in the class definition. Any `#includes` are also put in particular sections.

If I have a number of classes that are fairly interdependent, or collectively represent a functionally distinct module, I will combine them into a source library by creating a `.h` file which `#includes` each `.hpp` file. When I make use of a class from this library, I only need to `#include` the header once without worrying about specifying `#includes` in particular places if I use any of the library classes as bases say.

Use of in-line definitions requires that certain things be borne in mind when using

my enhanced header (perhaps in general). No in-line code should require the inclusion



of any header that would not otherwise be required if the function was not defined in-line. This is because the whole design of the enhanced header assumes that member functions are defined in the `.cpp` source file. Unless the in-line code is very simple, I'd suggest that you keep code to the source file. For example, a constructor taking a reference to another class should not be implemented in-line because this would require that the header of the referenced class be `#included` first.

## Rounding off

I have been using this enhanced header for a few years now and I have enjoyed being able to forget worrying about whether the right files are being `#included` and in the right order. Nearly all the `#includes` are performed by the header, making life easier when it comes to pruning out `#includes` that are no longer necessary because of a design change.

Yes, there are drawbacks: a large header file, a search and replace upon first use, having to put particular `#includes` in appropriate places, and longer compilation times. Believe me, it's worth it. The extra compilation time and other minor hassle is about the same as the time that would have been spent in extra thought and fixing `#include` conflicts. The enhanced header is really all about structuring the `#include` process, and we all know the received wisdom that structured is better than unstructured.

The enhanced header assumes `public` and non-virtual base classes. While modifying it to eliminate unnecessary `#includes` for `protected` and `private` bases is possible, it may not be worth the effort if you rarely use such access for your base classes. Virtual base classes may or may not be a headache: something for those intrepid users of multiple inheritance to consider.

To minimise the size of my examples, I have left out sections for documentation, version control, etc. There is obviously plenty of scope for incorporating these into your own header and code file templates.

*Crosbie Fitch is yet another hapless victim that has been lured away from staid client/server systems development by the wicked sirens of cyberspace and virtual reality. Not yet part of the connected Internet he is currently working in Comunicado, somewhere in TCP/IP limbo.*



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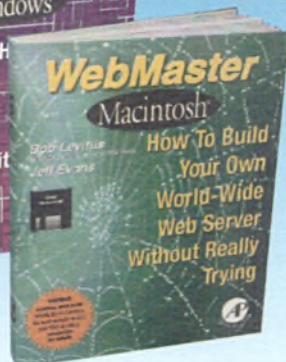
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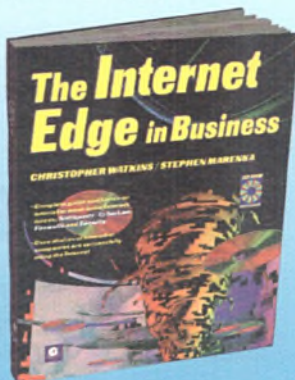
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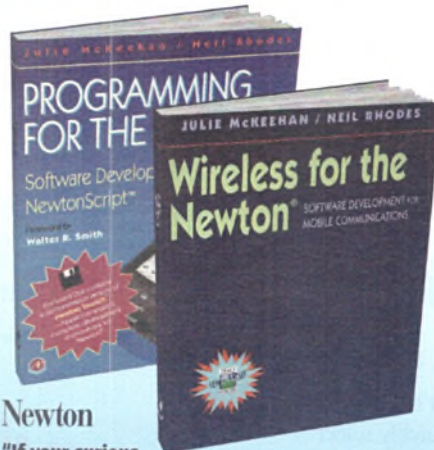


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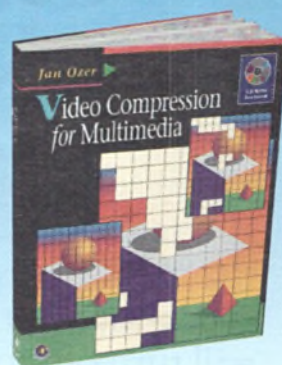
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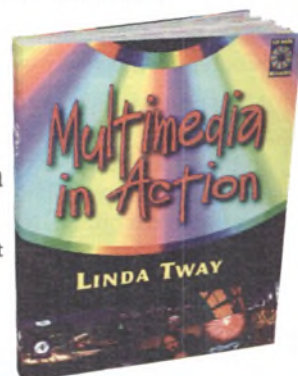
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mystery of address  
translation.

# The Domain Name Service



The Domain Name Service or DNS is part of the glue that holds the Internet together. Its job is to provide a translation from names to IP addresses (and vice versa). At the start of the Internet, name to address translation was done using a file known as `HOSTS.TXT`. The file was maintained by the Stanford Research Institute's Network Information Center, known as 'The NIC', and distributed from a single machine `SRI-NIC`. Administrators would periodically grab copies of the file using FTP. The file was the basis for the familiar UNIX `/etc/hosts` file that lists numbers and machine names.

This scheme did not scale. Not only did the size of the file increase as the Internet expanded but also the traffic from hosts accessing `SRI-NIC` grew. Names in the file needed to be unique and this was obviously not going to work for ever.

Paul Mockapetris was responsible for designing the architecture of a system that would replace the `HOSTS.TXT` file. He came up with an RFC (Request For Comments) which defined the Domain Name Service scheme. Now, I guess that I don't need to go into great discussions to describe domain structure for the *EXE* readership. It's becoming one of the fixtures of the universe.

We normally think of the domain scheme as a tree of names like a tree-structured file system, with each level separated from the others by a dot. Of course, these days we conventionally write names from the tree 'bottom up' showing the leaf name first. So the domain name `craggy.hillside.co.uk` is a full domain name for one of my machines. At each level in the complete name, the text component must be unique. This allows you to call your machine `zaphod` while distinguishing it from all the other machines called `zaphod` on the planet because the remainder of the domain name would be different. A name with no 'dots' is assumed to be in the current domain, so I can happily call my machine `craggy` internally.



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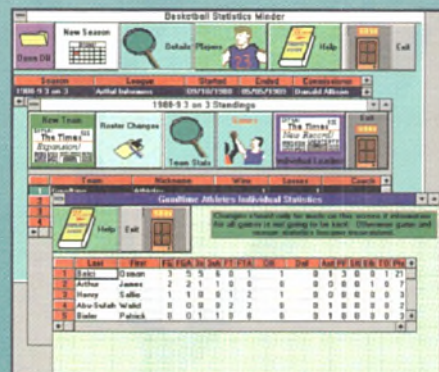
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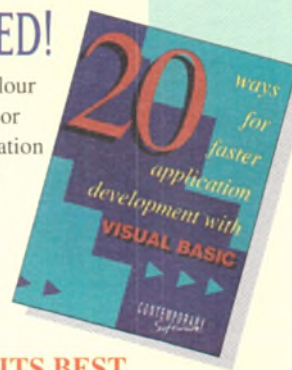
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At the beginning of adoption of the domain name scheme, it was possible to deduce the geographical location of a site from a domain name. Strictly, this is not a feature of the system, because the DNS is a way of logically dividing the namespace and is not a method of locating a machine in physical space. But at the outset, outside the US, it made sense to use country codes for top level domains. The X.400 mail protocol defined the use of ISO standard country codes in mail addresses and as the domain scheme was adopted by Usenet sites in Europe, it was decided to fit into this scheme. Other countries followed, for example, initially Australia used **oz** as its top-level domain name but gradually changed to using **au**.

Of course, we are recalcitrant Brits and needed to be different. Our academic network, JANET, used **uk** as its top level domain name. GB is the standard ISO code, but that does not describe the political unit in which we live. GB is a subset of it. Also, against the wishes of all mail system implementors in the UK, the academic 'powers-that-be' decided to use 'reversed' domains for JANET, a myopic decision that caused many people, including me, a great many problems.

I ran the early UUCP network in the UK. When we began to move its flat name space towards the use of domain names, I certainly considered adopting GB as its top level domain because I felt we needed to control our own namespace. I was persuaded to fit in with the expanding UK domain because I didn't want to have to cope with two names for my own site. It felt wrong to have **ukc.ac.uk** and **ukc.gb** as synonyms for the same machine.

So we bit the bullet and used the UK Name Registration Scheme (NRS), even though we then had to cope with swapping the names around from world standard form to the UK internal form. Having domain names the wrong way round has brought its own set of problems, which are also inevitably exported to outside the UK. Hopefully, the aberration will begin to die now as the NRS is no longer authoritative for JANET. If you still have a mail signature which contains a domain name in JANET order, then change it.

As a postscript to all this, I think that I regret the passing of the ability to be able to deduce someone's location by looking at their domain name. OK, this was never a guaranteed feature, but there was a time when you could say that mail from **somewhere.com** had originated in the USA, and I feel that this was a good thing.

## The domain scheme

From the start, the DNS was designed to be a distributed database held together by nameserver programs running on all participating machines. To find the address for a particular machine, you first have to find the nameserver that contains the data for the domain. The system works by *delegation*. Any organisation that is responsible for managing a part of the domain namespace can pass the task of managing a subset of their namespace to someone else.

The organisation provides the primary nameserver (or nameservers) for its domain. If you really want to have correct details about that domain, then you must query that nameserver which will have the *authority* to give you complete information about a domain. Strictly, a nameserver will give you details about a *zone*. A zone is all the information for the part of the domain name namespace that the nameserver controls apart from any names that are delegated elsewhere.

Top domains are managed from the NIC in the USA. It delegates part of the top domain space to other organisations. So the **uk** domain is managed by University College, London, who were the first Internet node in the UK. UCL runs part of **uk** namespace itself and delegates its running of the main domains to other organisations. EUnet GB runs the **.co.uk** domain and delegates names to other Internet Service providers or end-user networks. To find my

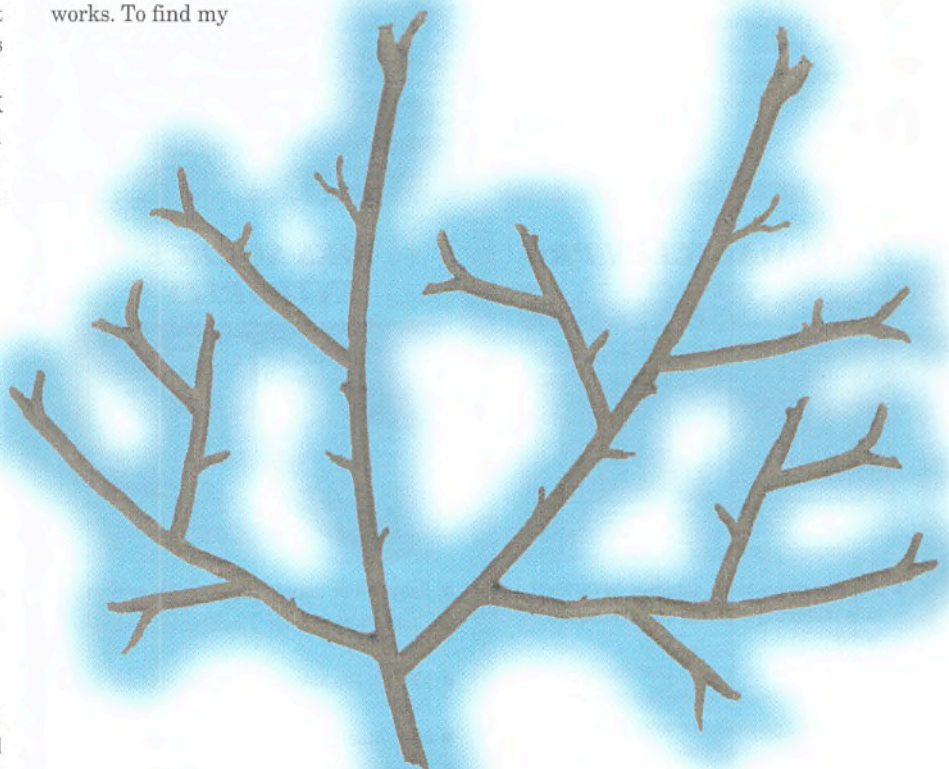
address, your nameserver will query a top-level server looking for **uk**, and this will pass you onto UCL, who will pass you onto EUnet GB because you are looking for **co**.

My namespace **hillside.co.uk** is actually managed directly by EUnet GB because my connection to them uses ISDN and I prefer not to have the nameserver traffic on a dialup line. I *could* have the files that control my local domain on my machine if I wished. When I need to change the details then I can edit a local file to inform the world of the presence of a new machine on my network. Most leased line users do this.

The DNS distributed scheme makes a great deal of sense. It means that local administrators can manage their own namespace by controlling local files. It means that it's easy to create names at any level in the hierarchy, and pass those names down to the people who are actually administering the namespace.

