May 1995

EXE

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The Software Developers' Magazine

GIF Grief

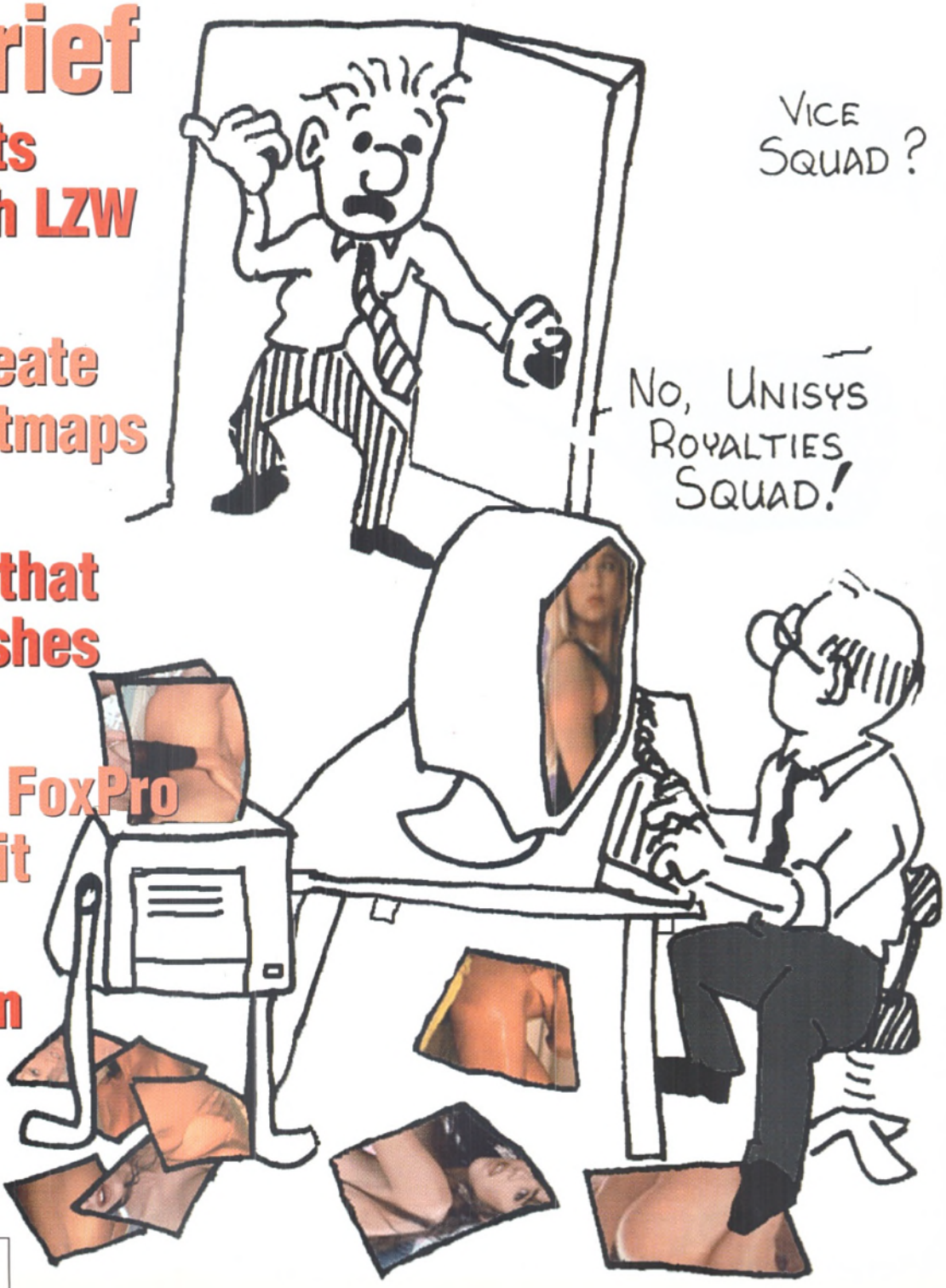
Unisys gets heavy with LZW

How to create fisheye bitmaps

C++ code that never crashes

Microsoft FoxPro goes 32-bit

A primer in Borland's Delphi



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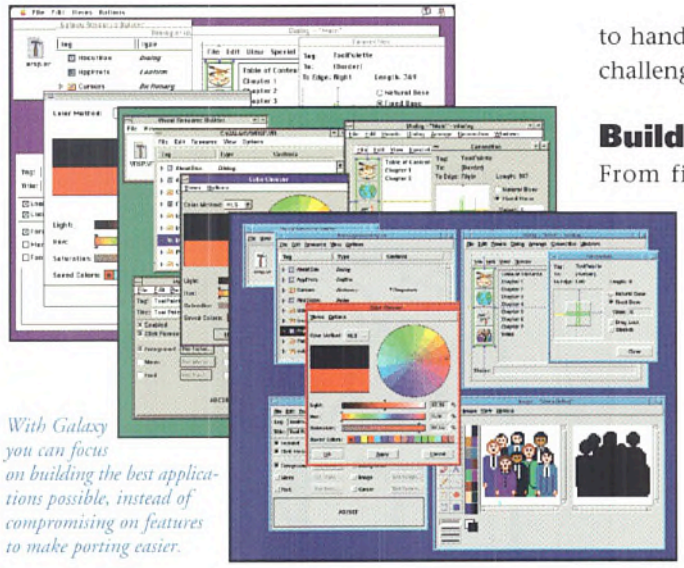

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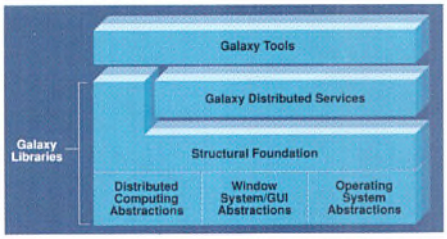

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The Software Developers' Magazine

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Display Advertising Manager: Marc Warren
Recruitment Advertising Executive: Marc Green

Marketing & Promotions: Suzanne Chamberlain
Subscriptions: John Wallbank

Front Cover Picture: Mike Paterson
Printer: St Ives (Roche) Ltd.

Production Editor: Mark English
Production Manager: Kate Adams

Display Sales Executive: Steven Miles

Office Manager: Jacqui Ramrayka
Publisher: Sandra Inniss-Palmer

Repro: Clerkenwell Graphics/Ebon
Typesetting: Clerkenwell Graphics/Ebony

Advertising email: stevenm@dotexe.demon.co.uk
Subscriptions 0171 439 4222 (John Wallbank ext2214) **Fax:** 0171 437 1350 ISSN: 0268-6872
Subscriptions. EXE. is available by subscription at £35 per annum (12 issues) in the UK: see subs card within this issue. The magazine is published around the 1st of the month. To subscribe or if you have a subscription query, please call 0171 439 4222 or write to The Subscriptions Manager, **EXE,** (address above). We can invoice your company if an official company order is provided. Back issues are available at £3.50 each. 'A Subscription implies that this journal will be sent to the subscriber until one of the three expires' (AG Macdonell.)
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EXE: The Software Developers' Magazine is independent and not affiliated to any vendor of hardware, software or services. It is published by Centaur Communications Ltd, St Giles House, 50 Poland Street, London W1V 4AX.
EXE Advertising/Editorial/Production Telephone: 0171 287 5000

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News & Views

TURBO C++ 4.5

This major new release of Borland's entry level C++ compiler is quite simply the best in its class. Includes a 16-bit subset of Borland C++ 4.5 plus a host of new features aimed at students, hobbyists and beginners.

These include a multimedia QuickTour which covers the latest IDE and C++ features. There is a help file with technical info and tutorials, a complete list of answers to frequently asked C++ questions, and thousands of pages of online docs.

There are five new games with full source code - Turbo Meteors (an Asteroids-like game), Turbo Blocks, Turbo Cribbage, Turbo 21, and Turbo Mah Jongg, and several free VBX's including a deck of cards, dice, gauges, & sliders.

Elements from Borland C++ include the full IDE with integrated GUI debugger, BRIEF-based editor, C++ object browser, and multi-target project manager, plus their application framework OWL 2.5 and OCF (Object Components Framework) for OLE 2.0 support. Plus all the latest C++ features like templates, exceptions and RTTI (run-time type information).

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CIRCLE NO. 081

Soap Flakes

Back in the jug agane

IT IS A CURIOUS place, the entrance to the publishing house Centaur Communications on Poland Street in Soho. A 30 foot long corridor with floor to ceiling mirrors all the way. Like being in part of the Dalek city from *The Dead Planet*. I was there by appointment to meet The EXE Publisher, a legendary and feared figure on this magazine, and my former boss.

She was sitting waiting in the lobby at the end, and recognised me almost immediately. She came straight to the point. 'Cliff is moving on to do the Internet stuff. We need an Editor. Schifreen's too expensive, Kemp's gone AWOL, so you'll have to do.'

'But Madame Publisher', I said (she is rather keen on formalities), 'I have got another job. These days I work for Quin Butterworth Spangenthal, purveyors of fine software to the programming gentry.'

Puzzlement crossed her fierce-but-beautiful face, left to right. Evidently she hadn't considered the eventuality of me having obtained other employment. Then she smiled.

'That's all right - we'll subcontract you. I'll fix it up. Start Tuesday, 9 o'clock sharp.'

'But Madame Publisher', I said again, 'you don't understand. I can't be Editor if I work for another company in the business. There's a conflict of interest the size of a 40 tonne Arctic.'

'Pooh', she said scornfully, 'that's all right. We'll set it up so that you don't do any product reviews, you don't choose the material to be reviewed, and if I read so much as a squeak about QBS, I'll personally break all the fingers in your right hand.'

'But Mad...'

She cut me off. 'And you can tell the readers all about it too, so if they sniff anything dodgy, they can let me know. If they're right, it'll be finger time. Yes, you tell them.'

Which is what I am doing, Dear Reader (and Dear Grey Matter and Dear System Science *et al*). Only for obvious reasons, I'd much prefer it if you told me first, to see if we can't work out a less digital solution. And while you're there, please tell me what you make of the magazine: what you think of it, what you think of the little changes I am making, what we should be doing, what we should not be doing. You'll find email and snail mail addresses and phone and fax numbers and all the other palaver on the masthead on the Contents page. I hope to hear from you.

The interview seemed to be over - but there was something I had to know, something which had been puzzling me for many months. Something concerning the name of the magazine. 'One more thing,'I called out, as The Publisher stamped off towards the lift. 'What did you do with the dot?'

But answer came there none.

Will Watts

I am not a number

ACCORDING TO Richard Cox, a telecommunications consultant, there were '431,460,000 usable telephone numbers' before PhONEday. Where does this total come from? Cox explains 'there are 900 available number groups from 0100 to 0999. In each of those groups, there are 799 number blocks (200-998) with 1000 numbers in each block. Out of those numbers, on average 60% can be [allocated] at any one time. This allows for not using certain numbers due to a high risk of error, due to number on recorded announcements, etc.' That's how we ended up with the initial figure. After April 16, the number of available phone numbers is multiplied by 10.

We probably only need about 29,000,000 of these numbers. But with the current geographic rationale for the numbering system, several cities will still run out of numbers within a few years. Did you know that there's no standard for phone numbers? Yes, every field of software, hardware, telecommunications has at least a few standards affecting it, but the phone number territory is still wild. Even without guidelines most countries, especially in Europe, have adopted logical schemes. But in the UK we're stuck with this evolution of the geographic area code.

Phone numbers were first created when all the phone systems were purely electromechanical and each phone number was clearly routed through a defined path of exchanges. At that time it was logical that phone numbers described a path to reach the subscriber with the first digits identifying his or her local exchange. With electronic exchanges, mobile phones, *number-for-life*... the geographical approach doesn't mean much anymore. It is not uncommon for a local phone call to be routed through a remote exchange because it carries less traffic and hence it's cheaper for the telecommunication company. Which puts into question the definition of a local call.

Why will all this have an impact on us, end-users of the telephone system? For at least one reason: PhONEday must be only the first change in a series of number shuffling. In the next 10 years there should be at least one more renumbering, if not two.

Numbers will change again on a national scale. People will be able to keep their numbers for much longer if not for lifetime. So it will no longer be possible to create applications that deduce the location of a phone from its number. The concept of the phone directory will need to be revised. Where should be listed the mobile phone number of someone commuting between Oxford and London? In the Oxford directory? In the London one? In both? Or in all UK phone books, since it would cost the same to call this number from wherever?

A whole new realm of development will be possible. Since phone numbers will be more and more associated with people, not where they are, applications should take advantage of this fact.Consider this: when you will call your PC, it will read the phone number of the incoming call. And it will know it's yours. With its text to speech application it will then read out the most urgent email messages you received.Possibilities are endless.

Looking forward to the next National Code Change? Do you have any suggestions on how to name it? If so you can always call Oftel on 071... sorry 0171 634 8700. What about PhONEday the comeback, PhTWOyday...

David Mery

Ambridge blues

I BELIEVE THAT Robert Snell caved in far too easily. After all, what do these Borchester lawyers know about copyright legislation as applied to software?

If you have better things to do on Sunday mornings than sit on your backside listening to Radio Four then you need briefing. Robert Snell is the token software developer in the BBC's eternal story of everyday farming folk, *The Archers*. Fate has not been kind to Snell. Not only is he married to the character who is the most tiresome of the whole clan by a long chalk. Not only does he have to set up and maintain all the PCs in Ambridge - and I think we all know what a pain being known as the local 'computer expert' can be.Not only does he have to put up with all this, now the pernicious Pebble Mill scriptwriters have heaped on him the added indignity of making his little one man company go bust.

This is what happened. Snell, sensing that his ailing enterprise needed a boost, had adapted an application that he had slung together for a local fruit canning factory, and was trying to flog it in his particular vertical market niche. The fruitiers somehow got wind of this, and sent him a nasty solicitor's letter claiming that they owned complete copyright on the program and demanding that he withdrew. Snell, who is something of a wimp, consulted the local legal talent and they advised him to capitulate and go into liquidation.

Now the Beeb hasn't really given us enough information here. For a start, we don't even know what Snell's application did, or what it was written in. This is typical of the programmerist attitude the BBC takes, by the way.If it had been a blocked slurry pipe in the pig unit on Lakey Hill, we'd have been given all the gory details.

One would have thought he could say to the canning factory: lay off or you're doing all your own tech support and upgrades. Even if they had bought the source code - and I reckon that they did - this counter threat would surely give them pause for thought. But he clearly signed a truly terrible contract if his lawyers told him he couldn't sell on a different program which incorporated some parts of the canning app. How is a jobbing programmer to exist if, every time he sells an application, he also sells the rights to his library of bits and pieces of code? Is one really supposed to start every application one creates from a blank sheet?

It's a serious point.But while you ponder it, don't forget poor Mr Snell, who is the victim of a wicked injustice. I am hereby starting a campaign to put things right. Wednesday week we march on Broadcasting House. You bring the placards.

Meanwhile at Grange Farm...

WW

Guest Opinion: ODBC and the Euro-sausage

JIM HACKER'S finest hour in 'Yes Minister' was his populist stand against a bureaucratic directive from Europe attempting to standardise the sausage. Today, the intense European debate echoes with similar arguments as we seek to balance the opposing forces of commonality and individuality. On a smaller stage, ODBC, the database connectivity standard, arouses equally deep passions with committed adherents and sceptics.

Looked at from a European perspective, the debate is, of course, not surprising. What right has Microsoft to invade the hallowed grounds of data access, dictating basic methods that some database specialists had cut their teeth on. 'Leave our great British sausage alone,' they cry.

Some highly competitive industries migrate toward a standard without any formal directives. Test drive any new car today, and you'll be surprised if you don't find the indicators and windscreen wipers in their usual location. Those cars that had probably excellent proprietary interfaces, like the Seat Ibiza or the Citroen BX, soon found consumer pressure towards standardisation overwhelming.

In the complex business of IT, such pressures needed a voice. Probably, even without the initiative from the now defunct SQL Access Group, Microsoft would have taken a lead. Why? Consider the then imminent explosion in Windows acceptance and emergence of end user tools. The whole dream would crumble without a coherent and uniform approach to data access.

The fact that Microsoft promote the standard is paradoxically used by ODBC-sceptics as evidence of its closed and proprietary nature. This is particularly surprising, since a number of companies, including my own, supply drivers and development toolkit technology beyond the Windows stable to OS/2, Macintosh and UNIX.

However, in the time honoured tradition of the IT industry, we are not content to allow a standard to establish itself. No sooner are we implementing the latest trend than we find the pressure to abandon it becomes the latest flavour. Such is the myth surrounding the 'abandonment' of ODBC in favour of OLE 2.

The reality is that OLE should really be considered another 'way in' to ODBC, a layer or interface for tools to use to access the Driver manager/drivers that do the real work. The real danger with OLE implementations is that we revert to 'the old days' by another name; direct access to specific databases via OLE requires as many proprietary gizmos as the database APIs, losing all the benefits we have gained and are gaining daily with ODBC.

Realistically, most companies are just about catching up with ODBC. Over 170 tools available today are ODBC compliant. Many corporates are demanding ODBC as a pre-requisite to develop 'desktop standard' systems for their users. Many of these companies are also on a long-term strategy of providing a mixed set of applications that include existing shrink-wrapped applications (say, MS Office), customised applications (say, Notes, Excel Macros, Q+E QEFs, etc), and internally developed applications.

Although they all have different needs and tastes, they all need data access.And ODBC is the only common solution for them all.

Perhaps all that remains to be said to ODBC sceptics is that great British retort... 'Sausages!'

Dr. Tony Hill is the UK General Manager, Intersolv, the company which owns the well-known Q+E ODBC drivers. For further information he can be reached on 01727 812812.

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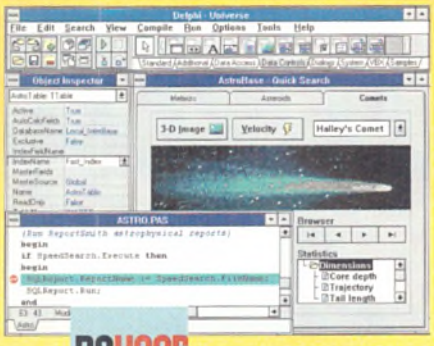

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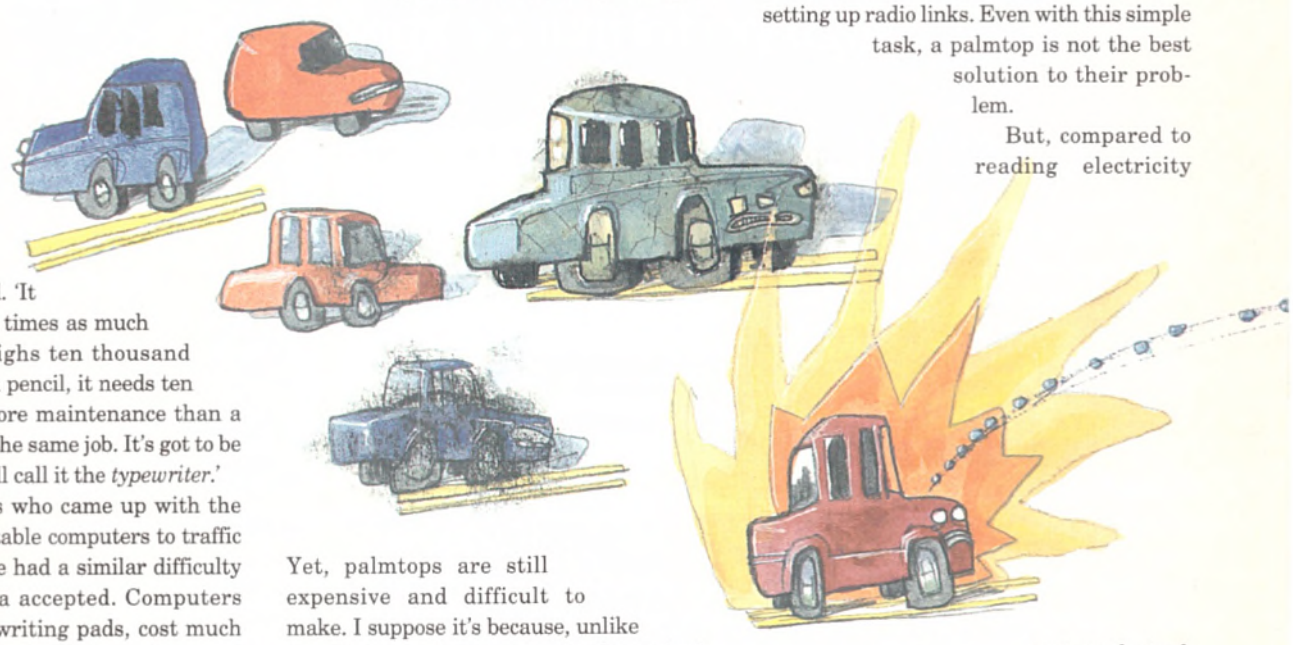
CIRCLE NO. 082

Mayhem!

Traffic wardens have been issued with portable computers. 'Is this more of Big Brother?' asks **Jules**.



'I've got this great idea,' he said. 'It costs ten thousand times as much as a pencil, it weighs ten thousand times as much as a pencil, it needs ten thousand times more maintenance than a pencil, and it does the same job. It's got to be a winner! I think I'll call it the *typewriter*.'

Whoever it was who came up with the idea of issuing portable computers to traffic wardens must have had a similar difficulty in getting his idea accepted. Computers weigh more than writing pads, cost much more, require batteries which run down and must be changed and can have their entire contents destroyed by an irate recipient of a parking ticket far more comprehensively than any writing pad. But, he must have been very persuasive, because despite traffic wardens being noted for a certain conservatism and lack of a sense of humour, portable computers is what some of them now have, complete with little printer and roll of paper for issuing of tickets.

In a way, it's surprising that portable computers are so hard to make. Considering that even in the most powerful desktop, there can't be more than two square inches of active silicon. We've had display technologies for years which have been designed for portable applications, from Sinclair's folded CRT to the modern LCD panels that are used in portable TVs. We've had a whole range of sparse button-driven interfaces, from those used on digital watches, even those used on telephone dials, to the complex hierarchical menu systems used to configure modems and printers. Touch-screen technology is sufficiently advanced that we can make the entire display surface sensitive for the sake of a few extra microns of thickness. We've been developing low-power technology for so long that it's now possible to buy watches with more welly than a desktop machine from five years ago.

Yet, palmtops are still expensive and difficult to make. I suppose it's because, unlike the PC, there's been no accepted standard, so most small machines are made in comparatively short runs and require a lot of custom tooling to localise them to a specific job.

The electricity distribution companies have been using palmtops for a while. Instead of sending a little man with a pad of paper, they send a little man with a computer. Instead of writing the numbers on his pad, he types the numbers onto the machine. This is a nice, simple job. The machine can be pre-programmed with the streets to be read each morning and only 10 different keys are required to define each reading.

What is saved by this exercise? The numbers don't have to be re-keyed into the main computer back at the office. This eliminates a significant number of errors, because the operators no longer have to decode the reader's shaky writing, and they don't have to keep an eye on each line as they're typing. Of course, they don't have to do anything at all apart from cash their giros, which from a certain point of view is also an advantage, but that's a different story.

But even the power companies are looking at easier ways of reading meters. They've played with getting the meters to transmit their totals down the very wires which they are measuring, and they've played with parking a van in a street and setting up radio links. Even with this simple task, a palmtop is not the best solution to their problem.

But, compared to reading electricity meters, the traffic warden's job is significantly harder. It's not just numbers that have to be typed in, it's letters too. It matters what time the record is created. The offence has to be added, which may be done with a menu, but given the bureaucrats' love of meaningless numbers probably continues to be an abstract number, which probably appears on a table on the back of the machine for easy reference. Finally the ticket must be printed and the machine has to make sure it hasn't run out of paper or ink, or even Sellotape.

Now, there's all kinds of useful information an electricity meter reader can find. It can consider demand as a function of time of day. It can measure the number and frequency of brownouts or interruptions (where I live, that's an important measure, because we get so many) and other more technical measures. But that's not true of a traffic

warden; all the relevant information is right there in front of him; time of day, vehicle registration number, location, offence code, and recipient abuse rating. What could the wardens possibly gain from automation?

As far as I can see, not a lot. I understand that purely digital information still does not qualify as evidence, so the machine will have to print a duplicate ticket at some stage, which still needs to be filed manually. Some re-keying is saved, but not much, and the poor warden has to carry even more equipment than before.

But if there was a period, in a particular machine, where no tickets were printed, it's conceivable that the warden wasn't searching for victims, but was instead sleeping on a park bench or humping other traffic wardens under the articulated lorries. Motion sensors inside the machines would be able to detect idle time, and thus identify the skivers. The internal programs could detect aborted entries, which might correspond to wardens bowing to threats or bribes, thus directing internal investigations.

Giving computers to traffic wardens is Big Brother-ism, but it's not directed against you and me, it's directed internally. In some ways it's a good thing, being able to use a computer to accumulate circumstantial evidence, but in other ways it's very bad. There's a vast quantity of circumstantial evidence which must be sifted, which presumably will be done by automated filters, the reliability of which must be highly suspect. What's more, normal mutually-acceptable working practices, when subjected to this kind of detailed analysis, look very poor. Pressure on the workforce to work unreasonably hard or unreasonably consistently will lead to poorer performance in the long run.

Whether or not you think that the long-term reduction in performance of traffic wardens is a good thing, the principles can be extended to other jobs. Production line working was the bane of the 20th century and few people are sorry to see the reduction in its popularity. Portable computers, particularly those attuned to specific jobs, are able to bring back all that was worst about production lines, and they will do it quietly, insidiously and perhaps without anyone noticing.

There is some good news. At least it happened to traffic wardens first.

