23,20

## EXIT:

The Software Developers' Magazine

## On the road to Cairo

Windows NT 4.0

## Stallman: Coder of ethics

Fixing C++

Slicing as a debugging technique

Reviews: Fusion and Objective Toolkit





## The Software Developers' Magazine

1 October 1996

Dear reader,

As you may well notice, this issue of *EXE* is missing all quotes and extended characters in all the articles. To be precise this concerns all non-standard characters in the Century Schoolbook serif font used for the body text. This problem happened at our typesetter who is investigating the matter. We didn't discover it until we received the first printed copies.

It is unfortunately impossible to reprint the issue since we have to book slots at our printing and mailing houses long in advance. We have no choice but to mail you the issue the way it is.

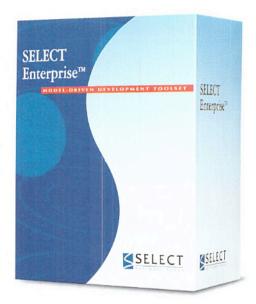
I would like to express my sincere apologies and hope it will not spoil your enjoyment of *EXE*.

Yours.

David Mery, Editor

(dmery@dotexe.demon.co.uk)





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## The big vote

In the August issue s letters page we asked for comments on the handwritten style used for code in Francis Glassborows regular column. We set up a special page on *EXE OnLine* for a vote on the subject. First, a word of thanks to all who took the time to come and talk to us about it at various exhibitions and to those who participated in the vote.

There is a contrast between the result of the Web-vote and the live discussions that we had. The Web-vote has been fluctuating but is mostly in favour of the printed version. On the other hand, most of the readers who talked to us were in favour of the handwritten style. Does that reflect two different psychological profiles within our readership?

Here are some of the comments we received, in no particular order:

This printed version is so much easier to read and to copy from if necessary — it s the format you normally see your own code in anyway.

Interesting typefaces r us.

For readability of specific examples, I would prefer the typefaced style. However, the handwritten style would be very suitable for presenting pseudo-code examples where a rough idea of what is needed would be sufficient to pass an idea across.

Standard Please!

Vol 11-Issue 5 / October 1996

Although I do handwrite some small code specs, I find that it doesn t scan as readily as printed text. I suppose it s what you re used to — after all most code is printed text.

Perhaps a script-like typeface could be used instead of pure hanwritten script?

I think that a font that has very distinctive curly braces would be preferable. Many Courier fonts make a curly brace look too much like a parenthesis.

The script idea is good but its just not legible enough:-)

The handwritten script style is just too cute. However, your use of braces, although styled after K&R C is what I object to. In particular, scope indentation and visually matchable braces contribute the most to readability. I m particularly partial to what might be described as the Plum Hall Style.

Would you accept code written on the back of an envelope for review? Would you publish an article I d scribbled on the back of the proverbial pack of 20? I think not!

I prefer the non-handwritten style.

Love the handwritten version!

I have been in contact with Francis regarding one of the problems a few months ago—there was a typo in the code—and he told me that he didn t write the code fragment: it was someone in the office. Since the purpose of the column is to get us to think about the operation of the code it shouldn t have additional errors in it! I would hope that the normal form is taken from working code fragments—so has possibly seen a compiler and is not subject to copying errors.

I quickly lose my place with standard code style—it all looks the same so if you look away for a moment there is nothing to drag your eye back to the last line you read.

The handwritten code uses more bandwidth and is full of recognisable features that help you find your place again.

Handwritten. Also please can you more carefully copy-edit your code fragments? Experienced programmers don t mind but beginners probably find it a bit confusing...

Francis s code looks the way my code looks in my head before I type it.

As can be seen from the small sample above, readers tend to react strongly either for or against the handwritten style. Since there is no clear cut vote either way, I ve decided to keep it (I ll leave it to you to guess which I voted for). But let me go through some of these comments: the code is handwritten in-house and any transcription error

is our fault and not Francis s. So far there have been a few — not many, but still too many. We will take extra care to ensure that the transcription is faultless. The layout of the code is as per Francis s indications. This code has not seen a compiler at *EXE*, but since most snippets contain some potential errors or are just guidelines it would not do much good to compile them. We are currently in the process of experimenting with script-like typefaces so stay tuned.

Ed

## Some lose a dot, some win a dot

or those old time readers, PR contacts et al, EXE is called just EXE (and it still rhymes with sexy). We suppressed the initial dot more than two and a half years ago! Please get used to it. The only place where we kept the dot — spelled out, mind — is in our email address, just to add to the confusion.

What build is your NT 4? Microsoft produced one day s batch of NT 4 CDs before finding some problems with it and stopping the production line. This version of NT at boot-up displays (Build 1381) - without the quotes, According to Mark Hassall, BackOffice Product Manager at Microsoft UK, this CD was just shipped to a handful of journos in the US and didn t make it across the bit of water. Hassall told us that Microsoft found a minor application bug . The corrected version was none other than (Build 1381). still without the quotes. Have you spotted the difference? The bug was supposedly too minor to justify a new build. Several messages in Usenet newsgroups suggest that it might be in fact build 1384. And the bug? I haven t manage to find a dotless build so I can t say for sure, but the wildest rumours have been heard

David Mery

# Mayhem

verybody in the world has their little secret. You know that it s wrong. You regret doing it. And then, years later, when the tabloids suddenly object to you being a cabinet minister, they dig up your hideous skeleton and hound you from office with your tail between your legs. Well, I too have a little secret, and if you promise to tell nobody, to keep it just between us, I ll tell you what it is.

I just accepted a programming job in Visual Basic.

Okay, I realise that doesn t have the earth-shattering implications of Whitewater or porking one s secretary, but for me it s really something. I can t stand VB, and I always swore I d never have any truck with it, but I accepted the work anyway.

My client is in the nichiest of all niche markets. He has found a task that everybody hates, but that everybody has to do because it s part of the job — for those very few people who do the job, that is. He s computerised that task, and although he s done little more than create a library of common solutions, he s built in some sweet optimisations and cute graphics, and made a program which is a genuine pleasure to use.

There s something else you should understand. My client was, and is, an expert in his field — but his field is not programming. He knows how to solve his problem, and when he writes a program to express that solution, he s not interested in language purity or efficiency of execution. He just wants to write a simple, workable program. It was people like my client who built our industry, it was people like him who invented most mainstream applications before they became mainstream, and it s people like him who make computers into the genuinely useful general-purpose tools that they are.

Originally, his program was written in Quick Basic, but his customers started to demand a Windows version, and he was forced to translate it. Presumably, just like lots of other semi-professional programmers, he thought that a tool called *something* 

If Windows tools were simpler,

Jules May could hope to avoid them...

Basic would be roughly the same language and he d have no real problems making the conversion. And, just like a lot of other semiprofessional programmers, he discovered that instead he had to learn to program all over again.

What VB does, it does very well, and I d be the first to admit it contains some very good ideas indeed. However, the moment you try to do anything which the designers didn t anticipate, the language suddenly turns against you. In many cases, it s easier to switch to C to accomplish your task than to fight with VB itself. That s why my client needed help. He had done as much as he could with his program in VB, and needed help to take it any further. The very tool which had promised him the easy ride he needed had dumped him.

That s why I object to VB so much: switching to VB is by no means as easy as it s claimed to be, and if a programmer is going to invest the time needed to learn it, he may as well learn how to use a more general tool. This, I suppose, is the motivation behind Delphi. Unfortunately, Delphi doesn t pretend to offer the easy learning curve that VB does, and the neophyte Delphi programmer must spend a long time getting started. For all its advantages, Delphi can thelp my client either.

The differences between modern languages derived from Pascal, C and Basic are diminishing every day. The nitty-gritty of syntax can no longer hide the fact that they are all block-structured, procedural languages, universally considering goto as harmful. Pascal has the advantage of the static link, but even that is rendered relatively useless when it s cast into an object-oriented form. Language design is virtually



stagnating, which would be fine if the currently available languages could do what is demanded of them, but they can t.

We have known for some time that programming is in a state of crisis. Building applications is becoming more difficult and expensive with each passing day, and the reliability of the resulting software is questionable at best. Programming nowadays is done by experts, using languages designed by experts, and even they have a hard time. If the massed ranks of professionals are finding things so arduous, isn t it ridiculous to suggest that semi-professional and amateur programmers can write decent code?

Actually, no it s not. Programming was just as difficult back when it was done on kitchen tables using Dartmouth Basic. In those days, people may have Im sorry Jules, bu Jou've written smaller pro-

grams, but every-

body was at it,

and there were

more programs

in circulation. Programming today is difficult precisely because it s a large, centralised undertaking. The languages are old-fashioned precisely because commercial programmers must control every aspect of the machine in order to make their programs slick and fast. That s why programming is expensive and unreliable.

But semi-professional programmers don t need to add that much polish to their programs. They need to be able to throw some functionality together, tinker with it until it looks nice, and expect it to work. Semi-professionals are not writing monolithic wordprocessors: they re writing specialist niche applications that you and I wouldn't even think of. They don't need to produce million-line pro-

grams; they could make a good living

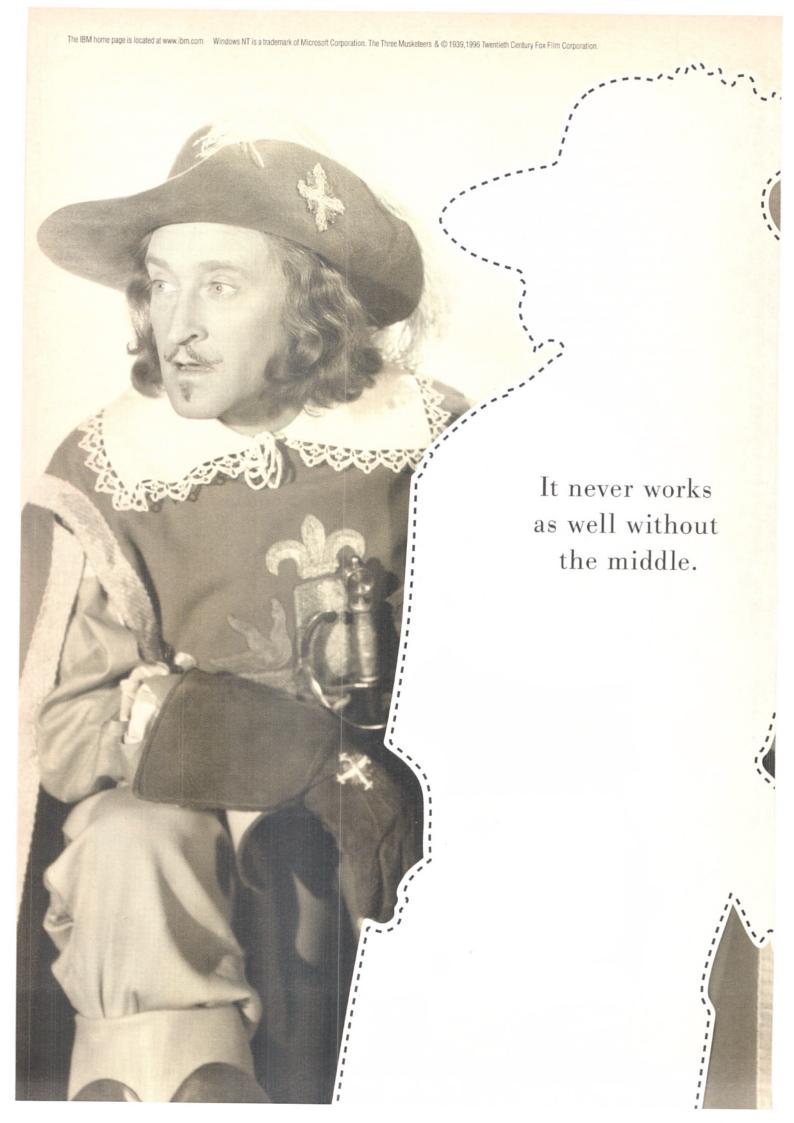
from five thousand line programs, if they could only get to write them.

The funny thing is, experts need the same thing: to be able to assemble simple functionality to demonstrate their ideas, and then gradually refine the functions until the program works properly. Being able to mess around with a program until it comes out right is not the wicked and pointless hackery it s made out to be. Far from it: fiddling with a program is how you refine your ideas so that you can know it solves the problem it is intended to solve.

I m not going to suggest that Dartmouth Basic was a major contribution to software engineering: it was ugly, slow, and riddled with peculiarities. But it did democratise programming, and I think that s what s missing from modern tools. We don't have any effective Windows tools with the simplicity of Dartmouth Basic, Logo, or Forth (although versions of these languages have been tweaked to work under Windows), and my client needs one.

On the other hand, I m not going to write it. If I did, he wouldn t need me any more.

Jules used to be a programmer. Now he works in VB. He can be contacted on 01707 662698, or on cix as jules@cix.compulink.co.uk





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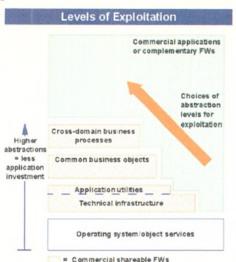
## IBM joins Java in San Francisco

IBM and more than 50 international partners are set to join the Java riot with the San Francisco Project. The initiative, announced at Object World West, will define a series of Java-based high-level application frameworks for building business-critical applications.

The first roll-out of the vertical Shareable Frameworks next year will deliver a base of services, classes and utilities to provide a consistent interface for building distributed multiplatform applications, as well as a core of objects common across many business solutions, such as general ledger, accounts payable and inventory control. The project aims to use the Java virtual machine to provide hardware isolation, and IBM intends to support the frameworks on NT, AIX, AS/400, MVS, HP-UX and OS/2.

Future extensions to the project are being discussed by advisory groups set up in Europe, America, Asia and the Middle East.

The project is by no means alone in the race to define standards for distributed business objects. The Object Management Group (OMG) is currently in the consultation stage for defining its own CORBA-based standards, and Microsoft is pushing its rival DCOM-based LOBjects vision. However, none these technologies will be available until some time next year, and in the meantime proprietary frameworks from enterprise ISVs like SAP America and SSA are multiplying rapidly.





Sun Microsystems has announced a new webenhanced version of Solaris 2.5.1 for SPARC and Intel platforms. Sun claims the platform can offer internet server performance improvements of up to 300%. Sun Microsystems: http://www.sun.com

IBM and Netscape have announced the development of a native OS/2 Warp 4.0 version of Netscape Navigator that will support native speech recognition and navigation. The product is currently in beta testing. IBM: http://www.ibm.com

Sunsoft has licensed technology developed by IBM subsidiary Taligent to add support for key components of Unicode to Java. Demos are available at http://www.taligent.com

Contemporary Software has packaged its three most popular award-winning ActiveX controls into the Sheridan Components Suite. The suite contains the Calendar Widgets, Data Widgets 2.0 and Designer Widgets 2.0 toolkits, and is available for £250. Contemporary Software 01344 873434

The Sun User Group has been restructured into the Sun User Forum, to provide a more practical and commercial focus for members. Info from http://www.SunUserForum.org or call Jane Morrison on 01763 271894

## Netscape supports OMG's IIOP as the ONE standard

Netscape has thrown its weight behind the OMG s Internet Inter-ORB Protocol (IIOP) as the standard for internet-based business applications. It has licensed Visigenic s VisiBroker for Java ORB for inclusion in both Netscape Open Network Environment (ONE) and Galileo, the next version of Navigator.

VisiBroker is a CORBA 2.0 compliant ORB that is fully implemented in Java, enabling client code to invoke methods on objects distributed over webs as if they were local to the applet. It implements all of the standard s features, including support for fault-tolerance, load balancing and secure bridging, and can use Netscape s Secure Socket Layer for extra protection.

Netscape s Open Network Environment (ONE) is intended as an framework for development and deployment of network-centric applications. It incorporates both existing and new internet standards such as HTTP, HTML, the Lightweight Directory Access Protocol, Java, JavaScript 1.1, and the Internet Foundation Classes, alongside Netscape s Client and Server Plug-in and security APIs. Another feature is LiveConnect, a common object and messaging model for communication between Java and JavaScript applets, Plug-ins, and ONE services. Platform-specific object models can use this service through the Java Runtime Interface (JRI) API.

Supported by more than 50 companies, the environment is part of a drive to evolve HTML beyond a document description standard into a platform-independent framework for specifying application components and interfaces. Netscape is pushing this independence, along with claimed superior security, as an advantage over Microsoft's ActiveX platform.

Netscape: http://home.netscape.com

## Microsoft's internet tools improve security

Microsoft has released betas of CryptoAPI 2.0, extending the high-level support for authentication, signing, encryption and public key infrastructures provided in version 1.0, currently shipping with Internet Explorer 3.0 and NT 4.0. (Macintosh and 16-bit Windows versions will be shipped in early 1997).

The API provides an operating system-level interface to third-party cryptographic service provider (CSP) modules that deliver cryptographic technology from specific vendors, currently including BBN, Cylink and Spyrus and Microsoft (based on technology from RSA Data Security). Separating the technology in this way avoids export issues, and enables improved ciphers to be used as they become available.

Microsoft is using the technology to reinforce the COM standard, providing a set of COM interfaces encapsulating the API s functionality available on its Web site. These interfaces make it possible to access the API from languages like Java and Visual Basic.

CryptoAPI: http://www.microsoft.com/intdev/security/



The Windows NT Show on 2<sup>nd</sup> October will see the launch of **Braintree's NT Auditor**, a new security auditing and management application.

Braintree: 0161 945 1511.

Intasoft has released version 3.4 of its change, configuration and version control tool AllChange. The new release can be fully integrated with MSCC compliant tools like Visual C++ and VB, and costs £3457 for a 5 user licence. Intasoft: 01392 217670.

Metrowerks is set to add support for the Sony Playstation to its CodeWarrior development environment. The Mac OS version is available now, with a Windows version due by the end of the year for \$499. http://www.metrowerks.com.

Rogue Wave has released version 2.0 of its

LAPACK.h++ linear algebra class library, which now uses templates, enabling developers to use their own numeric types. The library costs £675 for Windows (95 & NT), OS/2 or UNIX versions, with an optional accelerator module available for £395. Contact Grey Matter on 01364 654100

Logic Works and Rational Software have released an integration link that enables object modelling tool Rational Rose and database design tool ERwin to exchange metadata. The link is available free of charge from http://www.logicworks.com

## Be up to date

Developer Release 8 of the BeOS operating system has shipped with integrated support for 3D graphics, mail, the internet and remote login capabilities.

The multiprocessor OS integrates modular SMTP and POP-based email support into its built-in database, and includes an object-based web browser. Developers will be able to take advantage of new user interface elements, direct access to graphics hardware via the Game



Kit, and lightweight 3D graphics with the 3D Kit.

Be has also announced a partnership with Metrowerks, aiming to integrate support for the Java environment into a future version. Java development facilities are set to be incorporated into the CodeWarrior for BeBox development kit.

The new version of BeOS supports a much wider base of hardware devices, and Be has reaffirmed its intention to support machines other than its own BeBox by demonstrating an early version of BeOS for PowerPC-based Macs at the MacWorld exhibition last month. The company is discussing its plans for this technology with Be developers, and expects to introduce a product based on it early next year.

▶ URL: http://www.be.com ▶ Be Europe: +33 1 49 06 73 77

## Photon microGui brings internet to embedded systems

NX Software has added internet access capabilities to version 1.1 of the Photon microGui for its QNX realtime OS for embedded x86 systems. The new release incorporates a news reader, an email program, and a web browser based on embedded web technology from Spyglass, the company that provided the technology for Microsoft Internet Explorer.

Like QNX and Photon, these components are highly modular, enabling designers to scale functionality up or down to suit memory and processor requirements. To ease internationalisation, Photon supports Unicode UTF-2, and has an application builder with a language editor that lets developers translate applications into several languages and still keep a single executable. QNX-based embedded applications can be controlled or monitored in graphics mode from Windows (3.1, 95 & NT), OS/2, or X-based Unix, enabling control functions even for embedded systems with no graphics hardware.

▶ URL: http://www.qnx.com ▶ QNX UK: 01923 284800 ▶ email:QNXeurope@QNX.com

## Developer Academy II: Java Academy!

This year's Visual Tools Developer Academy was a riotous affair. Most delegates agreed that the move to a new location at Keble College, Oxford University from the previous site at Cambridge was worthwhile. Most of the sessions were well-attended, in particular the Advanced C++ Techniques presentation—which took an hour and a half to present but three days to comprehend—and those on VB Script. Late and Wild sessions in the evening were notable for the enthusiastic audience participation.