All of this may seem to be putting all one's eggs in one basket. If the authoritative data for some part of the namespace is stored on one machine, then what happens if that machine goes down? Well, the DNS gets around that by defining two types of nameserver.

A *primary master* server is one which derives its authoritative data from a set of files stored on the machine. A *secondary master* gets zone data from a primary master and stores it in a file.





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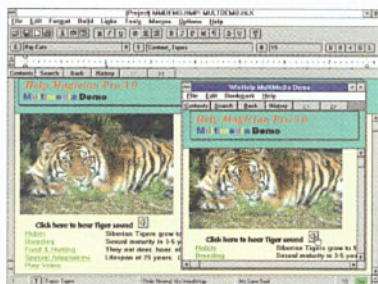


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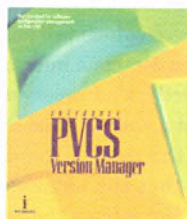
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Periodically, it will check that the data that it holds is up-to-date and will load new temporary zone files if the information has altered. Nameservers often contain both primary and secondary data: it's rare to have a nameserver that is solely primary or secondary.

Once we have replication of data from a primary nameserver to a secondary, we create a need to ensure that the secondary data is current. First, each zone file has a serial number that should be incremented when the data is changed forcing a secondary reload. Second, there are three timeout periods. The first forces the re-acquisition of the data after a specified interval. The second defines the re-try time if the primary server cannot be contacted to get the data. The third specifies the time after which the data is presumed to be useless and will not be presented by the secondary server as authoritative information.

You can use the ability to be a secondary nameserver to force caching of data locally. On my main machine, I run a nameserver that is secondary for my domain to the EUnet GB nameservers and this means that I don't go offsite for nameserver lookups for local machines.

Most people run more than one nameserver for their site. In fact, every nameserver is supposed to nominate a backup nameserver that can be queried. This spreads the lookup load somewhat and also means that you can reboot your primary nameserver with impunity knowing that lookups in the namespace will continue.

The duplication of nameservers starts at the top. The NIC provides a file that contains the names and addresses of ten 'well known' root nameservers; its URL is `ftp://ftp.rs.internic.net/domain/named.root`. This file changes rarely and is loaded into your local nameserver providing a set of constant starting points. It's worth checking whether this file has changed from time to time.

You can appreciate that a DNS query can be a complex operation contacting many machines to find the nameserver that services the zone. Most of the complexity that is needed to service a query for the DNS is handled by your local nameserver program. To speed up the lookup process, the nameserver will cache any information that it collects. This means that DNS traffic does not predominate on the Internet. However, once a cache is established, you need some way of timing out the data and forcing the local nameserver to contact the authoritative source again. Each domain administrator supplies a time to live for the data in their zone. This time is used to flush caches in nameservers, so that the administrator will

know how long they will have to wait before a change in their files will be present on all the nameservers in the world.

## Reverse lookups

Of course, we don't just need to translate domain names into IP addresses. We want to be able to perform a reverse lookup, translating an IP address into a domain name. This is done much more often than you think.

Reverse lookup is often used for data logging or for deducing where some mail has come from. Reverse lookup is also used for validation. I run the `tcpd` IP wrapper on my machines to limit which hosts can use certain facilities; this relies on reverse lookup to check a machine name. The FTP daemon program that I use will lookup the IP address of a caller and will refuse to play if the string that it is handed is different from the site that caller claims to have come from.

People running firewalls sometimes seem to fall foul of this system, they feel it's desirable for them to hide the names of internal machines from outside gaze by not registering them in the DNS. They also feel able to export unregistered IP packets onto the Internet. I am unsure why they think that this is a safe thing to do. These people are often the most strident in the defence of what they do, saying that anonymous FTP means that they should have the right to send me packets that I cannot validate. Well, I beg to differ. Anonymous FTP means that you don't need a login name to access part of my machine: you are an anonymous user. I am not prepared to deal with anonymous sites.

Reverse lookups are handled by a cunning use of the lookup mechanism. The IP address is reversed and used to construct a name in the `in-addr.arpa` domain, so my machine `craggy.hillside.co.uk` has an IP address of `192.88.50.1` and a site wishing to perform a lookup on the address will lookup the address `1.50.88.192.in-addr.arpa`.

The reason for the reversal of the IP address is simple. IP addresses are hierarchical, being split into *classes*. However, the number reads from left to right with the left most bits being used to denote the class and the right most bits used for machine numbering or further subnetting on a site. I have a Class C address and my network number is `192.88.50`. My local addresses use the bottom 8 bits.

To allow me (or in fact, EUnet GB) to control my reverse name space, the NIC needs

to delegate my network number to me in the form `50.88.192.in-addr.arpa` so that I

can associate the correct machine name with the correct number in the nameserver that controls my zone. So IP addresses are reversed to make them behave like domain names for delegation.

People often forget to set up reverse lookups in their nameservers and then wonder why they cannot use the Internet fully.

## Record types

We have seen that the DNS contains at least two types of data. One maps names to IP numbers and one maps the reverse lookup of the IP address back to the name. These will actually be in two different zones, one for the domain name and one for the reverse lookup `in-addr.arpa` namespace. For any zone, the DNS contains several different types of *record*. The record has a key which is a domain name, a class (which is always IN for Internet), a type and some associated value or values. The number of values will depend on the record type.

When a query is made to the nameserver, you supply the context in which the query is made by giving the record class and type. There are a couple of programs designed to allow users to query the nameserver. The documentation for these programs assumes that you know about record types. The following could be included in a 'pocket guide'.







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The basic record that is used to map a name to an IP address is the **A** or *address* record. The IP address defines an interface and it's often the case that a machine will have several interfaces, so it's perfectly possible to have several **A** records mapping the same name to different IP addresses.

If a machine has aliases, (for example, my machine `wooded.hillside.co.uk` is also known as `ftp.hillside.co.uk` and `www.hillside.co.uk`), then the alias is included as a **CNAME** (*canonical name*) record. A **CNAME** maps one name to its 'canonical' form. Canonical forms are defined by **A** records and give an IP address for their key. When the nameserver is given a name to lookup and finds a **CNAME**, it replaces the name it is seeking by the canonical name and does another lookup to find the IP address.

It would be possible for me to define these aliases using **A** records to map `www.hillside.co.uk` directly to an IP address. However, some applications, notably `sendmail`, need to know that a particular name is an alias so they can change any mail name to its canonical form. It's better to mark an alias as such by using a **CNAME** record.

The **PTR** record is used to map the reverse lookup, mapping the IP address expressed in `in-addr.arpa` form to a canonical name. The value that the IP address maps to must be a canonical name.

As I have noted, each zone will specify a nameserver, or better several nameservers that will act as authoritative sources of data for that zone. This is done using an **NS** (*nameserver*) record. The **NS** record will give the name of each nameserver that provides data for this site. Beware that this name must be a canonical name, so an **NS** record cannot point to a name defined by a **CNAME**: it must point to a record defined by an **A** record.

Each zone will start with an **SOA** (*start of authority*) record. This has a bunch of arguments: first, it has the name of the machine that supplied the data; second, it has a 'fake' machine name that gives you the email address of the person who controls the data. The **SOA** record for `hillside.co.uk` has `pc.hillside.co.uk` as its second argument, you replace the first dot by an '@' and derive my mail address. This information is not used by nameservers, but is intended for use by humans providing them with a contact address at the site. The remaining **SOA** arguments are used by secondary nameservers to timeout their copies of the data.

The DNS also provides routing information for the email by using an **MX** (*mail exchanger*) record. When processing mail, programs like `sendmail` will process a destina-

tion address like `pc@hillside.co.uk` by looking up the name that appears after the @ symbol as an **MX** query.

**MX** records have a priority number and a canonical name. It's usual to have several **MX** records for any particular mail address. The sending machine will try each one starting with the lowest priority value until it manages to deliver the mail.

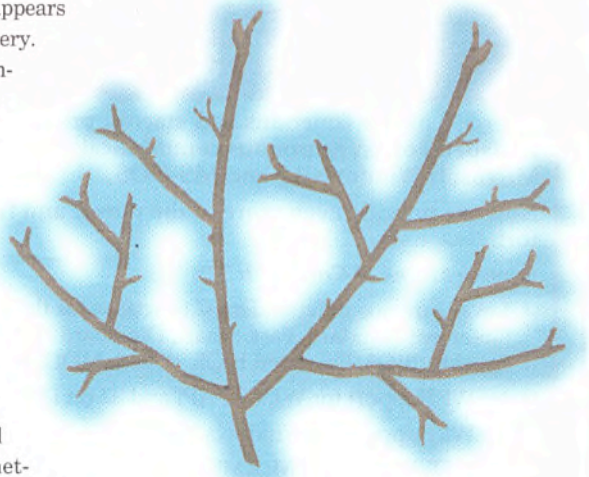
Mail addresses can be machine names but are often domain names forcing the delivery of mail to one mail gateway machine on a local network. There are many advantages to this, the main one being that email addresses become very wide spread amongst your contacts and using a domain name means that you don't have to change your email address every time you move from one machine to another internally.

There is no reason why the mail needs to be delivered to a machine in your domain. You can point an **MX** record at any machine with an **A** record in the DNS. It's quite possible to have an **MX** record for a site that is not actually connected to the Internet. Many service providers that support dial-up access do this.

For example, a site can connect to you via UUCP and it would be perfectly reasonable for you to point an **MX** record for that site at your mail machine, assuming that your mail machine can recognise that it needs to take special action to deliver mail to that site. In my case, **MX** records for `hillside.co.uk` point at EUnet GB's machines, so that I can use ISDN efficiently. Mail is delivered to me using UUCP: batching the mail and sending it in a single call is cheaper.

There are several other record types that can be used to supply additional information about the entries. The **HINFO** record supplies host information for a machine. The arguments are supposed to come from a set of Machine names and System names defined by the *Assigned Numbers RFC* (currently RFC 1340) but this is not enforced, largely because no-one is using this data. The original idea of the **HINFO** record was to allow programs to deduce the type of the remote system and adapt accordingly. This hasn't happened and so few sites supply **HINFO** values. The **TXT** (*text*) record allows you to add text strings to your zone information. Again this is not widely used.

Finally, you can use the record type **ANY** to make a general query from one of the nameserver lookup programs. This can be useful if you are looking for any type of data for a domain.



## Where to find things

If you poke about your UNIX system, you will not find anything called 'DNS' or any daemon that contains those three letters. The DNS is usually supported by a daemon called `named`. On a Sun, it's called `in.named`. Sun's implementation is different since it sits behind the Network Information System (NIS).

There are also a set of standard *resolver* routines that are compiled into programs that wish to query the nameserver. These often consult a control file, so it's possible to have name services provided by a remote machine. A common firewall technique is to run a special nameserver on the firewall supplying external addresses, while pointing the resolver routines on the firewall at an internal machine that supports internal addresses.

There are also a couple of ancillary programs that can be used by humans who want to query the nameserver. Most vendors supply `nslookup` which can be a little hard to use. I prefer to use the `dig` program, emanating from the University of Southern California Information Sciences Institute (USC-ISI), this is somewhat more friendly. For example, it will automatically setup reverse lookups for you.

The public domain version of `named` is now maintained by Paul Vixie and can be obtained using anonymous FTP from `ftp.vix.com`.

Finally, I have made considerable use of the excellent *DNS and Bind*, written by Paul Albitz and Cricket Liu. It's published by O'Reilly and Associates with the ISBN 0-56592-010-4. ■

*Peter Collinson is a freelance consultant specialising in UNIX. He can be reached electronically as `pc@hillside.co.uk`, on WWW at <http://www.hillside.co.uk> or by phone on 01227 761824.*



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# C++, an enhanced C

C and C++ are two languages separated by a shared syntax.

**Francis Glassborow**  
calls for a divorce.

I have dedicated most of this month's column to some C/C++ compatibility issues but first here is some code for you to inspect. It's defect ridden even though most compilers will accept it with no more than a few warnings.

```
#include <stdlib.h>
unsigned char memory[100];
struct memory;
void printf(char*, char*, char*);
int main() {
    int i;
    volatile int v;
    char strn[100], memx[100], my_mem[100];
    unsigned char LC_memory[100];
    i=v=0;
    printf(strn, memx, my_mem, LC_memory);
}
```

My answers are later in this column but see what you can spot before you read on. By the way, you should distinguish between C and C++.