Jules is not, and has never been, a traffic warden. I bet that surprised you. What's more he doesn't hate them, because he accepts that anyone working for a large bureaucracy leaves their personal responsibility in the locker room. He imagines they would be hilarious at parties, were they ever to be invited to one. If you know a traffic warden, or have met one socially, you can tell him about it by calling his new number, 01707 662698, or by emailing jules@cix.

Information overdrive

If you haven't hiked a cyber ride on the information superhighway and, to use a *Wiredism*, run the risk of turning into an *anoraknophobe*, then you should sprint along to the Information Superhighway exhibition running until 3rd September at the Science Museum in South Kensington. There are three parts to the exhibition. The first is a showcase of new technology which examines the comms infrastructure and demos packages like E-World. The second, *Surf City*, is aimed at both newbies and experienced *Net Heads*. In the final section, *Looking into the Future*, visitors can find out what it would be like shopping online, working in the global office and how interactive television will work. Admission is £5 for adults. For those who can't make the trip to South Kensington, do not despair, the Science Museum is putting most of its collections on the Web right now.

OMG goes OLE

Ah ha. Could the OMG be bowing under pressure from the combined voices of DEC and Microsoft on the CORBA committee? Looks that way. OMG has issued a Request For Proposal to provide transparent access between CORBA and OLE/COM. There are two parts to the RFP. The first is a gateway between existing OLE/COM and CORBA. The second will take into account the next release of OLE, which will support distributed objects. Understandably, Microsoft was pleased with the news. Chris Stone, president and CEO of OMG, still looks forward to the day when millions of PC desktops will be able to tie into ORBs from hundreds of suppliers.

Big Mac

Has it really been just over a year since Apple launched the PowerMac? Sales of the machines have exceeded the manufacturer's first year expectations. Michael Spindler, president and CEO at Apple, described the PowerMac as the most ambitious and successful product introduction in Apple's history. The one-millionth unit was shipped in December 1994. So far over 560 native applications have been released. Apple has put in place a number of programmes aimed at developers wishing to write native applications. There is the Apple Developer Technical Support group with two porting labs, and PowerMac pages on the World Wide Web with literature, sample code, training and FTP. For more information call Apple on 0181 730 2480 or point your Web browser to http://www.info.apple.com/dev/developerservices.html.

IT's show time

Come to the EXE show. We'll all be there and it's going to be cool. It's all happening on the 8th and 9th June at the Royal Horticultural Halls, Westminster. There will be over 70 exhibitors including some of the biggest names in the business: IBM, Computer Associates, Gupta, Powersoft and Symantec to name but a few. Among the list of exhibitors are some familiar faces. These include User Interface Technologies whose managing director is Niall Mansfield, our *Open Systems* columnist; Rhino Publishing and Chris Sennit whose *OO application building in* VO featured in the December 1994 issue of EXE; Bits Per Second with VB guru John Marsh, who wrote *OCX for the aspiring alchemist*, in EXE August 1994 and Citadel Software. If you can remember back to the heyday of *.EXE*, Dave Mansell of Citadel was the man who brought us *The Mouse's tail*.

There are also 20 technical workshops running over the two days of the show. These include four 'guru' hours where leading figures in the software development world speak of new technologies and the increasing demands of today's software. Among them will be Eiffel's progenitor, Bertrand Meyer. Highlights of the workshop sessions include *Cybernauts*, a session for aspiring Internet wizards, *Mastering the Pixel* to blow your mind with graphics programming, a *Development Tools Showcase* and a *Programmers Forum*, chaired by ACCU chairman and C++ columnist Francis Glassborow, with advice from leading techies.

Entry to the exhibition is free to ticket holders. The ticket hotline is 0181 7102190. It will cost £10 to attend each seminar, pre-registration is needed.

Excuse for reuse

A recent European-wide survey sponsored by CenterLine has brought up some startling revelations on the extent of software reuse in the in the industry. Some 90% of the 300 companies surveyed said they were using C++. Smalltalk came an extremely poor second with 4% and Eiffel only managed 1%. Reuse is seen as the most important benefit of object oriented programming. Improvements in code quality was cited as the number two benefit and faster development time came in third. The question of what exactly constituted code reuse produced some strange replies. Apparently 24% of those asked considered cutting and pasting as code reuse. Well, let's face it, it does cut down on the typing. Interesting enough, only 25% were developing their own reusable class libraries and 24% were using commercial class libraries.

While the majority of companies are investigating the benefits of code reuse, only 9% have actually developed reuseable framework libraries. And only 3% have adopted a corporate wide reuse programme. Nevertheless, for 38% of respondents, a reuse programme will become an issue in the future, 21% said within a year. Yet while there was general agreement upon the overall benefits, high entry costs and lack of commitment seem to be the main reasons for not adopting the technology. In fact, 17% of companies have no plans at all for a reuse programme. There is generally a bad feeling among developers regarding reuse tools. Fourteen percent believe there is a distinct lack of them and 8% expressed the opinion that there was a distinct lack of class libraries. Obviously there is some unwillingness to accept new tools and methods. But 13% felt that training overheads were significant barrier preventing code reuse.

In spite of claims that Sun is about to be knocked from the top spot for Unix workstations, 60% of those surveyed were using Sun kit. The HP 9000 came second followed by IBM RS6000.
On Unix development platforms, UnixWare has had little impact, Solaris is still the most popular Unix development environment. Even though IBM marketed OS/2 as a platform for developing and running Windows applications, it has made little impact, with only 10% of respondents using it. NT has almost caught it up and Windows is still the dominant PC platform.

The survey predicts that NT will grow over the next 12 month to 43% market share at the expense of Windows, which doesn't leave much breathing space for the much thwarted Windows 95 offspring. OS/2 is also set to grow to 17% at the expense of DOS.
The survey is conducted every six moths by ICLP for CenterLine Software. CenterLine can be contacted in the US on 001 617 4983288.

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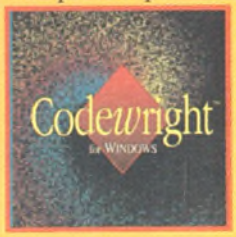

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CIRCLE NO. 083

CommonPoint not very common

Taligent released the final beta reference release of its CommonPoint frameworks. But this release is still limited to Taligent's investors - a small group of selected developers. According to Joe Guglielmi, chairman and CEO of Taligent, 'the final reference release [should be] delivered this summer'. The current beta includes yet another, the beta of cpConstructor, a GUI development tool, the first product in the CommonPoint Developer Series. The second one will be TalDE, the Taligent Development Environment. Taligent is on 001 408 2552525, alternatively you visit the Web site http://www.taligent.com.

Powersoft European meeting

Powersoft is organising its first European user conference in Berlin, 18-22 June. The conference focus will be on the new technologies incorporated in Powersoft Enterprise Series and on multiplatform support. Topics will include enhanced database support for Oracle, Sybase, Informix and Watcom. Powersoft and Watcom are both subsidiaries of Sybase. Parallel to the conference will be a CODE partner exhibition. CODE is the Client/server Open Development Environment partner program of Powersoft. To attend, contact Jane McCarthy at Powersoft Europe on 01494 555513.

C++ goes parallel

EUROPA, the working group on parallel C++, announced its roadmap for the creation of European standard for object oriented languages for high performance system. The London Parallel Application Centre maintains an archive of the roadmap available at http://www.lpac.ac.uk/europa/index.html or by ftp at ftp.lpac.ac.uk. You can also call LPAC on 0171 975 5315.

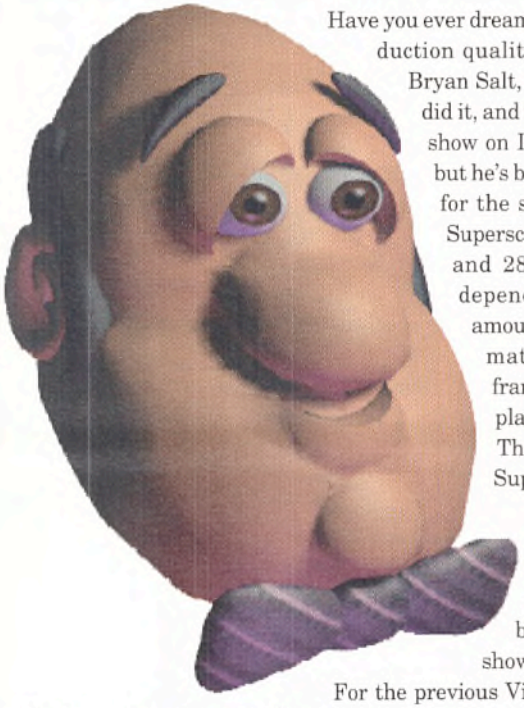
NeXT gets Objective-C

NeXT acquired all the rights of Objective-C from Stepstone. This object oriented programming language has been used by NeXT as the reference language for NeXTStep. Stepstone has a licence allowing it to continue to market its compiler products. NeXT also shipped NeXTStep Developer 3.3 for Intel, SPARC, PA-RISC and Motorola 68k, and NeXTStep 3.3 for Sun and HP workstation. Even though NeXT obviously wants to push Objective-C, Developer 3.3 includes an improved C++ support. More information can be obtained on the Web at http://www.next.com, by email at nextanswers@next.com or by faxing NeXT at 001 415 7803990.

Office compatible

After the latest round of bad press on Windows 95, Microsoft desperately needs to convince developers to write applications for the platform when it finally arrives. As you would expect, the MS Office team is well ahead in its development effort. In fact, Microsoft has announced a new addition to the Microsoft Office Compatible programme to help developers writing software. Office Compatible 95 will publish the technical specification for creating Office applications. Once enrolled , developers will obtain a Basic Toolkit, which includes information needed to create Office compatible software. A quarterly newsletter and an online service are available. Applications developed for use with Microsoft applications may be submitted to Veritest, an independent agency for conformance testing. If the software passes, the product can 'wear' the Microsoft Office Compatible 95 logo. The testing is priced at $800 for the first application submitted.

Virtually Impossible



Have you ever dreamt of transforming your PC in a 'TV production quality' virtual reality authoring station? Bryan Salt, an independent 'VR design specialist', did it, and the result was the Virtually Impossible show on ITV. The first series has now finished, but he's busy inventing a whole raft of new tricks for the second one. The virtual world ran in Superscape VRT. On a Pentium 90, between 9 and 28 frames per second are generated depending on the polygon count and the amount of texture. The goal for a perfect animation is to reach an animation of 17 frames per second minimum. VRT can display a peak of 13,000 polygons per second. The virtual world is created and run with Superscape VRT but all the textures are rendered using 3D Studio. The usual sequence is to create the objects in Superscape VRT then texture them in 3D Studio and eventually import them back in VRT. The five worlds used in the show took about 90 days for Salt to create.

For the previous Virtually Impossible, five PCs were networked together, some working on the foreground and others on the background. Only the changes in the scenes are transmitted on the network. To reduce the processing power required only the rooms that can be viewed are turned on. As soon as a participant changes room, part of the virtual world is turned on while another is switched off. Even though it is counter intuitive, animated backgrounds do not cause a bigger performance hit than simple ones. Why? Simply because the background is redrawn every frame anyway. About 50% of the screen is textured and there are usually less than 300 polygons per room. For speed reasons the system runs at VGA resolution with 256 colours. The whole creation is surprisingly small: each world occupies a maximum of 4 MB including texture and sound. Salt is currently working to distribute the processing even further, having several computers working on the same foreground and/or the same background.

Another activity of Salt is to create 'impersonators' - talking heads. These heads have a personality. The one in our picture is Ron. Ron is active, he can move his head and his eyes. When he talks his mouth moves accordingly. What's impressive is that Ron, and his colleagues, are all animated with Superscape VRT on a PC. Impersonator's resolution is only 300 by 200 pixels, but up to 30 frames per second can be generated in real time. To give a sync aspect to mouth movements, Salt designed a box which at one end connects to the joystick port of the PC and on the other has a microphone. The mouth moves according to the volume and the frequency of the sound which are sent as the two axes on the joystick port. The complete design of an impersonator takes about ten days. Salt is on 01483 574445 and Superscape on 01256 745745.

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Unix in Windows 95

For the aficionados of the Unix shell, MKS is shipping version 4.4 of its toolkit running in Windows 95 and NT 3.5. The bundle now includes a GUI tape utility. The toolkit is also available for DOS, Windows and OS/2. Mortice Kern Systems (001 519 8842251) sells Version 4.4 at $299.

imProVed and more CuStomisable

Intersolv is shipping PVCS Version Manager 5.2. Its graphical interface provides a side-by-side view of the differences between two versions of a file. Event triggers set before and/or after PVCS commands can automate common processes such as sending an email message when a version is promoted. Security has been enhanced. Customisability of PVCS enables its use for simple version control to full software configuration management. Intersolv (01721 812812) sells PVCS Version Manager at £400.

CORBA everywhere

At the recent Object World conference in Boston, IONA previewed a product which will integrate Visual Basic and Orbix, IONA's object request broker (ORB). Orbix-OLE will enable Windows developers using tools such as VB, PowerBuilder or Visual C++ to invoke CORBA compliant objects transparently anywhere on the network. Orbix-OLE should be available at the time you read this. IONA also shipped a beta version of Orbix for VxWorks, the embedded real-time operating system from Wind River Systems. IONA is on 00353 16686522 and its email address is info@iona.ie.

Power Case

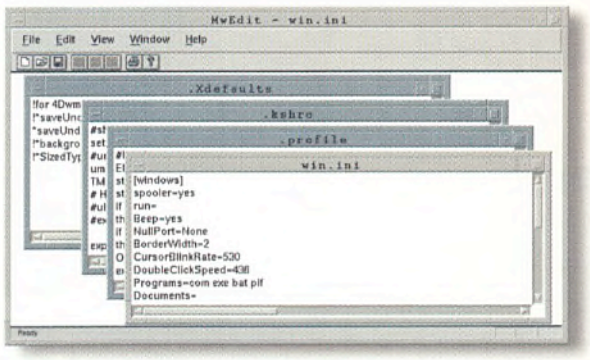
Developers who use EasyCase can now create and maintain the graphical data models of their PowerBuilder applications. EasyCase Database Engineer for PowerBuilder allows developers to import, export and update PowerBuilder table structures and extended attributes. Tables can be reversed engineered to place their structures within the EasyCase data dictionary. Once there, it is possible to manipulate the data model with EasyCase, then export it back to PowerBuilder. EasyCase Database Engineer also offers various extended attribute editors at table and column level. There is also a set of editors for edit styles, display formats and validation rules. Tables can be transformed from one type to another. Database Engineer for PowerBuilder is priced at £690 and is available from Great Western Instruments on 0117 9860400.

Solaris WorkShop on x86

SunSoft WorkShop is now available under Solaris x86. As in the SPARC version, the WorkShop comprises a suite of development tools for building Solaris applications. These include ProWorks 3.0 which provides an IDE and offers on-demand runtime error detection. There is also iMPact 1.0, a multi-threaded development tool which allows the developer to set breakpoints and navigate through parallel execution paths within the same application. It can be used to debug both C and C++ multi-threaded applications. ProCompiler C++ 4.0 is the C++ compiler in WorkShop. Sun claims it can cut down compilation time by up to 300 percent and supports the latest developments from the C++ standards committee including templates and exceptions. The C compiler, ProCompiler C 3.0, provides optimisations for the Pentium. Team development is available courtesy of TeamWare 1.0 which offers a suite of code management tools.

Until June 30th 1995, developers can purchase a Developer Pak Bundle that includes Solaris 2.4 for $695, a saving of more than 75 percent over the cost of buying the tools and operating system separately. Developers with previous versions of ProWorks for Solaris x86 can upgrade to SunSoft WorkShop for $495. For details of WorkShop jump to http://www.sun.com/sunsoft/Products/Developer-products on the Web or call Sun on 01276 451440.

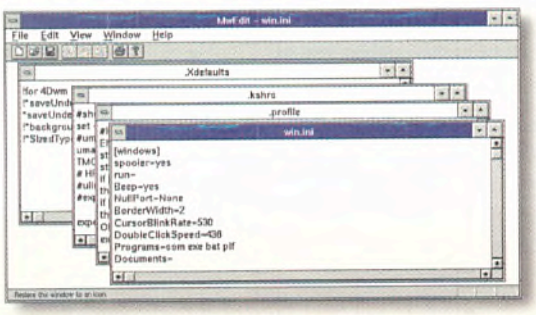
Full MFC for MainWin



MainSoft has introduced a new version of MainWin, the company's Windows API for Unix. The big changes in version 1.2 are full source for the MS Windows help engine and inclusion of the 32-bit Microsoft Foundation Class libraries (MFC 3.0). MainSoft says that its implementation of Windows Help under Unix is full-featured and is compatible with PC .HLP files, so developers can create one source of online help for both Unix and Windows.

The MFC library lacks ODBC, Winsock and OLE 2.0 support. However it does provide the user interface supported in the Windows version with features such as tab dialogs and dockable toolbars. MainSoft claims performance increases between four and eight times over the previous release. By supporting Windows raster operations (ROPs), bitmap manipulation has been increased fourfold. X-Windows restricted the number of ROPs to 16, and these were only two-way, for specifying source and destination. Under Windows there can be up to 256 3-way ROPs which give a brush parameter as well. MainWin brings the enhanced bitmap support of Windows to Unix.

Other aspects of Windows supported by MainWin include source for the CTL3D.DLL 3D control library, and the MFC *extension DLLs* technology which reduces load on the system by running a shared MFC library. In addition, MainWin combines the X11 colour mapping facility with Windows' colour model. This provides a means for applications to setup private colour maps. MainSoft has added DEC Alpha running OSF/1 to the list of supported platforms, which already included Solaris, SunOS on SPARC, HP-UX on HP9000/700, and IRIX on SGI Iris and Indigo machines. The cost of a development licence is £3995 for each platform required. MainWin is distributed in the UK by Personal Workstations on 0171 2310333.



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CIRCLE NO. 085

Red Box is not Unix

UnixWare 2, dubbed 'Red Box', has been released by Novell. This is not a Unix system: it does not yet comply with the full list of 1170 function defined by the X/Open. But UnixWare 2 is XPG4 compliant and should be submitted for X/Open Unix approval later this year. Novell also released Distributing Computing Environment (DCE) and Common Desktop Environment (CDE) products for UnixWare 2. The Application Developer's Kit cost $995 and the Runtime kit, $275. The Cell Directory Services and the Security Server cost $1,995 each. Novell is on 01344 724000.

Got a VCR?

How about inviting Bjarne into your sitting room? University Video Communication sells a range of videotapes featuring many gurus of the software industry. Among the tapes are 'The design of C++' by Bjarne Stroustrup, 'Object-oriented programming' by Dan Ingalls, a designer of Smalltalk, 'Encapsulation and inheritance in C++' by Mark Linton of Silicon Graphics and 'The principles of OLE 2.0' by Tony Williams of Microsoft. Until the end of the month, each tape costs $39.99 instead of $50. And yes, they are available in European PAL as well as American NTSC format, surprisingly. UVC can be reached at 001 415 8130506. UVC also has a Web site at http://www.uvc.com/.

4GL for Windows 95

Crystal for Windows, from Intelligent Environments, is a 4GL development tool for Windows 95 and NT. The 32-bit GUI development environment supports ODBC connectivity. Crystal's developers drew from their experience acquired with AM, a very popular OS/2 development tool. Crystal's introductory price is set at £1,1000. Intelligent Environments can be reached by phone at 01932 772266 or by email at tostrer@ieinc.com.

Write ISDN code

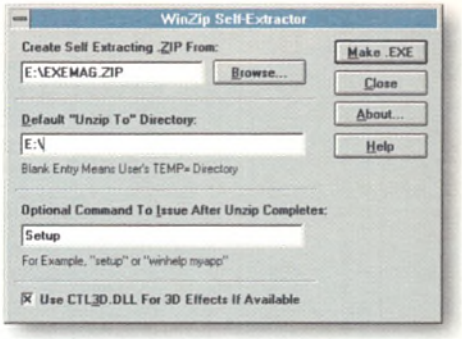
Fed up with modem speeds? Is 28,800 bps just not fast enough for you? WiSDN is a new toolkit for adding the facilities of ISDN to Windows applications. It has come about through a joint venture between OST UK and Clipet Communications (OST is a manufacturer of ISDN cards for PCs, Clipet produces ISDN software). The toolkit works in conjunction with OST's PcSnet plus card and supports features such as SIM-ISDN for simulating ISDN calls in real time. OST can be reached on 01753 533331. Clipet is on 01603 618899.

Magic CodeWarrior

Metrowerks plans to release CodeWarrior Magic in the second quarter of this year. As its name suggests, it's an application development toolkit for Magic Cap, the agent communication platform developed by General Magic (see EXE February). The first version, CodeWarrior Magic developer release DR1, will run on both 68k and PowerPC Macintoshes. When the product is available, General Magic will open its developer platform outside the current very restricted access (see CeBit News in the previous issue).

The product is based on CodeWarrior MPW tools and on General Magic's object-oriented development environment. There will be no need to have a Magic Cap personal communicator to develop and debug an application as the complete Magic Cap environment will be emulated on the Mac. No mention of Telescript in the announcement so it's release is probably not imminent - unsurprising given that its development started 18 months after Magic Cap's. According to General Magic, a similar environment for Windows is planned for the second half of the year. CodeWarrior Magic should be priced around £200 including free upgrades to the next three subsequent releases. It will be available from Full Moon Software which can be reached at 01628 660242 or by email at sales@ctalk.exnet.com.

Windows self-extractor



With WinZip Self-Extractor, Windows self-extracting zip files can at last be created. Most Windows setup programs use Windows compression module while most DOS install applications use the zip format. But when a Windows setup uses zip, usually you can see the screen flicking to a DOS box and back. WinZip Self-Extractor transforms a .ZIP file in a Windows self extracting .EXE program. It also has an option to launch the unzipped program automatically.

Users can just double click on the file and the unzipping and installation is automatic. But DOS users can use any PKUNZIP compatible utility on the .EXE file. The self extracting file is about 12 KB larger than the original .ZIP. WinZip Self-Extractor comes with a royalty free licence to distribute self extracting files and costs $49 from Nico Mak Computing.

A new version of WinZip v5.6 has been released, now supporting popular Internet compression formats such as TAR, gzip and Unix compress. Both Windows and NT versions cost $29. The NT version also runs on Windows 95. Evaluation copies can be found on the WWW at http://www.winzip.com/winzip/. Nico Mak can be contacted by email at nicomak@winzip.com.

Distributed C++ compilation

Version 7.0 of Symantec C++ features distributed network compilation on Windows 3.1, NT and Windows 95 computers. NetBuild uses a server feature of the compiler to check if any machine on the network running Symantec C++ 7.0 is idle (see EXE January p.26 for a review of the beta). If it find any available computers, it distributes the build task between them. That's not the only new feature of this release. It includes an object oriented browser/editor which can display information in three different views. One of them represent classes graphically in a tree structure allowing the developer to just prune and graft to modify the class inheritance. Another is similar to the three-pane browser found in Smalltalk while the last one is an editor with Brief and Epsilon keystroke compatibility. All views can be modified using Symantec Basic.

The package is shipped with MFC 2.51 and 3.0. The language itself supports exception handling, runtime-type identification and templates (16 and 32-bit). For 16-bit development it requires Windows 3.1 running on a machine equipped with at least 16 MB of RAM. To generate a 32-bit application, you'll need NT or Windows 95 (build 324 or later) and 20 MB of RAM. It costs £149 until the end of May and £209 thereafter. Symantec is on 01628 592222.

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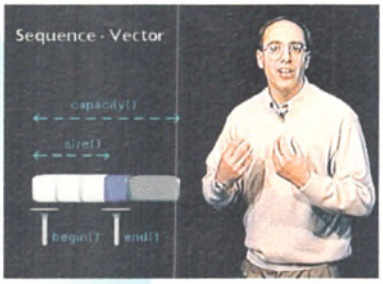

The speed with which C++ has been evolving has left most developers feeling like tortoises watching a fast disappearing hare run off into the distance. Most books have also been overtaken by events. This video tutorial looks at features currently being introduced by compiler vendors.
It examines the syntax and also spells out the implications for your code. For instance the first tape looks at the benefits of Exception Handling and the challenges involved in using it to build more robust applications. We also examine Runtime Type Identification (RTTI); namespaces, bool, explicit constructors and much more.

What is the Standard Template Library (STL) ?

The standard template library was primarily written by Alexander Stepanov and Meng Lee of Hewlett Packard and was adopted by the ANSI/ISO committee in July 1994. Until the emergence of STL, the standard C++ library was simply an assortment of unrelated classes. This situation has changed dramatically with the acceptance of STL, because it is not just a library. STL is a coherent extensible architecture for C++. STL provides a standard for designing library components which support interoperability. In other words, you can write classes with the assurance of being able to use them with one supplier's algorithms, and another's container classes, as long as both support the STL architecture. The second tape visually explains the conceptual framework that the standard template library provides using many animations and diagrams. **Additionally a free disk containing the Standard Template Library source is included.**

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CIRCLE NO. 086

Letters

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

Life without BIOS

Sir,

I wonder if any of your readers can help? I need to know about driving hardware devices without using the BIOS? That may sound like a strange thing to do, so let me explain...

I have been writing my very own little pre-emptive multi-tasking operating system [on a PC] and have succeeded in running several tasks in parallel. The limitation is that these tasks and their data must be in memory and the tasks themselves can only manipulate the contents of memory. This avoids any problems of interfacing with hardware. Now the obvious next step is to allow the tasks to read/write files, send data to the printer etc. But, and it's a big but, any calls to the BIOS (eg through INT 13h, to read the disk) will do a 'busy wait' and hang the machine until the operation has completed. Most other operating systems make good use of this I/O delay to give processor time to other tasks.

Ideally I want to call a (BIOS) routine to initiate the read and then suspend the task and continue another. When the read operation has completed and raised an interrupt, I can handle this and resume the suspended task. If no such BIOS routine exists, I will have to write my own to initiate the read, including setting up the DMA chips. A daunting prospect given that I don't have any details on how to that either! I'd also have to do the same for each device (printer, floppy and hard disk, keyboard etc).
Any suggestions would be most welcome.