Developer conferences are not all about hard work, of course, and the organisers laid on entertainment every evening including jugglers, illusionists, giant Scalextric tracks, a gala dinner and the obligatory pub crawl. Many delegates were keen to return next year, and agreed that the unique location together with the friendly organisers made for an interesting and successful four days.

The next event in the Developer Academy series supported by *EXE* will be the Java Developer Academy, to be held between 18-21 November at the Royal Agricultural College, Cirencester. Speakers will include Steve Elliott and Paul Bellchambers of Sun, Carl Christensen of Domino Systems, and Dr Hans Rohnert of Siemens Germany, and topics of discussion will include AWT, Java APIs, VRML, and the Network Computer concept. As with the Visual Tools Academy, one day will be given over to in-depth tutorials. Various pricing options are available, depending on the length of time attending and whether or not accomodation is required.

- ▶ For more information or to reserve a place, call Emma Hilditch at Interactive Information Services
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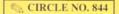
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Contrary to information received in time for the September issue, Windows NT Workstation 4.0 shipped to manufacturing on July 30<sup>th</sup> with support for Distributed COM. Although DCOM has been around in the guise of remote automation, this is the first time it has shipped in a base operating system (see On the road to Cairo in this issue).

Visual Components' new Geopoint is a 32-bit ActiveX component that renders MapInfo and AutoCAD with thematic shading based on data categorisation. It costs £180 from Grey Matter: 01364 654100.

The ObjectSuite product family from Visual Numerics has been extended by the IMSL Charting Module for C++. The library supports many 2D and 3D charting functions on Windows 95 & NT, and costs £495.

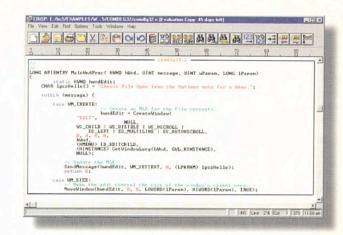
Grey Matter: 01364 654100.

Oracle Corporation has made Windows NT a 'tier-1' port of the Oracle7 database engine. As such, future releases of the NT version will appear at the same time as other platforms. http://www.oracle.com/.

French company **DFL** has created a trio of **ActiveX** controls for internet developers. Light Lib Images, Light Lib Business and Light Lib Multimedia can be used to add complex multimedia and charting features to pages. The controls will be available from October 10<sup>th</sup> for \$199 each. DFL: http://www.dfl.com

## **CRISP and dry?**

any software profes-VI sionals find it traumatic to move to another platform and find their chosen editor not available. For Brief enthusiasts who ve been looking for a 32-bit solution. Pacemaker Software has CRiSP 5.1, the latest version of its multi-platform editor. CRiSP is fully Brief compatible and features a C-like macro language. The editor integrates with a number of popular development tools including Microsoft Visual



C++ and the Java Development Kit. Colour syntax-highlighting is available as standard for 30 languages (including C++, AWK, Pascal, PostScript, TeX and HTML) and more can be defined.

All the usual features are there such as auto-formatting, bracket/brace matching, search/replace using regular expressions, and the curiously-named Sanity Checking which resolves conflicts where multiple users have amended the same file. Pacemaker is at pains to point out that not only developers use CRiSP: apparently, other professionals from geophysicists to clinical technicians find it handy as well. This versatility extends to the range of platforms covered, which includes Solaris, SunOS, SCO Unix, Linux, Windows 95/NT and 3.x, and OS/2.

Pricing varies according to platforms and number of users, starting at £75 for a single-user Linux licence. Contact Pacemaker for more information.

Pacemaker: 01666 840333
Fax: 01666 840260

## Novell releases Green River and calls it IntranetWare

Novell launched NetWare 4.11 or IntranetWare, and release 5 of its GroupWise messaging offering. Both products feature some remote Web access. In GroupWise, all the mailbox functions, including viewing the directory, can be accessed via a standard Web browser (HTML 1.0). In IntranetWare, the network management traditionally locked to a particular console can be operated remotely via a browser. IntranetWare is fully SMP out of the box (up to 32 processors). Both IPX and TCP/IP are supported, IntranetWare is shipped with NetWare/IP 2.2 and DHCP. The current offer is only IPv4 but Novell is expected to release IPv6 support sometimes next year.

The NetWare Application Launcher (NAL) lets network manager control which desktop applications a user has access to. In addition to the benefit of this central management, it s a first step towards independence between the user and his machine. A user can log on any computer and still have access to the same applications.

According to Novell, IntranetWare is network C2 ready . Since a product needs to be shipping to be certified, Novell will have to wait to finish its certification process. The C2-level security covers the entire network from the client to the server. To ease migration to this release, Novell provides DS Migrate (from Preferred Systems) and some automatic hardware detection. NetWare Web Server 2.5 is included as well as 32-bit clients for most other operating systems.

Novell UK: 01344 724000 UK Web site http://www.uk.novell.com/uk/ Price TBA

## European Java DevCon shows wide interest in 'Active Java'

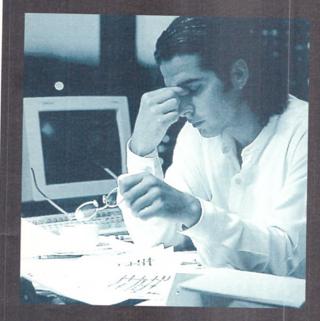
Microsoft's recent Java DevCon in London attracted a great deal of interest from software developers and IT managers, even though most of those present admitted to not having written any Java. Those who had done so admitted that it wasn t yet a primary business concern. Most delegates felt that it would soon be a major concern, however, and the majority expected to have to write either all or at least a significant proportion of their work in Java within the next year.

Among the speakers from Microsoft US was Greg DeMichillie, head of the development team responsible for Visual J++, version 1.0 of which was exclusively released to UK developers at the conference before its release in the US. DeMichillie faced complaints from angry delegates who have been unable to run the release versions of several Microsoft products including Internet Explorer 3.0 and Visual J++ second beta because of the delays in getting retail NT Workstation 4.0 out to MSDN subscribers.

Most sessions in the conference concentrated on building active Internet content with Visual J++, rather than pure Java development. Particular emphasis was put on making COM work with Java, and on DCOM under NT 4.0.

Microsoft: 01734 270001 Fax: 01734 720002

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London W1V 4AX, or email **editorial@dotexe.demon.co.uk**. Your letter will be
considered for inclusion unless it is marked 'not for publication'. Letters may be edited.



## Bless you!

Dear Sir,

Bernard Greenberg's letter explaining the pgazonga message in Multics Emacs was fascinating and amusing, but Bernard might care to know, as a self-confessed language buff, that gazonga did not originate as a comic-strip phoney Italian word from the 30 s or 40 s. It s cod German and dates from the First World War.

In the same way that homecoming Tommy Atkins Franglaised countless French idioms (eg a ne fait rien into San fairy Ann), he changed Jerry s exclamation of Gezundtheit! when someone sneezed (roughly our Bless you!) to Gazonga! or, more commonly, Gazonka!, Gazonks! or even Bazonka! This has long since died out of colloquial English but used to be very widespread and survived for many decades.

As late as 1960 or so in darkest South Pembrokeshire, my mate s seventy-something Grandad would still merrily cry Gazonks! if you sneezed near him. And at around the same time, Spike Milligan published a poem starting:

Say Bazonka! every day! That s what Grandma used to say Hardly IT-related, but interesting, ja?

Robert Sproat London

This is utterly fantastic. My deepest gratitude.—Bernard Greenberg
My favourite homophonic translation is the following by Fran ois Le Lionnais: Un singe de beaut est une joie pour l'hiver for A thing of beauty is a joy forever.—Ed

## Merlin: RIP OS/2?

Dear Sir.

Was your comment column Merlin: RIP OS/2? written simply to provoke a response? If so, I suppose it has succeeded. Taking the points in order: there have been a lot of beta tests that were really publicity stunts. But the Merlin beta is a genuine test programme. Of course there are bugs in the beta — that s why beta tests are run.

Have the newsgroups gone quiet? While the beta was active, there was a lively discussion forum on CompuServe. Personally, I just don t find Internet newsgroups a particularly valuable resource.

If the user interface weren t revamped, people would complain. So why complain when it is?

Merlin will run perfectly well in 16 MB, which is now essentially the standard for any graphical OS. For voice processing or software development, or other special applications, more is needed, not unreasonably. The real beta test took place almost entirely in the US. So inevitably the voice recognition was based on American speech.

Install problems were a major part of the beta test. But reports from the US of the gamma version indicate that the release version will be much more solid.

Is it *bad* for OS/2 to be the first operating system to have built in support for Java? Wouldn t computer users *like* to have operating system independence?

The OS/2 user community is alive and well, and rather bored with forever reading obituaries for OS/2. Are the users of other systems so insecure that they have an overwhelming desire to see everything but their chosen system abandoned?

Martin Brampton euros2@ibm.net

Martin edits EurOS/2 magazine, available at http://www.moorestephens.com/euros2/ I m sorry if you took my article to be an exercise in OS/2-bashing: it wasn t meant that way. The point I was trying to make is that IBM has had a great 32bit OS for years and yet has totally failed to make an impression on the mass market. Unfortunately, what it does not understand — and Microsoft clearly does - is that it s no good having a sound architecture and advanced OO design if the user interface is not consistent and support for common hardware is poor. OS/2 is technically a better OS than Windows 95, I agree, but that does not make up for sloppy interface design. IBM has had half a decade

to get this right - and yet it never has.

Voice recognition: is it a gimmick, or not? If not, then we have to take IBM seriously and count it as part of the base operating system, in which case 32 MB RAM is a reasonable minimum to run Merlin as it was intended to be used. If it is a gimmick, then why bundle it in the first place?

Let's face reality. I install Windows NT: it takes half an hour, autodetects my network settings and allows me to use my display adapter to the highest resolution in the best refresh rate. I install Merlin, I have to quit halfway through because I didn t write down all the network card details I needed, then it refuses to drive my display beyond 1024x768 and when it does that, it insists on interlacing. These are both beta products, so that s not an excuse. Which system do you think I m going to persevere with? These are the problems that real users face, and this is the problem that IBM continually fails to face. If OS/2 dies, it won t be because it s not a great OS - it is. It will be because IBM, after all these years, still cannot see the wood for the trees. - Neil Hewitt

## QuickStart

Dear Sir,

If you are as minimally enthused by the Windows 95 desktop as I, and are more conventionally endowed with a C compiler than Dave Jewell's Delphi, you might be interested in my translation of his QuickStart utility to VC++. Forget the W95 Desktop; QuickStart is the utility to have running all the time.

The VC++ code is available on *EXE* OnLine, and at our own Web site, being http://www.poptel.org.uk/phdcc.

There is little about the VC++ code that is different from the original. I haven t provided an ICON, leaving this as an exercise for the reader. A more ambitious exercise might be to use quicksort to arrange the menus in alphabetical or whatever order.

John Cant johncant@in-net.inba.fr

# On the road to CAIRO

Windows NT 4.0 vastly improves on the networking and internet capabilities of previous versions, but can it fight off NetWare 4.11? **Karl Dallas** finds out...

he fact that Microsoft and Novell are shipping significant upgrades of Windows NT and NetWare at roughly the same time has increased the FUD (fear, unease and despair) quotient in the networking community to a remarkable extent.

Both NT 4.0 and NetWare 4.11 (codenamed Green River) are still in beta at the time of writing, and a full comparison of the two won t be feasible until the shrink-wraps ship. On balance, while NT is now probably the best application server you can buy, with vastly enhanced networking capabilities, it still can t compete with NetWare for the delivery of file and print services, though it s getting there.

Windows NT 4.0 Server still has some way to go before it fulfils all the promises of the long-awaited Cairo — now likely to be distributed to selected developers as a preview version in November. However, the fact remains that NT 4 represents as big a step forward from version 3.51 as version 3.5 was upon all of its disappointing predecessors.

For its part, Novell is beginning to recover from its failure to convince NetWare 3.1x users to upgrade to the 4.x platform with its enhanced NetWare Directory Services, and the further enhancements to NDS available in Green River make it a much more powerful option for large corporate accounts. The fact that Microsoft still hasn t achieved full integration of NDS with its own NTDS will give Novell some breathing space before Cairo finally comes on line — the first implementation is due some time in 1997, but the full set of improvements probably won t be available until the following year.

Not that NT 4 should be regarded as any kind of maintenance upgrade on the road to Cairo. If you compare its list of current features with those yet to come, it will be obvious that the new version represents a quantum leap over all previous ones, particularly so when it comes to networking.

It is the improved Windows 95-style interface that will leave the biggest impression on end-users, but network administrators will be more struck by its ease of installation. Upgrading an NT 3.51 server takes a matter of minutes, with all the hardware settings carried over to the NT 4 registry with virtually no user intervention.

Upgrading Windows 95 workstations to NT 4 workstations is another story, however. Microsoft maintains that people who recently upgraded to Windows 95 are hardly likely to want to undertake a further upgrade to NT 4 Workstation so soon after, and at any rate there are different design goals behind Windows 95 and Windows NT



Workstation . However, having suffered continual system crashes with Windows 95 — requiring three reinstallations in a single week, recently - compared with the rock-solid stability of the NT 4 beta ever since it was first installed, I think most users would be prepared to endure the price penalty of yet another installation for that sort of peace of mind (see page 20, Upgrading from Windows 95 to NT 4).

A clearer upgrade path from Windows 95 is one of the factors that will be addressed by Cairo, and a significant role in this will be played by the new Windows Driver Model (WDM), promised within the next six months, which should allow driver code to be shared across all 32bit versions of Windows.

## 32-bit workstations

In Microsoft's own words: NT 4 Workstation is the most powerful 32bit desktop, with high performance and industrial strength reliability and security. On the other hand, Windows 95 is touted as the easiest way to a 32-bit desktop with a reduced set of requirements, comprehensive compatibility and easy installation.

The most significant difference between the two from the developer's point of view is NT 4s total lack of support for virtual device drivers (VxDs), meaning some applications written with VxDs in mind notably many communications and fax programs - won t run. Nor will any programs which require direct access to the hardware, such as games and some legacy PC software. In addition, NT isn t as clever as Windows 95 at detecting the hardware configuration during installation, and some features like plug and play and (for laptop users) advanced power management, are not available.

Since NT 4 is not so smart at detecting the addition of new hardware, it s surprising that it lacks the Windows 95style Control Panel icon for installing new devices. When installing a Creative Labs modem-and-sound-card PhoneBlaster combination card, the sound section worked perfectly, but the system couldn t find the modem, whatever COM port is was configured as.

However, NT 4 does not share Windows 95 s inability to pre-emptively multi-task 16-bit applications, and keeps all programs running in protected memory space. It s not uncommon for a badly behaved 16-bit application to bring down an entire Windows 95 system, but under NT 4, it s virtually impossible. NT can also offer native support for OS/2 1.3 character mode applications.

Windows 95 doesn t yet support DCOM (see below), and the only multimedia APIs currently supported by NT 4 beta are DirectDraw and DirectSound, though others (eg DibEngine, DirectInput, and RealityLab 3D graphics libraries) are well on the way. There is currently no support for Microsoft Network on NT machines - surprisingly, it proved impossible to access MSN Internet services, even using dial-up networking - though this is promised.

Windows 95 offers file system-level disk compression, which NT doesn't need, since the default NTFS filing system supports transparent file-level compression. Remember, though, that NTFS is not accessible from a DOS floppy if for some reason NT doesn t load properly.

Both Windows 95 and NT 4 come with native 16-bit client Net-Ware software, and it s a breeze to upgrade this to Novell s new 32-bit client on a Windows 95 machine. An NT version can be downloaded from NetWire or the Novell Web pages, but it just would not install, probably because it s targeted at NT 3.5x systems - it may be significant that there s no NT client on the Green River beta CD-ROM.

Despite the superficially similar user interface, there are significant differences in how some features work on the two platforms. Dialup networking is one of the affected services: when a Windows 95 system is connected, there is a single item on the disk bar, which brings up a disconnect dialogue when right-clicked. NT 4 has a dial-up networking monitor, which offers hang-up as only one of its options.

Hardware wise, Windows 95 needs 8 MB of RAM (as a strict minimum) and 40 MB of hard disk space, while it would be a brave person who tried to run NT 4 without at least 32 MB of RAM (preferably 64 MB), and the system files gobble up 120 MB of disk space. And, of course, Windows 95 is restricted to the Intel chip set (386 and above), whereas NT 4 also runs on Alpha, MIPS, and PowerPC machines.

## Internet Information Server

NT 4

disappointing

predecessors

After gradually eroding the power base of Unix Web servers, fighting off the seductive Macintosh platform, and conceding nothing to thirdparty developers of Internet alternatives on NT, the Internet Information Server (IIS) which ships with NT 4 Server has emerged as a fast, solid and easily managed leader of the pack.

It seems only yesterday that I was (correctly) advising a technical conference that there wasn t an NT Internet server that could equal of any of the tried and tested Unix platforms (in fact, it was in January). It might have been true then, but it isn t now - and it is Microsoft's effort represents as that has made all the difference.

Quite apart from the server's speed and big a step forward from stability, the availability of the Internet version 3.51 as version Server API (ISAPI) will be a boon to developers, who will have access to 3.5 was upon all of its server variables and will be able to use nested if...then statements. ISAPI should put an end to arguments about whether native APIs are better than server-side CGI scripts, making available the faster API-route to people who already know their CGI via third-party programs like the PerlIS high performance Perl interpreter.

Since IIS supports associations, you can run a Perl CGI script with PerlIS by referencing it directly in a URL. You can download a beta of PerlIS from ftp.perl.hip.com (but note that you will have to match its version number with an equivalent version of Perl).

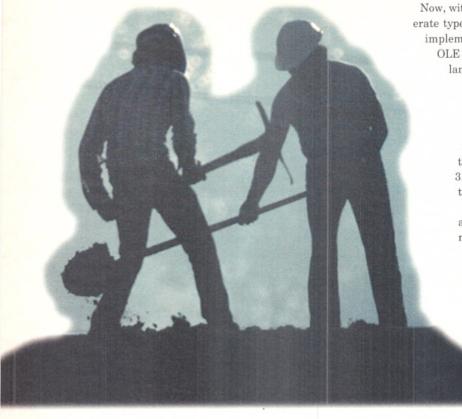
IIS offers improved database programmability with the Internet Database Connector (IDC), which allows multiple database queries to be grouped together, providing improved performance.

In addition to IIS, NT 4 Server comes bundled with Microsoft Internet Explorer, the Microsoft FrontPage Web-page creation program, and Microsoft Index Server. This automatically indexes and permits all users to search the full text on an IIS server in any of seven different languages, as well as properties of files (such as author and subject). The server supports a wide variety of formats, including Word documents, Excel spreadsheets and HTML pages. Additional formats may be supported with content filters, which can be created by software authors, using the IFilter ActiveX programming interface.

Net administrators can create customisable query forms so that users can select the parameters of their search. Maintenance and administration is made easy by completely automatic operation of the index server, including automatic updates, index creation, optimisation, and crash recovery after power failure. Built-in tools enable administrators to optimise their query service, providing information like the number of queries processed and the response time. Indexing a site increases file storage requirements by 40 per cent, so that 10 MB of files will have an index of 4 MB.

## PPTP

An important enhancement of NT s Internet capabilities is support for Point-to-Point Tunnelling Protocol (PPTP) which provides a way to use public data networks such as the Internet to create a virtual



private network connecting client PCs with servers. PPTP offers protocol encapsulation to support multiple protocols via TCP/IP connections, and uses proven authentication and encryption technologies to preserve privacy when sending information over non-secure networks. In effect, this turns the Internet into a virtual private network . PPTP works with IP, IPX, and NetBEUI-based networks and

is expected to be available for Windows 95 by the end of the year.

Other vendors are planning to support this new standard.

## DCOM

The complex shifting of gears at Microsoft that has enabled it to make a 180-degree shift in policy towards the Internet over the past year has caused some confusion, and fuelled industry gossip that technologies like Distributed Component Object Model (DCOM) are likely to be postponed for some time, if not abandoned entirely. Nothing could be farther from the truth.