## Time for a divorce

Many programmers view C++ as an enhanced C with greater type safety, support for user-defined types and mechanisms to manage object-oriented programming styles. This is the way that it started in the early eighties. I do not think it is any longer true. Over the last decade there have been many minor (and some major) adjustments to provide better support for the object-oriented paradigm. To my mind, the end result has been to create a different language rather than a powerful dialect. C and C++ share many superficial similarities, not least the

eccentric syntax designed by

K&R. The programmer may not even realise how problematic that syntax can be for implementors writing compilation tools. The recent introduction of yet another keyword, **typename**, basically to support the parsing of code, should hint at some deep problems.

C was designed as a small, powerful language for producing efficient code in the days when typical compilers for languages such as Fortran produced code up to ten times the size of hand-coded assembler. Those were the days when we regularly used separate development and production

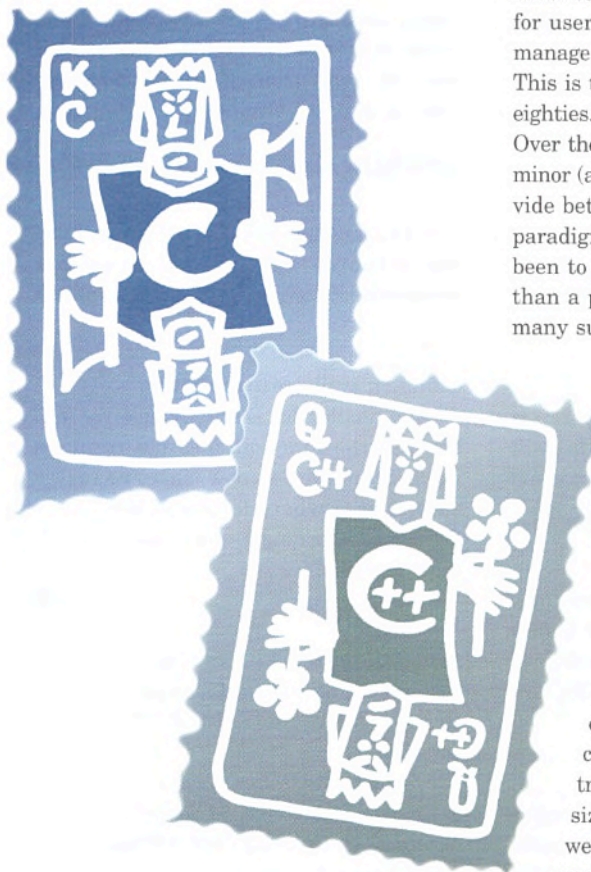
compilers (development compilers produced slow, over-size executables; production ones took for ever to generate an executable). The claim that C remains a small language seems to smell of language politics - the small number of keywords has been sustained by overloading the original keywords with extra meanings. There is also the issue of reserved words: I know of no other languages (apart from C derivatives) that are as profligate with reserving *wildcarded* spellings.

By wildcarded I mean an identifier that includes 'wild cards' such as **str** followed by any combination of upper and lower case letters, digits and underscores. It is not only the specific function names, macro names, etc listed in the standard headers are reversed but whole reams of other useful spellings. In my more frustrated moments I have been known to suggest that programmers start all identifiers with **x**, **y** or **z** as I think that is safe and easy to remember.

C++ is a far larger language, with a steadily increasing number of keywords created after the designers realised that overloading the existing ones was becoming insane. It's also one that has subtly changed the rules for identifiers. Right from the start it unified the namespaces for ordinary identifiers and tags. I believe this was necessary to support direct use of tag names as names of types without having to go through C's **typedef** mechanism. The result is a subtle hiding of names when a C programmer uses the same identifier as a tag and an ordinary identifier. I believe that any consequential breakage of correct C code generates a diagnostic but that does not mean that incorrect C may not compile to do something odd in C++.

## head for headers

The next C++ step was to change the rules for standard headers. In C, if you do not include a standard header your code will be largely free of the constraints placed on identifiers by that header. Though be careful, there are still constraints on identifiers with **extern** linkage. In C++ there is no such guarantee. Once you include any standard header file into C++ source code, any and all of the other standard headers may have been included indirectly. Of course most implementors will not mess up the C standard headers but I believe they are allowed to do so. As soon as you write **#include <iostream.h>** you must assume







that all other standard headers may have been included.

C++ is trying to solve the problem of name conflicts by introducing user defined namespaces. Unfortunately this is not proving to be as

simple as it first appeared to be. The first two implementations to support *namespace* interpreted the draft rules differently. This is particularly bad news as it suggests that there are at least two reasonable views. It will take time to resolve these different views. I have no doubts that we need a namespace facility, but like other extensions - templates and exceptions - I am not convinced that we should delay producing a standard for the core of C++ until these are sorted out. Regrettably, if we go with what we have Standard C++ will be a mess. Too many of those responsible, for whatever reasons, want an all encompassing standard now, however defective it may be. I still hope sense will prevail and C++ will be standardised incrementally - core, extensions and library.

Such differences between C and C++ causes stress between the two but you might think that insufficient cause for advocating divorce. I think that the time has come to stop pretending that C++ is just 'a better C'. As long as we continue to do that we mislead programmers. Take, for example, the difference between assignment in the two languages. In C, to quote the ISO C standard:

'the value of the right operand is converted to the type of the assignment expression and replaces the value stored in the object designated by the left operand.' (6.3.16.1) and earlier:

'An assignment operator stores a value in the object designated by the left operand. An assignment expression has the value of the left operand after assignment, **but is not an lvalue**. The type of an assignment expression is the type of the left operand unless the left operand has qualified type, in which case it is the unqualified version of the type of the left operand.' (6.3.16)

The emphasis is mine, because that is exactly what the value is in C++. In so far as is possible, C++ assignments evaluate to references not values. This has far reaching implications, not least that user defined assignments should return references not values.

I think that it is such changes in the semantics between C and C++ that makes it important that we overtly accept that they are different languages largely bound together by shared syntax.

Now go back and read the code problem at the start of this column.

## Detecting use of reserved identifiers

I believe that user declaration of a reserved identifier in C code is a defect that should be diagnosed. It has long been an irritant to me that development tools do not provide the option of checking source code for such defects. With the growing use of colour in editors I have longed for an editor that would, optionally, identify reserved identifiers by colour. As most editors do not parse code, making the detection completely correct in the context of included header files has not been a possibility.

Symantec could have provided the facility in the latest release of its C++ development tools. Indeed, it could provide even more, such as an option to highlight type names. I hope it will consider such for its next release of C++.

Meanwhile I have found an editor which supports colouring wildcarded identifiers. CRISP from Pacemaker Software (01666 840333) is an editor that was originally developed on Unix systems but is now also available on most PC platforms. This is not the place for an in-depth review, but it is a product worth trying, being highly customisable with sensible GUI support. To some extent, it is what Brief could have become with continued development for graphical environments.

## That code

Here is my line-by-line commentary. How-  
#include <stdlib.h>

ever do not take my word as gospel.

This effectively means that all identifiers

unsigned char memory[100];

starting with 'str' are reserved.

As this line defines *memory* with *extern* linkage, it infringes on the reservation of  
struct memory;

identifiers starting with *mem*.

No problem in C, though pretty silly as it is bound to cause confusion. In C++ this will hide the previous declaration of *memory* and

void printf(char\*, char\*, char\*);

cause all kinds of subtle problems.

Not allowed in C because, though you may declare the prototype of a standard library function, it must match the version defined in the standard. Apart from being silly, C++

int main() {

should accept it.

In C this means that *main* takes an unspecified number of arguments, so any command line parameters are fine but ignored. In C++

this means that the function explicitly takes no arguments so strictly speaking a command line with parameters on it should generate a run time error. I doubt that it actually will.

int i;  
volatile int v;

Note that this means that *v* may be changed by events unknown to the compiler.

char strn[100], memx[100], my\_mem[100];

*strn* violates the reserved spelling of *stdlib.h*. In C, *memx* is all right because it only has block scope but it's a potential defect in C++ because technically *stdlib.h* might have included *string.h*. In C *my\_mem* is also fine, but in C++ it violates the rule reserving '\_' for implementing name mangling algorithms.

unsigned char memory[100];

Possible problem in C++ because of the reserved identifiers in *locale.h*

i=v=0;

No problem in C, though a poor coding style. But I think C++ might produce unexpected results because the value of *v=0* should be a reference to *v* which is volatile, so the value must be read from *v* and might have changed after the 0 value was written to *v*.

printf(strn, memx, my\_mem, LC\_memory);

In C, this might be linked to the library function *printf()* and will result in reading uninitialised storage. C++ should require a  
}

definition available to the linker.

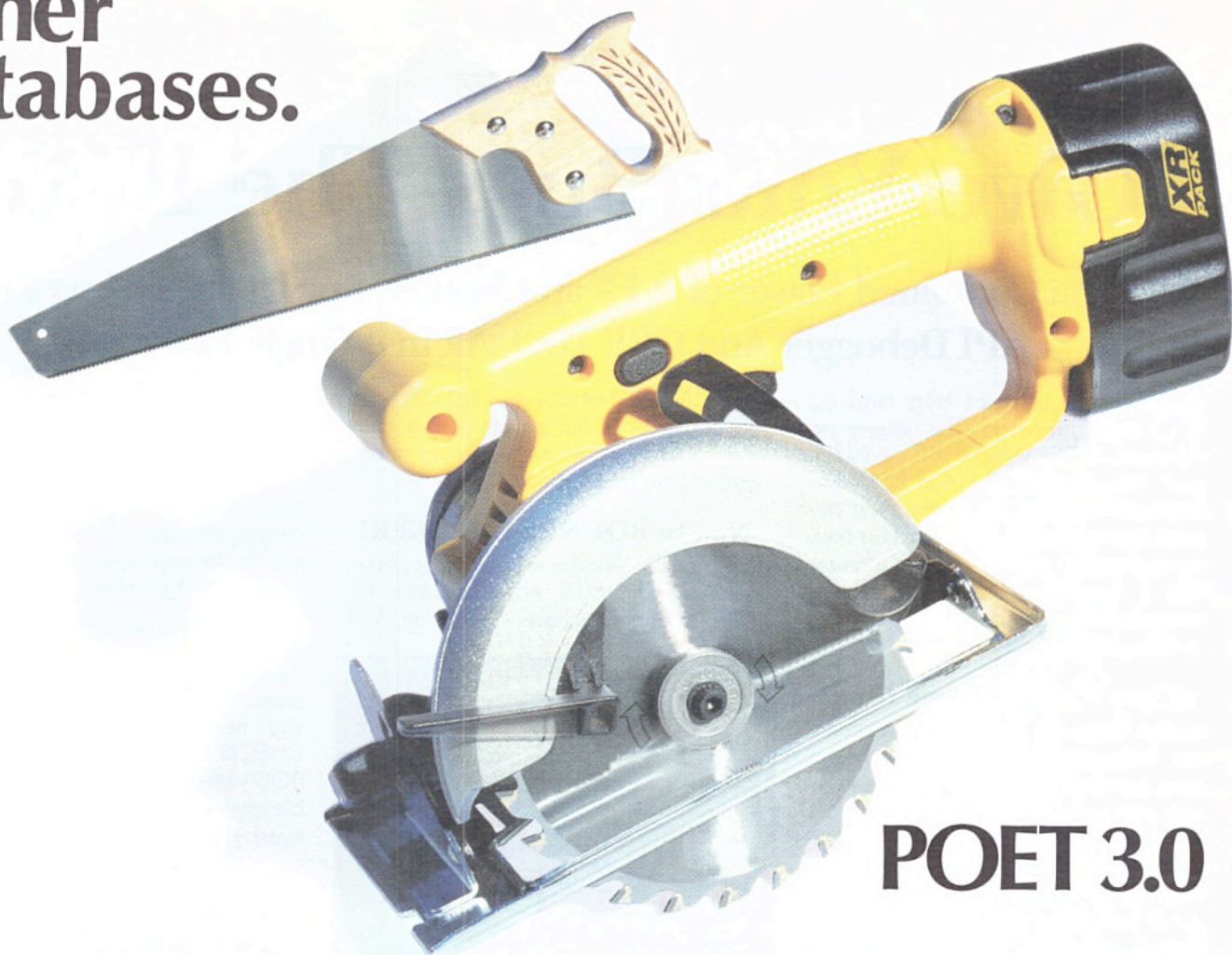
And finally, this is strictly an error in C because the function does not return a value. Stupidly, C++ now makes *main()* a special case where falling of the end is defined as returning 0 - not true code or any other function.

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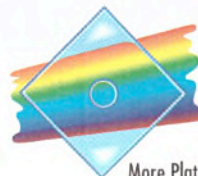
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With the current wave of component-based software, it's perhaps a surprise that many C/C++ development tools appear to be becoming more monolithic. Vendors promote their products on the basis of how 'integrated' they are (the *I* in IDE) - typically you'll get a GUI-based compiler, linker, debugger, browser, text editor and resource editor all working in seamless harmony. Programmers get spoiled by all this - after all it's easier to program if you don't have to run five tools at once and make sure they're all in step. For many developers command-line tools are daunting as well as a tad *passé*.