Dave Bartrum
Analyst / Programmer
British Airways

If you really are driven to these lengths, .EXE ran a series of articles covering DMA programming beginning May '93. You did keep all those back issues in a safe place, didn't you?

Reader not impressed

Sir,

I have received yet another complimentary issue and invitation to subscribe - this must be the third in recent months. A couple of years ago I did send off my cheque for a year's worth, but now I'm hesitating. It is only fair that I should tell you why.

As a worker in IT rather than a student of it, I don't have much time to study the more esoteric aspects of software development. I don't care how profound thinkers such as Mr Stroustrup view the world, I just want to get my software working before the users assault my office or the boss starts forcing deadlines.

I need examples, short **working** examples, rather than mere demonstrations of better programming techniques. After writing a few 'noddy' programs based on such examples I can then improve my style, free from distractions such as the software failing to run, or spending hours listening to music on someone's technical support help line.

The type of magazine I want to subscribe to would be a hybrid of *EXE* with its authoritative but esoteric material, and *PCW* with its simple, useful examples but heavy advertising and 'flashy widget' reviews.

Publications such as *PC User* come close to my ideal, but could do with even more training articles to increase the hit-rate with work I might currently or shortly be faced with.

How to source a large number of such articles without paying a fortune to a large variety of authors?

One method might be to ask out-of-work contractors to submit contributions but my guess is that this would be a difficult and expensive approach. After all, being skilled enough to write useful advice, such people could probably charge £40-£50 an hour for spending their time developing real projects instead of writing about them. They might also be understandably reluctant to broadcast the kind of trade secrets that could turn hundreds of junior programmers into potential competitors. I think we all display this kind of behaviour to some extent.

An alternative occurs to me. Who stands to gain from spreading know-how about various programming languages and methodologies? The suppliers.

Surely their sales figures would improve if potential buyers already had a good stock of 'how to' articles and examples of working code. They could then reach for their cheque books with less trepidation.

The only other way the punters can obtain this knowledge without paying up front is to borrow or pirate the software and take a look at the read me files, on-line help and example code. Such a person might have intended to buy the package properly later but never 'got around to it'.

If the above reasoning contains any truth, it follows that *EXE* could only stand to gain by approaching the developers of software packages, compilers, libraries and utilities, requesting 'how to' articles and short source code examples.

The suppliers would also gain. Their name and trademarks would be seen repeatedly by an almost captive audience. surely a company such as Microsoft would at least give six months supply of (eg) 'OLE methods in Visual C' just to see the effect on sales.

I don't think that a few over-simplistic examples would lower the tone of your publication in any way, it is after all possible to extract the news from a copy of the *Sun*.

Jon Lester
Sittingbourne
Kent

There are a lot of interesting points raised by Mr Lester's remarks... and no room here to deal with them satisfactorily. So I'm going to dodge for the time being. But I do wish to re-emphasise the point that we do pay attention to readers' comments. Please write and tell us how you would like to see the magazine develop.

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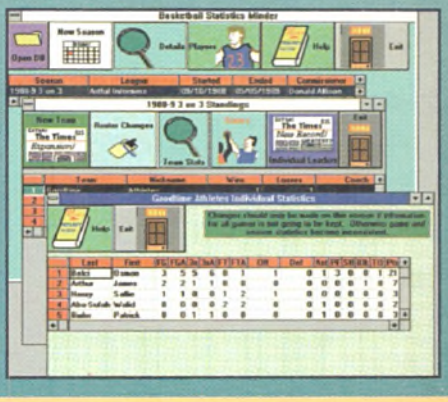

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CIRCLE NO. 087

Patent grief

In the recent years the LZW compression algorithm has been widely used in many applications. Software developers assumed they could distribute LZW programs royalty free. Then Unisys sprang its surprise... **David Mery** reports.

In any application developed today, it is inevitable that some bits of code or algorithms have already been invented somewhere else. How can one be sure that an application does not infringe any patent? The answer is not straightforward. Diana Gruber, authority in computer games and author of the recent book *Action Arcade Adventure Set* points out that 'no startup company can afford to do a patent search on every algorithm in a program'. Even if developers could, several months or years can separate a patent filing from the time it is effectively granted. No patent search will find these potential infringements. Then again, the patent holder might not react immediately to infringements, and suddenly appear out of the blue demanding royalties on a long established application. This is what happened to GIF.

CompuServe developed GIF (Graphics Interchange Format) in 1987 and promoted it as a royalty-free standard for bitmaps. It is widely used on CompuServe itself but also on the World Wide Web and as an effective way to exchange images between graphical applications. It has the advantage of being simple while coding images in a 'lossless' manner, *i.e.* without losing any information of the original image. Unisys, patent holder for the LZW compression algorithm used in GIF, reacted only in early 1993. CompuServe eventually signed an agreement in mid-94. But instead of informing the developers' community immediately CompuServe 'initiated a process to secure similar licence that would benefit its GIF developer community' says Tim Oren, CompuServe Vice President, Future Technology.

On December 29, 1994, CompuServe made a public announcement. This was the start of a riot. Many developers learned for the first time that GIF was using a patented algorithm. CompuServe had not only negotiated a deal for itself but also one for other GIF application developers. The 'Agreement for use of Graphics Interchange Format' specified a royalty scheme valid *only for GIF software used in conjunction with CompuServe*. According to the same text, Unisys 'granted to CompuServe a licence to sublicense' on June 21, 1994. Tim Oren explains why the announcement was made so late: 'The reason for the gap between Unisys' notification and the public announcement was that a negotiation was taking place in the interim. It's hard enough for attorneys to come to agreement over such a sensitive, adversarial issue. It would have been even worse in a glare of publicity. The eventual announcement could have been handled better, we must confess, and we failed to obtain all the rights that we wanted during the course of the negotiation.'

As the GIF case shows, infringing software can become a standard before the patent holder decides to enforce his right. 'The *sole* reason Unisys is able to collect royalties at all is that LZW is widely used, and they started enforcing their rights late' says Timothy Wegner, member of the Stone Soup Group and a developer of the famous Fractint fractal program.

'The problem is with granting software patents...it is suffocating the industry' - Battilana

in GIF city

Unisys's late action generated heated comments not just because it started to charge royalties, but also because it didn't offer anything more than when LZW was 'free'. As Timothy Wegner puts it: 'There are many variations of LZ compression today, not all encumbered by patents. LZW has no special virtue or advantage. It is just a legal technicality. Consider what value I get from Unisys as a developer: 1) they didn't help me implement LZW in my software; 2) they provide no value or support to application writers using LZW; 3) their patented algorithm has no special virtues or advantages, newer variants are better in every respect - faster and compress better; 4) they charge a fixed royalty regardless of the value LZW provides to the application; and 5) if I write a book about my own free Fractint program and include it, I owe royalties!'

Hardware or software licence?

When GIF was released in 1987, Larry Wood, Founder and President of the Go Graphics' Group housed some of the development effort in the forums he was managing. At that time, he says, 'there was some talk on the board about the LZW patent, but the general opinion was that it only applied to devices, such as modems or possibly communications programs, but not stand-alone software. Someone, CompuServe, me or a shareware author, should have consulted an attorney at that point, but no one did.'

One of the first official licensed use of the LZW algorithm was effectively for the V.42bis compression protocol for asynchronous communication commonly used in modems. Bill Pechey, Hayes European Technical Director, remembers the discussion at the time: 'V.42 bis was developed by the then CCITT Study Group XVII (now called ITU-T Study Group 14). There were several proposals - the LZW one was best, it offered the best compression ratio with the least computing power. A variant, not infringing the Unisys patent, was suggested, but its performance was slightly worse and it was not adopted'.

In the case of V.42bis the patent issue didn't come as a surprise. Pechey explains that 'there were three companies that claimed royalties in V.42bis - Unisys, IBM and BT. The three patent holders got together (with a bit of pushing) and made a one-stop deal. Most modem suppliers took up this deal which was a one-off payment of several tens of thousands of pounds. I seem to remember that there was an alternative per-unit scheme but it wasn't popular.'

Mark Starr, Unisys's Vice President and General Patent & Technology Counsel points out that the situation has changed: 'Unisys is no longer licensing its patents for use with V.42bis compliant (landline) modems for a one-time fee. Licences are still available for V.42bis compliant modems, but the terms vary depending on the scope of licence grant desired.'

Regarding other uses of LZW, Starr is pretty confident that 'Unisys has made efforts to assure that developers are made aware of the need for a licence from Unisys for TIFF-LZW and other applications, even though the patent law does not require such efforts. For example, the Aldus TIFF Revision 6.0 specification has for years included a notice about the Unisys patent, including the Unisys address to which developers who want to use TIFF should write to concerning a licence. A similar notice has appeared in the PostScript Language Reference Manual as long ago as the second (1990) edition. CompuServe was to insert a notice in GIF related specifications. Finally, the Unisys patent has been available from various patent offices since 1984 and its applicability has been written about extensively over the years in various publications.'

'LZW was the best algorithm, it offered the best compression ratio with the least computing power' - Pechey

Certainly many articles on the LZW algorithm have been published, including one by Terry Welch - the 'W' of 'LZW' - himself (see box out on *Patenteese*). But only the most recent make any mention of the patent issue. Hardware manufacturers had long been aware of the issue, as most modem and printer manufacturers confirm, but the situation wasn't so clear regarding TIFF and GIF applications.

Raymond Gardner is one of the few developers who realised the potential risk very early and tried to come to an agreement with Unisys. He was working on an archiver that would have been compatible with SEA's ARC. 'In October 1989 I heard about the Welch patent, and called Unisys to discuss it. I was referred to a Unisys lawyer named

Mark Starr in Bluebell, PA. I called him and we talked for about 30 minutes. It was a pleasant amicable conversation, and I still remember parts of it pretty clearly. We talked about the rightness of the concept of software patents. He thought they were right, I thought (and still think) that they are wrong. He argued that it would be illogical to disallow them because no clear line could be drawn between hardware and software. I saw his point but remain(ed) unconvinced that some reasonable way to disallow them might not be formulated.'

Starr doesn't have such a clear memory of this conversation: 'regarding letter and phone calls allegedly exchanged with Unisys. We have not verified these letters and phone calls. The fact that an individual may send us a letter does not indicate that we agree with its contents or that its contents accurately reflect any dialog which they may have had with Unisys.' Nonetheless, we have heard from several developers that they sought clarification of the LZW issue long before the CompuServe annoucement.

How much?

To muddle the situation further, each use of LZW is treated differently. Licences for TIFF-LZW applications are available under similar terms as for GIF, but the licence fee is 0.65% of the selling price instead of the 0.45% for GIF. In addition, the minimum and maximum fees per disposition and the registration fees are different. The licence to use TIFF-LZW provides for inclusion of GIF capability at no additional cost. These terms are limited to single PC/workstation applications and do not apply to servers or to online information service providers.

Michael Console Battilana, president of Cloanto, an Italian software house, has an explanation for this difference in treatment between TIFF and GIF: 'TIFF is not as widespread as GIF, and it does not rely on LZW as GIF does. TIFF is not an official standard in the online-community (Internet, BBSs, etc.) as GIF is (was). TIFF is very complex and has many different compression options. LZW is only one of these (although a very popular one, until now).'

Startlingly, the standard Unisys terms are cheaper than CompuServe's - and CompuServe's apply only to application used in conjunction with CompuServe! 'Cost to developers will be a $1.00 one-time licensing fee and a royalty payment of 1.5 percent or $0.15, whichever is greater, per registered copy of a program containing the LZW technology. CompuServe will not profit from this service.'

How come? Go Graphics Group's Wood has an explanation: 'It turns out that the Unisys agreement is cheaper, but remember, when the news broke, Unisys did not have an agreement in place. The figure we now see in the Unisys agreement is not the one they started with. The early figures they gave me were higher, but were lowered as a result of internal discussions, as well as consultations with me.'

Software released before 1995 and freeware appears safe. According to a policy clarification issued on January 6, 1995 'Unisys will not pursue previous inadvertent infringement by developers producing versions of software products for the Internet prior to 1995 ... [and] ... GIF-based software products marketed prior to 1995 ... The company does not require licensing, or fees to be paid for non-commercial, non-profit offerings on the Internet'. An LZW patent FAQ issued the same day clarifies the last point: 'Our focus is on commercial, for-profit developers. Freeware is exempted from licensing fees.' Which suggests that information providers using the LZW technology, like most WWW sites on the Internet, must secure a licence if they start to make a profit.

How to react?

Unisys's position drove Raymond Gardner to abandon the use of LZW: 'Mark Starr told me that Unisys considered it a hardware patent, but agreed that it could cover software implementations. (I later noted that the patent itself contains a complete LZW implementation written in Fortran for the Univac 1100 series). I asked him about a licence just to cover my ass, noting that I probably wouldn't make any money on the shareware I was planning to release. He told me "it would cost $5000 just to do the paperwork". (I remember that very clearly!) I said that seemed out of the question for someone like me. What would Unisys do if I just skipped getting a licence? "Probably nothing, but there's such a thing as making an example out of someone". So we concluded our conversation with me in a sort of legal limbo. Unisys was not licensing the patent to small-timers in any reasonable way, not pursuing infringers but also not giving any clear go-ahead to use the algorithm in software. I was pretty pissed off. As a matter of ethics and out of fear of legal action, I couldn't use the algorithm I'd spent weeks tweaking and tuning. Others who didn't know or care about the patent just went ahead. I didn't consider it a reasonable situation from a standpoint of economic justice.'

When Battilana contacted Unisys at the end of 1992, it still hadn't yet sorted out how to deal with the issue. 'We were sufficiently concerned that we contacted Unisys to see what had to be done. They replied to CompuServe instead, and left us thinking for several years that we could use LZW in applications such as GIF loaders/savers.'

The future

The situation created by Unisys prompted many developers to look for alternatives to GIF. The well accepted JPEG format was 'lossy' - some picture detail is lost in compression - so it wasn't a viable alternative. The first step was to replace the compression algorithm used in GIF by a royalty free one. But since this meant being incompatible with the current GIF format, a group was founded to write an improved lossless graphic standard. The fruit of their efforts is PNG (Portable Network Graphics), and it has many advocates.

'PNG is extremely close to our requirements - in many cases it outperforms GIF' - Oren

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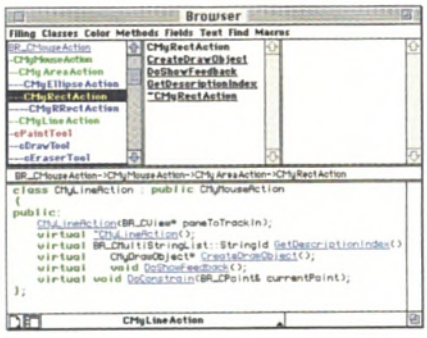

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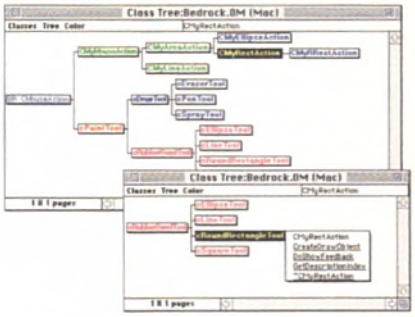

This is where the similarities end.

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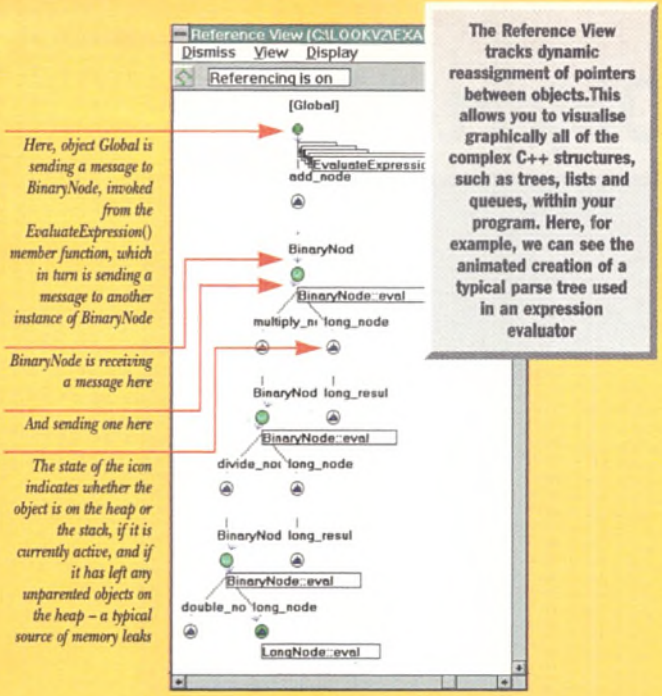


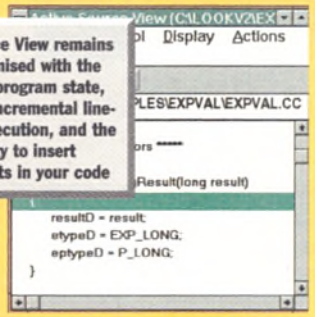
Here, object Global is sending a message to BinaryNode, invoked from the EvaluateExpression() member function, which in turn is sending a message to another instance of BinaryNode

BinaryNode is receiving a message here

And sending one here

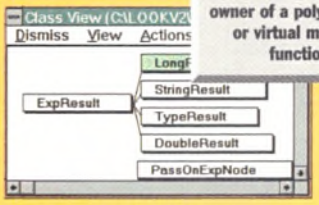
The state of the icon indicates whether the object is on the heap or the stack, if it is currently active, and if it has left any unparented objects on the heap – a typical source of memory leaks

The Reference View tracks dynamic reassignment of pointers between objects. This allows you to visualise graphically all of the complex C++ structures, such as trees, lists and queues, within your program. Here, for example, we can see the animated creation of a typical parse tree used in an expression evaluator

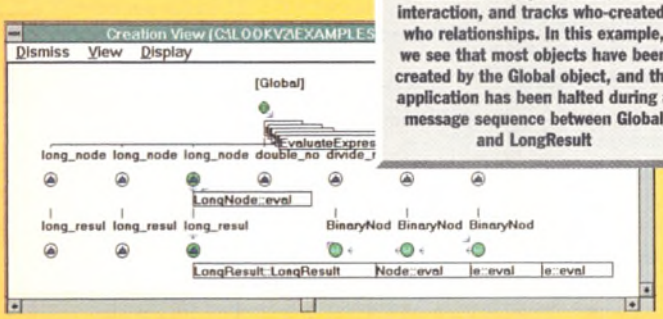


The Source View remains synchronised with the current program state, allowing incremental line-by-line execution, and the ability to insert stop-points in your code

Like all other views, the Class View is synchronised with the current state of the program, and is particularly effective at pinpointing the exact owner of a polymorphic, or virtual member function



This Class View shows that LongResult is the currently active class, this means that a member function defined in LongResult is now executing. For large applications, when you only want to view a small proportion of the total object population, the Class View is one place where you can specify filter criteria that exclude classes and member functions of no interest. LOOK! comes pre-supplied with skeletal filter sets that operate on OWL and MFC libraries



The Creation View depicts an animation of object creation and interaction, and tracks who-created-who relationships. In this example, we see that most objects have been created by the Global object, and the application has been halted during a message sequence between Global and LongResult

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Wegner considers that 'PNG has all the advantages of GIF and none of its weaknesses. The LZW problem creates an opportunity to redo a standard. Usually standards, warts and all, go on and on. PNG has the basic lossless compression but with a better algorithm that compresses more and is free of royalty problems as far as anyone knows. Plus PNG supports gamma, alpha channel, CRC checking, and true colour. PNG does not have the messiness of some of the very ill-advised GIF89a extensions (plain text, graphic control). Going from GIF to PNG is really a no-brainer. There is very little opposition. CIS management *could* have been an opponent, but they support PNG. After some initial stumbles with their "developer's agreement", CIS management has behaved very well, and even seemed enlightened'.

Jean-loup Gailly, of zip and gzip fame, is working on 'zlib' a general purpose data compression library to be used in PNG. Everything has been done to ensure that the code doesn't infringe any patent: 'I've personally spent of a lot of time searching data compression patents to make sure that my deflate code doesn't infringe any known patent. CompuServe has independently made a patent search to confirm this. The rest of the PNG working group has concentrated on the technical aspects, not the patent aspects. Among the 10 megabytes of email exchanged during the design of PNG, only a small portion refers to patent issues. Those issues were dealt with privately by CompuServe and myself.'

CompuServe's Oren confirms: 'We are working with the PNG group, in hopes that PNG will be GIF24'. This was the original name given by CompuServe to their effort to develop a new 24-bit colour graphic standard. 'Technically, the latest draft is extremely close to our requirements. In many cases it performs better than GIF for an equivalent image. We are now reviewing the intellectual property issues involved, since we don't want to be responsible/involved in another situation such as LZW/GIF. We need to be satisfied that we won't encounter any other patent issues, and we have retained an outside reviewer to check for them.'

Since CompuServe has secured a Unisys licence, it can continue to use GIF... at a price. This is how Oren sees the future: 'We will continue to support GIF on the service for some time after the release of PNG/GIF24, but would begin conversion immediately, and make reference code available to developers. We retain the option to develop a separate GIF24 spec, but as I said we are quite happy with PNG as it stands, subject to patent review. We have several developers working on this, and one of them is the original designer of GIF, Steve Wilhite.'

Back to the 1960s

In the meantime Paul Needham of Media Architects, makers of a TIFF handling VBX called ImageKnife found a way to keep the TIFF and GIF formats in their VBX without having to pay the royalty themselves. 'Given that most customers will **not** want to license GIF and/or TIFF/LZW and pay royalties to Unisys, we believe that the usage of these formats will drop off quickly. CompuServe is moving to replace GIF with a public domain standard as soon as possible. It is therefore Media Architects' intention to lock these features starting with ImageKnife/VBX 2.0 so that customers that want to use them must first contact us and

Patently absurd

Some software patents cover techniques so basic that application development can look more like a legal battle than the creative process it should be. If all existing patents were enforced few applications could be written or they all would need to license dozens of patents. Below is a list of some of the most absurd ones.

Patent 4,197,590 filed 19/1/78, granted 8/4/80.
Method for dynamically viewing image elements stored in a random access memory array
Inventors Josef S. Sukonick; Gred J. Tilden. Assignee NuGraphics.
Includes claims of 'XOR feature which permits part of the drawing to be moved or "dragged" into place without erasing other parts of the drawing.' This patent has twice been upheld in court.

Patent on expanding abbreviations with space character Filed 1984, granted 1988.
XyQuest, Inc. was forced to remove this feature from XyWrite; it had been added in June 1987. Emacs has had this feature since the 1970s.

Patent 4,653,020, filed 17/10/83, granted 24/3/87
Display of multiple data windows in a multi-tasking system
Inventors Harry Cheselka, Jeffrey S. Lucash, William R. Vincent. Assignee IBM
Apparently covers windowing.

Patent 4,555,775, filed 7/10/82, granted 26/11/85
Dynamic generation and overlaying of graphic windows for multiple active program storage areas
Inventor Robert C. Pike. Owner AT&T
This covers backing store technique as used in X-Windows. AT&T says, 'The "backing store" functionality available in the X Windows System is an implementation of this patented invention, therefore, your company/institution needs a licence from AT&T for the use of this patent.' The MIT AI Lab implemented this three years before the patent application was filed, but the implementor (Richard Stallman) didn't think it was worthwhile enough to publish a paper on it.

Patent 4,856,787, filed 3/5/88, granted 15/8/89
Concurrent game network
Inventor Boris Itkis. Assignee Yuri Itkis
Obvious slave-master scheme for playing poker, bingo, blackjack and keno; one computer runs the game, the others have touch-sensitive screens for input.

Patent 4,956,809, filed 29/12/88, granted 11/9/90
Method for canonical ordering of binary data for portable operating systems
Inventors Johann George, Trevor J. Thompson, David G. Conroy, Frederick H. Tudor. Assignee Mark Williams Co, Chicago, Ill.
Covers using a single standard byte ordering (say, big-endian or little-endian) for transfer of data between machines whose normal byte ordering is different. Paul Eggert (eggert@twinsun.com) says: 'This patent, on network byte ordering, covers any file header that tells you the endianness of the file'.

This list is based on 'Partial List Of Software Patents' originally compiled by Michael Ernst (mernst@theory.lcs.mit.edu) and available by ftp from mintaka.lcs.mit.edu:/mitlpf/ai/patent-list, one of the League for Programming Freedom site.

prove that they have licensed LZW from Unisys. We will then give them the appropriate code to turn on the property for one or both format.' This mechanism has been approved by Unisys.

Unisys's late action about GIF applications' infringements has had a few positive side effects. Developers have been alerted to the many problems software patents can create in their business. PNG, a better graphic format is being developed. It is being finished as we write this article. In fact a late email from Wegner points out that 'the first PNG viewer has been released - QVP by Oliver Fromme, a German programmer'.

But some people consider software patents to be very detrimental to the industry. Battilana found a safe way to go: 'I feel that the problem is with granting software patents in general. This is suffocating the industry. The only algorithms you can safely use are those published before the 1970s. We are lucky that authors such as Donald Knuth published so much useful material before it could be patented, or otherwise we would probably now have to pay royalties for it.'

■

PNG is available from the URL http://sunsite.unc.edu/boutell/png.html and from the GRAPHSUP forum on CompuServe.

Patenteese

There's a good deal of misinformation on the LZW algorithm and its patents. The situation is further complicated by the differences between US and European law. According to the US Constitution, the patent holder is granted a 17 year monopoly on the patent's use. Most companies try to establish their rights worldwide, so the famous LZW algorithm is also patented in Europe. Once a patent has been granted in one country, the patent holder can file the same application in another country only in the next twelve months. When a patent is filed in Europe, the European patent convention let the applicant designate the countries where the patent will be valid. In Europe, patents are valid for twenty years. Another difference, in Europe you can't patent something that has already been published. You can file a US patent up to one year after the publication.