DCOM extends the COM standard, which defines interfaces for creating component-based applications, so that components can communicate across networks. Since it uses the same tools and technologies as COM, previous investment in training and software will not go to waste. While the full DCOM implementation will not be available until the 1997 launch of NT 5 at the earliest, NT 4 does support all the basics, including instantiation and binding of objects across the network.

Indeed, that process began as long ago as NT 3.5, when the Microsoft Interface Definition Language (MIDL), originally used to define functional RPC (Remote Procedure Call) interfaces in DCE (Distributed Computing Environment) and Microsoft RPC, was extended to marshal the parameters passed on to a call stack into packets to be transmitted across process or host boundaries so that the function could execute remotely. In fact, MIDL is an attribute-extended subset of C++, supporting standard C constructs like enum, struct, union, and typedef. A MIDL compiler was included with Visual C++4.0. In effect, MIDL incorporates and extends the functionality of MKTYPLIB, the ODL compiler, eliminating the need to use different languages for proxy/stub implementations and type libraries.

Now, with NT 4, such interface descriptions can be used to generate type libraries, binary descriptions of COM interfaces and implementations as used in OLE Automation, allowing the OLE interfaces in a project to be described in a platform and language-independent manner.

NT 4 provides a new and simplified free-threading model for addressing re-entrancy and concurrency. This extends and improves the implementation of the original apartment threading model (so-called because method calls can be despatched only at well-defined control points) and should yield higher performance than NT 3.51 in single-machine scenarios, since it uses additional threads to achieve the re-entrancy requirements for OLE.

Free-threading will be a boon to developers working in a multi-machine environment, but it means that they must be much more on their toes. Since anything can happen at any time, with absolutely no regard to message queues, the responsibility for guaranteeing threadsafety is taken from the OLE layer and made the responsibility of the object — and, ultimately, that means you, the developer. In the wrong hands, free-threading can be very unforgiving.

OLE security has been beefed up considerably in NT 4, compared with 3.51, where instantiation of CLSIDs was not dependent upon the current login. Now the client s access token is referenced to allow or disallow CLSID functions.

## What's good about NT 4

- Much-improved, Windows 95-style user interface (ironically, this interface was originally designed to be a feature of NT Cairo).
- Quick and easy setup, if you re upgrading existing NT 3.x Workstation or Server or Windows 3.1x systems (but not Windows 95, see What s bad about NT 4, page 22).
- Wizards are provided for the addition of user accounts, group management, one-step file and folder access for Mac, DOS and NetWare clients, with security settings, adding printers, adding or removing programs, installing modems, installation or updating of network client workstations, and keeping track of software licences for servers and clients.
- Unattended Setup allows administrators to set up the install parameters for all users, such as whether the primary partition should be converted to NTFS or left alone, whether the computer will be a standalone server, serve as a primary domain controller, or a backup domain controller, in a simple ASCII text file.
- Performance has been beefed up considerably over NT 3.51, and this improvement in speed extends to the bundled Internet server.
- Windows 95 Remote Program Load (RPL) allows diskless Windows 95 clients to be booted from a Windows NT Server.
- Client and Gateway Services for NetWare have been extended to support NetWare Directory Services (NDS), including browsing of NDS resources, NDS authentication (including authentication to multiple NDS trees), NDS printing, and processing login scripts.
- Migration Tool for NetWare automatically ports NetWare 2.x and 3.x user accounts, group accounts, security information, login scripts, administrator accounts, files, directories, file attributes, and file rights to Windows NT Server without affecting the Net-Ware server in any way, so NetWare user services are not interrupted when upgrading.
- DNS Server is a completely new version of the DNS service, based on the IETF RFC 1053 standard, including a graphical administration utility and integration with Microsoft's proprietary Windows Internet Naming Service (WINS) and the industry-standard



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## REVIEWS

## What's bad about NT 4

- No easy upgrade path from Windows 95, since the registry formats are so different.
- Really needs 64 MB of RAM.
- ▼ NT Directory Services (NTDS) not suitable for large internet-
- Integration of NTDS with NetWare NDS not yet fully implemented.
- For workstations, Windows 95 provides some facilities not yet available in NT: plug and play, advanced power management, and support for a far wider range of devices.

What's still to be implemented (in Cairo?)

- a multi-machine environment, Object-oriented file system, with but it means that they the capability to store properties and enable content indexing, and likely to be must be much centred on the Internet rather than the LAN (or even the WAN), as originally planned, working with the Internet s DNS name space, supporting the Lightweight Internet Directory Access Protocol (LDAP) and allowing Internet domain names to be names of Windows NT directory trees.
- Integration of some of the technology from the database and replication engine from Microsoft Exchange s directory with the directory service, providing the ability to access multiple data types through a set of OLE-based interfaces, including OLE DB and OLE DS.

 Directory enabling of DCOM, which currently relies upon explicit, physical path statements for component location.

## Stable and mature but with no directory

to developers working in

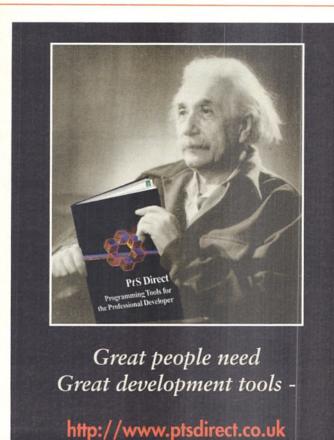
toes

Windows NT 4.0 is a mature and stable product, and provides more than adequate and easily programmable networking support for the small to medium company. Even though NetWare is a more powerful environment for larger corporates, many major companies are moving to NT with complete and justified - confidence. Despite the difficulty of Free-threading upgrading from Windows 95, NT 4 Workstation is also to be preferred as a standard, secure will be a boon environment for all desktop users.

The one missing factor in the puzzle is complete integration of the NT directory service with NetWare Directory Services, but there is every indication that this will be dealt with by the time Cairo has shipped, in its complete, NT 5.5 version.

more on their In the meantime, since NT and NetWare really address totally different requirements, it would be helpful if Novell and Microsoft took a rest from slagging each other off, and concentrated on making their network operating systems work better together.

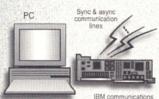
> Karl Dallas has been writing about computers since he taught hinself on an 8 KB Commodore PET in 1979. He currently runs his own Web publishing and WWW design consultancy business (URL http://www.houstonmedia.com).



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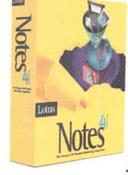
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## Upgrading from Windows 95 to NT 4

Surprisingly, though they look superficially similar when examined with Regedit, the format of the Windows 95 and NT 4 registries is totally different, so there is no straightforward upgrade path, compared with the ease with which Windows 3.1x workstations can be upgraded.

Microsoft recommends installing NT 4 Workstation into its own directory, creating a dual-boot system, reinstalling all your applications onto NT, and finally deleting the Windows 95 directory. Hardly an elegant solution, and since Windows 95 natively supports about 1000 more hardware devices than NT, you will have to make sure that your peripherals are already supported before beginning it.

Actually, it might be just as easy to install NT 4 over the top of the Windows 95 installation, and this would allow the system to move from FAT16 to NTFS, which would improve file access and disk space compression.

- Dynamic Host Configuration Protocol (DHCP) services for dynamic updates of host names and addresses.
- ▲ Network Monitor is a powerful network diagnostic tool allowing the examination of network traffic to and from the server at the packet-level and the capture of network traffic information for later analysis.
- ▲ System Policy Editor and User Profiles allow system administrators to manage and maintain users desktops in a consistent manner, standardising desktop configurations and controlling the users work environment and actions. Several different profiles can be maintained on a single machine, allowing completely different desktops to be presented, dependent upon the login name.

- ▲ NT 4 Server ships with everything needed for the creation and management of Internet or intranet services, including Microsoft Internet Information Server (IIS), Microsoft Internet Explorer, Microsoft Index Server, and the Microsoft FrontPage Web-page creation program.
- Microsoft Index Server automatically indexes and search the full text on a IIS server in seven different languages.
- ▲ Internet Server API (ISAPI) provides improved programmability.
- ▲ Point-to-Point Tunnelling Protocol (PPTP) lets users use the Internet as a secure virtual private network.
- A Remote users can take advantage of the Windows NT Server Remote Access Service (RAS) to dial into a Novell network.
- ▲ Re-startable file copy automatically begins re-transferring a file upon re-connection whenever a RAS connection has been lost.
- ▲ Idle disconnect automatically terminates a RAS connection if there has been no activity over the remote dial-up communications link after an administer-determined time period.
- Dial-up Networking can be associated with a file or application, so that when a user double-clicks on the icon of a file accessible only over dial-up, the connection is made automatically.
- ▲ RAS PPP-compliant Multilink channel aggregation enables clients dialling into the NT 4 server to combine all available dial-up lines to achieve higher transfer speeds, for instance combining two ISDN B channels to achieve speeds of 128 KB or even to combine ISDN lines with analogue modem lines for increased bandwidth.
- Multi-Protocol Router (MPR) enables small and medium-sized sites to deploy Windows NT Server as a low cost LAN-to-LAN routing solution for IPX/SPX, TCP/IP and AppleTalk, eliminating the need for a dedicated router. MPR supports the Routing Information Protocol (RIP) for IP and IPX and also enables BootP Relay Agent. Routing across a WAN is also supported.

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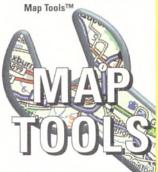
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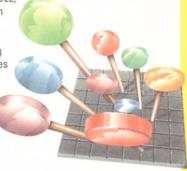
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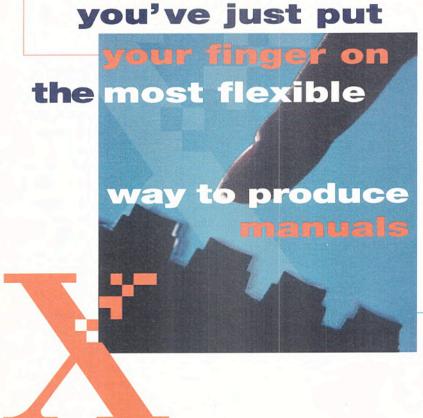
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## A piece of cake

lmost every programmer has endured the unpleasant task of sifting through hundreds of lines of code in order to find an error in just one. Tedium ad nauseum: there must be a better way. Enter program slicing.

Program slicing works by finding the parts of a program relevant to the value of a chosen set of variables at some chosen point in a program. A slice is constructed by deleting the parts of the program that are irrelevant to those values.

The point of interest is usually identified by annotating the program with line numbers to identify each primitive statement and each branch point. The term slicing criterion is used for the point of interest together with the set of variables whose value the slice must preserve. In this article the point of interest will be indicated by adding a comment to the program. In general slices are constructed for a set of variables, but herein only slices constructed for a single variable will be considered. For a slicing criterion consisting of a variable v and a point of interest n, the slice is constructed for v at n.

Having picked a slicing criterion one of two forms of slice can be constructed: a backward slice or a forward slice. A backward slice contains the statements of the program which can have some *effect on* the slicing criterion, whereas a forward slice contains those statements of the program which are *affected by* the slicing criterion. Backward slices can assist a developer by helping to locate the parts of the program which contain a bug. Forward slicing can be used to predict the parts of a program that will be affected by a modification.

## Backward slicing & debugging

A backward slice — simply a version of the original program with some parts missing — can be compiled and executed. An important property of any backward slice is that it preserves the effect of the original program on the variable chosen at the selected point of interest within the program.

Consider the simple example fragment of C code in Figure 1. Suppose the only concern is the effect of the fragment on the variable  ${\bf z}$  at the end of the program. A backward slice on  ${\bf z}$  at the end of the program can be built to

By focusing on selected subsets of code, program slicing makes debugging a piece of cake.

Mark Harman explains the technique.

focus attention on this aspect of the fragment—such a slice is shown in Figure 2. It is easy to see that the line  $\mathbf{r} = \mathbf{x}$ ; cannot affect the final value of  $\mathbf{z}$ , so it is not included in the slice. Slightly less obvious is that the

assignment z = y - 2; also has no effect upon the final value of z. It is not included in the slice because, although this statement updates the value of z in the middle of the program, the value assigned is overridden



## TECHNIQUES

```
x = 1;
y = 2;
z = y-2;
r = x;
z = x+y;
/* the slice point is the end */
/* of the program */
```

Figure 1 — A program fragment to be backward sliced.

```
x = 1;
y = 2;
z = x+y;
```

Figure 2 — The backward slice of Figure 1.

```
Pass = 0 ;
Fail = 0 ;
Count = 0;
while (!eof()) {
  TotalMarks=0;
  scanf("%d", Marks);
  if (Marks >= 40)
    Pass = Pass + 1;
  if (Marks < 40)
    Fail = Fail + 1;
  Count = Count + 1;
  TotalMarks = TotalMarks+Marks ;
printf("Out of %d, %d passed and %d
       failed\n", Count, Pass, Fail);
average = TotalMarks/Count;
/* This is the point of interest */
printf("The average was %d\n", average);
PassRate = Pass/Count*100 :
printf("This is a pass rate of %d\n",
       PassRate) :
```

Figure 3 — A faulty exam mark program.

```
while (!eof()) {
   TotalMarks=0;
   scanf("%d",Marks);
   Count = Count + 1;
   TotalMarks = TotalMarks+Marks;
}
average = TotalMarks/Count;
printf("The average was %d\n",average);
```

Figure 4 — The backward slice of the exam mark program.

```
x = 1; /* consider changing this line */
y = 3;
p = x + y;
z = y -2;
if(p==0)
r++;
```

Figure 5 — A program fragment to be forward sliced.

by the last line, thereby losing the effect of the first assignment.

Calculating the statements which should be deleted from a program is a tedious and intricate task, but fortunately slices can be calculated by a computer. This means that we can expect to see slicing technology in the next generation of case tools. A free prototype slicing tool, *Unravel*, is already available.

In this article I shall consider only the way slicing can be used to aid debugging and maintenance. It has, however, been suggested as a supporting technique for reuse, parallelisation of code, program comprehension, the calculation of metrics, reverse engineering, and program integration.

how slicing can help a programmer during

The program fragment in Figure 3 shows

the debugging phase of program development. The program is supposed to read in some exam marks and print the number of passes, the number of fails, the pass rate. and the average mark. Sadly, when the program is executed, the average mark always seems to be extremely low. This is a typical example of a unit test failure, and the developer would at this point be required to enter a debugging process to discover the cause of the bug. This process may take longer than it ought to because the developer will have to consider a lot of lines of code which could not have caused the bug. Clearly any effort spent examining lines which cannot have an effect upon the value of average would be wasted effort.

## Slicing to the rescue

A slicing tool can assist. The slice constructed for the variable average at the point at which it is printed out is given in Figure 4. It is about half the size of the original program, because it has to preserve only the effect of the original on the variable average. Running the slice will generate the same value for the average mark as the original. As the slice preserves the effect of the original program upon the variable average it is safe to ignore the other lines when tracking bugs which only affect the average mark. Slicing cannot compromise the debugging effort, but it can clearly assist it, since the slice is so much simpler than the original.

The slice in Figure 4 shows that the assignment of 0 to the variable TotalMarks occurs inside the while loop. This is clearly wrong, as this sort of initialisation belongs outside the loop. It should be executed at the start of the program, or at least before the loop begins. If the original code had been analysed the developer would probably have found himself saying no, that line cannot be the one I m looking for. It cannot affect the average value, which would be a virtual slice using the programmer's mental arithmetic. The advantage of a slicing tool is that it relieves us of this burden.

I won t pretend that slicing is some form of universal panacea. If, in the original program, the line that initialised the value of TotalMarks had been omitted, it would not make sense to say slicing could help locate the line which contained the bug! If a bug is

caused by something that is missing from a program, this same something will be missing from any slice of the program. However, even in this situation, slicing may be of some help as the absence of the missing something may be more noticeable in a smaller version of the program.

## The pebble and the pond

As systems are developed and maintained, modifications to parts of the programs that make up the system are frequently needed.

> We are all painfully aware that these changes can lead to

unforeseen side effects,
which often come back to
haunt us long after the
original change was
made. When part of a
program is changed the
effects of the change ripple through the rest of the
program. They can impact
upon other parts of the code

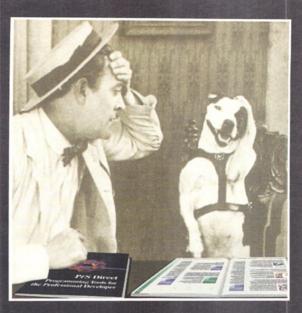
which ought to stay the same. Using forward slicing these ripples can be traced to establish which parts of the program may have been affected.

See how forward slicing works in the simple program fragment in Figure 5. Suppose the first line of the program needs altering. As this line assigns a value to the variable  $\mathbf{x}$ , any subsequent part of the program which ultimately depends upon the value of  $\mathbf{x}$  may behave differently after the modification. The forward slice constructed for the variable  $\mathbf{x}$  is given in Figure 6. It contains the lines of the program which are affected by a change to the first line. Notice that the line  $\mathbf{r}++\mathbf{r}$ ; has to be included in the forward slice, as its execution is controlled by the predicate  $\mathbf{p}==\mathbf{0}$  which is affected by the slicing criterion.

Forward slicing can be used to assist a maintainer who has located a bug (perhaps assisted by backward slicing) and now wishes to modify the program to correct the bug. In so doing the maintainer also wants to be sure that account is taken of the ripple effects of the change. To illustrate this approach to maintenance, consider the example program fragment in Figure 7.

Suppose that the line which prints out the value of the variable sum has just been added to the program. This line cannot cause any ripple effects, because it does not change the value of any variables. It does, however, reveal that the program contains a bug which was hidden until the value of sum was inspected. The value stored in sum always seems to be slightly too big (in fact, it is always one more than it should be).

In order to locate the cause of this bug a backward slice can be constructed on the variable sum to find the lines which con-



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## TECHNIQUES

```
/* Change to first line will affect */
p = x + y;
if(p==0)
r++;
```

Figure 6 — The forward slice of Figure 5.

```
n = 0;
product = 1;
sum = 1;
scanf("%d",&x);
while (x >= 0){
    sum = sum + x;
    product = product * x;
    n = n + 1;
    scanf("%d",&x);
}
average = (sum - 1) / n;
printf("The total is %d\n",sum);
printf("The product is %d\n",product);
printf("The average is %d\n",average);
```

Figure 7 — A program to be maintained.

```
sum = 1;
scanf("%d",&x);
while (x >= 0) {
   sum = sum + x;
   scanf("%d",&x);
}
printf("The total is %d\n",sum);
```

Figure 8 — The backward slice of Figure 7.

Figure 9 — The forward slice of Figure 7.

tribute to the calculation of its incorrect value. This slice is shown in Figure 8. It shows the initial value stored in sum is one. Since sum is a running total, it should be initialised to zero. The natural step is to replace the assignment sum = 1; with the assignment sum = 0; thereby correcting the bug. However, by changing an assignment like the one to sum, side effects may be unwittingly introduced because of the ripple effect.

A forward slice on the variable sum will trace the ripples and show what other statements will be affected. The forward slice contains the lines indicated by/\* AFFECTED \*/ in Figure 9. The reassignment to sum inside the while loop and the line to print out its value at the end of the loop are affected by the change. However, the slice also reveals that the code to assign a value to average and the line which prints out its value are affected. A change to sum will have a ripple effect on the variable average.

Fixing the bug in the initialisation of sum would introduce a bug in the assignment to average, but since forward slicing has forewarned of this ripple effect the ugly patch introduced to the assignment to average can be replaced with the correct assignment average = sum / n;

Finally a forward slice should be constructed for the new assignment to average to ensure that no new ripple effects are caused by altering the assignment to average. Such a slice would reveal that the only statement affected by the correction is the one which prints out the average exam mark, so no further action is required. A slicing tool helps both to identify the line of a program which causes a bug and to check that the modifications made to fix the bug do not introduce any more errrors.

## Unravel free slicing

Slicing was originally proposed by Mark Weiser in his seminal PhD thesis in 1979. Since then a great deal of research work into the development, improvement, and extension of the algorithms for constructing program slices has been conducted. Until recently the only tools for constructing slices were academic playthings which catered only for unrealistically small subsets of programming languages, but 1996 witnessed the production of a publicly available slicing tool for a real programming language. Unravel was developed by Jim Lyle, Dolores Wallace, James Graham, Keith Gallagher, Joseph Poole, and David Binkley for the American National Institute of Standards and Technology. The Unravel team has philanthropically made the tool and its source code freely available on the Web.