However, as Emacs aficionados out there will know, it's actually fairly easy to start adding custom functionality to an IDE - via third-party products - as long as your tool is capable of launching other processes and supplying them with command-line arguments. If you use Microsoft's Visual C++ to write an RPC server application, but need to re-run the Microsoft Interface Definition Language (MIDL) compiler every time you change the interface of one of your RPCs, you can add MIDL to Visual Workbench's *Tools* menu. Visual C++ will happily run the other program and redirect its output to one of its own windows. In fact, this is how Visual C++ compiles and links anyway - by invoking the command-line compiler or linker from within Visual Workbench.

A likely candidate for addition to your *Tools* menu is C-Vision from Gimpel Software, purveyor of the code analysis tool PC-lint. Like PC-lint, C-Vision is a text-mode-only, command-line based C/C++ analyser. It differs from its sibling product in what it does with your code. PC-lint serves one (albeit worthy) purpose - comprehensive semantic analysis of your program, in an attempt to identify potential bugs. C-Vision however has a number of distinct functions focusing on the overall logical structure of your code, and to this end comes as six separate executables.

The functionality of C-Vision can be split roughly down the middle. Three of the six programs - C-LINES, C-FORMAT and C-COMMENT - deal with the visual layout of code. The remaining three, C-XREF, C-TREE and C-TDUMP, generate various reports and diagrams describing the logical structure of your code, in terms of symbol usage, caller/callee relationships, etc. All the programs accept options in the form of command-line arguments; default behaviour is configurable via the `cvision.how` file.

## C-LINES

C-LINES is a source-code listing utility. It takes a C or C++ source file and produces a listing suitable for printing or viewing on screen. It

Is your code more tangled than the World Wide Web? Do your program listing bear more than a superficial resemblance to the Mandelbrot Set? **Roland Perera** discovers whether Gimpel Software's latest offering will help you find the method in your madness.

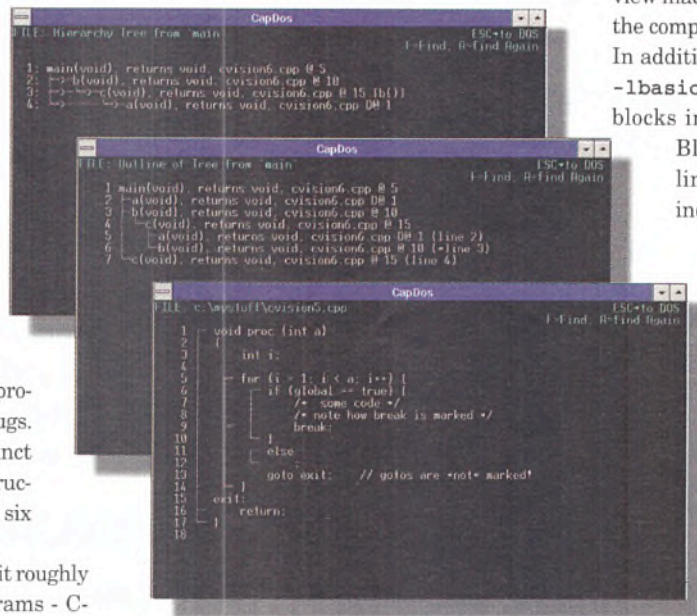
doesn't actually modify the original source file in any way so you can play around with C-LINES to your heart's content with the knowledge that your precious code remains untouched. The basic output from C-LINES, generated with the `-lbasic` option, simply adds line numbers to the body of your code, without formatting it in any way. By default, most of the C-Vision tools output to the screen via a built-in viewer, which allows you to browse through the tool's output. C-LINES however is perhaps more useful when redirected to a printer (`-o` on the command line) as then comments appear in italics and keywords in bold type.

So far C-LINES seems mundane enough. However it has several other tricks up its sleeve. Importantly, it properly preprocesses the source, scanning `#include` files and defining and undefining preprocessor macros as it goes. This allows it to identify code contained within a false preprocessor conditional, ie which is never compiled into object code. Various options allow you either to treat this 'dead' code as normal, to hide it, or to flag it as dead in C-LINES's output. If you need to define any extra macros, eg those defined by your compiler, you can add these to your `cvision.how` file. A handy feature is the ability to see the code after the preprocessor has done its stuff: you're able to view macro expansions in the form that the compiler itself sees.

In addition, C-LINES run without the `-lbasic` option will identify and mark blocks in your code (see Figure 1a).

Blocks outlined with a double line, like the `for` loop shown, indicate control structures that

respond to the `break` and `continue` statements. Single lines outline function bodies, `if/else` clauses, class definitions, and nested blocks. Block exit points (`break`, `continue` or `return`) are also highlighted by the presence of a horizontal bar sprouting forth from the vertical bar that outlines the block. This feature would obviously be useful to anyone trying



From front to back: Figures 1a, 1b & 1c

to grasp the flow of control of unfamiliar code. However, unstructured block exit keywords (`goto` and `throw`) are not flagged.

C-LINES's remaining function is the ability to add user-supplied titles and subtitles to its output. If C-LINES comes across a comment starting with the word `TITLE` or `SUBTITLE` in your code, it treats the line as identifying a section or subsection of the code. It then compiles these headings into a table of contents which appears as the last page of the output.



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## C-FORMAT and C-COMMENT

Unlike C-LINES, C-FORMAT and C-COMMENT both modify their input files (after backing them up). C-FORMAT is a source code reformatter: it attempts to free you from the tedium of making sure that your code is always correctly indented and that whitespace is used consistently. C-COMMENT's task is simply to rearrange comments as C-FORMAT completely ignores them, although if supplied with the `-iyes` command-line option it will automatically invoke C-COMMENT when it's finished.

Actually, calling C-FORMAT a 'source code reformatter' is a bit of a euphemism - as the documentation states, it takes 'a minimalist approach to reformatting', leaving most code unchanged except for adjusting indentation. In this respect it is a useful tool for implementing coding standards or for reformatting a complex tree of control structures after making a change to its logic. Like all members of the C-Vision suite, C-FORMAT is configurable, allowing you a degree of control over indentation, the positioning of braces, nested preprocessor commands and multi-statement lines. The obvious thing it's lacking in this regard is any control over vertical whitespace: it would be useful to be able to specify a gap of one blank line between functions, two surrounding every preprocessor block, and so on.

```
class B {
};

class D : public B {
};

void main ()
{
    D d;
    B *pb = ( B * )    & d; // incorrectly interprets unary & as
    binary &
    D    *    pd = &d;      // incorrectly interprets * type modi-
    fier as binary *
}

/* The relevant section of cvision.ops:

"& ", 5, 5 ; a & b
"&u ", 1, 0 ; &a
"&d ", 1, 0 ; char &s -- see discussion at *d, below
** ", 5, 5 ; a * b
**u ", 1, 0 ; *a, **a, ***a, etc.
**d ", 1, 0 ; char *s

Changed appropriate values to 5 to highlight problem! */
```

Figure 2 - C-FORMAT gets confused!

```
#define BUF_LENGTH 40
#define m(x) (x + 10)

int func (char*, int*);

void subroutine (int parm)
{
    int value;
    char buffer[BUF_LENGTH];
    value = func(buffer, &parm);
}

Symbol cross-reference produced by C-XREF:

Usage symbols:
# - a symbol is declared or defined
& - symbol's address is taken: &abc
= - symbol takes on a new value: i=1; or i++;
u - macro is undefined: #undef COUNT
? - a function is declared by being used
! - a function is defined

BUF_LENGTH, macro: 40    1#    9
buffer, char [40], LOCAL 9#    10&
func(char *, int *), returns int 4#    10
m, macro: (<1> + 10)    2#
parm, int, LOCAL 6#    10&
subroutine(int), returns void 6!
value, int, LOCAL 8#    10=

7 Total Symbols.
```

Figure 3 - Sample output from C-XREF

Where C-FORMAT falls flat, however, is in the layout of C++ expressions. This is where it could be extremely useful, especially for people working with programmers who pay little more attention to whitespace than their compilers. Running C-FORMAT with the `-lop+` option causes it to lay out expressions using a set of spacings defined for each operator in a file called `cvision.ops`. Unfortunately, C-FORMAT is far from being a fully-fledged pretty-printer, and is clearly incapable of properly parsing an expression or simple declaration. For example, in Figure 2 both of these very simple assignments are parsed (and hence reformatted) incorrectly. The cast is parsed as an expression, leading to the interpretation of an occurrence of unary `&` as binary `&`. Omitting the cast causes the pointer declaration to be read as an occurrence of binary `*`!

Pretty-printers usually work by building a parse tree from the source and then recreating the source from the tree, invoking an appropriate pretty-printing 'method' recursively at each node. C-FORMAT blithely allows the spacing method for a given node to override the spacing inserted previously by a node closer to the root of the expression. Take the expression:

5 + (4 \* 3)

Ideally we would want to be able to define a pretty-printing method for the `+` operator along the lines of

```
<pretty-print left operand>;
<print a space>;
<print the '+' character>;
<print a space>;
<pretty-print right operand>;
```

without fear of the two recursive visits to the left and right subtrees messing up the spaces we've already inserted on either side of the `+` symbol. With C-FORMAT, the opening parenthesis of the sub-expression `(4 * 3)` effectively nullifies the space inserted by the `+` operator, yielding:

5 +(4 \* 3)

In summary, the `-lop+` option is too flawed to be of much use to anyone, which is a shame.

C-FORMAT's companion C-COMMENT is a simple utility for laying out both C-style comments (delimited by `/*` and `*/`) and C++ comments (introduced by `//`). It works by logically grouping all the comments in a source file into *local comment blocks*, its unit of manipulation for reformatting, and then aligning all the comments in a given block. Command-line options allow you to customise C-COMMENT's notion of exactly what constitutes a comment block. So if you want C-COMMENT to end the current block when it comes to a line of code without a comment on it, use the `-lbd1` option. Similarly, should you wish to switch off the default behaviour of further delimiting comment blocks on lines of code containing `{` and `}`, you can specify `-lb{no` and `-lb}no`.

Further options tell C-COMMENT how to align each block. Comment blocks can be aligned as near as possible to their associated code, or given an absolute column number. Comments on a line without code can be aligned to the current level of code indentation. You can also choose whether multi-line comments are left as they are (the default) or formatted so that lines after the first are aligned neatly relative to the opening `/*`.

## Ships and shoes and symbol tables

Now I'm going to take a look at C-Vision's other half, the code analysis and tree diagramming tools. Source code is processed in two phases. First, the code is run through the C-XREF program. This generates a symbol cross-reference table and a `.hie` file, a non-human-

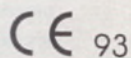


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readable database of hierarchy information. The second phase involves running C-TREE on the .hie file to generate various views of the data.

First of all let's focus on C-XREF. As well as building the .hie file, C-XREF produces a cross-reference table for all the symbols in a set of source files. For each symbol, it lists the line numbers where the symbol was declared, defined, assigned to or called as appropriate (depending on whether the symbol references a variable, macro or function). Like the other C-Vision utilities, it will display its output on screen via the C-Vision viewer unless instructed to send it directly to the printer. Figure 3 shows a simple example with seven symbols. From this table we can see that, on line 10, `buffer` is used, `parm` has its address taken, and `value` is assigned a new value. Note that compile-time lexical 'parameters' like macro and template parameters are shown as `<nn>` as in the definition of the macro `m` in the figure. While this perhaps increases legibility for macros, it certainly detracts from the readability of a template definition: see Figure 5 for an example of this.

Structure/class members are handled intelligently. C-XREF knows about implicitly generated member functions such as default copy constructors. Furthermore, references are split into class-level usage, and instance (object-level) usage. For example, the code shown in Figure 4 defines and uses `struct S`. The corresponding cross-reference generated lists all uses of members `a` and `b`, regardless of which instance of `S` is involved. Further down the table we see that it has also identified the

```
struct S {
    int a;
    int b;
} s1;

S *sp;

void zip () {
    sp->a = 4;
    s1.a = 4;
}

Symbol cross-reference produced by C-XREF:
```

a, int in struct S 2#	9=	10=
b, int in struct S 3#		
S, struct	1#	6
sp, struct S *	6#	9
s1, struct S	4#	10
s1.a, int	10=	
zip(void), returns void	8!	