Let's get the chronology right:

1977-78: Jacob Ziv and Abraham Lempel (how many times have they had their names misspelled?) publish two seminal papers in *IEEE Transactions on Information Theory*. 'A Universal Algorithm for Sequential Data Compression' is in Vol. 23 No 3 (May 1977), pp 337-343. 'Compression of Individual Sequences Via Variable-Rate Coding' was in Vol. 24 No 5 (Sept. 1978), pp 530-536. These methods are usually referred to as LZ77 and LZ78 respectively.

1984: Willard Eastman, A. Lempel, J. Ziv and Martin Cohn are awarded US Patent 4,464,650 'Apparatus and Method for Compressing Data Signals and Restoring the Compressed Data Signals', August 7, 1984 (filed August 10, 1981), Assignee: Sperry Corporation (which subsequently became part of Unisys). This appears to be a variant of LZ78.

1984: Terry A. Welch has his article 'A Technique for High-Performance Data Compression' published in *IEEE Computer magazine*, Vol. 17 Number 6 (June 1984), pp 8-19. It is the cover story. Welch has already left Sperry and works for DEC at the time the article is published. Note that the article is published before the patent is granted, but well after the patent is applied for. The article omits to mention this.

The Unix 'compress' utility debuts in 1984 as well, infringing the LZW patent before it is granted.

1985: Terry Welch is awarded US Patent 4,558,302 'High Speed Data Compression and Decompression Apparatus and Method', Dec. 10, 1985 (filed June 20, 1983), Assignee: Sperry Corporation. This also appears to be a variant of LZ78. The patent lists 181 claims in an incredibly dense 90 page document! The original algorithm is presented with pseudo algorithms as just 14 lines for the compressor and 12 for the decompressor.

1987: CompuServe debuts GIF, long after the patent is granted.

1989: Victor S. Miller and Mark N. Wegman are awarded US patent 4,814,746 'Data compression method', March 3, 1989 (file November 3, 1986). Assignee IBM. A previous application was originally filed on June 1, 1983, three weeks before the Welch patent was filed. The US patent office failed to recognise that they covered the same algorithm.

February 1989: Unisys is granted a European patent 0,129,439 for the LZW algorithm. It is valid in Germany, France, Great Britain and Italy. A patent is pending in Japan.

October 1989: Mark Nelson (author of *The Data Compression Book*) has an article on LZW compression published in *Dr. Dobb's Journal*.

December 1989: *DDJ* publishes a letter from Raymond Gardner noting that the method is patented. (They omit one sentence from the letter: '*DDJ* may be infringing this patent by selling the source code on disk.') Nelson's reply quoted Unisys lawyer Robert Bramson as saying that Unisys would license the algorithm for a one-time fee of $20,000.

March 1990: *DDJ* publishes a letter from Robert S. Bramson, noting that the one-time $20,000 fee is 'a concession to the modem industry... for use in modems conforming to the V.42bis data compression standard promulgated by CCITT... not a general licence under all applications...' He also notes that 'Unisys is actively looking into the possibility that a large number of software developers may be infringing one or more of our data compression patents. We have only recently become aware of these potential infringers and the process of taking action will take some time.'

For more information on the Unisys patent contact Welch Patent Desk, Unisys Corp., P.O. Box 500, Bluebell, PA 19424 Mailcode C SW 19, USA or email to lzw_info@unisys.com.

Adapted from a Usenet post of Raymond Gardner (rgardner@teal.csn.org) with some additional data found in the comp.compression FAQ maintained by Jean-Loup Gailly and available by ftp in tfm.mit.edu:/pub/usenet/news.answers/compression-faq/part[1-3] or any of the RTFM mirror sites.

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CIRCLE NO. 090

All you need to know about navigating the Internet with Mosaic

Mosaic is an important application that is becoming instrumental in the growth of the Internet. These books, created for Microsoft Windows, X, and the Macintosh, introduce you to Mosaic and its use in navigating and finding information on the World Wide Web (WWW).

It shows you how to use Mosaic to replace some of the traditional Internet functions like FTP, Gopher, Archie, Veronica, and WAIS. For more advanced users, the books describe how to add external viewers to Mosaic (allowing it to display many additional file types) and how to customize the Mosaic interface, such as screen elements, color, and fonts.

The Microsoft and Macintosh versions come with Enhanced NCSA Mosaic on diskettes; the X Window version comes with NCSA Mosaic on CD-ROM. All three books come with a subscription to The Global Network Navigator(GNN®), the interactive guide that makes the Internet more enjoyable and easier to use.

Another new O'Reilly book on a much-requested topic is *Managing Internet Information Services: World Wide Web, Gopher, FTP, and more*. It describes in detail how to set up information services to make them available over the Net. It begins by discussing why a company would want to provide Internet services and how to select which services to provide. Most of the book describes how to set up email services and FTP, Gopher, and World Wide Web servers. This book will be published in December.

Dale Dougherty & Richard Koman
1st Edition October 1994, 230 pages
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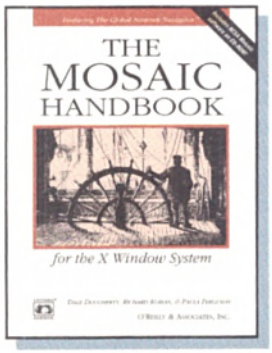

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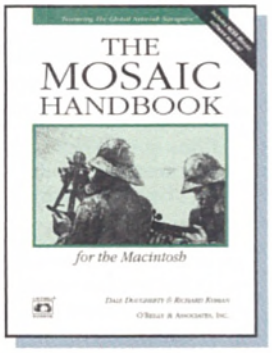

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CIRCLE NO. 091

Bitmap-Nipulations

Michael Covington

presents some C code to give the common or garden BMP file a bit of a twist.

Want to wrap a picture onto a sphere, fill it with copies of part of itself, or reduce it to an outline drawing? The program described in this article will do all these things, and more. It performs geometric transformations on Windows bitmap (.BMP) files, and is designed so that you can invent your own transformations and implement them easily. Our pictures show examples of what it can do.

How it works

A geometric transformation is what you get when each pixel in the image is replaced by a pixel from a different, computed, location. Accordingly, the heart of the program is the algorithm for deciding where each pixel should get its value from. That's the algorithm you get to customise. It's defined by the function `ComputePixel()`, which resides in an include file.

The rest of the program provides infrastructure for `ComputePixel()` by loading the bitmap into a huge array in memory and retrieving the value of any pixel on request. It then creates a new bitmap with the same format as the old one, writing pixel values into it, and saving the result onto a file.

What's in a bitmap

Windows supports four kinds of bitmap (.BMP) files: monochrome, 16-colour, 256-colour, and 16-million-colour. These use, respectively, 1, 4, 8, or 24 bits per pixel, and from here on I'll call them 1-bit, 4-bit, 8-bit, and 24-bit bitmaps.

Every 1-, 4-, or 8-bit bitmap contains a table that gives the actual red, green, and blue intensities for each colour. The values of the pixels are indexes into this table. Thus a 4-bit bitmap uses sixteen colours that the computer can display, and a monochrome bitmap need not be black on white. It can just as easily be khaki on hot pink. By contrast, a 24-bit bitmap doesn't have a colour table. Instead, it gives red, green, and blue intensities (each 0 to 255) in the three-byte pixels themselves.

The .BMP file consists of a header, a colour table and the data for the pixels. The header, in turn, consists of two data structures defined in

From left to right: The conversion program is an EasyWin Window with common file dialogs, an untreated image, a tiled image, a 'fisheyed' image, and effect of the edge detection filter

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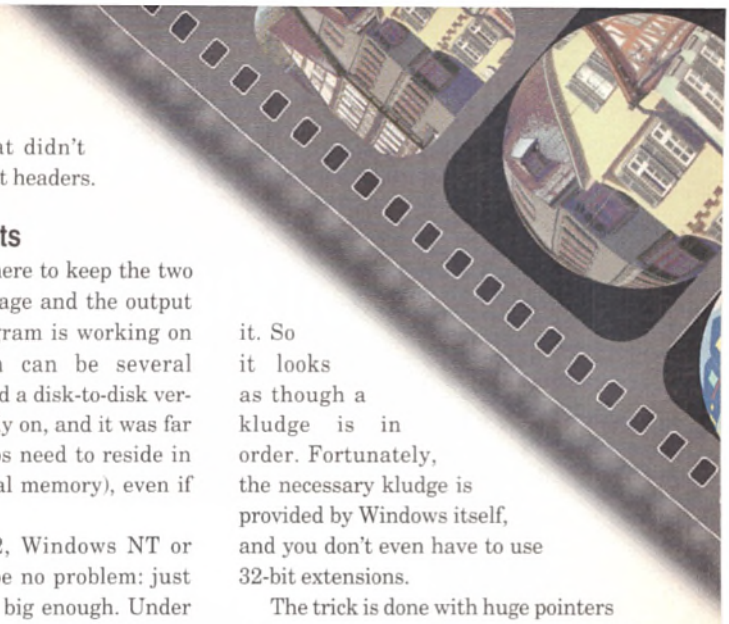

WINDOWS.H. These are a `BITMAPFILEHEADER` (14 bytes beginning with `'BM'`) and a `BITMAPINFOHEADER` (40 more bytes). See Windows API manuals for full information about what's in them.

Now look at Figure 1 (BITMANIP.C). This program doesn't actually decode the whole header, for two reasons. First, it doesn't need the actual colour values; all it's going to do is substitute some pixels for others, leaving the colour table unchanged. Second, the program creates its output file by copying the entire header unchanged from the input. Thus it need not decode all the header, merely reproduce it. The part that it does decode is called, naturally enough, `HEADER`.

The program *does* decode enough of the header to determine the basic dimensions of the bitmap and to verify that it isn't compressed. Windows supports run-length-encoded (RLE) compressed versions of 4-bit and 8-bit bitmaps, but this program doesn't process them.

If you get hold of a compressed bitmap file, or one that is slightly out of specification in some other way, you can convert it to standard, uncompressed format by loading it into Paintbrush and re-saving it. I've used this technique to salvage bitmaps generated by other software that didn't generate entirely correct headers.

Huge memory objects

The next problem is where to keep the two bitmaps - the input image and the output image - while the program is working on them. Each of them can be several megabytes in size. I tried a disk-to-disk version of the program early on, and it was far too slow. Those bitmaps need to reside in RAM (or at least virtual memory), even if they're huge.

Under UNIX, OS/2, Windows NT or Win32s, there would be no problem: just declare an array that's big enough. Under those operating systems, it would be perfectly OK to declare

```
unsigned char data[10000000];
```

if the machine could spare the memory. Or you could use `malloc()` to get millions of bytes as needed.

But plain Windows 3.x suffers a limitation of the 16-bit 8086 architecture for which it was originally designed: no memory segment can be larger than 65,536 bytes. The 386, 486, and Pentium have a flat 32-bit addressing mode, but Windows doesn't use it. So it looks as though a kludge is in order. Fortunately, the necessary kludge is provided by Windows itself, and you don't even have to use 32-bit extensions.

The trick is done with huge pointers and `farmalloc()` (which, in Borland C, calls the appropriate Windows memory-management functions). Just declare

```
char huge *OldBMP;
```

and allocate it with

```
OldBMP = (char huge *) farmalloc(size);
```

where `size` (a long integer) is the size of the whole file. `OldBMP` then points to a huge array of bytes the same size as the file. The

```
// BITMANIP.C   Michael A. Covington 1994
// Geometric transformation of Windows BMP files
// Borland C for Windows 3.1
#include <alloc.h>
#include <stdlib.h>
#include <stdio.h>
#include <windows.h>
#include <commdlg.h>
#include <sys\stat.h>
#include <string.h>
// -- Globals ------------------------
typedef struct {                // Part of Windows .BMP header
  char          id1, id2;       // Must be 'BM'
  unsigned long  filesize;       // May be 0 when read in
  int           junk1, junk2;
  unsigned long  ofsdata;        // Offset of bitmap in file
  unsigned long  bmisize;        // Must be 40 in Windows BMP
  unsigned long  width, height;
  unsigned int   planes;         // Must be 1
  unsigned int   bitsperpixel;   // 1, 4, 8, or 24
  unsigned long  compression;    // Must be 0
  // Ignore rest of header; all will get copied anyway.
} HEADER;
typedef struct {                // 2 useful numbers not in hdr
  int           bytesperpixel;  // 1, 1, 1, or 3 respectively
  int           widthbytes;     // Affected by rounding
} LAYOUT;
unsigned char   huge *OldBMP = NULL, huge *NewBMP = NULL;
HEADER          huge *OldHeader,     huge *NewHeader;
LAYOUT                OldLayout,           NewLayout;

// -- User interface functions -------------
void Quit(char* text1, char* text2){
  // Print 2 msgs, free dynamic memory, and end program
  printf("%s %s \n",text1,text2);
  if (OldBMP != NULL) farfree(OldBMP);
  if (NewBMP != NULL) farfree(NewBMP);
  puts("Program terminated.");
  exit(0);
}
void GetFileName(char* filename, int fnlength, char rw){
  // Calls a Windows common file dialog to choose a file.
  // filename = string in which to return full path to file
  // fnlength = length of filename
  // rw       = 'r' to read, 'w' to write
  OPENFILENAME    ofn;   // Data structure for file dialog
  // Initialize filename to invalid value (containing '*').
  // User will be forced to give an actual file name.
  strcpy(filename,"*.bmp");
  // Initialize ofn to all zeroes, then change some fields
  memset(&ofn,0,sizeof(OPENFILENAME));
  ofn.lStructSize  =  sizeof(OPENFILENAME);
  ofn.hwndOwner    = GetActiveWindow();
  ofn.lpstrFilter  = "Bitmap Files\000*.bmp\000";
  ofn.nFilterIndex = 1;
  ofn.lpstrFile    = filename;  // pointer assignment
  ofn.nMaxFile     = fnlength;
  if (rw == 'w') {
    ofn.lpstrTitle = "File to Write";
    ofn.Flags = OFN_PATHMUSTEXIST | OFN_OVERWRITEPROMPT |
                    OFN_HIDEREADONLY | OFN_NOREADONLYRETURN;
  }
  else
  {
    ofn.lpstrTitle = "File To Read";
    ofn.Flags = OFN_PATHMUSTEXIST | OFN_FILEMUSTEXIST |
              OFN_READONLY;
  }
  // Call Windows and check that result is nonzero
  if (!GetOpenFileName(&ofn))
    Quit(filename,"is not a valid filename.");
}
// -- Bitmap handling functions ------------
void LoadOldBMP(char *infilename){
  // Obtains huge memory object, reads entire file into it,
  // makes OldBMP and OldHeader point to it, validates contents,
  // initializes layout data.  Aborts program if unsuccessful.
  int                r;
  HFILE              infile;
  struct stat        infilestat;
  long               bytecount;
  r = stat(infilename,&infilestat);
  if (r == -1) Quit("Can't find file",infilename);
  OldBMP = (char _huge *) farmalloc(infilestat.st_size);
  if (OldBMP == NULL) Quit("Insufficient memory","");
  infile = _lopen(infilename,READ);
```

Figure 1 - Main program

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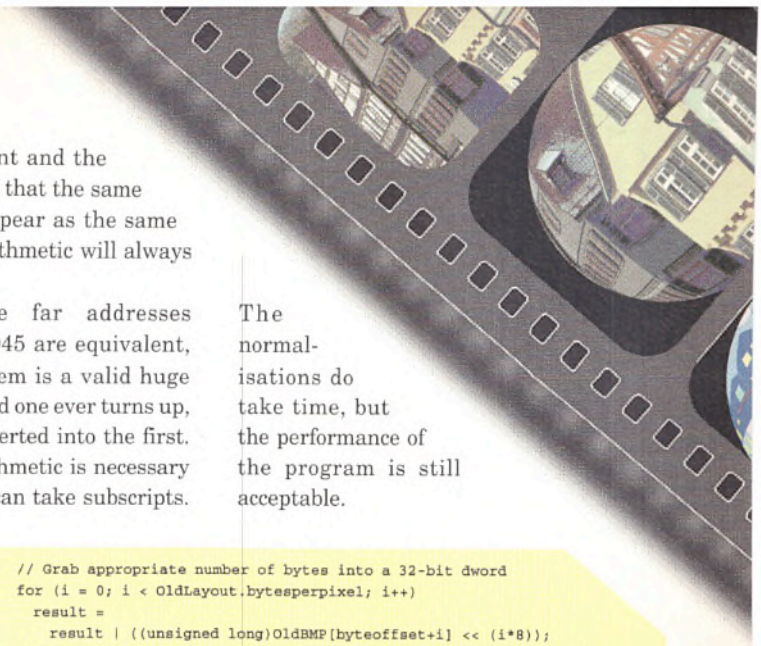
CIRCLE NO. 129



Windows functions `_lopen()` and `_lread()` then read the file into the array with remarkable speed. There is a similar function, `_lwrite()`, for writing the output back onto disk. And at the end, the huge data structures are freed by calling `_farfree()`.

'Huge' doesn't just mean that the data structures are big. It tells Borland C to make the addresses act like 32-bit numbers. A 'near' address consists of only a 16-bit offset. A 'far' address consists of a segment and an offset. And a 'huge' address is like a 'far' one except that the segment and the offset are *normalised* so that the same address will always appear as the same number and pointer arithmetic will always work correctly.

For example, the far addresses 1234:0005 and 1230:0045 are equivalent, but only the first of them is a valid huge address, and if the second one ever turns up, it will instantly be converted into the first. Normalised pointer arithmetic is necessary so that the huge array can take subscripts. The normalisations do take time, but the performance of the program is still acceptable.

```
  if (infile == HFILE_ERROR) Quit("Can't open",infilename);
  printf("Loading %s...",infilename);
  bytecount = _hread(infile,OldBMP,infilestat.st_size);
  if (bytecount != infilestat.st_size)
    Quit("Can't read",infilename);
  printf("Read %ld bytes.\n",bytecount);
  _lclose(infile);
  OldHeader = (HEADER _huge *) OldBMP;
  // Header = first part of file, interpreted differently
  if ( OldHeader->id1         != 'B' ||
       OldHeader->id2         != 'M' ||
       OldHeader->bmisize     != 40  ||
       OldHeader->planes      != 1   ||
       OldHeader->compression != 0     )
          Quit("Not an uncompressed Windows BMP file","");

  OldHeader->filesize = bytecount;  // Ensure correct value
  OldLayout.bytesperpixel = (OldHeader->bitsperpixel + 7) / 8;
  OldLayout.widthbytes =
    (OldHeader->filesize-OldHeader->ofsdata)/OldHeader->height;
      // Width of row in bytes has been rounded up;
      // exact value is computed from file size.
  printf("Successfully loaded %ld x %ld %ld-colour bitmap.\n",
            OldHeader->width,
            OldHeader->height,
            (1L << OldHeader->bitsperpixel));
}
void InitializeNewBMP(void){
  // Creates a NewBMP identical in size to OldBMP.
  // Copies entire header and colour table into it.
  // Remainder of it remains uninitialized.
  NewBMP = (char _huge *) farmalloc(OldHeader->filesize);
  if (OldBMP == NULL) Quit("Insufficient memory","");
  NewHeader = (HEADER _huge *) NewBMP;
  _fmemcpy(NewBMP,OldBMP,OldHeader->ofsdata);
  NewLayout.bytesperpixel = OldLayout.bytesperpixel;
  NewLayout.widthbytes    = OldLayout.widthbytes;
}
void SaveNewBMP(char* outfilename){
  // Writes NewBMP on a file.
  HFILE    outfile;
  long     bytecount;
  outfile = _lcreat(outfilename,0);
  if (outfile == HFILE_ERROR) Quit("Can't open",outfilename);
  printf("Writing %s...",outfilename);
  bytecount = _hwrite(outfile,NewBMP,NewHeader->filesize);
  if (bytecount != NewHeader->filesize)
    Quit("Can't write complete file",outfilename);
  printf("Wrote %ld bytes.\n",bytecount);
  _lclose(outfile);
}
// -- Pixel access functions ----------------
long ReadPixel(int x, int y){
  // Retrieves value of one pixel, rightmost in a 32-bit dword.
  // If coordinates out of range, returns nearest actual pixel.
  unsigned long  byteoffset;
  int                 bitoffset, i;
  unsigned long  result = 0L;
  // Bring within range
  if (x < 0) x = 0;
  if (y < 0) y = 0;
  if (x > OldHeader->width - 1) x = OldHeader->width - 1;
  if (y > OldHeader->height - 1) y = OldHeader->height - 1;
  // Figure out where we are
  byteoffset = (long)y * OldLayout.widthbytes
       + x * OldHeader->bitsperpixel / 8
       + OldHeader->ofsdata;
  bitoffset =  (x * OldHeader->bitsperpixel) % 8;
  // Grab appropriate number of bytes into a 32-bit dword
  for (i = 0; i < OldLayout.bytesperpixel; i++)
    result =
      result | ((unsigned long)OldBMP[byteoffset+i] << (i*8));
  // Shift whole thing to high end of dword, then to low end
  result =
    (result << (32 - 8*OldLayout.bytesperpixel + bitoffset))
      >> (32 - OldHeader->bitsperpixel);
  return result;
}
void WritePixel(int x, int y, unsigned long v){
  // Inverse of ReadPixel.  Stores v in NewBMP at (x,y).
  // Coordinates must be within range.
  unsigned long  byteoffset, mask;
  int            bitoffset, i, shift;
  unsigned char  bytev, bytemask;
  // Figure out where we are
  byteoffset = (long)y * NewLayout.widthbytes
       + x * NewHeader->bitsperpixel / 8
       + NewHeader->ofsdata;
  bitoffset =  (x * NewHeader->bitsperpixel) % 8;
  // Shift bits to appropriate position in 32-bit dword.
  // Create a mask with 1's in those positions, 0's elsewhere.
  shift = (8 - NewHeader->bitsperpixel) % 8 - bitoffset;
  v = v << shift;
  mask = (0xFFFFFFFFL >> (32 - NewHeader->bitsperpixel)) << shift;
  // Twiddle the appropriate number of bytes
  for (i = 0; i < NewLayout.bytesperpixel; i++){
     bytev = 0xFF & (v >> (i*8));
     bytemask = 0xFF & (mask >> (i*8));
     NewBMP[byteoffset+i] =
       (NewBMP[byteoffset+i] & ~bytemask) | bytev;
  }
}
// -- Function to compute the transformation ------------
#include "tiling.c"   // defines TITLE and ComputePixel(x,y)
// -- Main control functions ----------------------
void ComputeNewBMP(void){
  int x, y;
  printf("Computing...     ");
  for (y=0; y<OldHeader->height; y++){
    if (y%4 == 0)
      printf("\b\b\b\b\b%4.0f%%",100.0 * y / OldHeader->height);
    for (x=0; x<OldHeader->width; x++)
      WritePixel(x,y,ComputePixel(x,y));
  }
  printf("...Done.\n");
}
void main(){
  char filename[256],cmd[256];
  unsigned long x, y;
  // Get information from user
  _InitEasyWin();
  SetWindowText(GetActiveWindow(),TITLE);
  GetFileName(filename,sizeof(filename),'r');
  LoadOldBMP(filename);
  // Compute
  InitializeNewBMP();
  ComputeNewBMP();
  // Save result
  GetFileName(filename,sizeof(filename),'w');
  SaveNewBMP(filename);
  // Launch Paintbrush to view the results
  strcat(cmd,"pbrush ");
  strcat(cmd,filename);
  WinExec(cmd,SW_SHOWMAXIMIZED);
  Quit("All done.","");
}
```

Figure 1 - Main program (continued)

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CIRCLE NO. 094

```
// TILING.C - Include in BITMANIP.C
#define TITLE "3 x 3 tiling"
#define XX (3)   // break into 3 horizontally
#define YY (3)   // and into 3 vertically
unsigned long ComputePixel(int x, int y){
  return ReadPixel(x %
((OldHeader->width+1)/XX),
                 y %
((OldHeader->height+1)/YY));
}
```

Figure 2 - Tiling algorithm

Program overview

The program is a 'partly windowed application'. It uses a text-mode EasyWin window together with some common file dialog boxes. Two of the functions in Figure 1 deal specifically with user interface. `Quit()` ends the program, first checking whether `OldBMP` and `NewBMP` have been allocated, and freeing them if necessary. `GetFileName()` puts up a common file dialog box. Both of these can be extracted and used, in slightly altered form, in other programs.

The next group of functions deals with loading and saving bitmaps, making crucial use of global variables. The pointers to the bitmaps themselves, `OldBMP` and `NewBMP`, are global. So are `OldHeader` and `NewHeader`, which point to the same block of data under a different data type to facilitate decoding the header. The global structures `OldLayout` and `NewLayout` contain a couple more pieces of information that do not appear directly in the header, but would have to be computed repeatedly if they weren't stored globally.

Accordingly, `LoadOldBMP()` reads in a bitmap from a file and initialises the global variables associated with it. `InitializeNewBMP()` creates a new bitmap just like the old one and copies the header and colour table into it. And `SaveNewBMP()` writes the new bitmap to a file after all its pixels have been filled in.

Access to the pixels is handled by `ReadPixel()` and `WritePixel()`. These functions handle any Windows bitmap format (1, 4, 8, or 24 bits per pixel), using algorithms that are designed for versatility rather than optimised for any particular format. Some fancy bit-twiddling is involved. For example, `ReadPixel()` grabs up to three bytes into a 32-bit doubleword, then shifts it left to discard unwanted high-order bits, and finally shifts it right to bring the significant bits into the rightmost (low-order) position. `WritePixel()` has an even more complicated task, because it has to read up to three bytes, alter some of the bits while leaving others unchanged, and write the result back into the same position. It uses a mask to control which bits get altered.