Unravel currently runs on Sun/Sparc platforms and slices programs in ANSI C (although programs which contain goto statements are not handled by Unravel). The authors have taken care to implement the slicing algorithms as efficiently as possible, so the slices constructed are delivered in a reasonable time. The tool has a pleasant user interface (written for X Window) which allows the user to select the area of interest by clicking on points in the program text. The slice is displayed by highlighting the lines of the program which form it, so it is easy to see what is in the slice and what has been eliminated. Currently the tool produces only backward slices, but the effort required to add forward slicing is not too great.

Staff and students in my team at the University of North London are working on Unravel to provide a port to the PC and to investigate extensions to its functionality. I would like to acknowledge the major contribution made by the Unravel team to the public dissemination of slicing technology.

## Other forms of slicing

The approaches to slicing I have described above are known as static approaches, because the slices

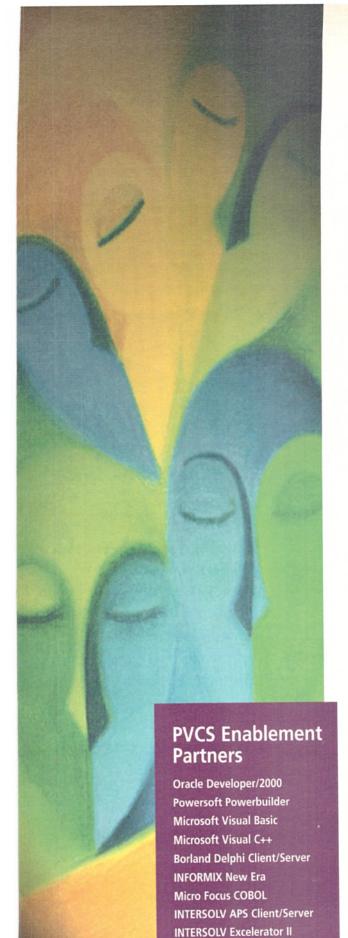
are constructed at compile time. In the dynamic slicing paradigm, slices are constructed once the input to a program is known. Many researchers in the field believe that these slices will provide an even greater benefit to developers

during the debugging phase as dynamic slices are constructed specifically for the test case that caused a bug to occur.

Some extremely exciting work is going on concerning a generalised slicing paradigm, called conditioned or quasi-static slicing. It acts as a bridge between the two extremes of static and dynamic slicing. A conditioned slice is constructed for a slicing criterion that includes the condition which causes the program to misbehave. My work on slicing indicates that it would be fruitful to set aside the restriction to command selection as the only technique for simplifying the original program into a slice. The idea is to allow any program transformation which preserves the original program s effect on the slicing criterion, thereby allowing the slicing tool to construct thinner slices. Although this approach would not help much in bug location, in some applications the thinness of the slices produced is the overriding concern.

While we wait for these developments to come about, program slicing is already an invaluable tool for tracking down the pesky bugs that crawl into code. Try the technique—it will allow you much more time for better things. Perhaps a gateau in the lunchroom?

Mark Harman is director of research at the University of North London School of Computing where he teaches programming in C++ and formal methods in Z. He can be contacted via email at .harman@unl.ac.uk. Dr. Harman s Web page http://www.unl.ac.uk/~mark/welcome.html contains more information about slicing. The Unravel tool can be dowloaded from the Unravel page at http://hissa.ncsl.nist.gov/unravel.html.



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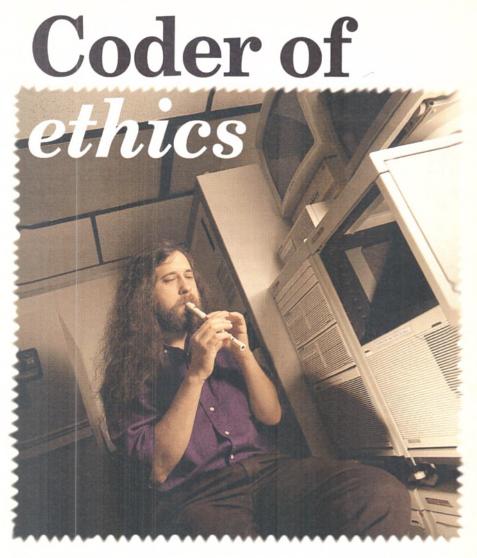
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Richard Stallman was originally responsible for the creation of the Emacs text editor, back when Emacs stood for Editor Macros and ran inside an editor called Teco. He moved on to start the GNU (GNU's not Unix) project with the idea of creating a completely free operating system. The final step of the project, an operating system kernel known as the Hurd, is beginning to be operational. On the way, Stallman has written, or inspired to be written, many pieces of excellent software that are freely available to you and me to use, change and pass onto others. Peter Collinson interviewed Stallman on the telephone earlier this summer.

## demigod

/n./ A hacker with years of experience, a worldwide reputation, and a major role in the development of at least one design, tool, or game used by or known to more than half of the hacker community. To qualify as a genuine demigod, the person must recognizably identify with the hacker community and have helped shape it. Major demigods include Ken Thompson and Dennis Ritchie (co-inventors of Unix and C), Richard M. Stallman (inventor of EMACS), Linus Torvalds (inventor of Linux), and most recently James Gosling (inventor of Java). In their hearts of hearts, most hackers dream of someday becoming demigods themselves, and more than one major software project has been driven to completion by the author's veiled hopes of apotheosis. See also net.god, true-hacker.

From the Jargon File v4.0.0, 24 July 1996.



Ithought that it would be interesting to begin with some of the history of you, what you started off doing, and where the idea of GNU came from. Let s start with the creation of Emacs.

The work that lead to Emacs started in 1973. I was at Massachusetts Institute of Technology working on a DEC PDP-10 using a programmable text editor called Teco. Teco had common editing commands like insert this text and delete so many characters. There were also control constructs and conditionals. The editor also had some variables that you could use to hold integers or strings. Essentially, the editor provided a programming language that you could use to extend its functionality.

Carl Mikkelson added real-time editing mode. It supported a completely different set of commands that would execute immediately: you would see the output updated immediately on the screen. It wasn t a very efficient implementation, so I completely rewrote it. Then someone said to me, how about providing a couple of characters that will run an arbitrary Teco program? So I

thought about that, and I realised that it was just as easy to attach a Teco program to any keystroke. So I did that. Then several hackers began writing large collections of Teco macros to redefine various characters. Effectively, they started writing editors in Teco.

Emacs was written in 1975. The concept was to take all the best ideas from the editors that had been written in Teco. It was accompanied by a library mechanism that enabled people to load in various libraries of Teco commands, and attach the commands in them to keyboard keys or just run them directly.

Once Emacs was in use, people started writing imitations of it. There have been over 30 implementations of an Emacs-like editor. One of them is GNU Emacs. I wrote that after I started the GNU project.

## What gave rise to the GNU project?

The reason for the GNU project was to make it possible to use a computer without using proprietary software. I disliked the way people were being pressured into accepting a way of life in which they are forbidden to share software with their neighbours: they are divided

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The reason for the GNU project was to make it possible to use a computer without using proprietary software.

and conquered by software owners. I decided that I would reject that way of life by putting together a complete system made of free software. It would then be possible to use a computer with just free software.

The next decision was to make the system compatible with Unix. I had never used a Unix system, but I had read about some of the good ideas of Unix. It was clear that the free system should be portable, and Unix was the only example of a successful, practical, portable operating system that ran on a variety of architectures.

## What was the first program that you started working on?

The first thing I started working on for GNU was Bison (a parser generator compatible with the Unix yacc program). I needed Bison to do a C compiler.

I had heard about the Free University Compiler Kit that originated in Amsterdam's Vrije (Free) University. I thought, well, we need a C compiler and it needs to be portable; so let's ask if we can use that one. I did, and I got a reply that was not merely negative, it was actually insulting. Andrew Tanenbaum was distributing the code, and said: No, it's only the University that s free; the software is not. Why don't you forget this silly idea, and write me a few free utilities that we can distribute along with the compiler to boost sales. I ll give you a cut of the proceeds. I quickly responded, my first project will be a portable C compiler.

## The C compiler, gcc, is one of the things that GNU has been extremely successful with. The compilers have been brilliant.

Yes. Well, the compiler I first started working on was not the one that we have now. I found a compiler that was already written, whose authors said I could use it. I added a C front end, and then I started coding the unfinished support for the M68000. When I tried to bootstrap the compiler over to the M68000, I discovered that it wouldn t run. The M68000 Unix system available to me would only let you have something like 64 KB of stack, and the compiler expected the stack to grow to many megabytes. Its memory usage was so heavy, that I put the compiler aside and worked on Emacs instead. That compiler turned out not to be usable, but I adapted the C front end to become part of gcc.

## When you had gcc, how quickly did you migrate it to lots of other machines?

Initially when gcc was released, it had support for the VAX and the M68000, which were the two machines that I wanted to use. Other people subsequently added the machine descriptions for other machines. One of the good things about free software is that you get lots of people to join in. And it s fun to join in. Generally once a program is released, and people start using it, some of those people will start helping. When you ve got a lot of people using the program, you ll have a substantial number helping.

## What do you think of Linux?

Linux was the first usable-quality free operating system kernel. When Linux was released, the GNU operating system was complete except for the kernel. By putting Linux and the extant parts of the GNU system together, people produced a free workable operating system that could be used for real work.

People usually describe the resulting system as a Linux system . The name suggests that the Linux system and GNU are fundamentally distinct. This is both true and not true. Linux proper is a program, an operating system kernel, and that program is indeed separate from the GNU project. However, the Linux system is mostly identical to the GNU system.

The work of the GNU project consists of writing programs. But the goal of the GNU project was not just to create several useful programs. The goal was, and is, to produce an entire operating system. A complete operating system consists of many different software packages. We found some free packages that were already available, things like X

## Linux

/lee'nuhks/ or /li'nuks/, \*not\* /li:'nuhks/ /n./ The free Unix workalike created by Linus Torvalds and friends starting about 1990 (the pronunciation /lee'nuhks/ is preferred because the name 'Linus' has an /ee/ sound in Swedish). This may be the most remarkable hacker project in history - an entire clone of Unix for 386, 486 and Pentium micros, distributed for free with sources over the net (ports to Alpha and Sparc-based machines are underway). This is what GNU aimed to be, but the Free Software Foundation has not (as of early 1996) produced the kernel to go with its Unix toolset (which Linux uses). Other, similar efforts like FreeBSD and NetBSD have been much less successful. The secret of Linux's success seems to be that Linus worked much harder early on to keep the development process open and recruit other hackers, creating a snowball effect.

From the Jargon File v4.0.0, 24 July 1996.

## **EMACS**

/ee'maks/ /n./ [from Editing MACroS] The nec plus ultra of hacker editors, a programmable text editor with an entire LISP system inside it. It was originally written by Richard Stallman in TECO under ITS at the MIT Al lab; Al Memo 554 described it as "an advanced, self-documenting, customizable, extensible real-time display editor". It has since been reimplemented any number of times, by various hackers, and versions exist that run under most major operating systems. Perhaps the most widely used version, also written by Stallman and now called "GNU EMACS" or GNUMACS, runs principally under Unix. It includes facilities to run compilation subprocesses and send and receive mail: many hackers spend up to 80% of their tube time inside it. Other variants include GOSMACS, CCA EMACS, UniPress EMACS, Montgomery EMACS, jove, epsilon, and MicroEMACS.

Some EMACS versions running under window managers iconify as an overflowing kitchen sink, perhaps to suggest the one feature the editor does not (yet) include. Indeed, some hackers find EMACS too heavyweight and baroque for their taste, and expand the name as 'Escape Meta Alt Control Shift' to spoof its heavy reliance on keystrokes decorated with bucky bits. Other spoof expansions include 'Eight Megabytes And Constantly Swapping', 'Eventually 'malloc()'s All Computer Storage', and 'EMACS Makes A Computer Slow' (see recursive acronym). See also vi.

From the Jargon File v4.0.0, 24 July 1996.

## copyleft

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From the Jargon File v4.0.0, 24 July 1996.

#### TECHNIQUES

Windows and  $T_E X$ . Many other packages had to be written specifically for the GNU project because there was nothing available that was free. By the early nineties, the only major missing package was the kernel. That s why the release of the Linux kernel made it possible to produce a complete system.

We already were working on a kernel at the time, but the design that we had chosen turned out to be hard work, harder than we thought. We are now about to make a preliminary alpha release of the kernel consisting of the GNU Hurd plus Mach.

The point is that the GNU system consists of more than the GNU software, the programs we wrote specifically for the GNU project because we found that they were missing.  $T_EX$ , for example, is not a GNU program, it wasn t written for the GNU project, and it s not distributed under the terms of the GNU General Public licence. However, we made it part of the GNU system, and we wrote other software around its presence.  $T_EX$  is not GNU software, but it s part of the GNU system.

Likewise, the systems based on the Linux kernel are not entirely composed of GNU software, but they are mostly identical to the GNU system. Therefore, I call them Linux based GNU systems, giving credit to the Linux kernel for its role, but also making explicit the role of the GNU project.

Was the notion of copyleft, the GNU General Public license (GPL), started at the same time as the GNU project or did that come later? That was part of the whole idea. I had seen the old free software community become

demoralised by being taken advantage of.

#### **FSF**

/F-S-F//abbrev./ Common abbreviation (both spoken and written) for the name of the Free Software Foundation, a nonprofit educational association formed to support the GNU project.

From the Jargon File v4.0.0, 24 July 1996.

#### recursive acronym

/n./ A hackish (and especially MIT) tradition is to choose acronyms/abbreviations that refer humorously to themselves or to other acronyms/abbreviations. The classic examples were two MIT editors called EINE ("EINE Is Not EMACS") and ZWEI ("ZWEI Was EINE Initially"). More recently, there is a Scheme compiler called LIAR (Liar Imitates Apply Recursively), and GNU (q.v., sense 1) stands for "GNU's Not Unix!" – and a company with the name CYGNUS, which expands to "Cygnus, Your GNU Support". See also mung, EMACS.

From the Jargon File v4.0.0, 24 July 1996.

People would say, Oh, how nice of you to give me a head start in making this commercial product. They would extract benefit from the community but would give nothing back. It was the equivalent of the enclosure of the common land.

I decided to make any enclosure impossible by drawing up legal terms that would make sure that any program derived from a GNU program had to be itself free. In other words, if people are using a GNU program as a basis for their work, by making improvements or additions to it, these changes would also have to be free software. This concept is known as *copyleft*.

So, from the very beginning, the first time I released a program, which was GNU Emacs, it came with distribution terms designed to implement copyleft. The licence has evolved to some extent over the years; the most important change was when I got the help of a lawyer to rewrite it and make sure that it would be legally enforceable using copyright law.

# One change was in the area of libraries. You ve got different licences for that now, haven t you?

There are certain programs for which we do give permission to link into a proprietary application. This is done, for example, with the C library. However, it is a step backwards in defending the user's freedom. We made that step as a compromise with other needs. Part of the idea was that if we made that compromise, we might get more people using the C library, and thus would have more people testing it and making improvements. And thus, ultimately, we would encourage more and better free software (not just more users). Another strand in the reasoning was the thought that we didn t want to entirely inhibit the availability of any proprietary program running on a GNU system.

These compromises will be beneficial if and only if they actually lead to giving a broader range of freedom to more users. It s not worth making a compromise simply to have more users. Whether a particular person wishes to use GNU software is his business. I hope that people will use it and enjoy it, but it s no skin off my back if someone chooses not to. I am not competing with anyone else for market share, I m trying to build a community.

#### Some people find the GPL too restrictive. Other organisations have gone for much less restrictive licenses, Berkeley for instance

Berkeley uses what I call pacifist distribution terms. People who don t want to have war going on within society take two different approaches. There s the approach of say-



One of the good things about free software is that you get lots of people to join in.

ing: we condemn aggression and we won t engage in it. Then there s the approach of saying: if we see anybody being attacked by an aggressor then we will fight alongside that person.

The first approach is simply saying, I m going to be non-violent, I will never fight anyone no matter what happens . The BSD software licence effectively takes that position. They are saying, Other people can take what we ve done and strip off the freedom, we re just never going to say no to anybody .

Whereas my attitude is that I m doing this work to give people freedom, and I m simply not going to let anybody else come between me and the users. No-one can deny any user the freedom that I meant to give everyone.

# There were also some people who have created free programs and after some period have decided to commercialise them. How do you feel about the Aladdin people, who ve done this with ghostscript?

The word commercialise, like the word sell, is confusing in the context of software. Strictly speaking, the words imply solely that someone is collecting money; but people tend to assume they also mean the imposition of proprietary restrictions. The collection of money and the setting of restrictions are two very different issues.

Free software is a matter of freedom, not price. Fundamentally, the issue is not whether somebody is making money. The issue is whether users have the freedom to share with their neighbour, have the freedom to make the software fit their needs, have the freedom to contribute to the com-

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# The collection of money and the setting of restrictions are two very different issues.

munity by releasing improved versions of the program.

So, I don't mind that Aladdin is making money from working on a free program. In fact, I think that s great. I do consider it to be somewhat of a problem that, for the first year, new ghostscript versions are only semi-free. Semi-free software is like free software but is limited for non-commercial use: use by educational institutions, students or individuals. We cannot include semi-free software in the GNU system on those terms; it means that we can only use new versions of ghostscript when they are a year old.

When people hear about the idea of free software and the GNU project, many of them suppose that it is based on the idea that there is something wrong with doing things for money. This is not true. The issue is about freedom, not price. The GNU project is not in any way based on disapproval of business. In fact, the GNU system is meant not just for individuals, students and schools, it s for businesses as well.

# Then you started the Free Software Foundation (FSF).

The Free Software Foundation was started in 1985 after the GNU Emacs started to become popular. GNU Emacs was proof that the GNU project was not just talk; we could and would write good software that people would want to use. So the Free Software Foundation was founded as a tax exempt charity to raise money to pay programmers who would work on the GNU system.

The FSF receives donations, but the most important source of funds for the foundation

has always been selling copies of freely redistributable information. This seems counterintuitive to many people because they use simplistic economic assumptions. It s interesting to see how an economic theory serves as propaganda by leading people to oversimplify the world in a particular direction; and then they entirely overlook possibilities which don't accord with that theory.

For example, I have been told many times that because people are free to redistribute copies, then I ll never be able to sell more than one copy of a free program. As soon as I sell one copy, whoever bought it will turn around and resell it. He will undersell me, and I will never be able to sell another copy. Contrast this with the reality: the Free Software Foundation gets most of the money to support its staff by selling copies of free information. Free in the sense that anyone is welcome to redistribute copies. We have found that even though people can copy our programs themselves, many people keep buying copies from us (and also from other distributors). Anybody is welcome to make copies of the Emacs manual, but we have sold probably around 50,000 of them.

# Your idea of freedom seems to impact on economics.

Yes it does, but you ve got to recognise that freedom is the goal and economic business models are the means to that goal. I look for various economic models for supporting free software development because these models will make more free software, but I m not aiming for any specific economic model. I m aiming to have freedom, not just freedom to do what I feel like, but freedom to live with other people on a basis I feel is ethical.

If a person wants a copy of a program I m using, I might not have time to go out of my way and make the copy myself and give it to him, but I certainly shouldn t stand in the way of his making the copy.

#### But if I write a program and sell it for say a dollar, I don t want you to copy it and give it to someone else because I also want to get a dollar from that person.

Right, but the point is that I would not heed your wish, because I would feel it was unethical to say no when my neighbour asks me to share the information.

# But you re depriving me of the dollar.

It makes no difference. Whether you, as the software vendor, have more or less money is secondary to good-will within society. All else being equal, I wouldn t mind if you got another dollar; but I wouldn t do wrong to my neighbour, I wouldn t refuse co-operation

with my neighbour, just to make sure that you got one more dollar. That s not important enough.

# But what happens if I m your neighbour?

Then I d let you copy programs the same way as somebody else. The point is, if one of my neighbours says to me, I really don t want you helping out others , I would respond, sorry, you re entitled to ask for my co-operation, but you re not entitled to ask for me not to co-operate with other people .

# In some ways, you want to challenge me selling the program in the first place, perhaps?

Yes, exactly. I wouldn t buy your program, if buying it meant promising you that I would not let a neighbour have a copy. I wouldn t lie to you, I would say no, thank you . That s the reason for the GNU project: I m saying no thank you to all that proprietary software.