7 Total Symbols.

Figure 4 - Class vs. instance usage

```
template <class T>
class X {
    T* p;

public:
    void fun ();
};

void X<int>::fun ()
{
}

void fun ()
{
}

void test (X<int> &x)
{
    x.fun();
    fun();
}

Symbol cross-reference produced by C-XREF:
```

fun(void), returns void	6!	19
fun(void), returns void	13!	20
fun(void) in template<<1>> X, returns void		6#
p, <1>* in template<<1>> X		3#
test(X<int> &x), returns void		17!
X, template<<1>>	2#	9
X, X<int> &, LOCAL	17#	19#
X<int>, class	17	

8 Total Symbols.

Figure 5 - Template example

instance `s1` and so can provide an entry for `s1.a`, telling us that the `a` member of `s1` is assigned to on line 10. However, the reference to `a` through the `S` pointer `sp` is not tied to a particular instance and so is not listed separately.

Although capable of processing templates, C-XREF doesn't distinguish between a template specialisation function and a normal function. Figure 5 shows that C-XREF lists both `void X<int>::fun()` and `void fun()` as `void fun(void)`. This oversight could have ramifications for regular users of templates.

## Back to your roots

Now on to the .hie file that C-XREF has created. A .hie file is a binary file containing information on functions, global variables, macros and user-defined class/struct/union/enum types, and as such is pretty useless. There are two utilities that process this file. C-TDUMP simply dumps its contents into a set of comma-delimited text files suitable for importing into database tables. You are then free to construct your own queries about this information.

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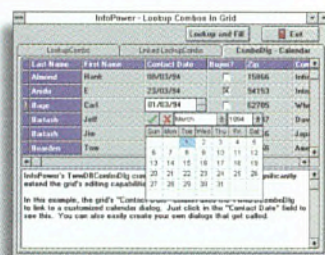


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C-TREE is a utility that takes a .hie file as input and generates tree/graph diagrams and various other 'views' of the hierarchy data. The two kinds of diagram that C-TREE can create are call graphs and class hierarchies. (Other non-graphical views include a function or class 'dictionary' and a symbol summary.) With both kinds of diagram, any symbol can be chosen as the root by specifying -lfxxx, where xxx is the symbol. The diagram can be inverted with the -la option to produce an 'access tree' - i.e. one which answers the question 'who uses x?' rather than 'whom does x use?'. Different filters can be used to limit the number of symbols displayed; you can even locate any unused global symbols with -lunused.

Graphs are displayed - on screen or paper - in one of two ways. The default style is a 'hierarchy tree', essentially a kind of Directed Acyclic Graph (DAG) where each node in the graph represents a function and each arc a call. The fact that a function can always call itself recursively, either directly or indirectly, means that there will often be cycles in a call graph. (Class hierarchies don't have this problem as it's not possible to have cyclic inheritance.) A DAG is a graph that has been made acyclic by removing certain arcs that are part of a loop and replacing them with symbolic references to the function called, as indeed they are in the original code. This allows the graph to be drawn in a hierarchical fashion.

C-TREE also provides an 'indented outline' style - a true tree - in which each function may occur at several nodes, once for each time it is called. Many people will probably find this kind of graph more readable than a hierarchy tree as the list of callees is readily apparent: a hierarchy tree makes the list of callers more apparent. Being a tree, a graph like this can be drawn hierarchically, although it will grow to infinite size if there is any recursion involved. To avoid this problem C-TREE doesn't expand any node that has already been expanded once. The hierarchy tree and indented outline styles are shown in Figures 1b and 1c.

Be warned though: the C-Vision utilities don't understand C++ like your compiler does! It's vital that you check that your code compiles correctly before you try to build a .hie file for it with C-XREF, or you'll run into trouble. For example, C-XREF doesn't require a prototype for each function called in a C++ program - rather than signalling an error if it finds a call to an undeclared function, it just quietly ignores any symbol usage by such a function when building the .hie file. Although your symbol cross-reference will show any symbols the function uses, they will not appear in the hierarchy tree generated by C-TREE. The same applies to C-FORMAT and C-COMMENT - don't run them on code with compile-time errors in it or strange things will happen!

So will C-Vision be your guiding light? If you run all your development tools from the command-line anyway, or are prepared to make the small effort to set up C-Vision to run from your IDE or editor, you'll find it a handy addition to your programmer's toolbox. Having said that, it's not exactly a state-of-the-art code analysis tool: it could do with a proper C++ parser for a start. Its strong points are its source code listings and the access tree and call graph generation facilities - if you've ever had to make headway into a large body of code written by someone else you'll know why.

If you'd like to buy a copy, C-Vision is available from Grey Matter for £145. You can contact it on 01364 654100.

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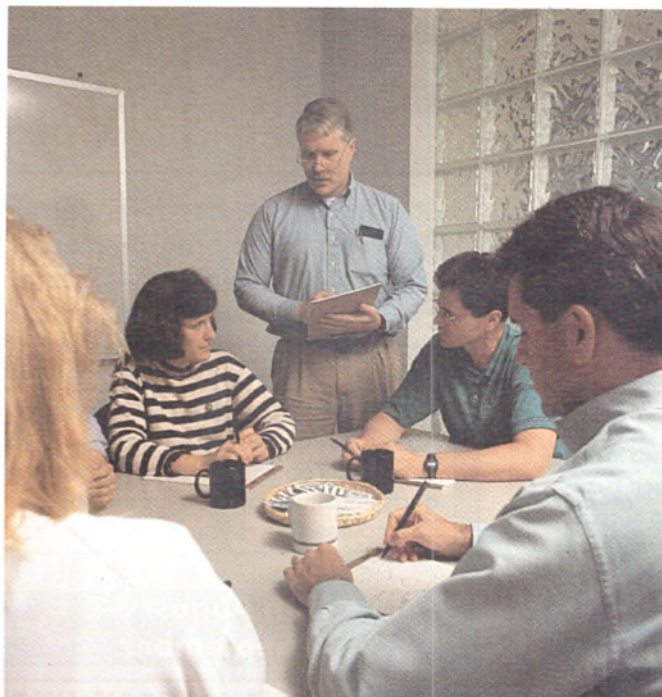
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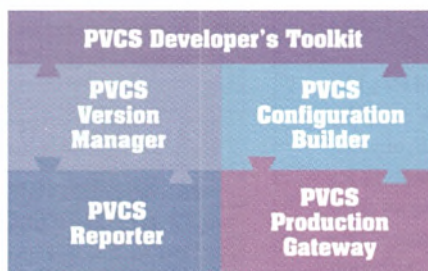
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Dave Jewell kicks off a new series on writing Delphi components by showing how to put together a simple task list component.

# An introduction to Delphi component writing

This is the first article in a three part series in which I'm going to examine the nuts and bolts of Delphi component writing. In this month's introductory instalment, I'll look at how to derive a very simple control from an existing one. In the two subsequent parts, I'll create a rather more complex component from scratch. I won't tell you what it is yet - but I can promise that it's something you'll want to incorporate into your own applications.

## Module mania

Most Windows programmers will be familiar with the functionality available in Microsoft's TOOLHELP DLL - it's a set of low-level routines that allow you to peek 'under the bonnet' of Windows, examining the tasks, modules, classes and the memory objects that are currently allocated. In this introductory article, I'm going to build a new component called **TModuleList**. This component will simply display a scrolling list of the currently loaded modules. You could use it - for example - as part of your own Heap-Walker style application. Do remember, however, that this month, the real object of the exercise is to demonstrate the rudiments of component writing.

## Correct pedigree is all...

As I made clear in an earlier article (*Developer's Introduction to Delphi, EXE, June 1995*), a correct choice of parentage is all important when creating your own components. As you can see from Figure 1, my **TModuleList** control is actually derived from a list box. In this case, I've chosen to derive it from **TCustomListBox** rather than from **TListBox**, since this gives more flexibility in what we can do with the component. I used the Component Expert to set

up the initial component unit used by **TModuleList**.

Once you've got your initial component unit, save it! I saved mine as **MODLIST.PAS**. At this time, it's a good idea to create a dummy, throw-away project. Add **MODLIST** to the **uses** clause of this project's form unit. This will ensure that we can conveniently make changes to the component source code, rebuild and execute the project in the normal way and immediately see the effects of any change. While developing Delphi components, you should always bear in mind that to test *run-time* code you only need to re-run the dummy application. However, to test *design-time* code you must rebuild the library; this incorporates the lat-

est component unit code changes into **COMPLIB.DCL**, the large DLL that Delphi uses during design-time editing.

In this simple component, I'm not going to introduce any new properties - there'll be plenty of that next month! Instead, we need to inherit all the required properties from our immediate ancestor - the **TCustomListBox** class. If you take the unit produced by the Component Expert as it stands and add it to the Component Library, you'll find that very few properties are available. You won't, for example, be able to change the colour of the module list component because the **Color** property isn't present. To make those properties appear in the Object Inspector, we need to place them in

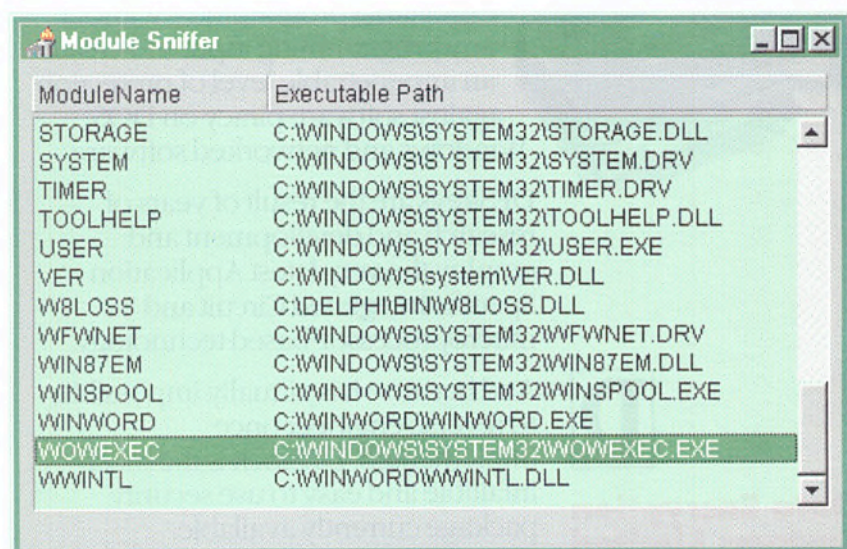
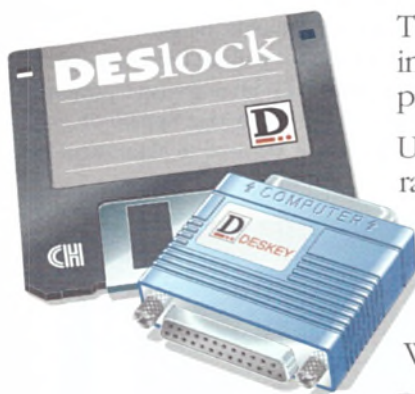


Figure 1 - Here's the **TModuleList** component in action. The first column displays the name of the loaded module whereas the second column gives the name of the associated executable, be it a DLL, EXE file or DRV module.





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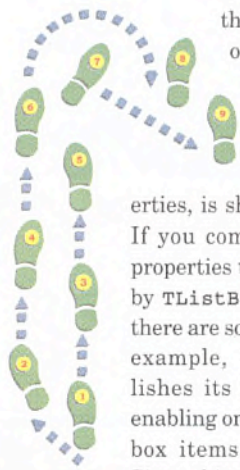
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the published part of the class definition. The final class definition - complete with published properties, is shown in Listing 1. If you compare this to the properties that are published by **TListBox**, you'll see that there are some omissions. For example, **TListBox** publishes its **Items** property, enabling one to set up the list box items at design time. Since this isn't applicable to

our derived component, the **Items** property isn't published and remains inaccessible. You need to think carefully about which properties make sense for your component and which don't.

If you look again at Listing 1, you'll see that the methods **Loaded** and **CreateParams** are both specified in the class definition with the **override** keyword. (More on these methods later.) The **override** keyword will only work with methods which have previously been defined as **virtual**. From this, we can infer that **Loaded** and **CreateParams** are both defined as virtual methods in some ancestor class - not necessarily the immediate parent class. Declaring a method as virtual simply indicates to the compiler that the method *may* be overridden in some descendant class, just as we're doing here in **TModuleList**. In Object Pascal, a virtual method can *only* be overridden through the **override** keyword. If this keyword was omitted, we'd be completely replacing the existing parent or ancestor methods with our own. In this case, it wouldn't be possible to call the old, ancestor method - it would be hidden and inaccessible. Sometimes this may be the right thing to do - it all depends whether you're supplementing the functionality of the original method or replacing it.