The bulk of the work is done by `ComputeNewBMP()`, whose algorithm, expressed in pseudo code, is essentially:

```
for y:=0 to height
  for x:=0 to width

WritePixel(x,y,ComputePixel(x,y));
```

where `ComputePixel()` is the user-supplied function that decides what should appear at each position.

The main program gets the input and output file names from the user, performs the computation, and, at the end, launches Paintbrush to display the newly created file.

Ttransformations

The simplest transformation is *tiling*, the copying of part of the image repeatedly to fill the whole. The algorithm is very simple:

```
ComputePixel(X,Y) :=
        ReadPixel(X mod M, Y mod N)
```

where `M` and `N` are arbitrary numbers In the program, they are a third of the height and of the width respectively, so the lower left ninth of the picture gets repeated. You could repeat an entire picture by placing it in the lower left ninth of a larger bitmap.

A fancier transformation is to project the whole picture onto a hemisphere. The mathematics is fairly complicated here, and this transformation is slower than the others. Essentially, the algorithm is

```
ComputePixel(X,Y) :=
  ReadPixel(X * asin(sqrt(X2 + Y2)),
            X * asin(sqrt(X2 + Y2)))
```

except that `X` and `Y` have to be measured from the centre of the picture, in units suitable to be arguments of `asin` (arc sine). What this says is that the projected picture is scaled according to the arc sine of the distance of each point from the centre. The effect is much like that of a fisheye lens.

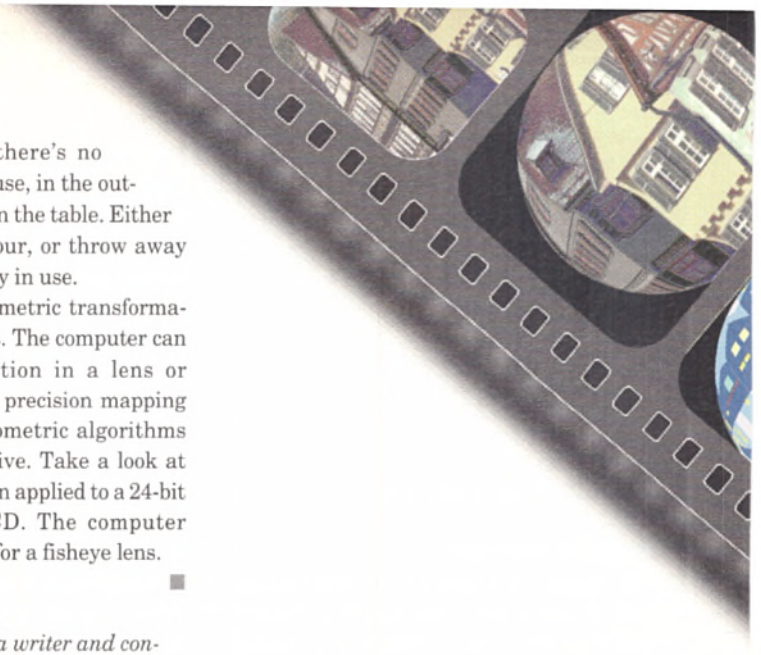
Finally, I have used a very primitive edge-finding algorithm: it puts white wherever the original pixel matches the pixels directly below and to the left of it, and puts black every-

```
// SPHERE.C - Include in BITMANIP.C
#define TITLE "Projection onto a Sphere"
#include <math.h>
#define EPSILON (0.0000001)
unsigned long ComputePixel(int x, int y){
  double xmid, ymid, xx, yy, delta, dist, factor;
  // Rescale x and y to measure from center, not corner
  xmid = (NewHeader->width - 1)/2.0;   xx = x - xmid;
  ymid = (NewHeader->height - 1)/2.0;  yy = y - ymid;
  // Compute distance from center, map onto range 0..1
  delta = xx*xx + yy*yy;
  if (delta < EPSILON)       // avoid sqrt of approximate zero
    dist = 0.0;
  else
    dist = 1.01 * sqrt(delta) / min(xmid,ymid);
  // Compute scaling factor using arcsine function
  if (dist > 1.0)
    return(0L);              // out of range
  else if (dist < EPSILON)
    factor = 1.0/1.57;       // avoid dividing by 0
  else
    factor = asin(dist) / (dist * 1.57);
  // Apply scaling transformation
  xx = xx * factor;      yy = yy * factor;
  // Back to original coordinate system
  x = xx + xmid;         y = yy + ymid;
  // Pick a pixel from the computed location, and return its value
  return ReadPixel(x,y);
}
```

Figure 3 - Algorithm for projection onto a hemisphere

```
// EDGEFIND.C - Include in BITMANIP.C
#define TITLE "Very simple edge finder"
unsigned long ComputePixel(int x, int y){
  unsigned long v;
  unsigned long black = 0, white;
  white = (2L << NewHeader->bitsperpixel) - 1;
    // Attempt to guess the code for white.
Sometimes wrong.
  v = ReadPixel(x,y);
  if (v != ReadPixel(x-1,y) || v !=
ReadPixel(x,y-1))
    return black;
  else
    return white;
}
```

Figure 4 - Edge-finding algorithm



where else. Thus, the pixels on boundaries of coloured areas end up black. More precisely, this algorithm *tries* to use black and white. It actually uses colour 0 and the highest-numbered colour, whatever that may be, because it doesn't actually look at the colour table.

Of course you can do more than one transformation, in succession, on the same image. One of the pictures shows what happens when a tiled image is projected onto a hemisphere. Another possibility is to apply the hemisphere projection to the same image repeatedly, making the middle bulge more and more.

From here to image processing

The main thing that separates this program from real image processing is that image-processing algorithms have to know the actual colours of the pixels, not just copy them from one place to another. For example, an image-processing algorithm might increase local contrast by shifting the value of each pixel away from the average of those around it. Other algorithms might adjust the colour balance and/or contrast of the entire picture, or convert subtle variations of intensity into bright false colours.

You can do image processing with this program if you work with 24-bit bitmaps, or if you add code to read the colour table. The former is preferable. The problem with colour tables is that there's no straightforward way to use, in the output, a colour that is not in the table. Either you find an unused colour, or throw away one of the colours already in use.

But even simple geometric transformations have plenty of uses. The computer can compensate for distortion in a lens or shrinkage of film (eg in precision mapping from photographs). Geometric algorithms can even alter perspective. Take a look at the hemisphere projection applied to a 24-bit image from a photo CD. The computer makes a fine substitute for a fisheye lens. ■

Michael A. Covington is a writer and consultant working in Georgia, USA. This article first appeared in PC Techniques. The cityscape image is an original drawing by Melody Covington. The photo is by Alfons Rudolph, and is used by permission of Eastman Kodak Company.

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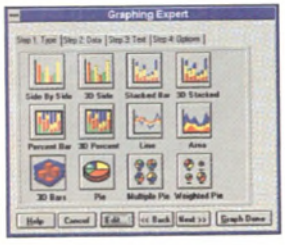

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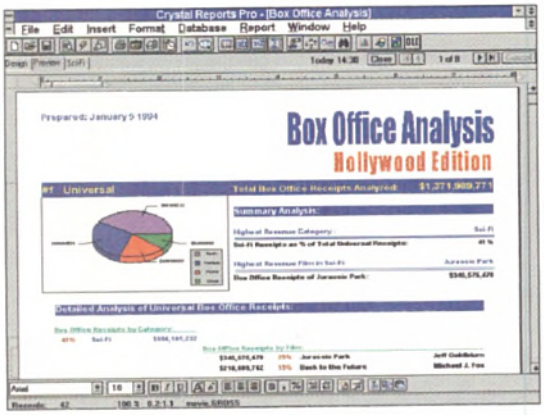

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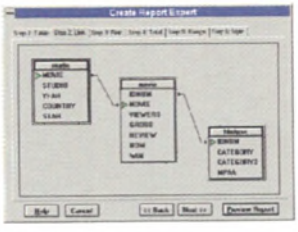

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The stuff of Legend

Judging by the reactions at Windows 95, the launch of Delphi seems to have caused quite a stir in the developer community. **Dave Jewell** checks out the newcomer from Borland to seperate the myth from the matter.

One or two tales of fantasy appear to have sprung up around Delphi. So let's start by clearing any possible misconceptions out of the way. First, at the present time, Delphi isn't 32-bit. If you want to write 32-bit applications for NT and Windows 96 (or is that 95?) you've either got to use some other development system or wait for the 32-bit version. Borland have committed to releasing this within four weeks of Windows 95 shipping.

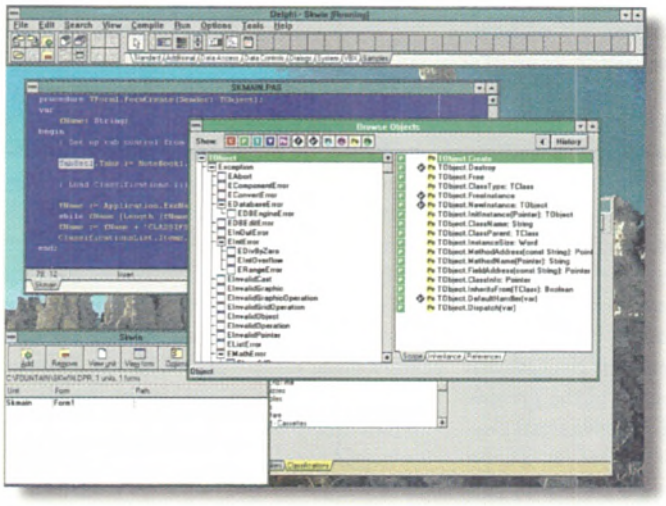
Second, Delphi doesn't allow you to create custom components that you can simply drop into a C/C++ or Visual Basic application. This myth derives from the editorial of an American programming magazine where the editor raved about being able to use Delphi components in Visual C++ and so on. This is not possible. Any components you create with Delphi are *Delphi* components. You can use Delphi to create VBX files, just as you can create specialised DLL's with any other mainstream development systems, but Delphi components will only work inside VCL executables.

Notice that I didn't say 'Delphi components will only work inside Delphi applications'. The good news is that it's very easy to create Delphi DLL's that are callable from applications written in other languages. So if you have masses of number crunching code written in C/C++, FORTRAN or what-have-you, it can still be given a nice user interface via a Delphi DLL.

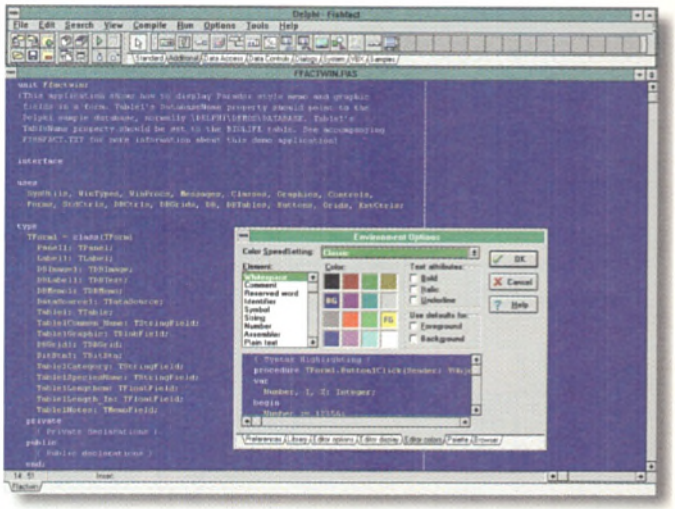
The reality

Delphi is based around an object-oriented Pascal compiler which produces truly executable code. Unlike Visual Basic, there's no need for a separate, run-time interpreter/library package which, of course, is what VBRUN300.DLL is all about. This results in faster execution and a simpler set-up procedure. On the negative side, however, this means that Delphi executables are considerably larger than Visual Basic equivalents. The minimum .EXE size seems to be around 150 KBytes.

One of the cornerstones of the Delphi philosophy is the idea of reusable components. A Delphi component is written using Delphi's object-oriented Pascal language and compiled into a .DCU file. DCU files are really just the familiar TPU and TPW files that Pascal developers have been using for some time. They are the Pascal equivalent of the OBJ files familiar to C/C++ developers but contain information that is far more complete. As an example, I recently heard someone on CIX comment that Delphi didn't have type-safe linking! The fact is, Borland's various Pascal implementations have had type-safe linking since separate compilation was introduced... long before C++ had such a facility. As I said at the time, telling a Borland Pascal or Delphi developer that he



Delphi's IDE includes much that's familiar to Borland Pascal and C/C++ developers, including the ObjectBrowser -not to be confused with the Object Inspector window!



Delphi gives a large degree of control over the development environment

lacks type-safe linking is like telling an Eskimo he hasn't got ice.

RADically superior

Delphi provides a RAD environment in which you can quickly build large and complex forms. It's similar to that of VisualBasic but Delphi's form designer facilities are superior in several ways. For example, many types of *component*, or *control*, can function as *containers*. This allows you to place other components within them. Group boxes, Panels and NoteBooks are all examples of container components. As you move a container around within a form, the 'children' of the container move with it, maintaining the same spatial relationship with respect to one another and to the enclosing component. The beauty of this approach is that you effectively have 'sub-forms' within the main form. You can move and rearrange these collections of components as desired.

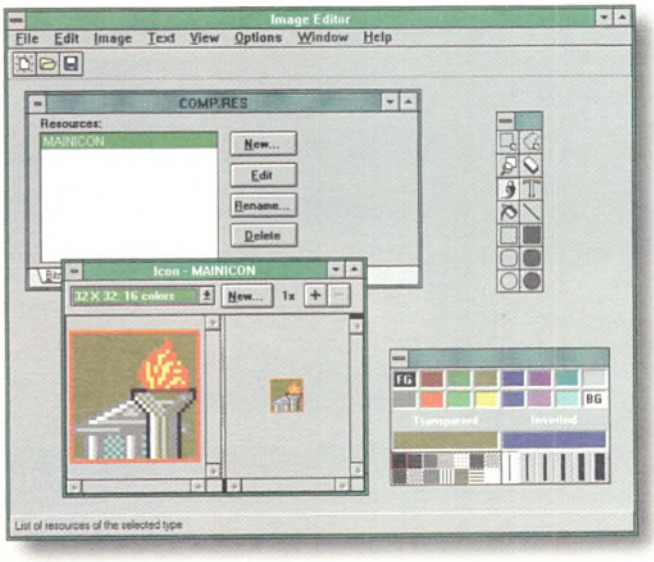
As I've already mentioned, Delphi components are compiled into object files that are linked with the main application. They all become part of the executable which means that you don't have to cart loads of assorted VBX files around with your program. From the perspective of the Delphi design environment, however, things are a little different. Each installed component appears on a tabbed Component Palette. The 'installation' of components depends on whether or not the code for each component appears in the COMPLIB.DCL component library file. Interestingly enough, this file is actually just an ordinary Windows DLL behind the scenes. Each time you rebuild the Delphi library, a new version of the DLL gets created. Since the design environment is able to make use of components which are contained in a DLL (COMLIB.DCL) this opens up some tantalising possibilities. It should be possible to create Delphi applications which directly employ DLL-based components. It's an interesting idea which doubtless requires a certain amount of low level chicanery. So I'll keep you posted.

The Component Expert is used to create your own new components, based on existing component classes

To C or not to C

One of the most regular criticisms of Delphi is the choice of language. 'Why wasn't it designed to use C++?' is the oft-heard cry. So at the risk of causing offence to C++ developers, I'd just like to say that Borland wanted a RAD tool, with the emphasis on RAPID. Current C++ compiler technology simply does not cut the mustard as far as compilation speed is concerned. It is therefore wholly unsuited to the iterative 'change a property - rerun - move a component - rerun -' development cycle employed by Visual Basic and Delphi developers. The opposite of RAD must surely be Slow Application Development and I'm afraid that C++ developers are going to stay SAD until C++ technology catches up.

Lest it be thought that I'm poking fun at C++ let me stress that I personally enjoy programming in C, C++ *and* Pascal. Borland's decision to base Delphi on Pascal must have been a tough one since they knew the market resistance they would face. However, I think they made the right choice. If I do have an axe to grind, it's with the C/C++ compiler vendors who stick like lemmings to the outdated and inefficient OBJ file format. By moving over to a more efficient object file format, it would be possible to eliminate many of the present bottlenecks in C/C++ compilation. At the same time, we could get rid of the hideous name-mangling hack and add true type-safe linkage to C++ *and* C.



The Image Editor program is itself written in Delphi

The bad old days

Wirth's original implementation of Pascal was intended as a teaching language. So it's not surprising that there was very little you could do with it. There was no separate compilation, type-checking was so rigid that you felt as if you were in a strait-jacket all the time and the whole thing was guaranteed to turn most programmers into gibbering idiots as soon as any real-world work was attempted. If I remember rightly, there wasn't even any concept of character strings. UCSD added this innovation as part of their p-machine implementation.

Happily, those days are long gone. Over the years, Borland have added extensively to their Pascal dialect without detracting from it's essential elegance, and there's been considerable convergence between Pascal and C/C++. Prior to Delphi, Borland had already added the `break`, and `continue` keywords, and the `PChar` type. A `PChar` is an array of characters terminated with a zero byte, like a C string.

Borland added support for the `PChar` to make it easy to call the Windows API routines, which exclusively use C-style strings, from a Pascal program. Interestingly, the pendulum has swung the other way with Delphi. The VCL class library now uses Pascal strings almost exclusively and provided that you stick to making VCL library calls, you'll never need to use a C string. There are routines for converting between the two different string formats for those times when you need to call the Windows API.

Fruit crush

Borland first added OOP capabilities to Pascal with the advent of Turbo Pascal 5.5. At the time, industry pundits compared the OOP extensions unfavourably with Apple's

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CIRCLE NO. 098

object-oriented Pascal dialect as used in MacApp. But how many developers use MacApp? Borland's OOP extensions have stood the test of time and been used in TurboVision, OWL and now in Delphi. I rather suspect that the number of Delphi users already dwarfs the MacApp community. Admittedly, Delphi Pascal lacks multiple inheritance, operator overloading and templates but what you lose in rampant features, you more than make up for in syntactic simplicity and compilation speed.

A number of new extensions have been added to the Pascal syntax which are best illustrated by making recourse to actual code. If you look at Figure 5, you'll see the Delphi class definition for the `TButton` class. This corresponds, as you might expect, to ordinary push button controls. The new '`class`' reserved word replaces the old-style '`object`' keyword that was used in previous versions of Borland Pascal. For the sake of backward compatibility, the older style '`object`' declarations are still supported but you must use the newer `class` declarations when creating Delphi objects.

Heaps of class

The newer class objects are always allocated on the heap. So you no longer have to use Pascal's memory indirection operator when declaring objects and referencing methods and fields of objects, it's automatically implied. The difference is illustrated below:

```
MyButton: ^Tbutton;
{ old-style object declaration}
{ with explicit indirection}
MyButton: Tbutton;
{ new-style class declaration}
{with implied indirection }
```

You can see in Figure 1 that the `TButton` class is derived from the `TButtonControl`. If you don't specify an ancestor class in a new class declaration, then the class is assumed to inherit from `TObject`.

More importantly, the new class declaration introduces a number of extensions which dovetail the object neatly into the Delphi environment. Firstly, you'll notice that there are four different sections within the declaration. These are private, protected, public and published. Private fields can only be accessed within the module where the class is declared. Protected fields can be accessed outside the module provided that the access is from a derived class. There are no restrictions on access to public fields. From an architectural standpoint, the published section is the most interesting as it 'exports' the properties belonging to the object. Published field declarations also generate special run-time type information which can be picked up and accessed through a Borland supplied unit called DSGINTF.PAS: the designer interface. It's through this mechanism that the Object Inspector operates at design time, picking up the list of properties belonging to a particular object class, calling the appropriate property editor code for each type of property, and so forth.

```
TButton = class(TButtonControl)
  private
    FDefault: Boolean;
    FCancel: Boolean;
    FActive: Boolean;
    FReserved: Byte;
    FModalResult: TModalResult;
    procedure SetDefault(Value: Boolean);
    procedure CMDialogKey(var Message: TCMDialogKey);
              message CM_DIALOGKEY;
    procedure CMDialogChar(var Message: TCMDialogChar);
              message CM_DIALOGCHAR;
    procedure CMFocusChanged(var Message: TCMFocusChanged);
              message CM_FOCUSCHANGED;
    procedure CNCommand(var Message: TWMCommand);
              message CN_COMMAND;
  protected
    procedure CreateParams(var Params: TCreateParams); override;
    procedure CreateWnd; override;
    procedure SetButtonStyle(ADefault: Boolean); virtual;
  public
    constructor Create(AOwner: TComponent); override;
    procedure Click; override;
  published
    property Cancel: Boolean read FCancel write Fcancel
                    default False;
    property Caption;
    property Default: Boolean read FDefault write SetDefault
                     default False;
    property DragCursor;
    property DragMode;
    property Enabled;
    property Font;
    property ModalResult: TModalResult read FModalResult
                        write FModalResult default 0;
    property ParentFont;
    property ParentShowHint;
    property PopupMenu;
    property ShowHint;
    property TabOrder;
    property TabStop default True;
    property Visible;
    property OnClick;
    property OnDragDrop;
    property OnDragOver;
    property OnEndDrag;
    property OnEnter;
    property OnExit;
    property OnKeyDown;
    property OnKeyPress;
    property OnKeyUp;
    property OnMouseDown;
    property OnMouseMove;
    property OnMouseUp;
  end;
```

Figure 1- Extensions to the Pascal syntax...

State your purpose

As an example of a property declaration, look at the declaration of the `Cancel` property in the `TButton` class. The source code name of the property is what appears in the Object Inspector. This particular property is of type `Boolean`, so the Object Inspector will automatically toggle it's value between `True` and `False` as you double-click on the property value. The new read and write keywords specify the names of routines or fields that can be used to access the property. In this case, a `read` or `write` of the `Cancel` property is mapped down onto a `read` or `write` of the `FCancel` field.

You can see that `FCancel` is located in the private part of the class. So you can't access the field directly, you must go through the property mechanism. Now look at the `Default` property.

As before, the `read` keyword specifies a direct access to the private `FDefault` field, but this time a `write` is mapped onto a call to the `SetDefault` procedure. Again, you'll notice that `SetDefault` is a private method of the class which can only be called through the property mechanism. There are big advantages to the `read`/`write` mechanism.

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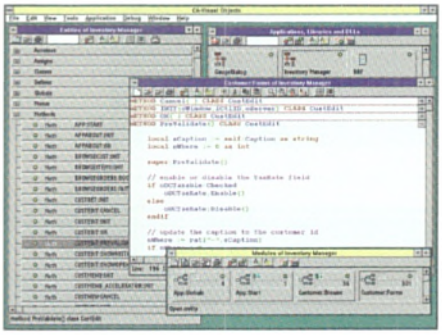

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Users of a class can access properties as if they were accessing public fields but the real implementation details can be hidden.

Just as importantly, the designer of the class can get control whenever a read or write access is performed. In the case of many Delphi components this means that you can, for example, just change a control's `Colour` property. The control will automatically repaint itself in its new livery. The same applies to `Enabled`, `Caption` and many other common property names. In each case, this same `read/write` mechanism allows the control itself to 'get a look in' when a property is read or written.

Incidentally, the `default` keyword (not to be confused with the `Default` property I've just been discussing) is used to specify the expected default value of this property. A particular property will only be allocated physical storage in the form file if it has a value other than the specified default.

Ancient Greek

The Delphi pedigree goes back a long way. The original PC version of Turbo Pascal gained popularity long before C was widely used outside of Bell Labs... Stroustrup was in diapers at the time! In its first incarnation it was a simple system, only capable of creating relatively small .COM files with no separate compilation. As time went by, the system became increasingly powerful, the concept of units was added and the maximum possible size of an executable file was greatly increased. The original Borland implementation of the language was based on a small, highly-optimised Pascal compiler hand-coded in assembler.

The nucleus of Delphi Pascal, Borland Pascal and Turbo Pascal is still centred around that same hand-coded compiler technology. As features such as object-oriented extensions and Delphi's more recent property-based interface to the Object Inspector have been added to the language the compiler has had to change. But it's the hand-coded, highly optimised compiler that makes Delphi compilations so fast. Even with the pre-compiled header facility used by most modern C/C++ development systems, Delphi invariably leaves them in the dust.

The format of the TPU file is another important reason why Delphi can compile and link applications so quickly. These files are essentially 'snapshots' of the compiler's symbol table. When a particular unit is referenced in a Pascal program, the compiler just loads the TPU file into memory, plugging the appropriate data directly into the current symbol table. This simple but elegant technique accounts for much of the frightening speed of a Pascal compilation! Incidentally, TPP's, TPW's and DCU's are all variations on the TPU theme.