Ethical behaviour is important to me. If I am contravening copyright law that prohibits me from copying something, then I feel that I am morally correct to disregard the law because that law is stopping me from behaving ethically. In some cases, I might be scared to ignore the law but I have no ethical qualms about ignoring it. But, if it were a

#### GPL

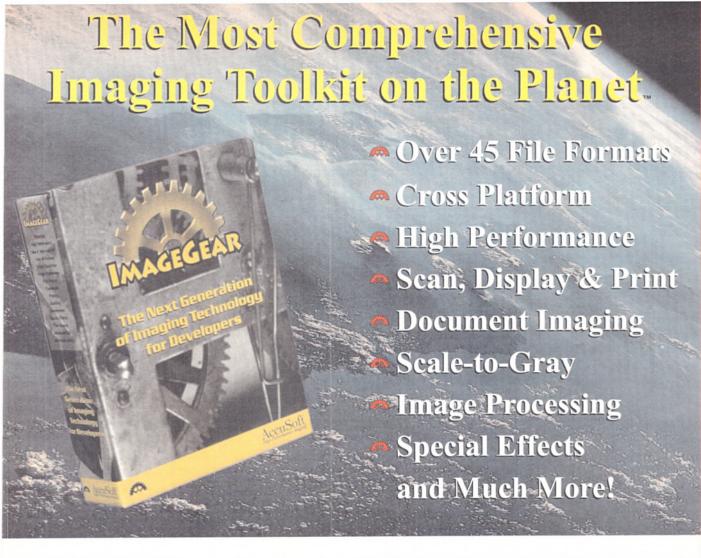
/G-P-L/ /n./ Abbreviation for 'General Public License' in widespread use; see copyleft, General Public Virus.

From the Jargon File v4.0.0, 24 July 1996.

#### GNU

/gnoo/, \*not\* /noo/ 1. [acronym: 'GNU's Not Unix!', see recursive acronym] A Unix-workalike development effort of the Free Software Foundaheaded by Richard Stallman <rms@gnu.ai.mit.edu>. GNU EMACS and the GNU C compiler, two tools designed for this project, have become very popular in hackerdom and elsewhere. The GNU project was designed partly to proselytize for RMS's position that information is community property and all software source should be shared. One of its slogans is "Help stamp out software hoarding!" Though this remains controversial (because it implicitly denies any right of designers to own, assign, and sell the results of their labors), many hackers who disagree with RMS have nevertheless cooperated to produce large amounts of high-quality software for free redistribution under the Free Software Foundation's imprimatur. See EMACS, copyleft, General Public Virus, Linux. 2. Noted Unix hacker John Gilmore <gnu@toad.com>, founder of Usenet's anarchic alt." hierarchy.

From the Jargon File v4.0.0, 24 July 1996.



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#### TECHNIQUES

matter of actually making a promise not to make copies for my neighbour, I feel that rather than lie, I should say, No. I can t promise that in good conscience. I don t want the program under those conditions, I ll just have to write another one.

Obviously if you want a certain collection of software, it s much easier when you get a bunch of people together to help write it. That s what the GNU project is about. It s not just individually saying no, it s together saying no to the proprietary software by ourselves writing free software to do every job.

o, what would your advice to me be? Here I am trying to sell you my software and you re saying I don t want to buy it if I can t pass it on for nothing . How do you want me to make a living?

Maybe you should change careers. If you can t make a living doing software ethically, then you should do something else, rather than working unethically. There s no ethical problem with being waiter, for example.

I faced the same question when I started the GNU project, and the decision I made for myself was that I would either write free software or do no software at all. I had no assured source of income, no guarantee that I could make a living from free software; but if I could not make a living in that way, I

decided that my ethical responsibility was to change careers, even become a waiter, rather than distribute software by taking away user s freedom.

What I found was, first of all, that by living cheaply, you make the problem less difficult. It s a lot harder to make a lot of money than to make a little money. So by avoiding luxuries that cost a lot of money, I ve made it a lot easier for me to make a living, and in fact, I ve been able to save money every year.

#### This is just called living within L your means, isn t it?

It s not a matter of living within your means, it s a matter of living cheaply, so that you have less pressure to make the ethical compromises that are needed to get a lot of money.

# But there is a bottom line which I need to survive

Well, the point is, the amount you need to survive is much smaller than the sum that many programmers feel that they cannot live without. Living on a small amount of money makes things easier. It s not just that it makes it easier to reject jobs that are somehow nasty or anti-social, it also makes it easier to reject jobs in which you re mistreated. You can reject a job for any reason, and spend less time working for pay.



I would either write free software or do no software at all.

In the event, I didn t have to become a waiter. I found that I could make a living doing consulting on free software. People were prepared to pay me a high rate for my work. There are lots of other programmers that can charge high rates too, but nonetheless they want to work for pay all the time because they re trying to get lots and lots of money. Whereas, I was only trying to sup-

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#### TECO

/tee'koh//n.,v. obs./1. [originally an acronym for '[paper] Tape Editor and COrrector'; later, 'Text Editor and COrrector'] /n./ A text editor developed at MIT and modified by just about everybody. With all the dialects included, TECO may have been the most prolific editor in use before *EMACS*, to which it was directly ancestral. Noted for its powerful programming-language-like features and its unspeakably hairy syntax. It is literally the case that every string of characters is a valid TECO program (though probably not a useful one); one common game used to be mentally working out what the TECO commands corresponding to human names did. 2. /vt./Originally, to edit using the TECO editor in one of its infinite variations (see below). 3. vt.,obs. To edit even when TECO is \*not\* the editor being used! This usage is rare and now primarily historical.

As an example of TECO's obscurity, here is a TECO program that takes a list of names such as:

Loser, J. Random

Quux, The Great

Dick, Moby

sorts them alphabetically according to surname, and then puts the surname last, removing the comma, to produce the following:

Moby Dick

J. Random Loser

The Great Quux

The program is

[1 J^P\$L\$\$

J <.-Z; .,(S,\$ -D .)FX1 @F^B \$K :L I \$ G1 L>\$\$

(where ^B means 'Control-B' (ASCII 0000010) and \$ is actually an alt or escape (ASCII 0011011) character). In fact, this very program was used to produce the second, sorted list from the first list. The first hack at it had a bug: GLS (the author) had accidentally omitted the '@' in front of 'F^B', which as anyone can see is clearly the Wrong Thing. It worked fine the second time. There is no space to describe all the features of TECO, but it may be of interest that '^P' means 'sort' and 'J<.-Z; ... L>' is an idiomatic series of commands for 'do once for every line'.

In mid-1991, TECO is pretty much one with the dust of history, having been replaced in the affections of hackerdom by *EMACS*. Descendants of an early (and somewhat lobotomized) version adopted by DEC can still be found lurking on VMS and a couple of crufty PDP-11 operating systems, however, and ports of the more advanced MIT versions remain the focus of some antiquarian interest. See also *retrocomputing*, *write-only language*.

From the Jargon File v4.0.0, 24 July 1996.

port myself so I could write free software. I would actually turn away paying work, once I had done enough in a particular year.

# How do you suggest that I raise even this small amount of money?

There are two methods that work. One is selling support services, which is how I ve made a living. Certain companies do this too, they sell free software support and develop free software (adding features) in the process. The other method that works is used by the Free Software Foundation — selling copies of free software. The purpose of the sales is to support a staff of programmers developing more free software.

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

The definitions in the boxes are excerpted from the Jargon File version 4.0.0, dated 24 July 1996. It can be accessed at http://www.ccil.org/jargon/jargon.html.

The Jargon File is published in book form by the MIT Press under the title The New Hacker's Dictionary (the third edition should be available this month).

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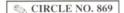
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# Constant troubles



The legacy of C's laissez faire attitude to string literals has returned to haunt C++. **Francis Glassborow** tries to cut the Gordian knot.

Even in C there are some potential pitfalls with string literals. Many texts are littered with code such as:

There are programmers around who argue that such code must work. If by this they mean that it must compile then they are correct, but if they mean that it must execute then they are seriously mistaken. Attempts to change characters in string literals have always been classified as having undefined behaviour.

String literals are syntactically arrays of char but semantically they are arrays of const char. For the first ten years of C s existence, there was no such keyword as const, with the resulting effect that a vast body of code built up contains the write to string literal defect. For some reason those responsible for C adopting const from C++ elected not to retrofit it to the definition of string literals. They may have had some justification, but it is hard to see how that could extend to (the yet to be added) wide string literals.

As far as C was concerned the problem was a quality of code issue. Good programmers would never write something like:

Even the rawest novice soon discovered that such code lacked that essential ingredient of actually being useful. However, any routine that uses a char \* parameter to obtain modifiable storage is vulnerable to a careless call with a string literal. A good compiler can detect the problem by using a compiler option that designates string (and wide string) literals as const. Microsoft was doing this covertly at the start of the decade when Martin O Riordan was its lead compiler developer.

One of the design criteria for C++ was to support the existing C code base. Instead of deciding that passing a string literal to a non-const char \* violates const correctness, and that any code that actually writes to a string literal is in need of maintenance, the designers elected to retain C s hands-off approach. This is a serious issue, since any breach of the const correctness of a program permeates outwards like a canker. For example, given:

then foo("literal") will bind to the wrong version. Granted, we can mend our code with a cast but, if it matters, it will still take far too long to locate and correct the problem.

There have been several attempts to repair this defect in C++. Finally, at the very last minute for changes at the last standardisa-

tion meeting (EXE September 96), Kevlin Henney provided a paper proposing that the type of string (and wide string) literals should be array of const char (and const wchar\_t). He also proposed a fix for existing defective code: add two deprecated standard conversions, to wit string literal to char \* and wide string literal to wchar\_t \*. Deprecating the conversions means that they may be removed in the next full revision of C++ (at least 12 years away) and, in the meantime, compilers can warn programmers that they are using a deprecated feature (like the overload keyword). When he wrote the paper, Kevlin believed that these new conversions would allow all existing code to continue to work under the new rules while still supporting the correct overload choice.

He was wrong, as I discovered when I came to defend his paper against the experts of Core 2. Some of the cases that will break are relatively common idioms. In the absence of an active proposer, the existence of these problems would have resulted in the paper being returned for reconsideration. In the current instance that would have meant a delay of a dozen years, during which time programmers would always be in danger of being bitten by the inappropriate type of (wide) string literals. In the event, I managed to raise sufficient support to get the paper to a formal vote where it passed (25:6 in X3J16 and 7:0 in WG21)

#### Code that breaks

I am not going to provide an exhaustive list of traps, but some examples may help you understand what to prepare for. The key feature is that we did not provide a standard conversion from const char \* to char \* — no one would have accepted that. What we did was to provide a conversion from string literal to char \*. This means that at the time the conversion is made, the type must still be string literal and not const char [] or const char \*. For example:

This works under the old rules but in future the catch clause in bar() will not catch the object thrown by foo(). By the time "Failed" is thrown it will be of type const char \*. Though rare, this is a nasty problem because it only manifests itself at execution time when unexpected behaviour has occurred.

Moral: do not throw string literals in exceptions and make sure to have a very good reason when you do not qualify a type as const within a catch clause. If you stick to these rules you will suffer fewer surprises during execution of delivered code.

Something like the above example would be rare in current code but the next one (on top of page 44) would be relatively common.

To understand why this fails you need to know that the type of the alternatives in the query operator must resolve to the same type. As

#### TECHNIQUES

"yes" and "no" are arrays of different sizes their type immediately decays from string literal to array of const char to const char \*. That is, the value on the right hand side of the assignment is of type const char \*. There is no conversion from that to char \*.

This is only one of the more extreme instances where the compiler's rules will have carried out a conversion that hides the existence of the string literal to a char \* special conversion.

The sooner we start weeding out places where we use code that handles string literals as char \* the more likely it is that our code will continue to compile on the next generation of compilers. In practice, popular compilers will have a backward compatibility switch to allow you to hang on to your defective (even buggy) code, but we should not be counting on such support for mediocrity.

#### Two books of note

C++ Report is one of the best publications for the serious C++ programmer. It is not for the novice or light weight programmer: some of the material it prints challenges the intellects of the best C++ programmers around. The recently published C++ Gems — Programming Pearls from the C++ Report (ISBN 1884842372, about £35) is a collection of 42 articles from its first seven years. If you do not have access to the originals and wish to develop your C++ skills and insights this book belongs on your bookshelf.

Rapid Development — Taming Wild Software Schedules (ISBN 1556159005, £32.49) is not about RAD: it is an excellent book on how to meet your delivery dates (which, of course, includes setting achievable schedules). Those familiar with Steve McConnell's previous book, Code Complete, will already know that his writing is both informative and a pleasure to read. Wherever you may be in the software development hierarchy (code hacker to managing director) you should benefit from reading this book.

#### Last month's problem

The problem was how to prevent a compiler from optimising away a copy constructor. This was the gutted code:

Good programming practice dictates that a copy constructor should always stick strictly to the semantics of copying, that is it should do nothing more than make a copy. However, there are various situations in which this is too restrictive. For example, the semantics of the auto\_ptr<> template dictate that the copy constructor changes the item copied because ownership of the encapsulated pointer must be passed to the new version. There are also programming idioms that make special use of the destructor of an object. In this sense it is not possible for a compiler to deduce that mt is not subsequently used after nt is constructed there will always be a call to its destructor, which every once in a while will be significant. None-the-less the ISO/ANSI C++ Committees decided to permit aggressive optimisa-

tion of copy constructors in cases where the only subsequent use of a copied object is its destruction.

There is no point in just switching off optimisation: elimination of copy constructors is an essential feature of C++, not an extension.

When the problems of overly aggressive optimisation of copy constructors came up last year I suggested that we might fix them by making volatile qualification of a copy constructor mean that such a copy constructor might not be optimised away. Many experts thought it was an interesting idea but we never had time to properly analyse all of the consequences. The issue was never resolved.

The problem was raised again at Stockholm in the guise of whether we should rewrite the relevant section so that the copy constructor would have to be called for a case such as the above. However the current wording supports a program technique (hack) to force copy construction even if the only use of the original and the copy was a destructor call. Just write:

Now both mt and nt are used after the copy and so the copy must actually be made (unless you have allowed some implementation specific non-standard aggressive optimisation of copy constructors). Interestingly, all but the most ineffective of compilers will optimise away the guard uses of mt and nt. That is, your code will do what you wanted and the extras will go away.

Maintenance programmers please note: removing some pieces of apparently useless code may break the program, even though the compiler is going to ignore them.

#### This month's problem

Consider the following code:

There are many times when you want some local data to persist between calls of a function. We all know that the way to do this is to use static variables. The problem is how to do this when we are writing a multi-threaded program and want the data to persist on a thread by thread basis. Any ideas?

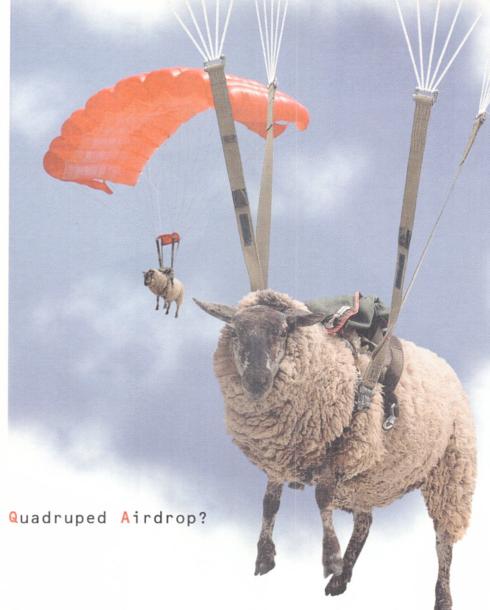
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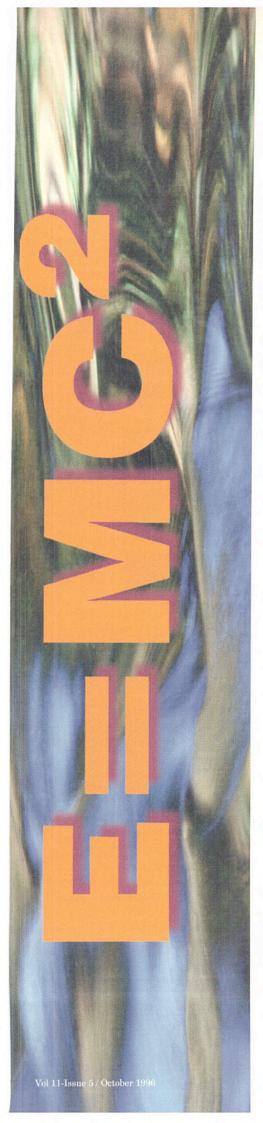
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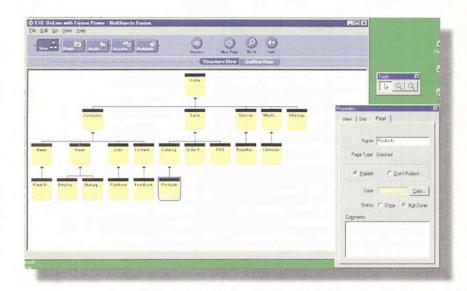
# **Fusion Power**

hen I presented a group test of four Web page editing packages in these pages recently (see EXE, June 96) I imagined that it would be some time before another major round-up would be needed. In hindsight, that was a forlorn hope! With a raft of companies queuing up to deliver bigger and better tools including Netscape with Navigator Gold 3.0 and SoftQuad with HoTMetaL Pro 3.0 - the market for Web editing and design tools is in an excited state of flux. With the exception of Java, no other development area is evolving anywhere near as quickly (and you could argue that Java is only a part of the overall Web development toolset).

Recently a new kind of Web editor, Net-Objects Fusion, hit my desk, promising to make light work of maintaining thousandpage sites and sporting a revolutionary editor which, apparently, would make Web page design as easy as DTP. Let me make it clear at this point that I tested the most recent beta of the product, version 0.9.5 (which should be the last before final release), so some features which should be in the final product were missing or only partially implemented. However the product was close enough to the final version that I believe that most, if not all, of my conclusions will still be valid when Fusion 1.0 ships. At the moment, the product is available for Windows 95 and NT 4.0, but a Macintosh version is expected by the end of the year.

NetObjects' new tool aims
to bring the flexibility and
ease-of-use of desktop
publishing to the arcane
discipline of Web site
design. Neil Hewitt takes a
look at the product's final
beta and in the interests of
a thorough review creates
the ultimate site...

One element of Fusion's marketing claims which certainly proved true is that it is wholly unlike any other product available today. Without exception, dedicated Web editing tools to date have taken a word-processor-like approach to creating HTML pages, be it the hand-coded approach of the versatile WebEdit or the WYSIWYG style of Microsoft's FrontPage. In fact, one of the first vaguely WYSIWYG HTML creation tools for Windows was Internet Assistant for Word 6.0, a tool which let the user build pages (albeit fairly unsophisticated ones) within the normal Word environment. Later generations of the Internet Assistant took a differ-



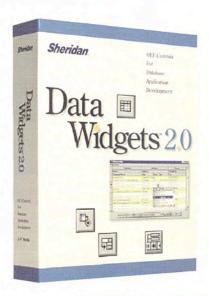
 $Figure \ 1-Just \ drag \ and \ drop \ the \ pages \ to \ move \ them \ about \ the \ site.$ 

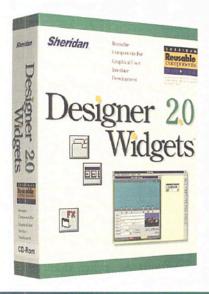
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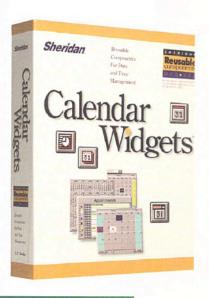
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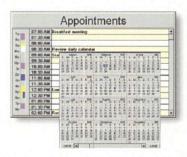
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ent approach, offering an easy route to turn Word documents into HTML pages. NetObjects approach allows Web pages to be designed like magazine pages, with full control over layout and very rich content. Fusion makes this possible by incorporating the widest support yet seen for active content such as Java applets and Shockwave presentations, and by clever use of HTML tags to give the illusion that text and graphics can be positioned anywhere on the page (within some small limitations detailed later).