## Create Catastrophes

The next job is to add the various module names to the list box. Every Delphi component (and indeed every **VCL** object) has a built-in **Create** method which is invoked when the component is first instantiated. Many components override the **Create** method so as to perform their own initialisation. For example, if you define an integer property, **WombatCount**, as part of your class definition and specify that this property has a default value of 12, then it's your responsibility to set the property to this value in the component's **Create** method - we'll see plenty of examples of this next month. Again, many components which

need to allocate memory do so in their **Create** method and free the memory in their **Destroy** method.

From the foregoing, it might seem like a good idea to add the various module name strings to the **TModuleList** component in its **Create** method. However, this would actually be a very bad move and would result in a run-time exception being raised. The **Create** method is called very early on in the lifetime of a component. It's actually called before the component is associated with a specific parent window and it turns out that this association needs to be in place before you can start adding items to the list box - Figure 2 shows the result of trying to do the job inside the **Create** call!

A better place to add the list box items is in the **Loaded** method. Every derivative of **TComponent** has a **Loaded** method which is called once all parts of the component have been loaded from the form file's stream.

Listing 2 shows the **Loaded** method that I ended up with. First, it's necessary to add **TOOLHELP** to the **uses** clause of the component unit since we're calling the **ModuleFirst** and **ModuleNext** routines from the **TOOLHELP** DLL. Since we've overridden the existing **Loaded** method, it's essential to call the original inherited method before doing anything else.

Since our **TModuleList** component is made up of two columns, we need to set up a tab value so that things line up nicely. The call to **SendMessage** issues a **LB\_SETTABSTOPS** message to the list box window handle associated with the component (always remember that API-level window handles and device contexts are accessible through a property called 'handle' for windowed controls and Canvas objects, respectively). When issuing a **LB\_SETTABSTOPS** call, the tab stop units are normally specified in dialog units. If I were doing this 'properly', I'd convert from a pixel value by using the **GetDialogBaseUnits** API call to determine the scaling factor involved - the approach here is a little unrefined, but it's only intended to demonstrate component building.

It's also worth reiterating that as a rule, you should avoid making Windows API calls wherever possible. By sticking to the **VCL** class library, you end up with code that's both simpler and more portable to the 32-bit version of Delphi. In this specific case, there's no option but to make an API call. (This is because the **VCL** framework doesn't support the concept of setting tabs within list boxes. This is a curious and surprising omission. Of course, once you're happy with deriving new components from old ones, it would be an easy matter to create your own 'superlist box' which has a new property cor-

responding to an array of tab settings.) Fortunately, the layout of the **LB\_SETTABSTOPS** message remains the same for both Win16 and Win32, so no code changes should be needed when moving to the 32-bit version of Delphi.

## On the Fly Style Changes

The use of **LB\_SETTABSTOPS** presents one further problem: this message will be politely ignored by a list box control unless it was actually created using the **LBS\_USETABSTOPS** style - something which the **VCL** library doesn't bother to do. Yes,

```
type
  TModuleList = class(TCustomListBox)
  private
    { Private declarations }
  protected
    { Protected declarations }
    procedure Loaded; override;
    procedure CreateParams
      (var params: TCreateParams); override;
  public
    { Public declarations }
  published
    { Published declarations }
    property Align;
    property BorderStyle;
    property Ctl3D;
    property Color;
    property DragCursor;
    property DragMode;
    property Enabled;
    property Font;
    property ParentColor;
    property ParentCtl3D;
    property ParentFont;
    property ParentShowHint;
    property ShowHint;
    property Sorted;
    property TabOrder;
    property TabStop;
    property Visible;
    property OnClick;
    property OnDblClick;
    property OnDragDrop;
    property OnDragOver;
    property OnDrawItem;
    property OnEndDrag;
    property OnEnter;
    property OnExit;
    property OnKeyDown;
    property OnKeyPress;
    property OnKeyUp;
    property OnMeasureItem;
    property OnMouseDown;
    property OnMouseMove;
    property OnMouseUp;
  end;
```

Listing 1 - Class definition for **TModuleList** component

```
procedure TModuleList.Loaded;
const
  tabstop: Integer = 50;
var
  fResult: Bool;
  me: TModuleEntry;
begin
  inherited Loaded;
  { Aieee! Call SendMessage directly! }
  SendMessage (Handle, lb_SetTabStops,
    1, LongInt (@tabstop));
  me.dwsize := sizeof (me);
  fResult := ModuleFirst (@me);
  while fResult do
  begin
    Items.Add (StrPas (me.szModule)
      + #9 + StrPas (me.szExePath));
    fResult := ModuleNext (@me);
  end;
end;
```

Listing 2 - **TModuleList** initialisation





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CIRCLE NO. 267





you've guessed - by the time the **Create** and **Loaded** methods get to do their stuff, the associated list box window has been well and truly created! Fortunately, the designers of the VCL library provided another method call which enables you to change various aspects of a component immediately before it's created. This is the **CreateParams** call. When the **CreateParams** method is called, it gets passed a pointer to the **TCreateParams** data structure shown below:

```
type
  TCreateParams = record
    Caption: PChar;
    Style: Longint;
    ExStyle: Longint;
    X, Y: Integer;
    Width, Height: Integer;
    WndParent: HWND;
    Param: Pointer;
    WindowClass: TWndClass;
    WinClassName: array[0..63] of Char;
  end;
```

The **CreateParams** method is at liberty to change any members of this field. Seasoned Windows programmers will recognise similarities with the processing of the **WM\_CREATE**

message which is also passed a pointer to a data structure containing a number of create-time parameters for the window that's about to be created.

As with the **Loaded** method, it is crucially important first to call the inherited method using the **inherited** keyword. The **CreateParams** ancestor method is responsible for assigning initial, default values to the various fields in the **TCreateParams** data structure, so if you forget to make this call, you'll end up with complete garbage being passed to the **CreateWindowEx** API call - an interesting debugging exercise! The code for the **CreateParams** method is given in Listing 3.

### Run-time versus Design-time

If you try out **TModuleComponent** for yourself, you will notice that it displays the list of loaded modules at design-time as well as at run-time. This is a nice feature and it's used extensively by Borland's own data controls - as soon as you connect to a data source, you'll see individual fields of a record appear. Being able to display 'live data' at design time doesn't require any special work on our part - it's the default behaviour.

Sometimes you'll create components where it isn't appropriate to display data at design time. You can check for whether or not a component is being used at design time by using the **ComponentState** - a property of all classes derived from **TComponent**. **ComponentState** is actually a set

variable which can contain one or more of the values shown in Table 1. If you wanted to prevent something happening at design time, you might write a fragment of code like this:

```
if not (csDesigning in ComponentState) then
begin
  { Don't do this in the form designer... }
  ....
end;
```

### Improvements

As has been said elsewhere, the **TModuleList** component is a simple example designed to introduce you to the rudiments of component writing. In a real-world application, there's a big reason why it wouldn't be adequate: it only 'looks up' the list of running modules when it's first initialised and is blissfully ignorant of any subsequent changes such as new modules being loaded, or others being removed from memory!

There's an obvious way around this: you could associate a timer with the **TModuleList** component, causing the module list to be rescanned once every 50 milliseconds (say). In order to reduce unnecessary flicker and updating, you might want to keep track of the total number of entries in the list box, only updating the list box when the new module count differs from the old. Of course, this introduces the possibility that a module might be unloaded coincidentally with a new module appearing, thereby causing the change to be 'missed'.

Another useful improvement that you could make to the component is the inclusion of a published 'Tab' property. As it stands, the component has a tab position which is 'hard-wired' at 50 dialog units. By publishing a 'Tab' property, you could allow this value to be modified under program control by other interested parties. This would make it easy (for example) to associate a Header component with the module list. Changing the dividing line of the header would automatically cause the module list component to follow suit.

So how do we publish new properties for a component, and how do we arrange for 'things to happen' behind the scenes when those properties are changed? For these and many other delights, tune in to next month's instalment, when I'll be starting the development of our mystery component!

Dave Jewell is the author of 'Instant Delphi' published by Wrox Press and 'Polishing Windows' by Addison-Wesley. He can be reached as [djewell@cix.compulink.co.uk](mailto:djewell@cix.compulink.co.uk).

<b>csDesigning</b>	The component is being manipulated in the form designer.
<b>csDestroying</b>	The component is about to be destroyed.
<b>csLoading</b>	The component is being loaded from a filer object.
<b>csReading</b>	The component is reading its property values from a stream.
<b>csWriting</b>	The component is writing its property values to a stream.

Table 1 - Possible values which may be held by the set variable **ComponentState**

```
procedure TModuleList.CreateParams (var params: TCreateParams);
begin
  inherited CreateParams (params);
  with params do Style := Style or lbs_UseTabStops;
end;
```

Listing 3 - Forcing the **LBS\_USETABSTOPS** Style bit

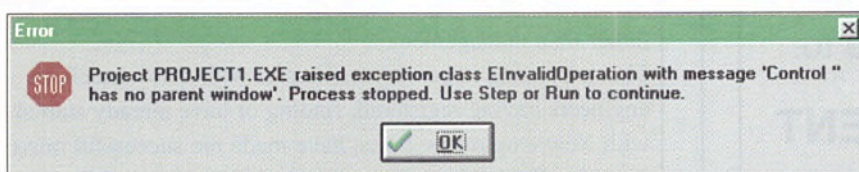


Figure 2 - How (or rather, when) not to add strings to the listbox. There are many restrictions on what you can and can't do within an overridden **Create** method. It's often easier to use the **Loaded** method instead.



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JOB		JOB		JOB	
<b>DELPHI DEVELOPERS</b>		<b>'C'/C++/UNIX/RDBMS</b>		<b>MULTIMEDIA DEVELOPERS</b>	
<b>LOCATION</b>	<b>SALARY</b>	<b>LOCATION</b>	<b>SALARY</b>	<b>LOCATION</b>	<b>SALARY</b>
<b>S.London</b>	<b>To £25K + Bens</b>	<b>City</b>	<b>£30,000</b>	<b>City</b>	<b>To £30K</b>
<p>Our client, a highly successful consultancy and product development group specialising in the financial sector has seen rapid growth in recent years. As a result, five development consultants are required to assist in new development and existing product migration. Applicants should have at least eighteen months Borland Pascal and SQL experience - excellent communication skills are also necessary. Successful candidates can not only expect a highly competitive salary package, but will be trained to use a Borland's Delphi client/server product.</p>		<p>This international settlements house established in 1970 is now developing its next generation of software and is searching for two highly skilled developers with excellent 'C'/C++ programming skills under UNIX with experience of Oracle and/or Powerbuilder. You will need to have a strong academic background, with excellent interpersonal skills and enjoy working as part of a highly motivated team. This is an ideal opportunity to work with the latest technologies in a technically challenging environment.</p>		<p>Europe's leading CD-ROM publishing company is seeking to recruit Windows development and testing staff at all levels of experience. They are building teams now to work on a number of new titles to be released into Europe later this year. Ideally, you will have worked in a multimedia environment developing software under either MS-Windows or on the Apple Macintosh. Any experience of writing or using graphics software, sound or animation would be useful, but is not essential.</p>	
REF: PP/1		REF: DE/2		REF: FS/3	
<b>3D GRAPHICS/MULTIMEDIA</b>		<b>'C'/UNIX</b>		<b>ORACLE DEVELOPERS</b>	
<b>LOCATION</b>	<b>SALARY</b>	<b>LOCATION</b>	<b>SALARY</b>	<b>LOCATION</b>	<b>SALARY</b>
<b>Herts</b>	<b>To £16K</b>	<b>Home Counties</b>	<b>£18-£32K</b>	<b>Berks</b>	<b>To £30,000</b>
<p>This is an exceptional opportunity to work for one of the leading international players in the multimedia field. They are now expanding their product range of multimedia enabling technology. As part of this expansion they are searching for a junior Software Engineer with 3D Graphics, 'C' and/or C++ programming skills under MS-Windows. Any experience of UNIX would be advantageous. Don't miss this opportunity to work at the leading edge of graphics and multimedia development. Call us now!</p>		<p>High calibre Software Engineers are required by our client, a leader in Open Systems Technology. Suitable candidates will have at least two years 'C' programming experience in a UNIX environment. Knowledge of UNIX operating system development (kernel, utilities), assembler, level programming or compiler writing, although not essential, will be highly desirable. Working in a small, dynamic team, you will be involved in the development of new products and the support of existing products by investigating problems and creating solutions.</p>		<p>This international provider of telecommunications services is growing at a tremendous rate and is looking for several Oracle Developers. Suitable applicants will have at least eighteen months experience of developing Oracle based systems, backed up by strong inter-personal skills. Any knowledge of Oracle Case, Forms 4, Reports 2, PL/SQL, Pro*C or Oracle Financials will be advantageous, although training is available. Successful candidates will be developing UNIX based Oracle financial and purchasing applications through all stages of the project life cycle.</p>	
REF: DE/4		REF: LC/5		REF: JD/6	