A brief farewell

In next month's article, I will conclude this developer's look at Delphi by discussing the VCL class library, the database controls and the writing of Component and Experts. ■

Dave Jewell is a freelance consultant, Windows developer and author of Instant Delphi from Wrox Press. When not eating quiche, you can contact him as djewell@cix.compulink.co.uk

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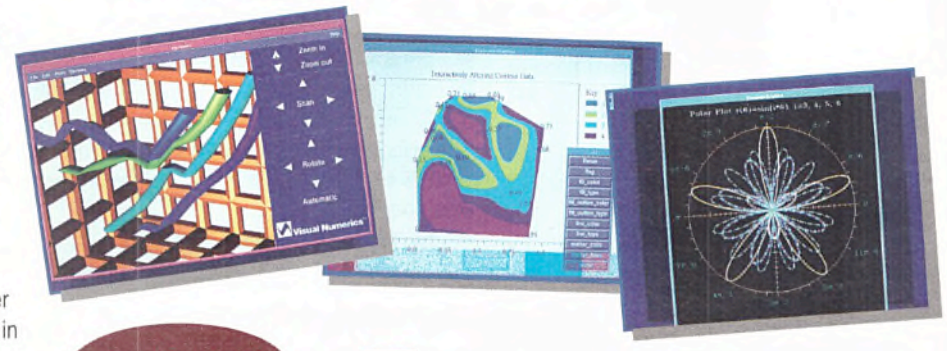

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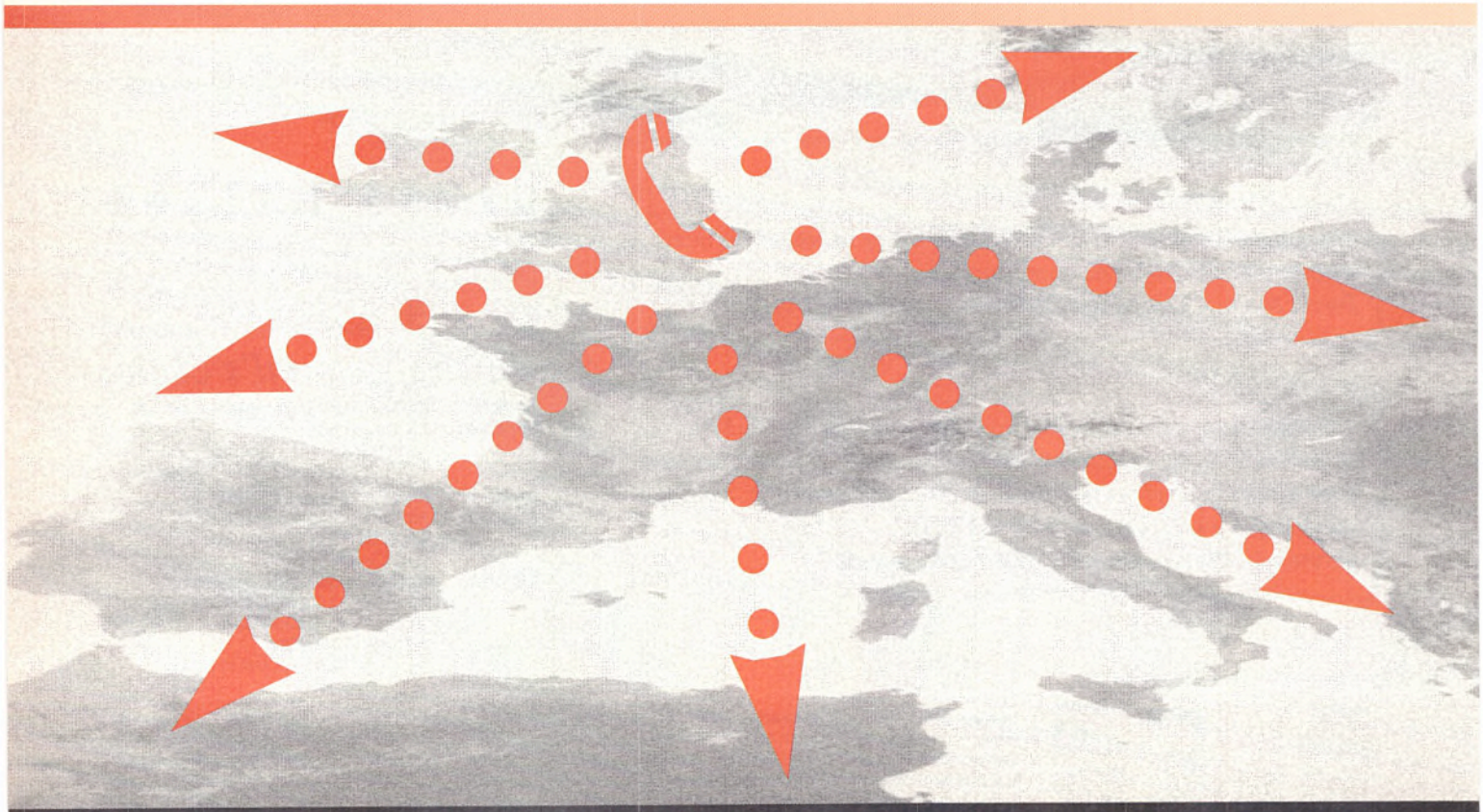

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Bullet-proofing your code

When something goes wrong, which C++ mechanism should you use to deal with the problem? **Charles Weir** argues for a methodical approach to selection.

What should our code do when it finds a problem? How should it handle something unexpected? Bad parameters to a function, missing configuration files, garbage typed in by a user: a robust system will detect all of these, and take some action for each. If we, as programmers, write a system that doesn't do this,the very least we can expect is rude phone calls from our users when the software misbehaves in unpredictable ways.

In a large project it is also important that all the code handles errors consistently. If Jim's functions all return an error status code, and Joan's throw C++ exceptions, then Jim and Joan are inflicting significant confusion on developers who must interface to both. They're not doing much, either, for the poor programmer who must maintain the system when they've gone.

So consistency in error handling is 'a good thing'. It matters less which approach we use, so long as the approach is consistent across the entire project. Thus decisions on error handling are part of the project strategy. We must make them early in the project. This article will describe an approach to C++ error handling and the technical ramifications of some possible choices.

Types of error

What is an error? Consider for example a function that returns a list of file names corresponding to a given wild card specification string (using a list template class):

```
getFileList
        ( const char* specification,
        List<char*>& result );
```

The errors it might detect include: a call with a null pointer as parameter; an operating system error (no such directory, or out of memory) or simply that there are no files matching the given specification. Observe, though, that these three errors are different in kind. The invalid parameter will never happen if our code is correct. The lack of memory may terminate either the program or just the action. The invalid string is quite likely and needs to be handled in a helpful way. Table 1 shows how our `getFileList` function might handle different situation in two different applications, a file listing utility, and a file server. The key difference between the two is that the file server may have many clients and a failure in the server should not bring all the clients down, whereas failure of the directory utility can be allowed to cause failure in its clients.

In practice, we can categorise the types of error:

- *Internal Errors* are errors that cannot happen, at least in theory. Examples include data corruption, invalid parameters to functions, or calling functions in a sequence they do not support.
- *External Errors* are (rare) conditions where the processing of an action cannot continue due to a fault within the computer system. Examples might include a network fault, an unexpected file system error, or running out of memory.
- *Anticipated Errors* are situations where the external input to the program is not what was expected. Examples might be garbage input typed by the user, or an out-

Situation	*Simple Directory Utility*	*File Server*
Some files match	Answers a list of files	Answers a list of files
No matching files	Answers an empty list	Answers an empty list
File system error (eg invalid directory)	Terminates program abnormally with an error message	Terminates request with an error status reply
Invalid pointer parameter	Terminates program abnormally	Terminates program, logs

Figure 1 - How `getFileList` might handle situations in two different applications

```
#ifndef NDEBUG
#  define assert(p) ((p) ? (void)0 : (void) (cerr << \
                "Assertion failed: " #p ", file " __FILE__ ", line " \
                 << __LINE__ << endl, abort()) )
#else
#  define assert( p )
#endif
```

Figure 2 - Possible UNIX implementation of assert( )

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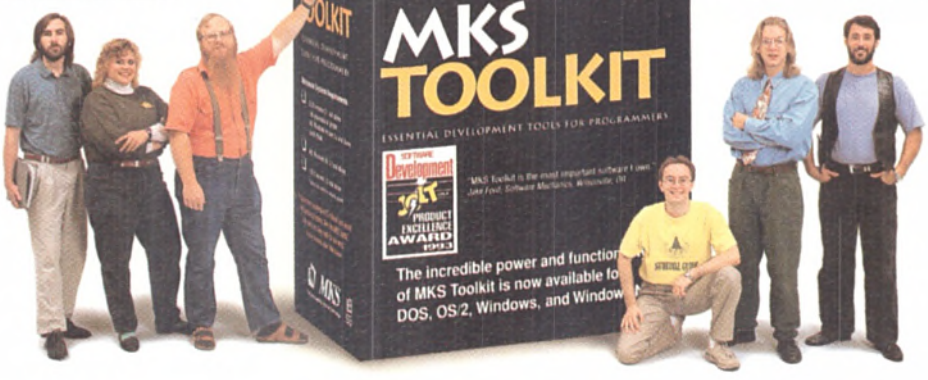

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The key point about this categorisation is that we are not pre-judging what action to take as a result. It is, after all, likely to be different in different applications. The following sections examine each type of error in more detail, and suggest an approach to handling each one.

Handling internal errors

The important feature of internal errors is that they do not happen. At least in a fully tested, production quality, released, and quality assured application, they shouldn't happen. In practice, of course, during the development and early test phases of a project some such errors almost certainly will occur. There will be bugs. We should like to check for them early so as to generate meaningful error messages rather than obscure system crashes. This requires us to insert tests into the codesuch as parameter checks and the like. Yet there is an overhead in processing time and code size to these tests so we want to avoid keeping them in the release version.

The solution to this is a C++ macro, `assert()`, or a variant of it. This library macro checks that its single parameter is true. If false, it uses clever pre-processor directives to display a helpful message with the file and line number where the problem occurred (ANSI versions usually also display the checking code as text), and then terminates the program. To compile the final version of the program we define the pre-processor macro `NDEBUG`. Now all of the `assert` statements compile out to nothing. Thus we can make the checks as complicated as we like, with no final performance penalty.

Using assertions

There are several points to keep in mind when using assertions. First, it is crucial that we don't use `assert` to handle errors that may still occur in the final system; since assertions don't exist in the final version, neither will this error handling. In addition, the location (file and line number) displayed by the error message is the place where the error was detected, while often the actual error is elsewhere. For example, in the `getFileList` example the assertion will fail if the caller passes an invalid parameter, but the fact that a bad parameter was passed tells us little. To debug the error we need to examine the stack.

Some implementations of `assert` display an error message then call `exit()`, which loses all information about the program state. In the MFC and Borland OWL Windows environments, the error display is a dialog box. So long as we are running under a debugger we can halt the application at this point and examine the stack. In UNIX environments, it is usually best to rewrite the `assert` macro (in a different header file) so that it calls `abort()` rather than `exit()`. Then we can use a UNIX debugger to examine the resulting core file. Figure 2 shows a typical UNIX implementation of `assert`. Note the clever use of pre-processor features. In either environment an examination of the function call stack is often enough to identify the problem.

So `assert` will validate the parameters of a function. Yet if the parameter is a pointer or reference, how can `assert` check it? We can check if it is zero, certainly, but that is hardly a very strong test. Instead there is a convention here which helps: a validation function. For each class, we define a function to verify that the instance data is in a consistent state. This function has the same name for every class - let's call it `isValid()` - and it is called from within an `assert` statement so that the calls are compiled out in the final version. Yet rather than return `FALSE` if the check fails, it uses assertions itself to give a better idea where the error occurred. For convenience it always returns `TRUE`. It will often be a virtual function, so that a call through a base class pointer or reference will call the correct version. For example, MFC defines the virtual function `AssertValid()` for `CObject`. Figure 3 shows an example implementation of the macro `assert` and an example of its use in implementing part of a simple string class.

Handling external errors

How do we handle errors that are unusual - errors which mean that the computer system is not behaving as expected?

In most cases the desired behaviour is to stop the unit or processing that caused the error; log, display, or send an error message; and return to wait for another request. What do we mean by 'a unit of processing'? We could find other names for it: an 'action', a 'scenario', or the 'processing of a single event'. But in C++ terms what we usually want to terminate is the sequence of function calls resulting from a single initial entry point. Alternatively, if we do not have a recovery plan for a particular kind of error we shall want to terminate the entire program with an appropriate error statement (message, log, or dialog box).

Consider, for example, a class representing a file, where the constructor opens the file itself (Figure 4). What do we do if there is an error on opening the file?

The answer, of course, lies in the new feature, *exceptions of C++*. A C++ exception answers our needs. The syntax of exceptions adds three keywords to the language. To raise an exception we use the `throw` keyword, while for code that implements the recovery from an exception, there is the `try...catch` construction. Stroustrup's

```
class String   {
public:
      int isValid() const;
      size_t length() const;
      // ...Constructor, destructor and other member functions go here.
private:
      char* ptr;
};
int String::isValid() const
      {        assert( this != 0 );
               assert( ptr != 0 );
               return 1; }
size_t String::length() const
      { assert( isValid() ); return strlen( ptr ); }
```

Figure 3 - Using assert() with a validation function

```
class File
{
public:
      File( const char* name ) { f = fopen( name, "r+"  );
                                 if ( f == NULL ) { /* What happens here? */ }
                               }
private:
      FILE* f;
};
```

Figure 4 - Part of a file implementation, showing a problem situation

book, *The Design and Evolution of C++*, describes exceptions in more detail.

As with most C++ features, exceptions allow a good deal of flexibility in the way they are used. The key decisions still rest with the programmer. In particular, we still have to define the classes that represent the different kinds of exception, the classes whose instances are thrown. So what should these contain, what is the exception class hierarchy, and how should the exception classes and the `catch` statements be structured to access their information?

```
class xmsg
{
public:
  // Uses compiler generated destructor, copy constructor,
  //  and assignment operator
  // (granted a sane implementation of the class string).
  xmsg(const string& s ) : str( s ) {}
  string why() const { return str; }
private:
  string str;
};
```

Figure 5 - One way to implement xmsg

```
class SystemError : public xmsg {
public:
  SystemError( const string& s )
  : Errno( ::errno ),
   xmsg( s + ": " + strerror( ::errno ) )
  {}
  int errno() const { return Errno; }
  // Uses compiler generated destructor, copy constructor,
  //  and assignment operator.
private:
  int Errno;  // Copy of the OS error number for this error.
};
```

Figure 6 - Possible implementation of a SystemError Exception reporting class

```
try
{
 ifstream s( "x" );
 if (!s) throw SystemError( "Cannot open file x" );
}
catch (xmsg& x)
{ cout << x.why() << endl; }
// Which displays: "Cannot open file x: No such file or directory"
```

Figure 7 - Example of using class SystemError

```
class Exception
{ virtual char* reason(); };
class Particular Exception : public Exception
{ virtual char* reason(); };
void foo()          { throw ParticularException(); }
// -- Value approach to catching exceptions:
try { foo(); }
catch (Exception x)      { cerr << x.reason() << endl; }
// Reference approach to catching exceptions:
try { foo(); }
catch ( const Exception& x ) { cerr << x.reason() << endl; }
```

Figure 8 - Value and Reference approaches to catching exceptions

Contents of an exception class

Each exception needs to contain enough information to allow it to be processed effectively. Thus every instance of an exception class needs to contain error codes, error severity codes and any other information pertinent to its particular error type. Similarly each error will usually require a string explaining the cause of the error.

Since we catch any exception class using a `catch` clause for its base class, it is very important that these base classes represent useful categories of errors. We have to be very careful to achieve a useful inheritance hierarchy for our exception classes. A key question is: are the types of error determined by the module of code where they occur, or by the nature of the error they represent? To take an example, if we write a library module which can have problems with a shortage of memory, do we throw an instance of a 'Memory Error' class (`xalloc`, for example), or do we throw an error specific to the library module (a `MyLibraryError` instance, perhaps)?

To answer this, consider the data we may need to include with the exception instance in order to process it. For a memory error, typically we might want to know the number of bytes requested, which will be implemented as a `bytesRequested()` member function on the exception class. But to have such information using the `MyLibraryError` class would mean having a `bytesRequested` data member. Either this would be defined in class `MyLibraryError`, and be redundant for other errors thrown by the library, or it would be defined in a specialist `LibraryMemoryError` class, deriving from `MyLibraryError`. The first option is distasteful and makes it awkward to add new types of error; the second leads to a proliferation of exception classes. So instead we derive global exception classes, such as the proposed ANSI standard `xalloc` class, or maybe one such as `FileError`, differentiating them according to the type of the exception thrown. After all, in processing a memory error, we seldom care precisely where it occurred.

Is there one base class for all the exception classes? We have some guidance from the ANSI committee's deliberations, in the form of the classes already defined for ANSI library errors: all exception classes derive from the class `xmsg`. Figure 5 shows a possible implementation of `xmsg` that conforms to the draft standard.

In creating an exception class derived from `xmsg`, we shall often want to create a composite string for the error description, by adding parameters to the basic text. We do this either by initialising the string as we

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want it in the constructor initialisation list, or by using the assignment operator for `xmsg` to change it later. (Beware: one or two current implementations of `xmsg` do not support this assignment operator correctly.) Figure 6 gives an example. It is an exception class to handle operating system errors. The POSIX `strerror()` function encapsulated in `getErrorString` is related to the more familiar `perror()` function. We might use this class as shown in Figure 7.

Note how we have encapsulated as much work as possible within this class. It takes on the work of retrieving the error information and producing a composite error message, so that a user accessing the error message using the `xmsg` class gets a meaningful and helpful message. If the project required such errors to be logged to file, or multiple language support, we would add this functionality to the class as well. This is a good example of object oriented reuse. By encapsulating functionality in the class we avoid the need to duplicate it in more than one location.

Catching C++ exceptions

C++ has a policy of having no policies. In exception handling, it supports two different approaches to the catch statement: pass by reference, and pass by value. In other words, the parameter to the `catch` clause may be either an instance, or a reference. But which should we use?

Figure 8 shows the two approaches in practice. The difference is clear: the value approach will call `Exception::reason()`; the reference approach will honour the type of the original exception and call `ParticularException::reason()`. In other words, the value approach does not respect virtual functions. So we have a clear choice. Either we use virtual functions to distinguish exceptions, or we use the value approach with no virtual functions. In the latter case we must ensure that the derived exception classes set up the data in the base classes correctly so that virtual functions are not required.

Which approach should we use in practice? Personally, given a free choice, I would favour the reference approach; it seems more, well, object oriented. However, consider what happens when we write a library function for reuse. If we throw value-type exceptions, they behave correctly whether the user chooses to catch them as values or as references. Whereas if we throw reference-type exceptions (containing virtual functions) and the user catches them by value, then the caller obtains the wrong versions of our member functions. So the only completely safe strategy to use in a library is to support no public virtual functions in exception classes. Indeed, this is the approach that the ANSI exception classes `xmsg` and `xalloc` have adopted.

However, it *is* safe to catch by reference whichever approach the exception classes take. So the rule we can adopt is always to catch by reference. But in exception classes for reuse in many systems, we should design exception classes not to use virtual functions.

Handling anticipated errors

Last we might consider the situation of the *anticipated* error: something that is quite likely during normal processing. Examples might include asking for a list of file names and finding none, or putting up a warning dialog box 'This is dangerous. Do you wish to continue?', and having the user select 'no'; or indeed any other form of unexpected input typed by the user or received from the outside world.

I strongly recommend against using exceptions to handle such errors. In terms of the C++ language, clearly they will work; the problem lies in software maintenance and debugging. The writers of a function must anticipate that an exception not caught may terminate the program. How-

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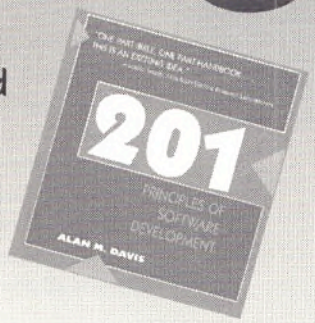

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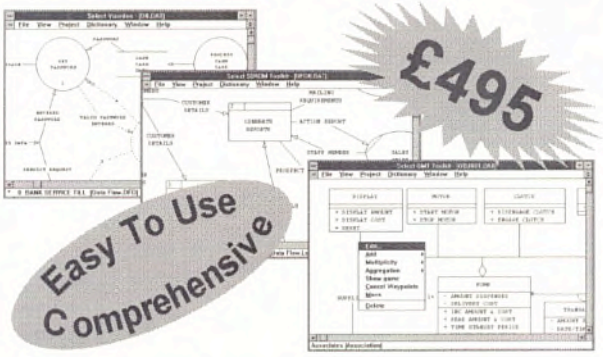

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ever for *anticipated* errors it is important both that it is clear from the interface that such exceptions can and will happen, and that they are handled gracefully. Exceptions also make it difficult to follow the flow of control. They are, after all, thinly disguised `goto` statements.

Most important of all, exceptions hamper portability, since not all compilers support them as yet. So instead, where possible, we prefer to handle *anticipated* errors using other C++ constructions: for example an empty collection (in the example where no files were found), a null pointer value, or perhaps a returned status code.

Consistent strategy

This article has identified three kinds of error condition which may occur in almost any C++ program and suggested ways of handling each:

- *Internal errors*, representing faults in the code.
- *System errors*, which are unexpected problems with the computer system or configuration.
- *Anticipated errors*, which are problems that may well occur as part of normal processing.

Figure 9 shows in a simple flowchart how we might decide between the error types in a given project, and how we would handle them.

Of course, in practice there will always be some choices and strategic decisions involved in choosing between the error types. For example, if the user provides the configuration file, is an error in this a system error or an anticipated error? The answer depends on our project. Nevertheless these questions will usually allow us to categorise and handle the majority of our error situations.

Whether we choose this approach or a different one, it is vital to establish a consistent strategy for error handling early in the project. With this in place, it becomes straightforward to anticipate and code for error conditions. This leads to fewer bugs, faster delivery and a more robust product. And that, after all, is what good programming is all about. ■

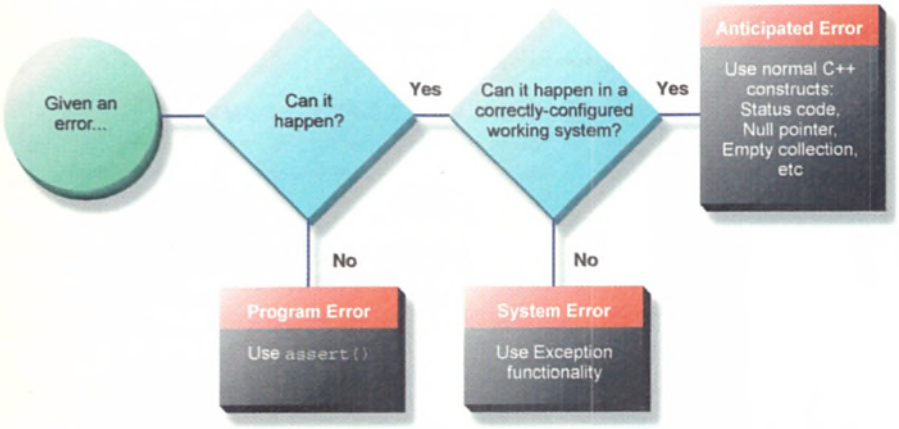

Figure 9 - Deciding between the error types

Charles Weir is a consultant with Object Designers Limited.

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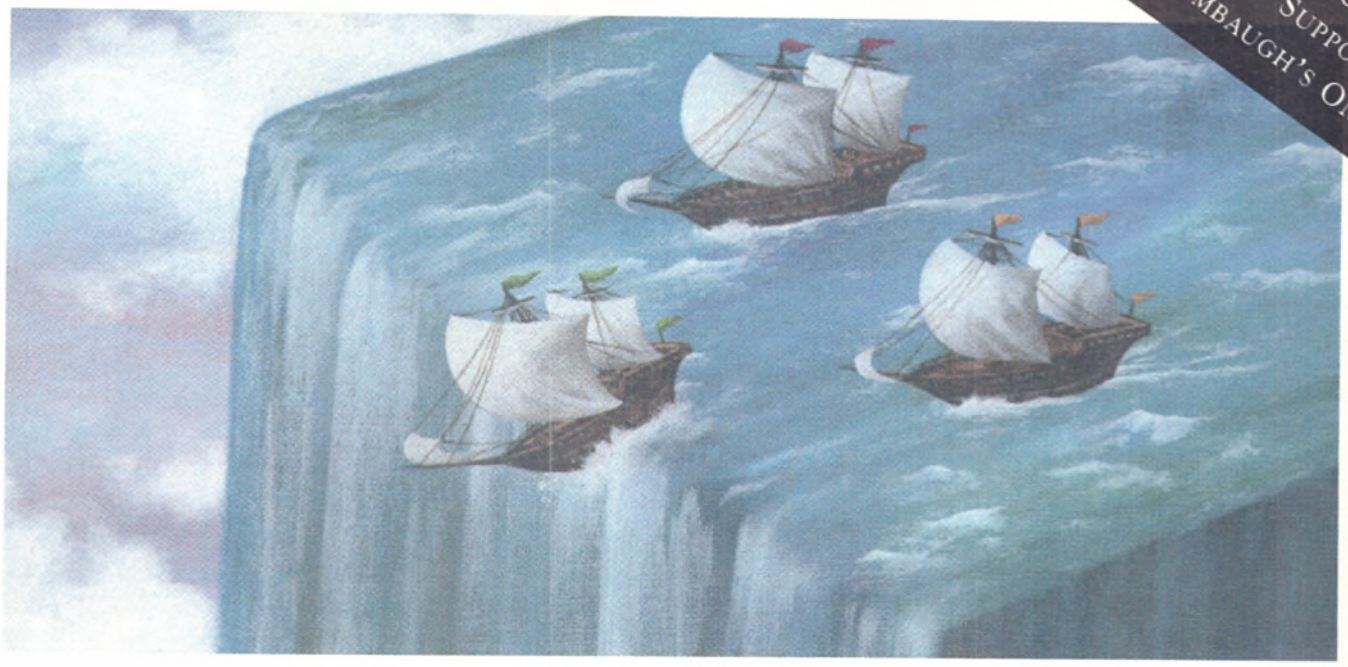

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Abusing Friendship

C++'s 'friend' facility is overused, argues **Francis Glassborrow.**

Visit your local supplier of computer programming books. Serried ranks of books claiming to help you learn to program in C++ will confront you. Pick one at random and look up references to *friend* in the index. When you do you will almost certainly find some code that looks like this:

```
class Mytype {
  friend ostream & operator <<
       (ostream &, const Mytype &);
  // rest of class
};
```

Such code is so common that you may never have stopped to ask yourself if it is appropriate. It took me far too long to identify the cause of my uneasiness . Indeed, when I first read *The C++ Programming Language,* Bjarne Stroustrup's use of `print()` member functions throughout most of the book puzzled me. To be honest, you might even have heard me criticise Stroustrup for not supporting `iostream`. This he deals with by providing overloaded versions of `operator <<` for class types that support output streams for writing their data.