In order to test the product properly, I wanted to use it on a real Web site. And since next month s is our 10<sup>th</sup> anniversary issue, I decided to use Fusion to create a 10 Years of *EXE* site within our *EXE* OnLine service. You can check out the results of my labours for yourself at <a href="http://www.exe.co.uk/fusion/index.html">http://www.exe.co.uk/fusion/index.html</a>, but before you rush off to start your browser, I suggest you read the rest of this review first.

#### Getting started with Fusion

From the outset, Fusion presents itself as a site design tool rather than a page editor: in fact, it would be pointless to try to use it to generate a single page. When started up for the first time it asks what kind of web the user wishes to create, offering a choice from a wide variety of site templates including personal, corporate and electronic publishing, which sets up a nearly complete online magazine, leaving it to the designer only to add the content. Once a site has been created, the design process kicks off with the first of Fusion's five views, the Site Structure Editor (see Figure 1).

The editor displays a hierarchical tree diagram of the whole site, with a handy zoom in/out tool which makes it easy to display even large sites entirely within the window. Parent/sibling relationships between pages are clearly displayed, starting from the top level of the home page and descending through each interlinked level.

Because I was used to the less rigidly ordered structure that FrontPage encourages, I found the Site Structure Editor difficult to use at first, and had trouble

Fusion would make Web page design as easy as DTP

visualising the connecting paths through the site. That was before I discovered that it s possible to change the position of any page or branch in the hierarchy by selecting it on the diagram and dragging it to a new location. This is a facility I would gladly kill for in my current site design tool. Right-click anywhere in the tree and you can insert a child page, or rename or delete the current page at which point you can watch, awe-struck, as Fusion restructures the site on-the-fly to take account of the change. Finally, for the detail obsessed, the Site Structure Editor has an outline view mode which, Explorerlike, pairs the site tree with a listing of files and attributes in the right-hand pane.

#### **Building content**

Double-clicking on any page in the Site Structure view or selecting the Page view from the

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Com

Figure 2 - Fusion s three pane layout.

rather cool looking ice-blue toolbar at the top of the Fusion window takes you down to the nitty-gritty: designing and editing pages. Precisely how much designing needs to be done depends on whether you have chosen to use a pre-built site model or boldly opted to start with a clean slate. Whichever method was used, the basic elements of a Fusion page are the same, and here s where the *big* differences between Fusion and other Web editing tools come in — and, incidentally, where my misgivings begin.

In the Fusion view of the world, each page consists of a header, a body, and a footer. Nothing wrong with that, as it s pretty much how any printed document is laid out. In Fusion, however, the divisions are enforced: the editing window is divided up into three panes and one element lives in each (see Figure 2). I found this rather confusing, especially as it s perfectly possible to have a header or footer which exceeds the amount of space available in the pane. The pane can be resized, of course, but only at the expense of the other two. Even on a 1152x960 screen, I found it hard to visualise the whole page as one item, and found myself forever looking at previews in Netscape. It was to escape this sort of editpreview loop that I began looking at visual Web editing tools in the first place.

That said, the display of each individual pane is fully WYSIWYG, more so than in any other Web editor. This is because of Fusion s adoption of the DTP metaphor, describing pages in terms of text boxes, graphic boxes, and other content. In order to write text to a page you must, in a Quark XPress-like manner, first define a text box of appropriate size and position (which can of course be changed later).

One of Fusion s boasts is that, through some clever trickery (explained in the box Top tables for pixel perfection), it offers pixelprecise element positioning on the page. Following the DTP metaphor further, a constantly-available properties box displays settings relevant to the currently selected object, and a floating palette of tools allows you to work with text, images, the tablebuilder, and a wide variety of other content, including sound files, AVI videos, Java applets, Shockwave presentations, Microsoft ActiveX controls, and database interfaces. This is certainly the widest content support of any currently available package, and through the use of a custom object format, NetObjects claims that it is possible to regularly update Fusion to take advantage of all the latest HTML updates and content types.

Adding a Java applet to a page is quick and painless (see Figure 3). The page editor shows precisely the space which the applet will occupy, and all the input parameters passed in the HTML code can be directly tweaked in the properties dialog: a nice touch. Other control types are similarly well-handled. The package comes with a number of useful Java applets and Shockwave graphics (including a rather silly rubber chicken animation and a pair of chattering teeth together with sound effects).

The text support is pretty thorough, too: size, style, colour and font can be changed in the properties dialog. Note that the choice of font is limited to the fonts available on the design system, and equally will only work properly if that font exists on the client computer as well. Making text into a hyperlink involves highlighting it, clicking the Link button on the properties dialog, and typing in the URL or a full/partial page title. Provided it finds only one page with that title, Fusion will make the link automatically, otherwise the user is asked to choose between all qualifying pages.

Images can be imported from several formats including the standard GIF and JPEG, as well as BMP and PCX, which are automatically converted into GIF format.

Once the page has been tweaked sufficiently, a single click on the preview button will display the page (or if required, the whole site) within any installed browser. With large sites this can take a long time to work as all the HTML pages need to be generated, since Fusion does not actually store sites in HTML format — all the content and design information for a site is stored in a single .NOD file. Although this probably makes it much easier to keep track of the myriad elements of a large Web site, I couldn t help but feel that it also made it much easier to accidentally destroy a large chunk of work.

#### Now for some unpleasantness...

It was at about this point in my deliberations that I reached a rather unpleasant conclusion. It is not possible to embed an image within a text box. Nor can you link text frames so that the text flows between them. Positioning an image on the left or right of the page with the text wrapping around it is not possible. You could put an image box on the page and define a text box beside it, but should the text be longer than the image it becomes necessary to add another text box below and manually cut the text to fit. Hardly an ideal state of affairs. In fact, as I

Adding a Java applet to a page is quick and painless

investigated closer I found that this is only one of several ways in which Fusion restricts the kind of layouts which are possible.

The most serious restriction is that Fusion constructs pages as an array of tables with fixed pixel sizes, so the content of the page cannot scale to meet the width of a browser's window. If you as a designer want people using 640x480 screens to properly view your Web opus, then about 600 pixels is as wide as you can go, and people with 1280x1024 screens will be left with a huge right-hand margin. Truth be told, this is totally consistent with NetObjects stated

goal of bringing DTP layout standards to HTML publishing: after all, printed pages don't resize automatically.

When editing pages with Fusion, it s very important to make sure that none of the elements on the page overlap at all. The page editor will happily let you position pictures over text and Java applets over pictures, but in the real world HTML elements like these cannot be layered (at least, not without Microsoft's new ActiveX layout control) and the positioning of these elements in the browser will be unpredictable. I really don't see why the editor couldn't be more intelligent about this and prevent the designer doing things that will produce stupid results.

Scripting languages are the current big thing in Web development. Fusion supports their use in pages, but only in a basic way — there is no script item on the control palette, for example. Instead, by selecting Layout script or Element script from a context menu you can choose to prepend, append, or insert your pre-written script text to either the page (or site) HTML header or to an individual element such as a block of text. This is one area that would benefit from significant improvements. It would be nice to see either direct support for script creation and editing in Fusion, or at least tight integration with forthcoming script-building products.

Frames with Fusion are a dead loss. You can t create them with the editor, and the Site Structure Editor doesn t seem to understand them at all. Frames (particularly the new borderless kind) are one of HTML3 s killer features, and I cannot understand why there are as yet no packages which let you work with them quickly, and most importantly, on the page with their content. If you have any intention to use frames in your Web productions, be prepared to spend a lot of time in Notepad, and use something other than Fusion for your main design package.

A major irritation is that external pages can only be imported one at a time, and in the current version Fusion s interpretation of them leaves a great deal to be desired. I gave up on the whole idea of re-using old pages, although I was able to re-use some of the text content with good old cut-and-paste. Fusion should not be used to maintain pre-existing Web sites as the amount of redesign work necessary would be huge.

# Of styles, banners, and navigation bars

Another of Fusion s proud boasts is that it can make site maintenance much easier. It implements a selection of what are termed styles which, basically, are a wide-ranging collection of graphics and text appearances which can be applied across the entirety of a Fusion-built site. The administrator can

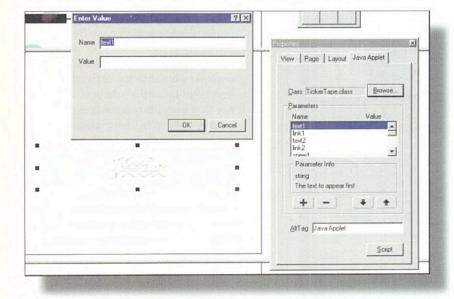
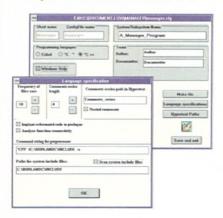


Figure 3 — Directly manipulating a Java applet s parameters.

# THE YEAR 2000 FOR C/C++ AND COBOL

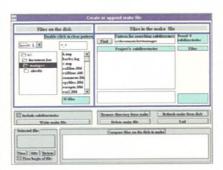


All programmers can write programs but it takes a special type to analyse, change and reuse code. The constant work overload has pushed analysis and maintenance into the background. The Year 2000 has changed all this.

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



#### TM1 OLAP FOR MULTI DIMENSIONAL DATABASES



222 TM1 PERSPECTIVES

Dr Codd, who created the rules for Relational Databases (RDBMS), claims that RDBMS in themselves are not enough. If you have been using RDBMS to provide analysis solutions for senior management you will know the shortcomings Dr Codd is referring to. TM1 has been providing OLAP software some ten years BEFORE Dr Codd defined the OLAP rules!

TM1 is a clean OLAP canvas with all the colours available. There are no limits. One or multiple cubes per application can be utilised. The ability to add cubes to a database over time as the application evolves with as few or as many dimensions as required is built in. The system auto-tunes and there is little or no scripting. Simple consolidations are separated from complicated roll-ups, complex calculation rules and functions. Inter-cube rules are a feature.

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then change the look and feel of a site with a single step within the Fusion environment. NetObjects has chosen to implement styles in a proprietary way, rather than use the asyet unfinished Cascading Style Sheets (CSS) specifications. Microsoft s Internet Explorer 3.0 is the only mainstream browser which supports the partial CSS standard, although Netscape has announced that Galileo (the future Navigator 4.0) will also support whatever standard is available.

The style view gives a full visual preview of all the elements of a style, which can be amended or replaced to suit your own taste. The collection of styles available is very wide-ranging, even in this early release. There are over 30 to choose from, and any aspect of any style can be redefined at will, or new ones created (see Figure 4). I particularly enjoyed Industrial which employs metallic-looking cogs and wheels for icons, and Rust which has some really good metal textures. Other fun styles include the rather eccentric Money which wouldn t look out of place in the breakfast news financial report, the swirly Whirligig, and the positively bizarre Sitting Duck where all the bullets and buttons become fairground-style rabbit and duck-shaped shooting targets.

The only let-down with the system is that it s not possible to apply a style to one particular page. It has to be the whole site or nothing. While it may seem logical to assume that a site should be consistent throughout, it can certainly be fun to have the odd page or section on a site which looks and feels a little different. With Fusion, the only way this could be achieved at all would be to

#### Top tables for pixel precision

Web page designers have long cursed the fact that it s impossible to place text and images on the page with single-pixel precision. Too many factors, like the width of margins, the justification of text, and the precise spacing of images are left up to the browser to guarantee solid results on every platform.

Browser vendors Netscape and Microsoft have been gradually remedying the situation, extending HTML with tags to give designers tighter control. Recently, Microsoft's ActiveX layout control has made it possible to overlay text and images at precise co-ordinates, although it stresses that this is only a temporary solution until these features become part of HTML (not likely to occur until a full cascading style sheet standard is agreed).

NetObjects has gone one up on the big boys, solving the pixel-precision problem by ingenious use of an existing HTML feature: tables. First introduced into HTML by Netscape, advanced tables are perhaps the most controllable elements within Web pages. Each cell in a table can have a precise width and height, precise spacing and padding, individual colour, invisible borders if required, and better still, can contain any other HTML content within itself. If dynamic behaviour is required, the size of table elements can be set in percentage terms, rather like frames.

All Fusion-generated pages are in fact very complex table sets. It takes some unravelling to understand the precise layout of the tables on a Fusion page, since there can be tables within tables within tables, and literally hundreds of individual cell settings. By precisely controlling the size of a table and its spacing, it s possible to exactly position text or images at a specific relative co-ordinate in either direction. This is also the secret of how text blocks can be so easily reshaped and resized: the text content just flows into the space created by the table.

Used properly, tables are an extremely advanced feature of HTML and allow for very sophisticated layout. Fusion's use of tables is among the most advanced yet seen, and the result is pixel perfection, every time.

build two separate sites and then create links between them.

Remember that in the Fusion world, all pages consist of a header, a body, and a footer. By default, the same header and

footer are used for all of the pages on a site. Since Fusion enforces a certain design methodology anyway, this makes sense, as it provides a consistent design which is actually very appealing. What happens is this: the header contains a graphic banner taken from the chosen style, onto which Fusion prints the page title in the appropriate font, colour and size, and underneath appears a navigation bar which by default consists of links to all the pages in the next level down of the site hierarchy. You can configure the navigation bar to include extra links such as the home page, or to point only to pages in the same level of the hierarchy, or the level above, or to use large or small buttons, or plain text links.

Because Fusion takes care of autogenerating all these elements, creating an easily navigable site is literally child s play. To add the icing on the cake, it s possible to define as many different header and footer layouts as you want and select the appropriate one for any page on the site.

# you want and select the appropria any page on the site. Counting your assets

The fourth of the five available views in Fusion is the Asset Manager, which provides at-a-glance summary information about the physical files and full link structure of a site. You can list all of the site s files, view every



Figure 4 — Don t try this at home, kids: a neon nightmare from the style gallery.

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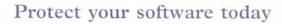
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#### REVIEWS

link (both internal and external), and see the data objects contained within the site. On this front, Fusion has full support for the DAO database integration format used by Visual Basic (and now by VJ++), enabling DAO objects to be inserted into a page in the same way as Java applets or other controls.

As an old-fashioned Web-weaver of the real coders do it with Notepad school [real coders do it with Emacs - Ed.], I prefer a slightly more hands-on approach than Fusion takes, with more control over the physical file structure of a site. For new or inexperienced site builders, however, the simplicity of the Asset Manager may be exactly what they need.

#### Publish and don't be damned

Designing and editing a site is all very well, but once the thing has been written and prepared, it has to be made available on the Web or Intranet. Here, many of the existing site building solutions fail to cater even for simple needs: FrontPage, for example, cannot be used to automatically publish a site remotely unless the remote server is running the FrontPage Server Extensions which unless you have a very good relationship with your service provider is unlikely to be the case.

The first part of Fusion s publishing process is setup, wherein options are set for the other two parts of the process, staging and publishing. It is here that the designer can opt to generate text-only, grayscale, or low-bandwidth versions of the site, and set FTP options. Clicking the stage button prepares the ground for HTML code generation, performing any necessary tasks such as generating grayscale versions of images, and then publish generates the HTML files for the site and FTPs them over a live connection to the World Wide Web, directory structure and all. It really is that easy, and begs the question, why on earth can t other site design tools do that too?

#### Final pros and cons

I was impressed by Fusion: it really does make it easy to develop, maintain, and publish Web sites with rich content and distinctive looks. For less code-oriented designers, who may have an artistic rather than technical background, the DTP-style editing will be a boon. That said, the package has a number of missing features and flaws which may put off hard-core Web developers.

Fusion does not give the designer as much control over the final HTML code as I would like. Special tags and attributes are not easy to add in: it can be done through judicious use of the scripting features, but more often than not requires manual inter-

vention in Notepad after the files have been generated. Even if NetObjects object standard lives up to its promise and enables Fusion to keep up with the latest HTML features and standards, meaning there should only ever be a short wait before new tags are supported, in terms of the Web even a month can be a very long time.

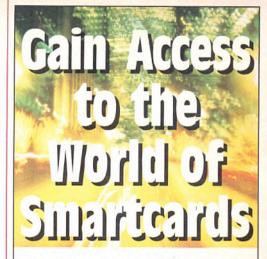
The inability to place images within text boxes is a major disadvantage in my book. There s absolutely no technical reason why this should be so: HTML has had provisions for aligning text around images since the first revision. Also, it should be possible to link text frames, DTP-style, so that text flows between them. For a package which has serious pretensions to bring DTP editing techniques to HTML production, this is a serious omission.

Less serious than this is the fixed size of the page layout. This, I think, is where my problem with this package lies. I wholeheartedly agree with the concept that Web pages should be able to be laid out with a similar freedom to the printed page, with overlapping elements, full typographical support, and colour control. However, I also believe that the unique nature of the Web — the control that the user has over the look of pages, the interactivity of pages, and active content - should be preserved at all costs.

A fairly high-spec machine is needed to run Fusion: I d recommend a Pentium-120 and 32 MB of RAM (under Windows 95) or 64 MB (under Windows NT 4.0) as a practical configuration. The software will certainly run on less, but like all good tools, productivity can only be maximised when it is performing at its best. Don t stint on the screen size and resolution, either: 1024x768 in 16-bit colour is the smallest display I would consider using Fusion with.

If you are willing to accept a lack of fine control over HTML code, and the stylistic limitations implicit in having a universal look and feel to your site, or if you have little time to waste on maintaining and developing the site, and if you are developing from scratch and not trying to take existing pages on board, then Fusion could well be the ideal tool for you. It has a host of intuitive and powerful features and really does make Web site design easy. However, if you have existing content which you want to carry along, or really need to be in direct control of the structure and code of your site, then you should probably look elsewhere for now. Keep an eye on Fusion, though, because it will certainly become much more powerful.

Fusion 1.0 costs \$695. NetObjects s Web site is at http://www.netobjects.com



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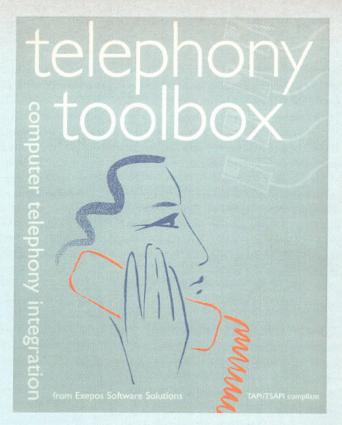
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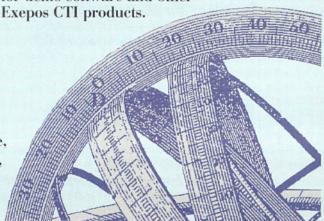
- Open WAV/MIDI files
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- Play WAV file
- Play MIDI file
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Exepos Limited, Acorn House, The Straight Bit, Flackwell Heath, High Wycombe, Buckinghamshire HP10 9LS Telephone: 01628 533143 Fax: 01628 533145 email: sales@exepos.com Stingray's toolkit aims to bring the convenience of component programming to MFC users. **Philip Harris** boldly dives in and experiences its bite....

# STIFFFF TOOLWIT

reating a successful Windows application nowadays requires an immense amount of effort. Customers demand the latest and greatest features and user interfaces. Providing them places great pressure on developers, particularly those without the huge budgets of the larger companies. As a result, many companies are springing up marketing OCX and DLL components which can be plugged into development environments to add these time consuming bells and whistles.

American company Stingray Software is no exception, however it has taken a slightly different route to most other companies. Stingray has produced the Objective Toolkit (originally called SEC++), a set of C++ classes designed specifically for MFC users, under both 16-bit and 32-bit environments. The classes are designed to fit in with the

standard MFC classes, and most are simply enhanced versions which add functionality. Just as MFC comes with complete source code, so does Objective Toolkit, enabling you to get under the hood and tinker if you wish.

#### View classes

Objective Toolkit provides two new view classes derived from the standard MFC CScrollView class. As the name suggests, the SECZoomView class adds full zoom functionality, providing excellent support for both zoom-to-fit and variable zoom modes. Zooming in and out can be accomplished in three ways: by specifying a zoom percentage, a target rectangle, or a target point and zoom delta for the amount to zoom the image by. Member functions that return the view to a normal 100% zoom and user defined limits for minimum and maximum zoom levels round out the class.