## CONTRACT VACANCIES - UK WIDE

Herts	Visual C++ Analyst/Programmers	3 months	City	Mac/Windows Text Handling Programmers	6 months	London	Visual C++/MFC Developers	6 months
London	Visual C++ Programmers	6 months	City	Text Processing	6 months	Surrey	Visual C++/MFC Programmers	6 months
Cambs	Visual C++ Programmers	6 months	Cambs	Text Handling Processing	4 months	Oxford	Visual C++/MFC Programmers	3 months
Berks	Visual Basic Programmer	4 months	City	Apple Mac Multimedia Developers	6 months	City	Visual C++/SDK Multimedia Developers	3 months
London	VC++/SDK Multimedia Developers	3 months	Cambs	Apple Mac CD-ROM Developers	6 months	W. London	C/C++ Progs x 2	6 months
Cambs	VB/OLE Developers	3 months	Cambs	Multimedia/CD-ROM Developer	4 months	City	C++/Banking Programmers	6 months
Surrey	Windows/Financial Appls. All levels	6 months	London	Sybase/SQL Server Software Engineer	4 months	London	Oracle, SQL, Forms Developers	3+ months
W. London	Windows SDK/C Programmers	5 months	Surrey	Visual C++/MFC Finance Developer	6 months	London	Windows/C++ Programmers	6 months
City	Windows SDK/C Developers	4 months	London	MS-Windows System Tester	3 months	City	Windows NT Senior Programmer	3 months
REF: FS/7			REF: FS/8			REF: FS/9		

Logistix Recruitment Limited  
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Tel: 0181-742 3060  
Fax: 0181-742 3061  
email: logistix@atlas.co.uk

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# BARGAIN BOOKS

THE BOOK PAGE

With Delphi moving centre stage so quickly, no apologies for including two excellent Delphi titles this month - demand demands it! Plus a brand new best-selling edition for Fox enthusiasts.

## Teach Yourself Delphi in 21 Days

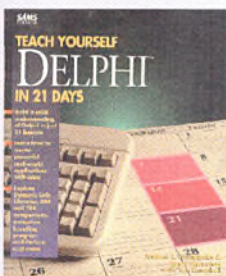
by Andrew J Wozniwicz & Namir Shammas with Ian Campbell

912 pages

Normal Price: £23.00

☆ Price to You: £17.25 ☆

How to program efficiently in Delphi by combining the power of visual programming with the Pascal language. Easy to understand examples and full code listings will help you become proficient in Delphi in just three weeks.



## DELPHI UNLEASHED

by Charles Calvert

930 pages

Normal Price: £35.50 (inc VAT)

☆ Price to You: £26.65 ☆

For medium to experienced developers, this book contains professional tips and techniques Delphi programmers need to create powerful applications.

Comes with learn-by-example CD-ROM containing hundreds of illustrative sample programs.



## FoxPro for Windows Developer's Guide 3rd Edition

by Jeb Long

1500 pages

Normal Price: £41.67 (inc VAT)

☆ Price to You: £31.25 ☆

Jeb Long, creator of xBASE, brings FoxPro developers right up-to-date with this new edition. Shows how to create robust database applications and covers the intricacies of application development with the new object-oriented, event-driven paradigm.

Comes with diskette of all source code for sample programs.



### Selection

Selection	RRP	Your Price
Teach Yourself Delphi in 21 Days	£23.00	£17.25
DELPHI UNLEASHED	£35.50	£26.65
Visual FoxPro Developer's Guide	£41.67	£31.25

Descriptions of all books below can be found in EXE Magazine, issues from February to July.

### Selection

Selection	RRP	Your Price
Heavy Metal Visual C++ Programming	£37.99	£28.50
Delphi Programming for Dummies	£18.99	£14.25
50LE Wizardry	£28.95	£23.30
C: The Complete Reference	£25.95	£20.80
The Visual C++ Handbook	£25.95	£20.80
Guide to the Best UNIX Tips Ever	£23.95	£19.20
Object-Oriented Graphics Programming in C++	£29.95	£22.50
Video Compression for Multimedia	£29.95	£22.50
The Fuzzy Systems Handbook	£34.95	£26.25

Leaping from BASIC to C++	£27.00	£20.25
The GUI Style Guide	£29.95	£22.50
Agents Unleashed	£29.95	£22.50
Database Developer's Guide with Visual Basic 3	£41.67	£31.25
Object Oriented Programming in C++	£27.50	£20.65
Win 32 API - Desktop Reference	£46.30	£34.75
Developing PowerBuilder 4 Applications	£35.50	£26.65
Heavy Metal OLE2 Programming	£38.99	£31.20
Unauthorised Windows 95		
Developers Resource Kit	£38.99	£31.20
Free Stuff from the Internet	£18.99	£15.20
Oracle Performance Tuning	£25.95	£19.50
TCP/IP Network Administration	£22.00	£16.50
sendmail	£24.50	£18.40
UNIX in a Nutshell	£ 7.50	£ 5.60

ORDER FORM ON NEXT PAGE

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## Free Games

This month we have two most excellent computer games to give away.

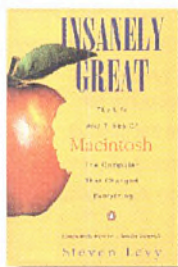
Virtual Pool (Interplay) is an authentic pool simulation game. It features accurate 3-D perspective and graphics, easy multi-player modes and trick shot lessons, and is endorsed by Steve Davis who says of it 'the whole thing is frighteningly realistic'. The game is on CD-ROM - to enter send in a postcard marked 'Virtual Pool'.



The second game featured is Striker '95 (Time Warner Interactive). This is the football game that captures all the action, thrills, excitement and atmosphere of the real thing. Features include expert match commentary by Andy Gray, full team and player edit facilities (create your own dream team) and a wide range of venues and playing surfaces. This game is also on CD-ROM - to enter this mark your postcards 'Striker '95' and send to the usual address.

## Free Books

We have one copy of 'Insanely Great - the life and times of Macintosh - the computer that changed everything' by Steven Levy to give away. It has been declared 'compulsively readable' by the Sunday Telegraph and 'Golden delicious' by EXE (April 95). The book tells the story of how the Macintosh computer came into existence and how it changed the way the world thought about computers and computer software. To win a copy send in a postcard marked 'Insanely Great'.



'Teach yourself Delphi in 21 days' by Sams Publishing will help you build a solid understanding of Delphi in just 21 lessons. The book uses easy-to-understand examples and full code listings and teaches you how to make use of the latest Delphi enhancements. Workshop sections help you to apply what you have learned. To enter send in a postcard marked 'Delphi 21'.



## Binders

The new EXE binders are selling very quickly. If you want to place an order, telephone our customer services department on 0171 439 4222 or fax 0171 439 0110. The binders cost £10.50 each and hold 12 issues of EXE.

**All competition entries must reach us by Thursday 31st August. Send your postcards to: Subscribers Club, EXE Magazine, St Giles House, 50 Poland Street, London, W1V 4AX**

### June Competition Winners:

Crossword Winner - H Partridge, Isle of Wight.

Network Security Book - David Ross, Halifax.

Borland C++ Book - Ian Brunt, Newcastle.

Wrox Press Delphi Book - G Sandlant, London, N Stoker, Tyne & Wear, Ian Brunt, Newcastle, David Ross, Halifax, Alice Mara-Potter, London.

Lasermoon - N Stoker, Tyne & Wear.



Watch out for your membership packs mailing this month!

Title	Qty	Price	BOOK PAGE ORDERS
			<b>Payment Options</b>
			Cheques or purchase orders only for the moment.
			<input type="checkbox"/> I enclose a cheque for _____
			(payable to EXE Magazine and drawn on a UK bank)
			<input type="checkbox"/> I enclose a company purchase order. Please send an invoice.
Shipping at £3.50 per order		£3.50	Simply fax 0171 437 1350 (with purchase order) or post (with cheque) this form with your order to:
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Name: _____			<b>Freepost 39 (WD 1414/29), St Giles House,</b>
Address: _____			<b>50 Poland Street, London W1E 6JZ</b>
	Post Code: _____		



**Ctrl****Break**

Please send your rants,  
raves and competition  
entries to:

**Ctrl/Break**  
EXE Magazine  
50 Poland Street  
London W1V 4AX

### Bitter Thought for the Day

'Does '24 hour support' mean that they'll call you after 24 hours?' - Anon.

### Any day now

Maximum brownie points to *P.C. Letter*, a bi-weekly (paper) newsletter, whose 'Official Vaporlist' charts a catalogue of programs Missing Suspected Poorly and the miscreants who propagate mythical tales of pending arrival. A small selection:

Product	Company	Announced	Original Date	Revised Date	Months in Vapor
Telescript	General Magic	2/93	Q4/93	Q2/94	27
Open Doc	Apple/Novell, etc.	6/93	Q2/94	Q4/94?	23
Lotus Comms Server	Lotus	9/93		Q1/95	20
'Trout' Conf	HP	1/94	???		16
Interchange	Ziff Interactive/AT&T	1/94	Q4/94	Q2/95	16
Microso...(That's enough Windows 95 - Ed.)					

*P.C. Letter* is available from Phillip R. Sutcliffe, Information Resources, Westwood House, Elmhurst Road, Goring-on-Thames, Reading, RG8 9BN. Tel: 01491 875386.

### Access All Areas

July 1995. As the rest of Britain boiled in the once-a-year heat wave the hardy fraternity of hackers sweltered manfully in the darkest depths of mysterious central London (*Get on with it - Ed*). Access All Areas, the first UK Computer Security and Hacking Conference was held at King's College on The Strand. Among those speaking was ex-*EXE* editor Robert Schifreen. Yes, he of The Great Prestel Duke of Edinburgh mail box case, resulting in the Computer Security Act.

Unfortunately Ctrl Brk was unable to make the date due to a prior arrangement with a Beer in the garden. But our Deputy Editor David Mery was there to fly the *EXE* flag.

'How did it go?' we asked.

'I bought a T-shirt' came the reply. 'I like the front a lot, but I'm not too sure about the back.'

Excepting T-shirts, one of the more cogent points to emerge from the conference was the fact that the best security tools seem to be developed not by multi-nationals but motivated individuals, and that these tools are generally to be found for free on the 'Net. In itself sufficient justification for all those hours Ctrl Break spends cruising, if any justification were needed.



### Poetry Corner

Our Editor At Large is a cultured man (it says here) with simple, but firm, tastes. 'I know what I like' he announced, 'and I like this here posting from a Demon tech support newsgroup, which looks like an e e cummings poem'. (We understand that e e cummings was a pioneer of occam, or grep, or some such lower case utility.) 'Put this in, you'll have 'em creased up with laughter'.

We defer to His Largeness. Here is the posting, reproduced (with the author's permission, although he wishes to preserve artistic anonymity) exactly as it appeared, including the subject line/title:

### lost bodies

When using demon dos based software, and posting more than one e-mail, you may be tempted to change the name of the \*.tmp file so that it is saved some other \*.tmp file.

don't do this, multiple e-mails will not overwrite each other, and doing this has caused the text body of a number of my letters to be ripped out. Fortunately they were to friends who i have regular contact with.

demon, please correct this in next version Or make the \*.tmp name uneditable (easiest). I think this on /offline software is excellent.. saves a lot of dosh.

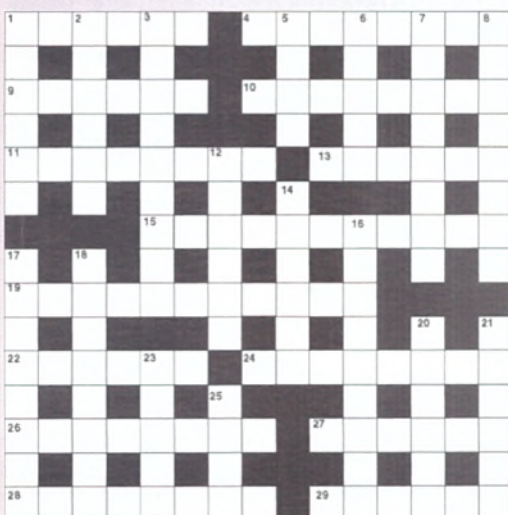
If you remain uncreased by chuckles, please send complaining email directly to willw@dotexe.demon.co.uk.