I read the carefully worded explanations for why providing operators such as inserters (`operator<<` for output streams), and `operator+` for commutative addition had to be global. As the arguments were valid, I swallowed the premise that they had to be `friend` functions so they could use the private data of an object. It was only when I started to think about it, and in particular to ask myself why Bjarne Stroustrup hadn't done it that way when his classes supported output, that the penny finally dropped. The need to make an operator global has nothing to do with friendship. For example:

```
class MyType {
public:  void printon(ostream &)
const ;
  // rest of class
};

ostream & operator <<
        (ostream & out,
             const MyType & mt)
{
  mt.printon(out);
  return out;
}
```

This does all the `friend` declaration did. Much more important is that this approach has potential for doing more. Before I go into that, let me highlight something else about Bjarne Stroustrup's approach that I have only recently recognised. It avoids polluting global space with overloaded operators. As a class designer I have a responsibility for providing my clients with all the functionality they need. But I also have a responsibility to keep out of global space if I can.

I should be providing the output functionality through member functions such as `printon()`. I should not be forcing versions of `operator<<` on people using my class. That choice should be theirs. If I use the `friend` route I pre-empt their choice, I impose my style on them. Sometimes I do not have a choice. For example, I always prototype my output member functions as `void printon( ostream & ) const;`. Indeed, I can hotkey my editor so that it provides this function prototype as part of my standard class framework (along with copy assignment, copy construction and a destructor). I have my editor rigged so Alt-C generates:

```
class xxx {
  const xxx & operator =
         (const xxx &);
  xxx (const xxx &);
public:
  void printon(ostream &) const;
  xxx (){};
};
```

```
template (class T) T operator + (const T t1, const T t2){
  return t1.addinto(t2);
}
template (class T) T operator - (const T t1, const T t2){
  return t1.addinto(t2.negate());
}
template (class T) T operator - (const T t1){
  return t1.negate();
}
template (class T) T operator += (T t1, const T t2){
  return t1=t1.addinto(t2);
}
template (class T) T operator -= (T t1, const T t2){
  return t1=t1.addinto(t2.negate());
}
```

Figure 1 - A template set for addition and negation operators

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I use a dialog to replace xxx by the class name when I am using one of the better editors.

I have to call my member functions something. This way I can provide a degree of uniformity across all I write.

These benefits of avoiding **friend** are small and some might argue that they are an illusion. The next benefit is, I believe, far more substantial. Using my method I can provide polymorphic operators, something that is impossible via the **friend** route. For example:

```
class Record {
public:
  virtual void printon(ostream &)
const;
  // rest of Record
};


ostream & operator <<
   (ostream & out,
         const Record & rec){
  rec.printon(out);
  return out;
  }
```

Now all classes derived from **Record** will automatically have the use of an inserter (<<). This will dynamically bind to the closest version of **printon()** for the specific subtype of **Record** being written out.

If the efficiency of using this method to provide an inserter worries you, you can remove the function call overhead by using **inline**. Frankly, if that's the only problem in your code, you are an exceptional programmer and will have already recognised such fine-tuning of an operation as a waste of your time. The time saved will be a tiny fraction of the cost of even the simplest use of the **iostream** library.

friend arithmetic operators

Another popular use of **friend** is to support arithmetic operators in an arithmetic class such as **Complex**.You should now realise that it is not necessary to use **friend** simply to provide global operators. You can adopt the same mechanism as that for providing an inserter. You provide a member function to do the work and wrap it with a global operator function if you decide to use an operator.

It seems unlikely that you would want to have a polymorphic arithmetic operator as you would not expect inheritance in this context. So the argument put forward that **friend** declarations document our intent may hold some weight. I am not convinced, because I still think the choice of using an operator should lie with the client and not with its designer. However there is another point to consider. Some operators fall into logical groups such as +, +=, -, -= and unary -. In fact this specific group of operators rely on two functions, addition and negation. Consider Figure 1.

With these templates I can provide this logical group of operators simply by writing two member functions. It would be nice if this worked reliably. Unfortunately the

Code using friend is so common that you may never have wondered if it is appropriate

rules for type deduction for template functions will probably not support the relevant type conversions. You will probably have to do without the template forms and replace them with normal global functions. None the less, this mechanism supports the concept of providing functionality in the relevant class as well as localising code so there is only a single piece of code for each concept (in this case, addition and negation).

When I suggested this approach to a C++ expert, I got the answer 'Yes, but that approach to subtraction will not always work.' This is true for any set type for which there is not a one-to-one correspondence between positive and negative values (such as the commonest representation of **int** by two's complement). I do not think that this is a valid objection because such asymmetric types will always have problems with boundary conditions. If you have an arithmetic type for which the following is not true:

```
a-b == a+(-b);
```

then you have a problem which - if important - will need special coding anyway.

Perceptual blockage

The use of **friend** to provide global operators to tackle the problems of supporting appropriate type conversions creates a serious mental block. Consider division and **Complex** numbers.

```
class Complex {
  friend operator /
    (const Complex &,
     const Complex &);
  // rest of class
};
```

What is wrong here? Well consider for a moment that, even with floating point units, division is one of the most demanding of machine level operations, followed by multiplication. In a computationally intensive program, do you want to load more computation than necessary onto your arithmetic operators?

If either operand is a built-in type I suggest you should not be encouraging an unnecessary conversion to a **Complex**, followed by more arithmetic than necessary. Those who are accustomed to using **friend** to support their global operators are unlikely to notice that there are other considerations in this case.

I am not going to argue strongly for the provision of extra overloaded versions of the division operator (and possibly, multiplication) for types like **Complex** but I do think 'there is something wrong with your approach to class design if you do not realise that you have a decision to make'. In my experience, the **friend** devotees usually lack this insight.

Not available

The access control **friend** is a vital part of the C++ language that supports many of the advanced idioms of the language. Such things as iterators would be much harder to write and would inevitably carry a considerable performance overhead if **friend** were not available. The new idioms such as Jiri Soukup's 'pattern classes' (more about them later in the year) would not be possible.

Novices must learn about the facilities and limitations of the language. At some stage they need to grasp the use of **friend**, but that is not a justification for authors abusing it with unnecessary or inappropriate use.

That by itself would be sufficient reason to re-examine much that has been written on the subject. But when you realise that **friend** prevents proper support for polymorphism and inhibits thought about encapsulating functionality and localising code, you have to question the value of books that abuse **friend**. The authors who do so are no friends of their readers. ■

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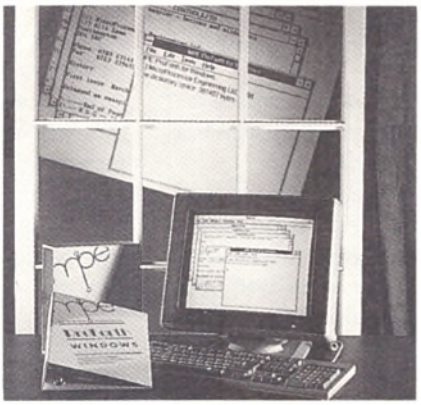

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FoxPro gets visual

Microsoft has introduced a new version of the Fox development language - and the revisions are not just surface deep. **Colin Hume** explains.

The xBase market in recent times has been a story of up and downs - ups mostly for FoxPro and downs for dBase. Being a Microsoft product has undoubtedly contributed to the increased developer acceptance of FoxPro, and FoxPro can now make a serious claim to be the xBase leader. As the leading product, FoxPro has pushed the xBase language to its limits. FoxPro has pioneered advances such as multiple-tag indexes and Rushmore query optimisation, but some aspects of xBase such as the DBF format have remained virtually unchanged since the early 1980s. Validation rules for example can only be enforced at source code level.

Microsoft acquired FoxPro after the launch of Access, causing some speculation as to the future of FoxPro. Developers expected that future releases of Fox would increasingly converge with Access, and that FoxPro might disappear as a distinct product. The latest release of FoxPro, Visual FoxPro 3.0 (VFP) shows that this is not the case. The Microsoft corporate presence is more apparent in VFP - for example the user interface Word for Windows lookalike, OOP is a major new feature, and the existing graphic design tools have been enhanced sufficiently to warrant the 'Visual' tag. New releases of xBase products tend to feature yet more extensions to the language. VFP is no exception, but Microsoft has chosen to address some of the fundamental weaknesses of xBase. This does raise some compatibility issues, but it also means that VFP represents a repositioning of xBase as a power database development tool with serious client-server pretensions.

VFP for Windows is due to be released by the time this article is published. It is reviewed here as a late beta, version 2.0A. A Mac version of VFP is planned, but is not likely to be available for around six months, with a DOS release scheduled after that. Visual Fox is a 32-bit application which will run under Windows 3.1 or higher, Windows for Workgroups 3.11, or Windows NT 3.5. A minimum of 8Mb of RAM is required. Win32s is installed with VFP to allow it to run under Windows 3.11 or Windows for Workgroups 3.11.

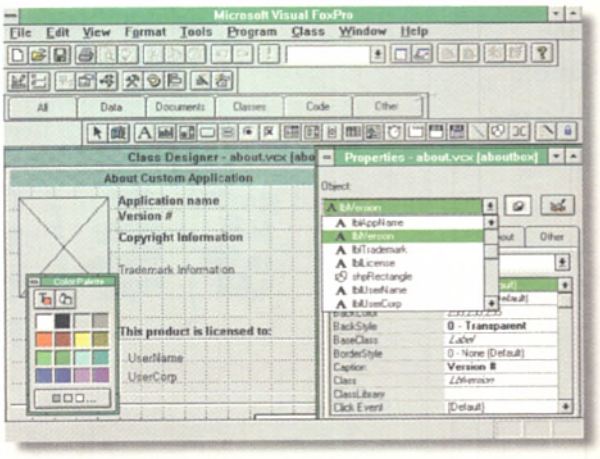
No foundation

FoxPro 2.5 for Windows was a more or less straight port of the DOS product into the Windows environment. FoxPro for DOS has always featured a GUI-type interface with buttons, menus, windows and mouse support. These features were implemented by extending the xBase `GET` and `READ` commands. Push buttons, for example, can be either be an individual `GET` or an array of `GETs` which required additional clauses to both the `GET` and the `READ` to allow end-user choices to be processed. FoxPro did not have proper event handling, instead relying on a wait state of some form to process events such as menu selections. In the interactive product this was provided by the command window, but distributed applications required an alternative, often a foundation '`GET`-less' `READ`.

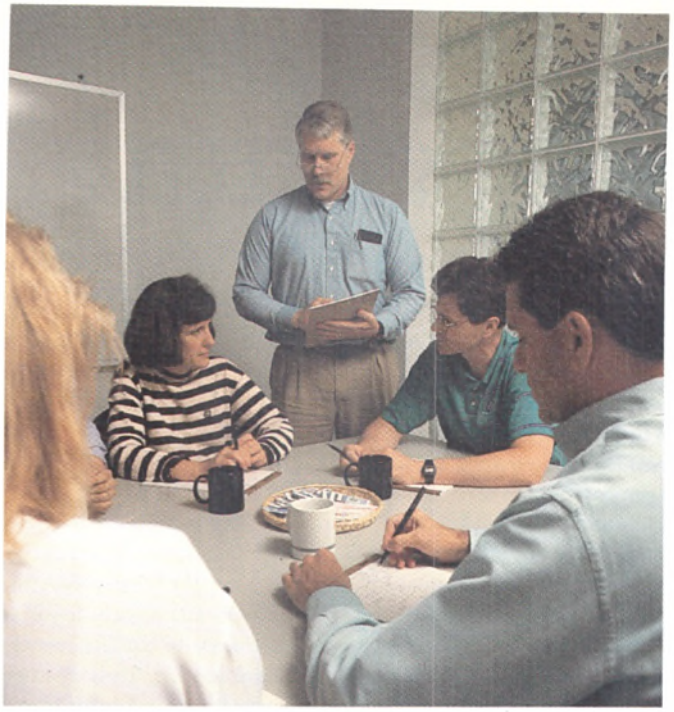
VFP offers a true event driven model which eliminates the need for foundation `READs` and the associated event-handling code it required developers to write. This is implemented as a new extension to `READ, READ EVENTS`. Events are handled automatically by VFP, using the event code associated with objects.

Objects of desire

Rapid application development using FoxPro for Windows 2.5/2.6, even with the visual tools, tended to be an exercise in the



Setting a Property in the Class Designer



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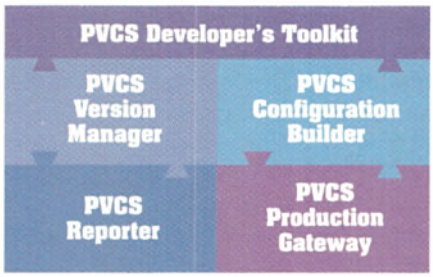

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deficiencies of procedural xBase. The adopted solution, as in many other development systems, is OOP. VFP is the first implementation of OOP in FoxPro and features single-inheritance, encapsulation, polymorphism and subclassing. Classes in VFP are divided into container classes and control classes. Container classes include column, form and grid. Control classes replace the GET extensions for items such as check boxes, and there is an EditBox class to replace @ EDIT.

Previous versions of FoxPro centred on a screen designer. In VFP this is replaced by a form designer. Forms and form sets are objects with their own properties, events and methods that are set in the form designer. There are a variety of toolbars in VFP, and customer toolbars can be created. The controls toolbar allows any control to be added to a form, including OLE controls. Tool tips are a feature of many current Microsoft products and are supported in VFP. The tip text is set through the Tip Text property; the ShowTips property determines whether or not tool tips are displayed.

The form designer works with other designers such as the data environment designer. Fields, tables and views can be dragged from the data environment designer and dropped on the form designer. The form designer creates a control matching the table element, for example dragging a logical field creates a check box control, dragging a table a grid. The grid control is an enhanced replacement for the FoxPro 2.x BROWSE. It is considerably more powerful and versatile than BROWSE, for example controls such as check boxes can be added to the columns of a grid.

In addition to the visual design tools such as the forms designer, objects can be created and manipulated in VFP programmatically with DEFINE CLASS and ADD OBJECT. This gives developers flexibility, although there are some restrictions such as no program code being permitted after one or more class definitions within a single source code file. Developers can choose to write class definitions rather than use the visual tools, but there are clearly implications in terms of both the initial application development and subsequent maintenance. As a general rule, and this applies to the current FoxPro 2.6 range too, visual tools should be the preferred option and manual coding should only be resorted to in exceptional situations.

An OOP version of FoxPro was not unexpected, but interestingly Visual FoxPro continues not only to support traditional procedural xBase to the level of the current 2.6 products but contains some extensions beyond those required to accommodate OOP.

One example is transaction processing using the standard BEGIN TRANSACTION, END TRANSACTION, ROLLBACK command set. Up to five transactions can be nested; the transaction level can be determined with a new TXNLEVEL() function. Another example is LOCAL variables as an alternative to PRIVATEs. A parameter can be scoped locally to a procedure or function by enclosing it in parenthesis such as

```
PROCEDURE WhatChoice(cChoice)
```

or alternatively, and perhaps preferably, by declaring parameters as LOCAL within a procedure or function with

```
PROCEDURE WhatChoice
LPARAMETERS cChoice
```

Tables, columns and rows

Of all the weaknesses of xBase, the most serious has always been the one at the core of the product, the DBF data file. The result of a Wayne Ratcliffe all-nighter in the late 1970s, the DBF in xBase terminology has confusingly and incorrectly been termed a database. The DBF is a standalone table, featuring fixed length records with field definitions stored in the header. Links between DBFs and indexes are limited to a byte in the header, which indicates whether or not a structural multiple-tag index has been created.

Associating standalone xBase DBFs as a database with at least some data dictionary features is an obvious advance, although it raises the issue of whether the existing data file format can be maintained. Microsoft have chosen not to side-step this issue and have revised the DBF format in Visual Fox. Visual Fox tables are not compatible with the Fox 2.x product range or any other products which can handle FoxPro DBF, index and memo files. There are import and export facilities in Visual Fox but old style xBase databases and records are out and tables, columns and rows are in.

Historically, fundamental changes in files structures have not been a problem for Microsoft. Users of older versions of the product or applications created with it are inevitably left with conversion problems, but this does not seem to have hindered the sales of Excel 5 and Word for Windows 6. It is not likely either to hinder VFP, in particular because as well as creating tables associated with a database Visual FoxPro also allows FREE TABLES, standalone data files similar to the traditional DBF. CREATE TABLE has been in FoxPro since version 2.5 but is now joined by ADD TABLE, ALTER TABLE and REMOVE TABLE. CREATE TABLE works differently in VFP, depending on whether or not a database is currently open. If a database is open the new table becomes a database table, allowing features such as long table and field names, captions and comments for fields, default values, validation rules and triggers. FREE TABLEs have none of these features, but by using ADD TABLE can be associated with a database retrospectively.

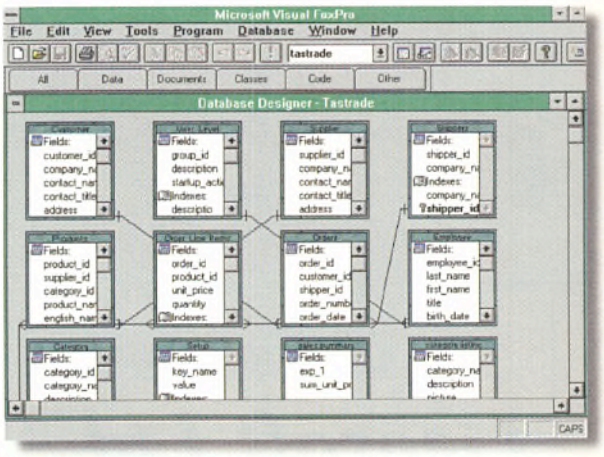
The REMOVE TABLE command converts a database table into a free table, deleting any validation rules etc associated with it from the database. With the optional DELETE clause, REMOVE TABLE both removes and deletes not only a table but also any associated memo file and structural index. ALTER TABLE adds a new dimension to FoxPro, by allowing changes to table structure under program control for example

```
ALTER TABLE accounts;
        ADD COLUMN 1996/7
```

or

```
ALTER TABLE accounts;
        DROP COLUMN 1993/4.
```

Another use of ALTER TABLE is in conjunction with an extension of indexing in VFP to include primary and candidate indexes. The primary index addresses a long-standing xBase DBF issue, the lack of a integral unique record or row identifier. Developers commonly use a numeric ID field and write



The Database Designer allows file links to be assigned visually

code to increment the value as new records are added. The ability of xBase to create a UNIQUE index does not help in this situation. UNIQUE indexes on the first occurrence of a value allows multiple values to be present. The new primary index does not allow multiple values to be present, but developers are otherwise free to apply it to any field or any index expression, such as

```
ALTER TABLE address;
        ADD PRIMARY KEY id;
        TAG AddressId
```

Only one primary index per table is permitted, but any number of additional non-duplicate value indexes can be created as candidate indexes. The candidate description implies that this type of index can be redesignated as the primary key subsequently, using ALTER TABLE. Primary and candidate indexes are only available as tags of the FoxPro CDX compact multiple-index file.

System tables, both with and without the DBF file extension, are a feature of FoxPro. This continues in VFP, where system tables take a DBC suffix. Views and validation rules are stored in the DBC. Tables can be removed from the database, but as already stated this converts them to a FREE TABLE and deletes any rules or triggers associated with them. For most developers there is likely to be little, if any, advantage in using FREE TABLEs, but it does avoid the need for immediate conversion if existing applications are involved.

Some features of xBase tables remain in VFP, in particular 'the four horsemen of the Apocalypse' - DELETE, RECALL, PACK and ZAP. Developers now recycle records as a matter of course, but an alternative way of dropping a record is required, perhaps in VFP 3.1?

The data file changes in VFP are in addition to some useful changes in data types, for both memory variables and field values. The changes to variables are a Currency type and a DateTime type. The DateTime variable avoids the need to combine the DATE() and TIME() functions, and allows times to be manipulated similarly to dates such as {12:15am}. Field data types have been extended to include Double, a double-precision floating point number. FoxPro has a float data type, but this is equivalent to the xBase numeric type and is present only for compatibility with dBase.

An important change in VFP is that NULL values are now supported, both in variables and more importantly in fields. A new ISNULL() function detects null values in variables or fields. Developers need to be aware that setting a null value does not assign a data type. The xBase approach of assigning the data type with the initial value is still required, for example

```
m.nDiscount = 10
m.nDiscount = .NULL.


?TYPE('m.nDiscount')
* returns N - numeric


?ISNULL(nDiscount)
* returns .T.
```

Client-server

FoxPro 2.5 onwards has featured a connectivity kit but VFP has significant extensions which allow it to be considered for the first time as a serious client-server tool. This includes a set of SQL pass-through functions and an Upsizing Wizard. Upsizing creates a database on the server with the same table structure, data and so on of the original VFP database. It allows a complete FoxPro application to be migrated to client-server.

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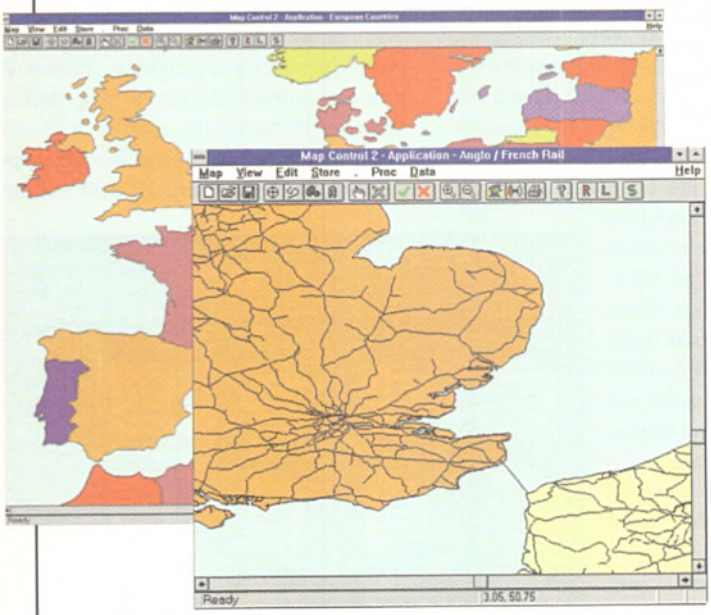

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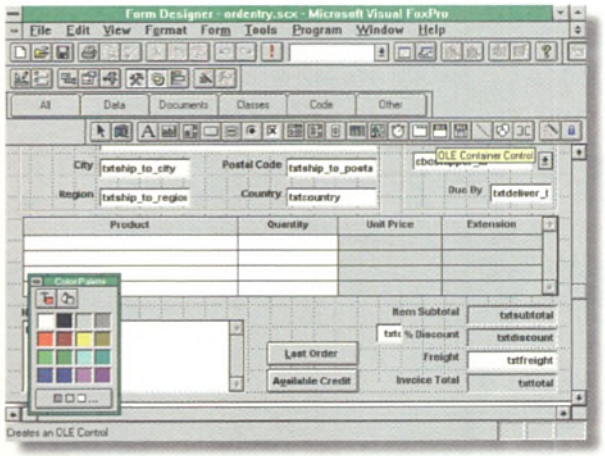
VFP's client-server features essentially provide developers with a more versatile product. They do not amount to VFP being a significant competitor to PowerBuilder for example, in particular because all versions of FoxPro primarily support single developer use.

Distributing applications

Visual Fox will be available in both standard and professional editions. The professional edition, like the current 2.6 range, incorporates the previously separate distribution library and connectivity kits. VFP produces smallish EXEs, less than 500Kb in most cases, which require a runtime module. The beta runtime, VFP300.ESL, is a large file (3.5Mb). Although this is probably bloated by debug code it is still likely to result in a file size of around 3Mb. There is an install wizard to generate sets of distribution disks; many developers will opt for their favoured Windows install utility instead.



The Form Designer in action

Conclusion

VFP is a far better product than might have been expected. Microsoft has achieved the right balance between new features such as OOP and the visual designers. It allows existing applications to run unmodified, and developers can code manually if they wish. The familiar FoxPro command window is still there.

However, there is a price to be paid for progress: the changes to the DBF format. In the short-term it may present some problems if products other than VFP are required to access Visual Fox data files. It is likely that, as with the CDX multiple-index file, FoxPro will set a standard that will be adopted throughout xBase.

Until now, Fox could reasonably claim to be a multi-platform xBase product. This is undermined by Microsoft's strategy of releasing VFP under Windows initially, with Mac and DOS versions to follow over the next year. Developers who need the multi-platform capability may be obliged to stay with the 2.6 range. It will be interesting to see if a DOS Visual Fox is ever released; Microsoft's commitment to do so is clear but developers are more likely over the next year to port FoxPro DOS applications to Windows than wait on a revised version of the product.

Moving xBase from DOS to Windows has proved to be a difficult task, one that previous market leaders such as CA-Clipper and dBase have not been equal to. VFP 3.0 will be a significant competitor to Visual Objects and dBase for Windows. FoxPro's position as the professional's choice for xBase applications development looks to remain unassailable. ■

Colin Hume is a journalist specialising in software.