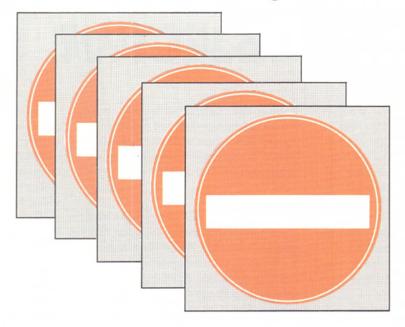
Implementing support for SECZoomView is very simple, provided your application already uses CScrollView in its view classes. If it does, adding support is a case of replacing CScrollView with SECZoomView in your header files and MFC macros, and adding a user interface.

The second new view class, SECPanView, is derived from SECZoomView and adds support for panning. The pan view gives the ability to grab the current view and scroll it in any direction with the mouse. Again implementation is simply a case of deriving from SECPanView instead of CScrollView and adding a user interface, which in this case takes the form of three functions: StartPan(), ContinuePan(), and End-Pan() which need to be called from your mouse down, mouse move and mouse up message handlers. SECPanView supports two modes of operation: SEC\_PANDELAY and



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```
void ConvertFile()
{
    SECPCX pcx;
    // Load PCX
    pcx.LoadImage("source.pcx");
    SECGif gif;
    // Convert image
    gif.ConvertImage(&pcx);
    // Save converted image
    gif.SaveImage("dest.gif");
}
```

Listing 1 — Loading a PCX image.

SEC\_PANINSTANT, which control whether the pan takes place after the user has finished dragging or continuously for instant feedback.

Using the SECPanWnd class, the SEC-PanView can be enhanced with an overview window, which shows the user a miniature version of the whole view with a dotted outline showing the currently visible portion. When the view is modified, the overview window is automatically updated to reflect the new state. Adding an overview window requires providing an interface to the ShowOverviewWnd() function and adding calls to update the overview window whenever you use UpdateAllViews().

The zooming and panning classes provided by Objective Toolkit are extremely easy to use. For anyone who needs to add flexible zooming support to their applications they are worth the price tag of the toolkit on their own. Figure 1 shows the Clouds sample provided with the toolkit which demonstrates the zooming and panning facilities.

#### Image classes

Dealing with complex file formats, in particular those of graphics files, has always been a tricky proposition for programmers. Although the majority of file formats have been published, a complete implementation of one can be a major undertaking. Objective

Toolkit restricts support to the most common formats: Windows Device Independent Bitmap (DIB/BMP), CompuServe's GIF, JPEG, PCX, Targa (TGA) and TIFF, providing all the functionality that the average user will need.

Using the image classes is very simple. Listing 1 shows a short piece of code to load an image in PCX format and save it again in GIF format. Speed-wise the toolkit performs well, and although loading an image is noticeably slower than in specialised packages such as Paint Shop Pro it will be more than sufficient for most applications.

In addition to import and export facilities, the toolkit includes a custom StretchDIBits() function to display images, with dithering if required, and some basic image processing functions. Images can be flipped horizontally and vertically, rotated in 90 degree multiples, cropped, and have their contrast adjusted. All of these operations are relatively simple, and although the library is missing some obvious functions such as brightness, the provided source can be used as a basis for any additional code required. Note that because each image format is implemented as a class derived from the basic SECImage class, any functions added to the base class will automatically work with all the supported formats.

As is the case with all graphics toolkits, the spectre of LZW licensing (see Patent grief in GIF city, EXE May 96) rears its head should you wish to use the toolkit's GIF and TIFF support in your application. Stingray has solved the legal complexities of implementing these formats by encrypting the code that relates to them. Once you have agreed licensing terms with Unisys you can return a form to Stingray who will then provide you with a code to unlock the GIF and TIFF support. At the time of writing, the licensing agreement with Unisys for a mass



market product costs \$1000 to set up plus a small percentage of the income from each product containing the code.

#### **MDI** alternatives

Since Windows 95 was released the official Windows Interface Guidelines for Software Design no longer recommends the use of the MDI interface. Microsoft is moving away from it in its Office applications and is advising other Windows developers to do the same. However, neither the operating system nor MFC has built in support for alternative interfaces. This is where the Objective Toolkit comes in.

Stingray has implemented two alternatives to the SDI and MDI application types, both of which are derived from the CFrameWnd class and are relatively easy to implement, given an app wizard-generated MDI application to work with.

The first alternative is the *Multiple Toplevel Interface* or MTI. This is best thought of as a mixture of SDI and MDI. As in SDI, there is one top level window which manipulates a single document. However, there can be multiple open documents, each with its own top level window. Opening a new document opens a new top level window, in a similar way as opening multiple instances of the same application might. The best examples of this type of application are the Windows 95 Explorer and Internet Explorer. Both SDI and MDI applications can be straightfor-

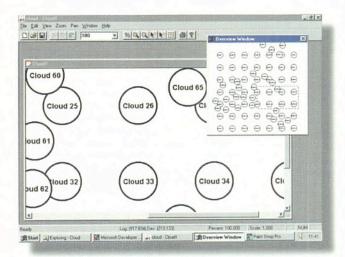


Figure 1 — The Clouds sample application, complete with overview window.

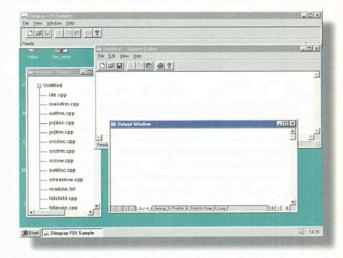


Figure 2 — An application built using the Visual Basic style Floating Document Interface.

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Objective Toolkit is a set of over 40 classes that include views, images, MDI alternatives and utility classes. These classes provide the ultimate MFC programmer's toolkit. Recent additions include Dockable Document Interface (DDI), Floating Document Interface (FDI), Workspace classes, Popup calendar class, Popup menu button class, Shortcut class, Compressing and Encrypting CFile derivative, Bitmap button, Filesystem class plus Component gallery objects for each OBJECTIVE TOOLKIT component to allow MFC developers to add a component with the click of a button using the Visual C++ 4.x component gallery.

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Objective Grid provides a full-featured grid control that supports a variety of cell types and can be used in many different contexts. For example, Objective Grid can be used as a child window, as a pop-up window and even in a dialog. Full ODBC support is provided via a set of CRecordSet derivatives. The developer can easily attach Objective Grid to any data source by overriding one C++ virtual function. Also, printing, print-preview, find/replace and cut/copy/paste are supported and completely integrated with existing MFC classes.

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wardly converted to MTI, and the Objective Toolkit User Guide provides step by step instructions. These, coupled with an example version of the Microsoft Scribble application converted to MTI, make the developer stask very easy.

The second MDI alternative is the *Floating Document Interface* or FDI. In this case the MDI main window is still used but MDI child windows are free floating on the desktop. One example of this style of interface is Visual Basic, which has been successfully using this approach for some time. The use of menus differs slightly to an MDI application: each child window can have its own menu as well as the main frame window, however this menu should only contain items that apply to all the FDI windows or the application as a whole.

As with the MTI interface, converting an MDI application to FDI is quite simple. However the conversion from SDI to FDI is less so and Stingray recommends converting to MDI before moving to FDI. That said, SDI applications are less likely to benefit from a conversion to the FDI interface. Figure 2 shows an FDI application in operation.

#### User interface extensions

User interface design is where the Objective Toolkit proves most useful. Four sets of classes in the toolkit provide a level of functionality which would be all but impossible using ActiveX or DLL approaches.

The first of these user interface extensions, the Workbook Document Interface (WDI), works alongside MDI-based applications to provide a tabbed interface to all currently open documents. Implementing a WDI interface is simply a matter of modifying an existing MDI application class to inherit from the SECWorksheet and SECWorkbook classes. That done, all that remains is to provide an interface to activate the Workbook

interface, or specify that it be turned on by default. Figure 4 shows a Workbook version of Notepad, the example is supplied in source form with the toolkit. Unfortunately, the default tabs used by the Workbook are quite chunky, and lack the subtlety of those used by programs such as Excel. However, the SECWorkbook class provides a range of member functions that can be overridden to customise all aspects of the tabs.

Following on from the Workbook interface is the Docking Document Interface (DDI), similar to the interface used by Microsoft Developer Studio in Version 4.x of Visual C++, but with additional functionality. Docked windows can be resized via splitter bars and floating windows can be resized horizontally, vertically and diagonallysomething not normally possible. In addition, dockable control bars can be set to stretch automatically when resized or use customised resize handling. Finally, a context menu is accessible by clicking on a dockable window with the right mouse button. A default menu is supplied, but menu items can be customised.

The DDI interface is implemented by enhanced versions of the CControlBar, CDialogBar, CToolBar, CMDIFrameWnd, CMDIFrameWnd and CMDIChildWnd classes. Creating a DDI interface in your application involves deriving windows and toolbars that would normally be derived from the standard MFC classes from the Stingray versions and then adding some resources to the project. As with the rest of the Objective Toolkit enhancements the migration process is very easy, however because of limitations in older versions of MFC, the DDI interface is only available for 32-bit environments. Figure 3 shows an example application demonstrating the DDI interface.

The ability to save an application s Workspace is familiar to many Windows users:



this is handled in Objective Toolkit by the SECWorkspaceManager class, which includes dialogs and supporting menus for saving window position, dimension and content information to the Registry.

The final user interface extensions provided by the toolkit are the SECShortcut classes, a set of classes and dialogs for customising the keyboard shortcuts used for menus within an application. Due to the fact that the classes use facilities only available under Windows 95 and NT, this is another facility which cannot be used in a 16-bit environment. Figure 4 shows the dialog used to edit keyboard assignments in a sample application.

#### Window/control classes

Objective Toolkit provides a selection of window and control classes. None of these components are particularly sophisticated, but they do save time and conveniently supply some of the nice touches that Windows application users expect.

The SECBitmapDialog class is an enhanced CDialog replacement that allows a bitmap to be displayed in the background of a dialog. Three modes are available for displaying the graphic: tiled, centred or scaled to fit. In a similar vein, the SECSplashWnd class implements a splash window which will remain displayed either for a set period of time, or until the user clicks on the window.

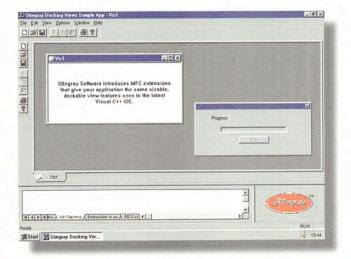


Figure 3 — The Docking Document Interface.

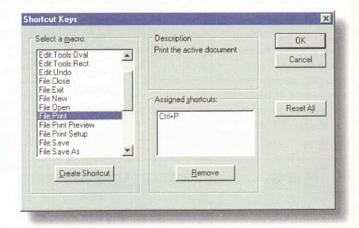


Figure 4 — Editing the keyboard assignments for menu items.



The SECMaskEdit class provides a useful subclassed CEdit which can be attached to existing CEdit controls to specify a compulsory format for data entry. It is possible to restrict the type of characters which can be entered at any position within the edit control allowing you to create, say, a telephone number edit control which will only accept numeric input. While the format of the data entered is restricted the data is not validated, nor is the MFC DDV capability supported although Stingray expects to rectify both limitations in future versions.

Microsoft has made Tip of the Day a regular feature of its applications, and it is supported by the toolkit in the shape of the SECTipOfTheDay class. This class, derived from Cdialog, lets you access a series of tips stored in an ASCII text file. Unfortunately, the class does not entirely eliminate the work involved in implementing a Tip of the Day: the application code must keep track of which tip was last displayed, so as to give the user a different tip each day.

The most complicated of the window/control classes is SECTabwnd. This class allows you to add Excel-style tabs to documents so that users can switch between the different views in your document/view application. The class supports SDI and MDI applications, as well as Stingray s own FDI, MTI, DDI and WDI interfaces, and can be used within dialogs. As with the Workbook classes, the colour, font and shape of the tabs can be modified but the default representation has a professional feel and will be sufficient for most people. Figure 5 shows a close up of the tabs and navigation controls.

For developers needing a date selection widget the SECCalendar class provides a quick and easy way to display a calendar in a window, a dialog or as a pop-up. The resulting calendar feels a little clunky, as it uses a grid of buttons to display days as opposed to the more sophisticated white panel style of Windows 95.

Three new button classes are provided, including a bitmap button which requires marginally less work than the bitmap button class MFC provides. The SECMenuButton class provides a simple button which when clicked displays a pop-up menu to the right or below the button. SECWellButton provides a button which displays the selected colour on its face, and lets the user select a new one from a colour well when clicked (see Figure 6). In addition to the colour well button, the SECColorWell class is a versatile CWndderived class which can be embedded within a dialog or CFormView to provide the user with a method of selecting colours.

#### Thumbnail support

Many graphics-intensive applications give users the option to display a thumbnail version of a file before committing to load the entire image. The Objective Toolkit thumbnail classes can be used to add thumbnail support to your application, provided it uses the serialise facility. A series of classes are provided, including a customised file dialog which handles displaying the thumbnail when the user is selecting a file, as well as a serialise function which saves the thumbnail and skips it when loading the full image.

Like the rest of the Objective Toolkit extensions, implementing thumbnail support simply involves changing a couple of class derivations. Unfortunately, by default the thumbnail will be the same size as your view — in many cases this will be too large and the application will have to contain custom code to draw the thumbnail at the appropriate size.

#### **Utility classes**

Objective Toolkit provides two CFile derivatives, one for encryption (using triple-Vigenere encipherment) and another for data compression. The compression performance is reasonable, with several test executables being reduced by about 50%, and data files by around 70%. Both classes are easy to use and although neither are based on top class algorithms, they are a worth-while addition to any developer s toolkit.

The SECFileSystem class and its associated member functions provide a range of functions for accessing files and directories, ranging from copying and deleting files (complete with wildcard support), through checking free disk space, to comparing the contents

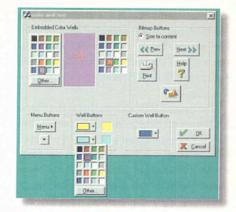


Figure 6 — Bitmap buttons, colour well buttons and controls created using the toolkit.

of files. While most of these functions are very basic they do provide a consistent interface across 16-bit and 32-bit environments, and if you don't already have your own functions the toolkit will save you writing them.

For most people, SECRandom will probably be the least useful class in the toolkit, being little more than a thin wrapper around the standard random number functions. The only significant enhancement is that it can return a weighted set of results. Finally, the SECRegistry class provides a common interface to the registry under 16- and 32-bit environments (although the 32-bit version does have enhanced functionality).

Documentation for the toolkit comes in the form of two manuals supplied on disk in Word 6 format. A user guide gives a brief overview of all the classes with descriptions of key member functions, while the comprehensive reference manual covers all the classes in detail.

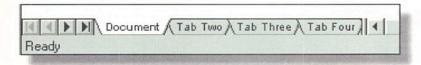
#### With source

Objective Toolkit is an extremely impressive package which costs significantly less than its competitors, particularly when you consider the range of classes and the fact that full source code is included. Integration with MFC is excellent, with the classes being extremely easy to use. Documentation is good, if a little brief in places but strong sample applications more than make up for that minor deficiency.

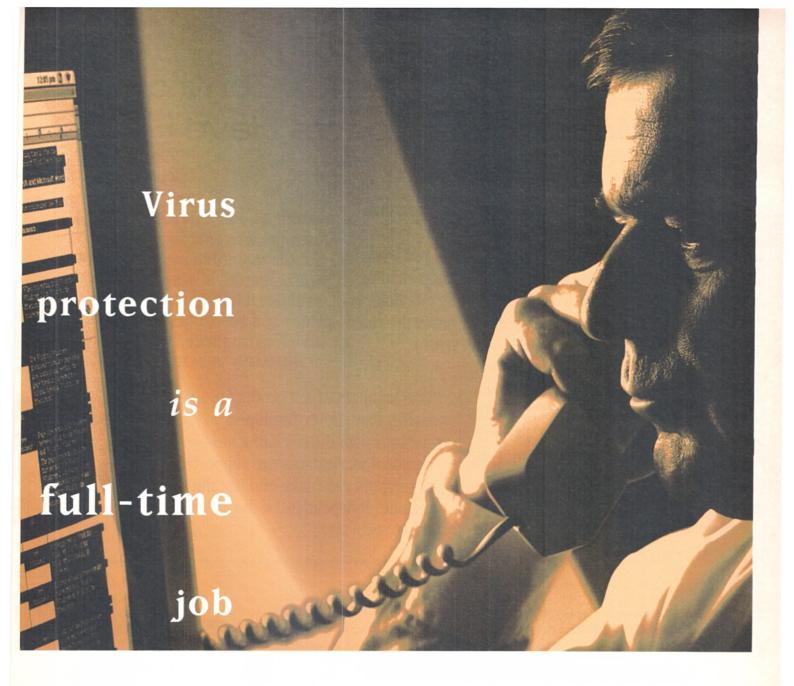
All in all, Stingray has produced an excellent all rounder, which is a definitive must buy for MFC developers.

Philip Harris is technical director of Digital Workshop, a PC software house. He can be contacted at piharris@cix.compulink.co.uk.

Objective Toolkit is available for £379 from QBS Software: 0181 956 8000. Stingray Software Web site is at http://www.stingsoft.com.



 $Figure \ 5-Excel\ style\ tabs\ and\ navigation\ controls\ created\ using\ the\ SECTabWnd\ class.$ 



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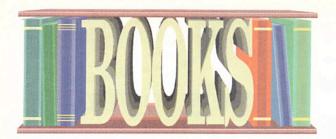
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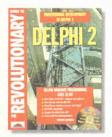
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Managing Change With Integrity



#### The Revolutionary Guide to Delphi 2 reviewed by Will Watts



elphi books occupy a whole shelf at my local Dillons, and you would think some would be good. However, even the most superficial of inspections reveals

many of the offerings to be either 1) tutorials so babyish even Visual Basic programmers would be insulted, 2) shameless reworkings of the bundled manuals, help files and old Turbo Pascal material or, 3) all of the above. Given the, ahem, indifferent reputation of the product s bundled docs, what your hard workin, hard livin Delphi professional needs is something with a bit of depth: a few words from somebody who has actually wrestled with the damn thing in anger.

Or in this case nine somebodies, including some of the brightest stars in the Delphi

galaxy. The Revolutionary Guide to Delphi 2 comprises 18 chapters, each written by one of the gang of nine on a subject dear to his heart. Bob Dr Bob Swart, an EXE reviewer and a brilliant question-answerer on CompuServe, contributes chapters on component building and his beloved experts (home-made IDE add-ons). Dave Jewell, a regular on these pages, has put in a chapter on Windows API programming, and Brian Long, formerly the long suffering blong from Borland s CIX tech support conference, has written an excellent and knowledgeable chapter on debugging. Ewan McNab tackles database issues over three chapters - points awarded for mentioning a few raw BDE functions, but it should perhaps have gone further, to include, say, the commonly used index rebuilding functions. Colin Winning waxes lyrical about Report-Smith ( create complex and sophisticated reports, the like of which can t be provided using [other] reporting tools ). He seems to

be completely sincere, so we should find out what exactly he is on, and try to get hold of some. Other contributors supply chapters that make up a general guide to Delphi. The text is readable, well presented and definitely *not* reminiscent of any manuals.

There is one major complaint: the Delphi 2 in the title is a bit of a stretch. The book is based on (16-bit) Delphi 1, and the contributors haven t yet had enough experience of the (32-bit) Delphi 2. This leads to some important omissions and poor stylistic hints.

#### V

#### Verdict: Uneven, but worth having

Title: The Revolutionary Guide to Delphi 2

Author: Swart, Jewell, Long, McNab et al

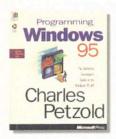
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 Wrox Press

 ISBN:
 1-874-416-67-2

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 £46.99 (inc CD-ROM)

Pages: 711

#### Programming Windows 95 reviewed by Colin Smith



he new testament of The Petzold Book, updated for Windows 95, has arrived. It follows the formula of the original tome, with familiar chapters on

MDI, DLLs etc, supplemented by the new Windows 95 chapters, covering the modern user interface, multitasking and multithreading, and OLE.

A total rewrite has been avoided — the authors have merely made updates where necessary, for example adding coverage of enhanced metafiles, paths, etc. The book has retained the classical C-oriented approach to Windows programming, which in the age of MFC and C++ may outrage some, but guarantees the widest possible audience.

One annoying change is the placement of the 150 page GDI section — it crops up as only the fourth chapter, just after Hello World and Painting with Text. I think this introduces the concepts of GDI far too early — there is a danger of bogging the newcomer down with the complexities of mapping modes, ROP codes, etc. The original book placed the keyboard and mouse chapters here, which helped to embed the concept of the Windows messaging system firmly into the head at an early stage.

The first of the Windows 95 enhancements are introduced in the MUI chapter, which covers a few of the new controls, such as the toolbar (including tooltips), statusbar and property sheets — well enough to get a programmer started. MM gently introduces the thread concept, complete with a short discussion of thread synchronisation issues and techniques, and thread local storage. Some thread execution diagrams would have been useful here to illustrate the points.