### Brion and Betty

by Neil Kerber



## PRIZE CROSSWORD



### ACROSS

- Keys to the simplest conditional (2,4)
- Get together the source statements? (8)
- Obtain second opinion on input (6)
- Check out terminal in the bottom of the castle (8)
- Repeats something about 21 (8)
- Like Lady Diana on Saturday somewhere (6)
- Practical appliance of knowledge re software to us (11)
- Remarks on printout (11)
- Story of New Testament shows real skill (6)
- Declare and find yeti somehow (8)
- Record presence in very immediate cell (8)
- Symbol for aluminium in the message (6)
- Lard feud? No way! - that's terrible (8)
- Bits of bits in a parallel process (6)

### DOWN

- Get NOTted! (6)
- FOR x: 1 TO 3 should do it (6)
- Such a program does things right (9)
- Network at the top of the bill ... (4)
- ... outside as well (5)
- Comes board with a shot inside (8)
- Twilight working time - not for odd people (8)
- Maybe crews from 'Byte' ... (6)
- ... save? (6)
- Totally necessary as petrol in France maybe (9)

- Got data by force? (8)
- Good model of wavy 27 (8)
- Link between IT and molecular engineering? (6)
- Units of machine action on the road (6)
- Sensed information as child rose over Will Watts (5)
- Mouth-watering options list (4)

### SOLUTION TO JULY'S CROSSWORD

**ACROSS:** 1. UTILITY 5. DISOWNS 9. DECKS 10. WINDOWING 11. THEIR 12. INTERFERE 13. SIEVING 14. SIGNBIT 17. LATENCY 19. RUNTIME 21. GROUPINGS 24. REFER 25. COTTAGERS 26. TRAIN 27. LOLLIPS 28. SORTERS **DOWN:** 1. UPDATES 2. INCREMENT 3. INSERTION 4. YAWNING 5. DENOTES 6. SCOUR 7. WRITE 8. SEGMENT 15. GENERATOR 16. BRIEFCASE 17. LOGICAL 18. YANKEES 19. RESISTS 20. ERRANDS 22. OCTAL 23. PLANO

There are three great books to be won as the prize for the winner of this months crossword.

Send your entries to the address above and you could be in with a chance to win 'Insanely Great' by Steven Levy, 'Hackers' by Steven Levy and 'The Whole Internet' by Ed Kroll.



# Modem tales

'Kids' stories, that's where the money is', Ms Stob's elder sister Parity advised our columnist. With the following consequence.

Once upon a time in Brixton, it rained dongles. When the children came out of school, there were brightly-coloured puddles of small plastic objects all over the playground that went *scrunch!* when you trod on them. A little girl bent down and picked one up and, sure enough, it had a two-way 25-pin D-type parallel connection on each end, with a nearly uncrackable encryption algorithm embedded in the EPROM within. 'They're dongles!' she cried happily, and all the children cheered, and started running around gathering up as many as they could. One of the boys discovered that you could fit a whole lot of dongles together into a wobbly kind of stick, and in another minute the biggest pretend-sword fight you ever saw broke out, with everybody waving clipped-together dongles in the air.

Soon lots of grown ups came out to see what the noise was all about, and they too began to gather up dongles. Women collected armfuls of them, and put them in bowls around their houses and tied them up with colourful head scarves into pretty bundles. The old people brought wheel barrows and took away tons of them to hoard for winter fuel, which was a silly thing to do as dongles don't burn that well, and give off noxious fumes when they do. The local gay population discovered that some of the precipitation comprised 'gender-benders' rather

than dongles - they hunted these out specially and proudly hung them through their pierced noses and nipples.

Everybody had such a splendid time that by evening there were hardly any traces of the rainfall left, except the occasional piece of splintered plastic casing or blob of epoxy resin in the gutter. And although, to this day, it is a buyers' market for software protection devices in Brixton, I don't believe that they have ever had such a marvellous rainfall again, nor have they in Southend, nor Gateshead, nor Aberdeen, nor even Truro.

\*\*\*

There once was a man who took courses. He was trained in Basic C, and C++, and Advanced C++, and C++ for Unix, and Object Oriented Design, and Object Oriented Analysis, and Powerbuilder, and Open Systems, and British Computer Society Part II, and Relational Database Management, and Theory of Image Enhancement, and Implementing ISO 9000 in a Small Company, and FoxPro. He lived in a software house with five friends, and whenever they said to him 'Hey, let's sort out that bug in the print preview routine', he would say 'Sorry, I'm off to a SQL Windows for Engineers course this week', and when they said to him, 'Please could you put

together a rough spec for the Waterhouse job' he would say, 'I'd love to, but I'm keeping my nose buried in this Prolog book - remember I'm off to Cirencester next week for Advanced Artificial Intelligence'.

As time went by, his five friends understandably became rather hacked off with this, and in fact ceased to be his friends. One day they said to him: 'Gordon, if you don't stop going on courses, and start doing some actual work, we are going to sack you.' The man went red in the face, and said: 'If that's your attitude, then I'm off' and he resigned in a huff.

The man went and applied for a job with a big corporate, and because the big corporate had a stupid personnel department - unusually thick even by the standard of such departments - and because the man had a huge number of certificates and qualifications and what not, he landed a plummy role at more than £60k, for which all he had to do was sit around in his office reading the paper, and occasionally do yet more courses.

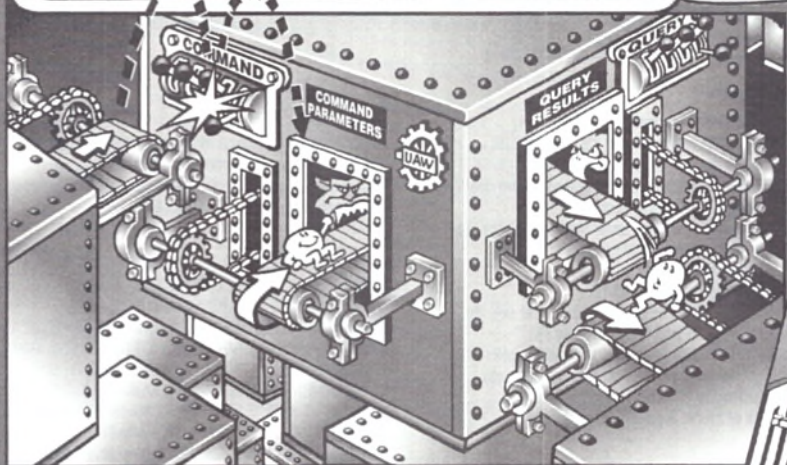
Meanwhile his old company, dragged down by excessive training costs, went under, and the five ex-friends ended up working under the man at the same corporate, only for one quarter of his wages, and with no car allowance.

*Moral:* Some buggers seem to be able to get away with it.

## OBJECT LESSONS

OL-sn01  
© 1995

BILL PROCTOR

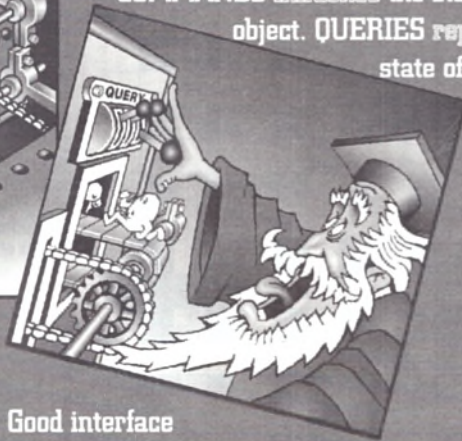


Object orientation is a simplifying technique in which program modules ("classes") function as blueprints for creating a fabric of smoothly interacting object state machines.



The compiler assures that object interfaces are properly referenced and that objects passed between other objects are compatible.

COMMANDS influence the state of an object. QUERIES report on the state of an object.



Good interface design is vital to successful object oriented software construction.



# Memory debugging does **not** have to be **painful.**

## Case #1: Leaks

### STEP 1

**HeapAgent ties leaks to specific objects, not just to source lines.**

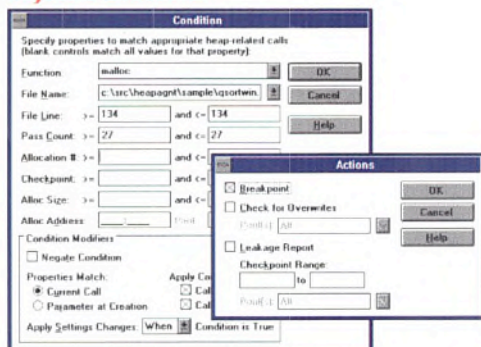
All leakage tools give you the source line responsible for the leak. However, in too many cases, a single line allocates hundreds of objects, while only a few leak. So you're still left in the dark as to precisely where the leaks are. HeapAgent reports the file, the line, and, for source lines that allocate more than one

Address	Contents	Size	Alloc	Check	Created By	File	Line	Pass	State	Read Only	No Free	No Realoc
242F:1500	smith\ud0	6	819	1	new	qsorwin.cpp	39	3	in-use			X
242F:1600	jones\ud0	6	818	1	new	qsorwin.cpp	39	2	in-use			X
242F:1630	fred\ud0	5	817	1	new	qsorwin.cpp	39	1	in-use			X
242F:1800	doug\ud0\ud0\ud0\ud0\ud0	815	1	new	qsorwin.cpp	16	1	in-use				
242F:1B04	C:\SRC\HEAPAGT\SAMPLE\QSORTWIN.CPP	431	1	new	qsorwin.cpp	134	27	in-use				
242F:1930	C:\SRC\HEAPAGT\21	11	1	new	qsorwin.cpp	60	1	in-use				X
242F:1904	ud0\ud0\ud0\ud0\ud0\ud0	10	1	new	qsorwin.cpp	110	1	in-use			X	
242F:190C	ud0F\ud07A\ud04	14	0	1	new	qsorwin.cpp	22	1	in-use			

object, a pass count. The pass count tells which pass of the line allocated the object, thereby tying each leak to a specific allocation and simplifying diagnosis.

### STEP 2

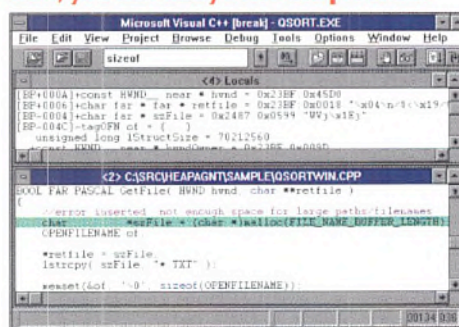
**Break precisely when a leaking object is allocated.**



HeapAgent not only reports the crucial pass count but also lets you put this information to good use. You can establish a *heap-event breakpoint* that lets you break to your debugger exclusively on the pass that allocates that leaking object.

### STEP 3

**Now, you can easily solve the problem.**



HeapAgent has caused a break just as qsorwin.cpp line 134 allocates its 27th object. Now that you're in your debugger, you can examine how the leaked object is used and why it was not freed.

## Other errors detected

- ✓ Overwrites beyond end of allocated blocks
- ✓ Underwrites before beginning of allocated blocks
- ✓ Overwrites over internal heap data structures
- ✓ Wild overwrites
- ✓ References to data in uninitialized allocations
- ✓ Writes into freed allocations
- ✓ References to data in free allocations
- ✓ Double-frees
- ✓ References to non-shared data owned by another task
- ✓ Changes to data in allocations marked "read only"
- ✓ Premature frees
- ✓ Unexpected resizing of allocations
- ✓ Invalid parameters to heap-related calls
- ✓ Retained references to reallocated memory
- ✓ Leakage – allocations not freed at end of program
- ✓ Leakage – at other points in program
- ✓ Leakage – filtered subset of allocations

# HEAPAGENT™

The only tool that both detects memory errors *and* pinpoints their cause.

**See for yourself! Try our FREE working model.**

**Call, fax, mail or email System Science today.**

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CIRCLE NO. 268



# Software Developers: Software Piracy Burns Your Profits.

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**COMDEX/Fall '95**  
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Each year, the illegal use of software consumes nearly 50% of your potential revenues. With the flames of piracy eating away at your profits, can you afford not to protect your software?

Software Obtained Illegally, by region, 1993 vs. 1994

Africa/Middle East	\$666,440,105 392,687,055
Asia	\$3,963,527,364 4,350,981,640
Europe	\$4,900,882,960 6,002,681,255
Latin America	\$821,992,751 1,334,894,665
U.S./Canada	\$2,487,360,944 3,131,455,600
<b>Total for 1993:</b>	<b>\$12,840,204,124</b>
<b>Total for 1994:</b>	<b>\$15,212,700,215</b>

Source: BSA

HASP® is widely acclaimed as the world's most advanced software protection solution. Since 1984, thousands of leading developers have used over one million

HASP keys to protect billions of dollars worth of software.

Why? Because HASP's security, reliability, and ease-of-use led them to a simple conclusion: HASP is the most effective software protection system available.

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