One of the best chapters in the book is What's this Thing Called OLE? It gives a crash course in OLE, discussing OLE basics, the various OLE technologies, and the structure of the underlying COM (Component Object Model) system.

Those starting off with an empty Windows programming bookshelf should fill it with this

book even if they are convinced that MFC is the way to go, as it will be useful when looking under the MFC hood and filling in holes in the bodywork.

On the other hand, experienced Windows programmers should consider more suitable books that concentrate exclusively on the new Windows 95 enhancements. This book is not just about the new goodies in Windows 95 — its intention is to take someone starting from scratch and give them the skills and confidence to tackle the world of Windows programming. Still, lets hope the OLE chapter pops up in a future Petzold book — and in the meantime it s useful enough to be worth borrowing a copy for.



#### Verdict: Recommended for beginners

Title: Programming Windows 95
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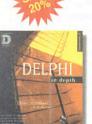


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Ronald Mak

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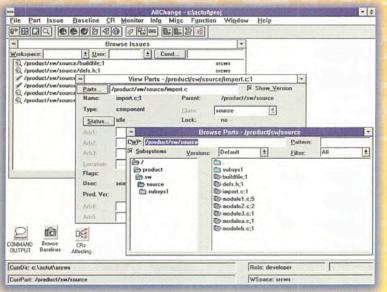
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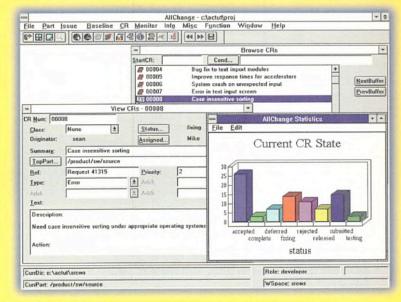
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REF SC/05/EXE

**DEVELOPERS** C/C++/VISUAL BASIC/UNIX/WINDOWS 95/NT SERVER Software House and End Users in Finance, Banking, Manufacturing, Commercial, Scientific and Government application environments require excellent C skills. Both Windows development skills W3.1 SDK, NT, X-Windows and Visual Basic or strong C, C++ solid operating systems and good application knowledge are again much in demand. Software development experience is the key, and being able to deliver high performance, high quality, well specified software in competitive time scales. Opportunities vary from small to large software companies involved in expert systems, GUIs, Image Processing, GIS, EIS, Communications, Networking and Object Orientated Databases. Graduates through to senior software engineers/team leaders are required. Please call to discuss

£14-£35K + benefits

#### UNIX/VMS/WINDOWS 3.1/95/NT MFC/C/C++

ALL LEVELS

A degree in computer of natural science, two years solid C/C++ programming experience and a sound understanding of UNIX, VMS or MS-DOS are required to work on large scale programs with user interaction. You will need an intelligent problem solving approach to work and be a quick learner to programmer software in an X-Windows, Windows SDK or NT environment, port software to different systems and liaise with customers to drive through product improvements. Excellent career opportunities for the right candidates.

#### £16-£28K

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Strong programming skills in C or C++ and Windows NT are pre-requisites for these positions. Experience in some of the following areas is also required: Windows 3.1/95, Windows NT, Windows SDK, MS C 7.0, MFC, Visual Basic, Visual C++ and Microsoft NT. Also desirable are Windows XVT libraries or networking skills. REF: SC/08/EXE

#### SOFTWARE ENGINEERS-SENIOR SOFTWARE ENGINEERS

Various Client/End Users, Software Vendors and Software Houses dedicated to strategic implementations of leading edge technology and integration of applications across different hardware and operating systems platforms require candidates to degree level with a scientific/technical development bias and 1-3 years experience. There are two main options

TECHNICAL DEVELOPMENT: Continued use of UNIX, VMS, MS-DOS, Windows NT (SDK, NT or X-Windows and Toolkits), Networking and Communications with companies offering technology based careers and management responsibility.

COMMERCIAL DEVELOPMENT: Using technical based skills already developed, but offering opportunities to apply analysis and design skills rather than remain 'a technical guru' in various environments including finance. Please call to discuss your particular career, growth and potential £12-£25K + benefits REF: SC/09/EXE

VISUAL BASIC SKILLS MUCH IN DEMAND - PLEASE CALL TO DISCUSS REF: SC/10/EXE HANTS/LONDON - VIRTUAL REALITY DEVELOPERS - MFC, C++ - to £35K REF: SC/11/EXE LONDON COMMS SPEC X25, X400 £40-60k REF: SC/12/EXE REF: SC/13/EXE C, C++/MFC - Countrywide



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Ref: BQ0023 (EXE)

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#### PC SYSTEMS SUPPORT

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have practical experience of Network PC installation and configuration with Novell Netware, Windows and ideally MS applications experience then THIS IS THE JOB FOR YOU. Call now for more information!

Ref: BQ34000 (EXE)

#### ANALYST PROGRAMMERS - C/C++

Birmingham Circa £25,000 + Benefits

If you are seeking a challenging and highly rewarding development role which will keep you abreast of the latest technologies, then this major international software house is the one for you. They provide software to over 80% of the worlds leading financial institutions, and are currently seeking Developers with solid 'C'/C++, a minimum of 1 years' commercial experience plus one or more of the following: Windows NT, Windows 3.x, SDK, UNIX or DOS.

#### SOFTWARE ENGINEERS - REAL-TIME/'C'

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#### WINDOWS DEVELOPERS

#### BORLAND DELPHI

City, London Bridge £16,500 to £32,000

The Company: Developers of advanced and innovative financial applications using the latest development

The Position: To join a team actively involved in the full project life cycle on brand new developments to the financial sector.

The Person: You will have gained at least 6 months of Borland Delphi experience from within any application area. Excellent opportunities exist within this well established, friendly and dynamic company. Ref: JJ-2W

#### 3D GRAPHICAL MODELLING

£17,000 to £35,000

The Company: Expanding company developing the latest in 3D CAD/CAM applications and modelling tools. The Position: To take a responsible part in the development of the core product, specialising in 2D & 3D modelling.

The Person: Ideally degree educated with at least 1 years Visual C++ development experience in a mmercial environment. Any knowledge of Windows 95, Graphics or 2D/3D experience would be beneficial

Ref: JJ-13W

#### 'C', XWINDOWS APPLICATION DEVELOPMENT Cambridge £18,000 to £25,700

The Company: Internationally recognised leader in the field of GIS applications to various market places. The Position: You will be involved in the development of applications within the digital mapping group.

The Person: Ideally you will have 18 months experience of 'C' Xwindows, Motif. Any additional experience of C++ and 'OO' experience would be very welcome.

Ref: JJ-11W

#### 'C' & Windows NT Derivatives Development from £24,000 to £38,000 + Benefits

The Company: Derivatives software house supplying over thirty of the worlds top banks with financial systems.

The Position: Development of Windows NT based derivatives trading software for use with renowned banking establishments.

The Person: Degree educated (preferably in mathematics) with 1-2 years commercial experience of 'C' development with Windows NT. Previous knowledge of the derivatives market would be ideal, as would experience of either team leading of project managing. Ref: DL-11W

#### GRAPHICAL TOOL DEVELOPMENT IN 'C' and WINDOWS

Cambridge

£30,000 - £35,000

This small but expanding software company supply advanced software to leading World-wide clients. Their key product is a Graphical Tool used for executive decisions and project management. They require a key developer to take control at an important time with skills in the following: 'C' GUI programming in Windows or XWindows and database design along with SQL. Attractive benefits and career progression exist in this

#### BORLAND C++ DEVELOPMENT FOR WORKFLOW MANAGEMENT North Cambs £20,000 - £26,000

Working at the leading edge of Workflow Management systems this company requires strong Borland C++
developers to join their dynamic teams. A minimum of one year's experience is required of Borland C++ and any exposure to OWL will be of great interest. New modules of development work is available for committed software Ref: PH-11W engineers seeking a good career move.

#### VISUAL C++/MFC

£27,000 package

The Company: A leading British market research company using the very latest PC database systems for a wide variety of clients.
The Position: Use the latest GUI tools to design and

Oxfordshire

develop the next generation of statistical evaluation and graphical display products.

graphical display products.

The Person: Innovative graduate with a year or more using Visual C++ with either MFC or OLE in a busy commercial environment.

Ref: MD-11W

#### VISUAL C++ & MFC BANKING CONSULTANCY £25,000 to £32,000 + Benefits

The Company: Established banking consultancy providing services to major banking organisations in Europe and the

The Position: Consultancy and development of Visual C++ & MFC systems for Windows NT developed on site at their clients London offices.

The Person: Between 2-3 years Visual C++ & MFC development experience not necessarily gained in the banking field. You will also need to be presentable and personable as client contact makes up an important part of this position. Ref: DL-12W

#### UNIX(SVR4) & WINDOWS NT DEVELOPMENT from £25,000 to £35,000 + Benefits

The Company: Financial Software House developing front office securities systems for international banking. The Position: You will be working on new client server securities systems for UNIX (SVR4) using C++. These systems will also be ported to Windows NT.

The Person: You will be degree educated with around 2-3 care comparied experience of developing UNIX systems.

years commercial experience of developing UNIX systems, strong C++ skills will also be required. Any knowledge of Windows NT would be beneficial as would experience of other versions of UNIX and relational databases.

0



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#### VISUAL BASIC & CLIENT SERVER Oxon/Glos border

This leading software house can offer graduates with a minimum of 1 year's Visual Basic experience an excellent opportunity to grow in a demanding yet stimulating environment. As a team member you will work on new projects which include Client/Server and Data Warehousing in addition to building front-end systems in VB. Good interpersonal skills required for all posts, some of which are at senior analyst/programmer and business analyst level.

# DEVELOPER - C / C++, Unix or Windows

Our client is a leading supplier of modelling software products for use in the fields of pharmaceutical and biotechnical research. These complex products are developed in C and C++ on a variety of platforms including Unix, Win95, WinNT and Macintosh with some being developed for the Internet. We are seeking people with a combination of programming excellence in C/C++ and outstanding academic achievement in a science subject (Degree, MSc, PhD). This is an excellent opportunity to work on leading edge products in a challenging and technically stimulating environment.

#### ANALYST / PROGRAMMER - C++ / VC++ **Bucks/Oxon border**

This global market leader has an excellent opportunity for an innovative Windows developer to work on a major strategic product. You will play a major role in developing a client/server flagship product written in MSVC++ using MFC libraries. The system will be rolled out to major corporates in Europe and feature PC to mainframe and Unix connectivity. The successful candidate is most likely to have a minimum of 18 months' C++/VC++ experience, together with an understanding of communications protocols, the Internet and Email.

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#### REAL-TIME

#### C++/REAL-TIME Herts - To £30K

Our client is predominantly a developer of software and a supplier of computer systems and associated support services for retail applications. Candidates should have experi ence of real time applications and either 2 years of C/C++ under UNIX or Visual/ Borland C++ in a Windows environment, preferably using the class libraries. Must be able to work well within a team. Ref: CP/1

#### REAL-TIME 'C' PROGRAMMER London - To £25K

Our client, a leader in its field of developing software for handheld computers, is looking for a Software Engineer with experience of developing low level 'C' software in a real time environment. Knowledge of communica-tions protocols would be advantageous for the development of their range of radio network products. There will also be the opportunity to work at the applications level if desired. Development experience of Visual C++ and/or Visual Basic would be useful in

#### C/C++ REAL-TIME Bucks - To £22K

Our client develops chips and software for the video conferencing industry. They are searching for candidates with a minimum of 2 years C/C++ programming, with experience of embedded real time applications. Applicants must be highly self motivated and a team

#### UNIX DEVELOPMENT

#### SYSTEMS ENGINEERS Berks - £20K to £35K

Our client, a major player in the world of computing are searching for experienced systems level engineers. Positions exist at all levels, with successful applicants joining small teams working on leading edge projects for the teams working on leading edge projects for the telecommunications industry. Specific technical requirements include a strong knowledge of 'C' and UNIX preferably to ker nel level, experience of device driver development will be of great interest. Rewards include and the opportunity to work for this prestigious сотрапу

#### NETWORKING/C/UNIX Herts - To £35K

These are excellent opportunities to work with his leading US company in a high technology team environment. We require at least two years post graduation experience where you have gained strong "C/UNIX programming skills. Experience with TCP/IP networking. IPX/SPX, Netware or NT connectivity will be Ref: LC/5

#### X WINDOWS/MOTIF Cambs - £20K - £30K

Excellent opportunity to develop a leading GUI product for the next century. Candidates should have at least four years post-graduation experience where they gained good 'C'/UNIX programming skills. In-depth knowledge of X-Windows and Motif essential. Ref: DE/6

#### C/C++/UNIX/NETWORKS Herts/Scotland - £30K - £45K

Excellent 'C' and/or C++ skills under UNIX are required to work for this consultancy/software house specialising in the provision of this net-work management software. Specifically they develop components needed to enable SNMP management, for UNIX and PC platforms including Windows NT, 3.x and OS/2. This is an opportunity to expand your existing network development skills in a consultancy environment.

#### LOW LEVEL ASSEMBLER Cambs - £20K - £25K

software engineer with strong Assembler skills is required to work on our client's core tools writing code for compilers, linkers and debuggers. This client develops MS Windows and UNIX based programming tools targeting There are also opportu nities to work on GUI software.

#### 'C'/UNIX DEVELOPER Berks - To £30K

Our client is a leading supplier of Systems Management software and services for Open Systems. The emphasis is on providing solutions, not just products, with services being a big part of the company's offering. They are looking to extend their development with people who have a practical knowledge of UNIX with design and programming experience in 'C' and Shell Environments.

#### **RDBMS**

#### ORACLEV7/NT/UNIX Oxon - To £30K

This world class provider of client-server soft-ware has a requirement for a talented Oracle database administrator. Technically, you should have two years experience as an Oracle DBA with at least one using v7. Knowledge of SQL is essential along with a sound understanding of Windows NT and UNIX operating systems. An excellent oppor tunity within a growing and highly respected company.

#### UNIX/INGRES C.London - To £28K

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

#### Ref: DE/11

#### PRO\*C/UNIX/ORACLE City - To £28K

This well established commodity brokers are searching for a self motivated developer with good interpersonal skills and experience of the whole project lifecycle. Excellent 'C' and Pro\*C with embedded SQL preferably from an Oracle background are required. You will have the opportunity to work in a client-server environment using the Oracle 7 toolset. Highly competitive salaries and challenging technical project work on offer. Ref: DE/12

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# OBJECT LESSONS OF THE PROPERTY OF THE PROPERTY

OBJECTS ARE STATE MACHINES. HIGH LEVEL OBJECTS ARE DEEPLY NESTED STATE MACHINES.





WELL, IT'S TRUE.
EVEN OOGL,
THE PUREST OF
THE PURE IN OO
LANGUAGES.
COMPLES TO PLAIN OLD
KERNIGAN & RICHIE C.



IF ONE HAD SUFFICIENT ORGANISATION & SELF DISCIPLINE, IT WOULD THEORETICALLY BE POSSIBLE TO WRITE THE IDENTICAL CODE DIRECTLY IN C.





# Old Objects, Old Danger

To Verity's eternal surprise, the PR people have started banging on about objects again. For the benefit of those who are too busy to read 'Booch clouds: the lighter side' as serialised in the Daily Mail, she has prepared an executive summary.

#### Verity, I think one of these new-style CORBA objects may have snuck into my current project. How can I tell for sure?

As everybody knows, with true distributed objects it s impossible to know anything about them except their interface, and even that may only sometimes be determinable at runtime. However, there are some tell-tale signs. Distributed objects tend to be coarse grained, and

#### Hold on. What s with this coarse grained stuff? Are we dealing with some kind of mustard here?

Silly! Coarse grained is an OMG-approved synonym for big. It was felt that because big contained only three letters, people would assume that it was an acronym and start writing BIG and try to puzzle out what it stood for.

#### How, um, big does something have to be before it is declared coarse grained?

For example, business objects are always coarse grained.

#### Business objects? What, like paper clips?

Actually, yes. Business objects are objects which model real world objects, so paper clips and helicopters are in , while linked lists, combo boxes and transactions are out . Probably.

We seem to be mired here. Lets try another tack. Which programming language will I

#### need to use to reap the benefit from these new objects?

Aha! A simple one. The new objects are designed to be accessed from any language with the same ease.

#### What kind of ease is that?

Well, since method names, parameter types and numbers all have to be determined dynamically, you should budget for around 25 lines of C per method call. Alternatively, an extra preprocessing stage allows C++ programmers to perform method calls as easily as passing a complex number matrix generated by a FOR-TRAN module into an eigenvalue calculator written in 1977 IBM JCL.

#### Great. Does all this dynamic linking business add any overhead to the program?

Do Hawaiian pizzas have pineapple chunks in their toppings?

#### I see. I must say, I m surprised you can use these things from C. Are you entirely sure they are proper objects?

Oh yes, they come fully laden with all the right bits: encapsulation, polymorphism and even multiple inheritance, which will please fans of the mix in style of design

And fans of class hierarchies which look like Auntie's knitting after the cat

#### has been at it. Verity, it s time to be straight with us: what exactly is the point of all this?

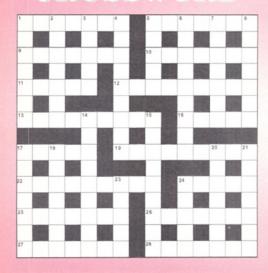
The powers that be have noticed that the great dream of object reuse has been, if not a complete failure, then a mighty disappointment. The idea is that coarse grained, language independent, OS-independent objects will hang about on networks, co-operating in complex applications slung together with a few lines of a scripting language.

#### Sounds like a noble ideal. But hold on you haven t explained what you mean by OS-independent.

Oh, all the world s major operating systems. Unix, Warp, Next, Sinclair Spectrum monitor program

And Windows? I suppose after all that you are going to tell me that Bill is planning to establish an incompatible standard of his own, to be released at some indefinite point in the future, while knowing full well that like all Earth dwellers we are running a Windows-only network therefore don t have access to any of this tech-

Of coarse. But at least I kept you busy for a few minutes. Who s for a Hawaiian pizza?



- What cpus do to data and their method (7)
- Flow of charge at the moment (7)
- Musical thee French work a mainframe (7)
- 10. Groves of an ivory tower (7)
- 11. Until the crude ~ (5)
- 12. Build a programming building block (9)
- 13. Outcomes of successful projects Charles affairs! (9)
- 16. Sib s daughter (5)
- 17. Description on software package (often best ignored) (5) 19. Single bit of strong advice to inform a straight
- graphic (9) 22. Strong em, like X, can damage chips (9)
- 24. What to do with a mouse or light pen... (5)
- ... alternatively use conditional keyword and hard water to make a hole (7)
- 26. Ask how to search a database file (7)
- 27. Hardware? No, central software to the knowledge engineers (7)
- 28. Wooden external network (7)

- Guy Fawkes output unit? (7)
- Program module used like onion skin (7) Delete sign of hesitation as in the orient (5)
- Forming a graphic outline? (9)
- Use linked list to find article in facial unit (5)
- 6. How inductors and capacitors resist! (9)

- Carry out our full title (7)
- The uneven rate of an operations centre (7)
- Data keeper (9)
- 15. Boffin from 10, say, rather than a technologist (9)
- Cryptic hard copy of how to behave when drinking (7)
- 18. Nemesis going back a step on screen? (7)
- 20. Location when first set up (or its very simple label) (7)
- 21. Holds in high regard how south meets east (the other way, rather)... (7)
- ... as highest aims lose fifty notions... (5)
- 24. ... and high dudgeon appears on the mountain top (5)

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| Ease of Learning     | 9.1             | 7.1                 |
| Ease of Use          | 8.3             | 7.2                 |
| Versatility/Features | 10              | 8.7                 |
| Compatibility        | 6.7             | 6.5                 |
| Speed of API Calls   | 0.9             | 1.2                 |
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