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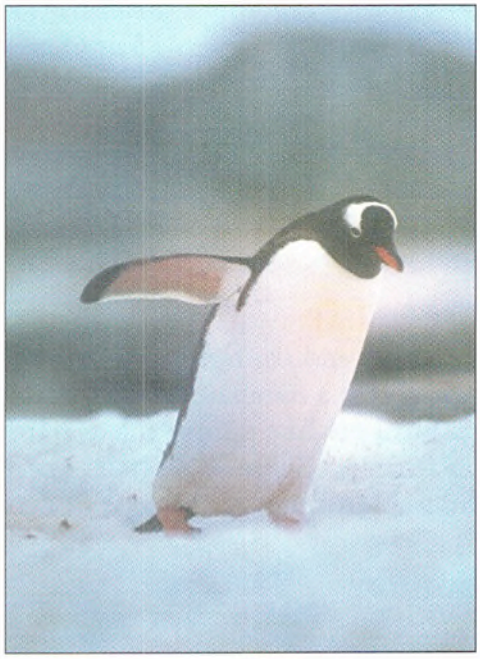

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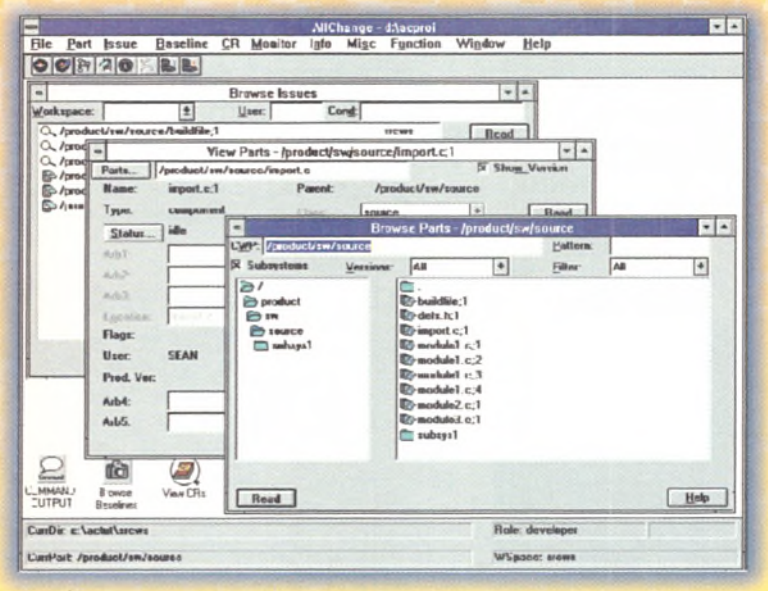

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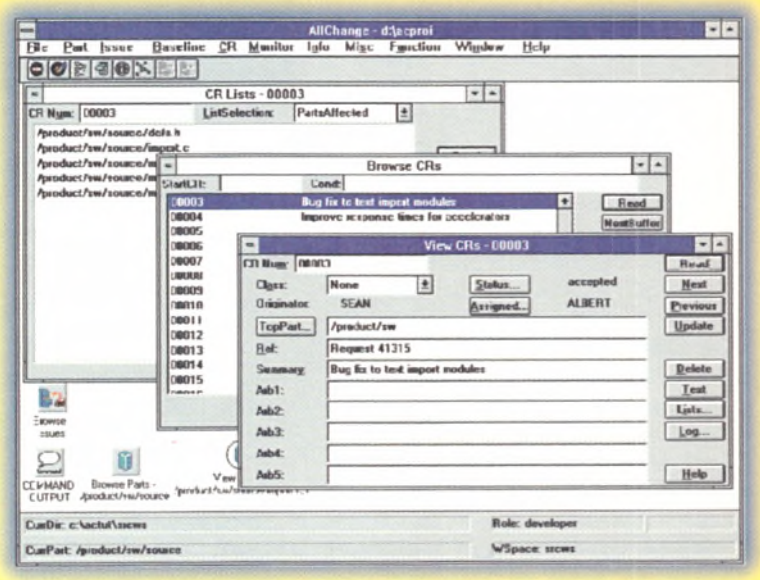

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A medium in the making

In his new role hiking the Internet, **Cliff Saran** needed to create Web pages quickly and easily. He came across Internet Assistant and Web Author, two tools that claim to do just that...

I am sure that by now many of you have succumbed to the graphical glamour of the World Wide Web. The recent rush of media interest, culminating last month in the launch of *Wired UK*, has turned the Net into quite a hip fashion accessory. And many, ourselves included, are looking to create their own Web.

As many of you are aware, pages for the Web are created in the Hypertext Markup Language (HTML). An HTML file is essentially an ASCII document interspersed with tags for formatting text and displaying GIF images. The tags are interpreted by a Web browser such as Mosaic, which renders the text or graphics accordingly. The browser has almost full control of how the page is displayed, severely restricting the extent to which the document's author can determine the layout of the page on screen. As a consequence, it is only necessary to learn a small number of tags in order to master HTML. Yet there are still tools available that make it even easier to create HTML pages. The generic name for such utilities is *Web Authoring Tools*.

Quick change

WebAuthor and Internet Assistant are both conversion tools, they take a document in an existing file format and convert it to HTML. This is achieved by providing a simple front-end for placing HTML tags directly into a document.

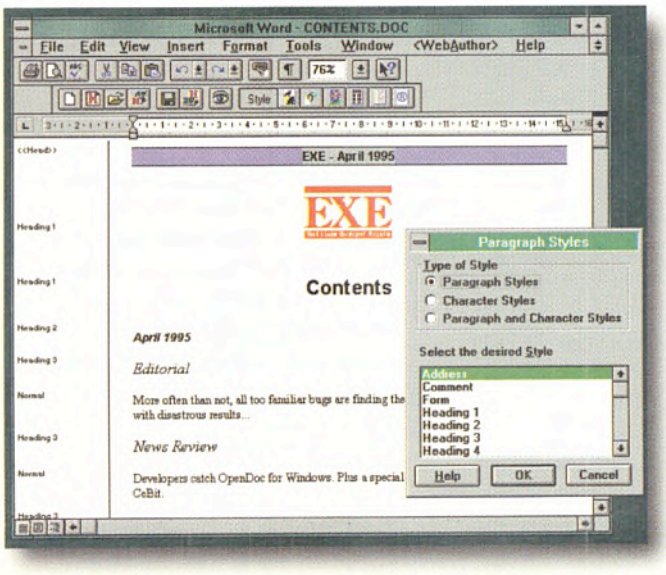

Figure 1 - Selecting a short list of HTML tags in WebAuthor

Beta copies of WebAuthor have been available for some time from the Quarterdeck ftp site `ftp.qdeck.com`. But I managed to obtain a copy of the shipping code. Final documentation had not been completed, so I can't comment on the printed manuals but the Online Help is context sensitive (through CTRL-F1) and seems pretty comprehensive. I downloaded a beta of Internet Assistant from `ftp.microsoft.com` as no final shipping dates are available yet. Both tools install on top of Word for Windows 6.0 as a new template and a suite of macros. Bear in mind though that Internet Assistant requires the 6.0a patch of Word.

Choosing a pattern

As with all templates in Word, WebAuthor is activated from `File, New...` by selecting the HTML60 template. When selected, this brings up a dialog prompting the user either to create a new HTML document, import an existing HTML document or load an HTML document created in WebAuthor. The package distinguishes between documents that it has generated and HTML files imported from elsewhere. The document files are .DOC Word files.

With a new HTML file it is necessary to specify a title first. An `Advanced Options` dialog can be opened to add optional information in the `HEAD` section of the HTML file such as `LINK`, `ISINDEX` and `META` tags. Once the required information has been provided, WebAuthor launches a new document in Word. This comes with a toolbar that allows the user to specify character/paragraph styles, load images, create hypertext links, add bookmarks and insert symbols. Those all important tags are specified in a drop-down list. Because the list is quite long, it can become a bit of a bind entering tags. Quarterdeck gives the user the option to simplify the list by only showing tags relevant to paragraph formatting or character styles.

Alternative images

Images are easy to load into a document from the Image Manager dialog. They can be stored as absolute file references or as relative to the document file. Alternative text can be provided for display on a text-only browser, or when image download has been suppressed on a graphical browser.

One of the most helpful inclusions in WebAuthor is the Anchor Manager which is an aid for setting up and subsequently keeping track of hypertext links. Links can be bookmarks, which are local to the current document. They can be external, to specify another file. Or they can be a URL which gives an address on the Web. Once created, a link is stored in an address book which can

be called up at a later date in order to make a reference to it.

The Form Manager is also pretty handy. It's used for building Web Forms, or dialog screens, with text boxes, radio buttons, check boxes and list boxes. Single, multi- and password style text boxes are available. There are four styles of button: `Submit`, `Reset`, `Image` and `Hidden` for passing hidden data to the form processor.

Poor preview

A document preview mode is included in WebAuthor. However, I found it of minimal use as it just displays the document in pretty much the same way as Word. And it doesn't allow editing in `View` mode.

To make matters worse, files created in WebAuthor are not, in fact, HTML files at all, but Word files in which the tags are represented as something that Word can display. To produce an HTML file from this it is necessary to run a converter. Unfortunately, even on a simple document, the conversion process takes an unreasonably long time. The reverse process of taking an existing HTML file and converting it into a WebAuthor document is also horrendously slow.

Weaving assistance

Loading an HTML document into Internet Assistant is far easier than with WebAuthor. For a start, documents are saved natively as HTML so no final conversion is required. And unlike WebAuthor, there is no start up dialog so users can work on a document as soon as they load it. In fact, the Internet Assistant HTML template adds `HTML` to the list of supported file types in Word's `Save` and Open dialogs. The HTM extension is recognised as well, so an HTML file can be loaded straight from disk into Word.

However, there is one drawback with Microsoft's approach. Each time an HTML document is loaded into Word, it must be converted, 'on the fly'. Fortunately, this process is less tedious than the equivalent conversion in WebAuthor.

A toolbar is provided for specifying various options in the HTML file. It offers buttons for adding a title, inserting GIF/JPEG images, creating bookmarks and specifying hypertext links. There are also various list options and a drop down list of styles. One thing that blemishes Internet Assistant somewhat is the fact that the hapless user is presented with a list of 35 tags from which to choose. Although with both tools it is necessary to map Word paragraph and character styles onto HTML tags, Quarterdeck's approach is far easier to use because it breaks the list into character and paragraph styles.

I also disliked the way that Internet Assistant includes the HTML tag alongside the description of each style. Admittedly, having the tags there in the list is beneficial for users who want to learn HTML. But surely the point of the tool is to hide the implementation? It feels as if Microsoft is unsure on how to position Internet Assistant. It may be acceptable to include actual tags in an HTML editor. But on a conversion tool?

On the editor front Microsoft provides a button for switching between Word's WYSIWYG mode and displaying the tags as text. While it is often useful to see tags when tidying up an HTML document, they lose much of their appeal when displayed by Internet Assistant in Word. It is probably better to load the HTML file straight into Notepad or any text editor and edit it there!

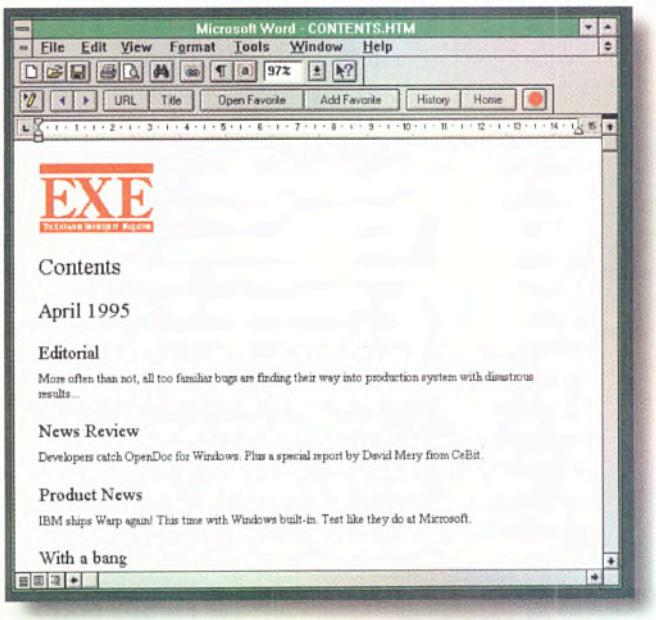

Figure 2 - Internet assistant's Web browser

Walk 'n' weave

The most impressive thing about Internet Assistant is its built-in Web browser. Rather than the WYSIWYG view of Quarterdeck, Microsoft has provided a fully fledged Web browser which gives users access to the World Wide Web.

The Microsoft browser works effectively, both on and off the Net and is particularly useful when you need to test pages quickly. There is a button on the Word toolbar to switch quickly to and from the browser. So it comes in very handy for testing whether or not links are working. With WebAuthor, testing involved saving to HTML, with all the work that entails, and loading the local HTML file in a browser such as NetScape. In my configuration, NetScape loads Winsock first, so the testing for Web Author pages is very time-consuming. Still, although Internet Assistant's Web browser is certainly useful, it is not one of the *standard* Web browsers. I found that, while ideal as a method for rapid testing, it was still necessary to load up the pages into more mainstream browsers. But, as any good Web author will advise: this should be done anyway.

Only so far...

It seems quite difficult to position these Web authoring tools. For knocking together basic HTML pages, they are ideal. But often, users will need to *tweak* the output to provide features of HTML unsupported. For instance, although the tools support image maps, they don't allow the user to create them. But the important thing is that they provide a working framework which the user can build upon.

The good news is that both tools provide conversions to and from HTML. But, of course, this process can be time consuming, especially in WebAuthor which appeared the slower of the two packages from my usage. The best thing about the Internet Assistant is its built-in Web browser and the fact that it uses HTML natively. This means that no final conversion to HTML is necessary to create the pages. However, as a side effect, every page loaded into Internet Assistant must be converted into a Word document. But at least the process is fast.

Slow but sure

All in all, however, in spite of its slowness I was more comfortable working in WebAuthor than Internet Assistant. Even though the conversion process is tiresome and there isn't a proper browsing facility. WebAuthor enables you to create pages quickly and easily. An that seems to me to be the most conclusive point. These tools are designed to allow anyone who has mastered word processing to create pages for the World Wide Web. Above all, they should be simple to use. ■

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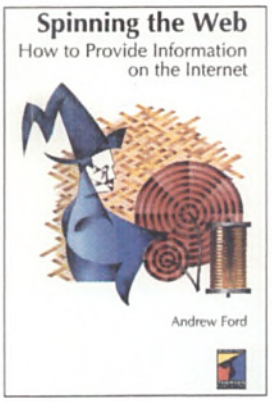
Two planetary images from The Encyclopedia of Graphics File Formats

Let's Surf again...

There have been a couple of excellent books on aspects of the Internet, mostly from the point of view of information providers. The first is by Andrew Ford and goes by the title of *Spinning the Web, How to provide information on the Internet* which is perhaps a tad misleading, as there are several other ways of being an Internet data provider.



This book fills a definite gap in the market. About a year ago, I was researching an article about WWW and its mark-up language, HTML which you need to know to create Web pages. I found a dearth of coherent material on it.Andrew Ford presents a very readable guide to authoring HTML. The basic stuff is well presented and the back of the book includes a handy pull-out reference card with a quick guide to the language. The reference card includes the mark-up for accented characters. But I was niggled by the fact that it doesn't provide the complete set. For example, the magic code for the pound symbol (that's POUND-CURRENCY-SYMBOL and not #) is missing.

There is a good section on how to turn a graphic image into an 'image map', enabling the user to click on any part of an image to make a selection. There are also instructions on how to set up forms for users to fill in, although you will need to write a program (perhaps in `perl`) to process the form. Sadly, there are no examples of such a program, but the interface is described.

There is also extensive coverage on servers: how to set them up, what configuration options they have, the good and bad side of each server. The approach to this analysis is somewhat clumsy, with each of the different servers in turn being 'reviewed' on the same aspects. You have to spend some time leafing though the chapters to find the text that applies to the server you are running.

Security on the net, the future of HTML, future developments and new abilities that will be offered to Web clients are also touched on. A satisfyingly complete resource guide tells you where to find the programs and documentation that you need to browse and supply data on the net.

All in all this is a good handbook for anyone providing data to the net. It's certainly the place I turn to for information on HTML.

Serving on the net

Managing Internet Information Services is by Cricket Liu, Jerry Peek, Russ Jones and Adrian Nye. It's another publication from the excellent O'Reilly and Associates 'zoo' of books (the covers usually portray animals). It attempts to pull all the information needed by administrators of various Internet services into one tome of about 650 pages. You will need to know a bit about administering UNIX systems in order to make sense of it all as the servers described are based on UNIX versions.

A history of the various servers is given with an explanation of where to get the programs that you need. The book also discusses how to build the programs, detailing the compile-time flags. You'll probably need to get and build the software as it's doubtful that your system has these servers available as standard.

There is also an introduction to basic service concepts and some discussion on standard services like `finger` and `telnet`. The description of FTP assumes the use of `wuftp`: a common publicly available server. I actually prefer to use `wuftp` on my machines rather than the standard `ftpd` supplied by the manufacturer because it has better control features. There are also some handy tips on how to set things up to suit your needs. For example, it describes how to create 'hidden' directories, where users can only get the files whose name they know.

WAIS, the Wide Area Information Service is also discussed. If you want to provide information that is 'indexable' and users would like to search it using keywords, then WAIS is for you. WAIS comes in three parts: an indexer, a server and some clients. The clients are many and varied. For example, Mosaic includes native WAIS client support. The book describes how to obtain and install the code, how to set-up and use the component parts.

From WAIS, we move to Gopher. Gopher is a way of presenting information to users indexed by a set of menus. Menu items can point to pieces of information, other menu items, to files and menus on other Gopher servers, to FTP archives, to `telnet` services, and more. Gopher was the 'killer' Internet application before WWW came on the scene as it is well suited to the text based interfaces that were common at the time of its creation. Although

Gopher's popularity was dampened a bit when its owners, the University of Minnesota, decided to license it for commercial use. Anyway, the book covers the commercial server and the last 'free' version of the software.

If you are thinking about providing information these days, you are more likely to be looking at a World Wide Web server. The contents here are much more 'server oriented' than those of *Spinning the Web* whose sections on HTML are much stronger. So the two books complement each other very well.

Setting up of the common servers is covered in great detail.Example scripts are available electronically. I am using one of their scripts, duly modified, on my WWW server. It's modified to work, actually.

The authors also cover running simple and complex mailing lists on a program suite called Majordomo,as described in April's EXE. There's a lot of good sensible stuff here about bounced mail and the perils of running mailing lists. The final really practical chapter is on `ftpmail`, a way of providing FTP access to people who only have email links. The book ends with some discussion of Firewalls, Legal Issues (US specific) and Intellectual property.

This is an excellent book and I am pleased to have it on my bookshelf. It has already solved many of my problems and has pointed me onto useful programs such as those to scan WWW server logs.

The book of protocols

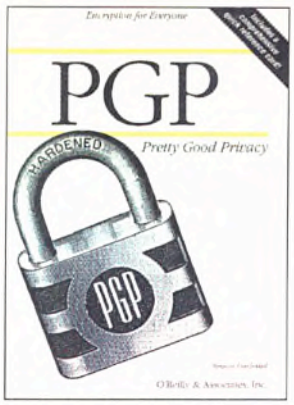
The second volume of an immense work called *TCP/IP Illustrated* by Gary Wright and W Richard Stevens is now available. Volume 1 by Richard Stevens has been out for a year and describes the protocols that are in use on the Internet and the programs that use them. Stevens writes in a very easy style and the first book is invaluable if you want to understand how the network actually works.

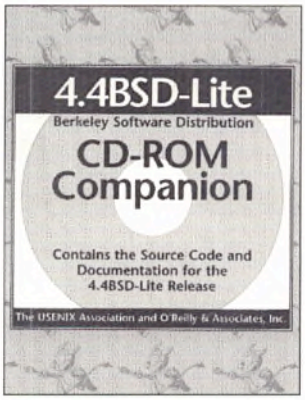
Volume 2 was out in the US in January of this year and is sub-titled 'The Implementation'. It takes the 4.4BSD Lite implementation of the protocols described in Book 1 and goes through the code line-by-line describing how the protocols are implemented. You can get the code from the Internet, or on a CD in the *4.4BSD-Lite CD-ROM Companion*.

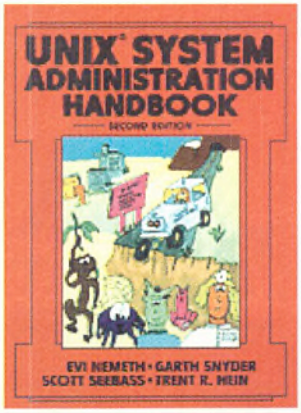
I am not sure that I will make direct use of this book even though I have a system based on 4.4BSD Lite running here. However, should I be modifying the code or wondering how it works, then this book is the place to look.

Running the system

The *UNIX System Administration Handbook* by Evi Nemeth, Garth Snyder, Scott Seebass and Trent Hein is in its second edition and has been much revised. It comes with a CD containing a bunch of useful programs gleaned from Usenet. The book pulls together the information that you need to run a UNIX system and presents it clearly from the viewpoint of the administrator. There's a wealth of practical tips and hints on 'good practice'. After all, it's easy to do things, but not so easy to do things in the most effective or efficient way.







Of course, there are many different flavours of UNIX and system administration is an area where systems have diverged. The book describes the main streams of development: System V and BSD using six example systems. For System V, the authors pick Solaris 2.4, HP-UX 9.0 and IRIX 5.2. For BSD, they use SunOS 4.1.3, DEC's OSF/1 2.0 and BSD/OS 1.1. This selection is intended to span the various different approaches to UNIX administration. Since I come from the same BSD background as the authors and run two of those systems on my site, I find it hard to judge whether the book will remain relevant to people running a site that is, say, predominantly SCO UNIX.

The book has three main sections. Basic Administration, Networking and a rag-bag called 'Bunch of Stuff'.

Basic Administration starts by pointing you at the information sources that you will find on your machine then moves into the fundamentals of running the system. There are chapters on bootstrap and shutting the system down, the powers of the superuser, the file system and the notion of processes. Some consideration is also given to the files that you need to alter and data you need to establish for each new user.

There is some lengthy coverage of devices and how to add drivers to the systems. The thorny world of serial devices also comes into play, with discussion on the different types of connectors and the various signals that are used on the cable. Disks are treated in the same way, with a review of the types of disk and cables and how to configure the disk for use with UNIX.

Periodic processes are covered with a discussion of `cron` and how to configure it. Backups and tape technology are also featured. There's much useful advice here on this important topic with descriptions of the dump and restore programs which someone decided that System V could do without for some mad reason. It means that you have to do backups with a program designed for tape archiving.

Thoroughly networked

The networking section of the book is excellent. It covers the basics of TCP/IP and other protocols like ICMP, routing, addresses, how to see if your network is functioning, hardware and the different choices that you have. It moves onto higher level protocols and issues.The Domain Name Service is covered in some detail, including how to set up your own name server.

Moving on from basic networking brings us to the Network File system and sharing files amongst machines. This includes discussion on NIS and NIS+. These are Sun's method of sharing files and propagating changes in their contents around your network.

There's a chapter on SLIP and PPP leading onto a discussion of the Internet. The section on electronic mail covers the basics of how to deal with `sendmail`, including much of the magic bits in the `sendmail.cf` file.

Language

Visual C++
C/C++
SQLWindows
Visual Basic
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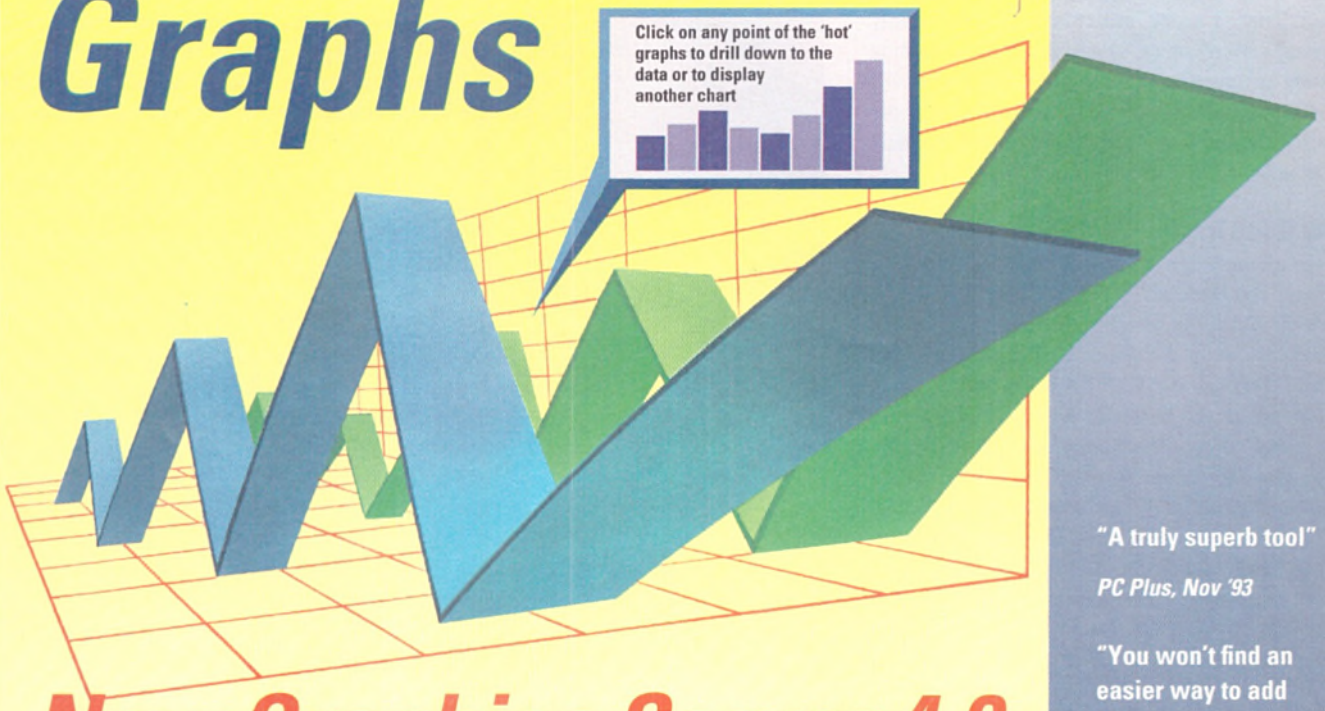
Powerbuilder
FoxPro
Windows4GL
Access

Programmable Graphs



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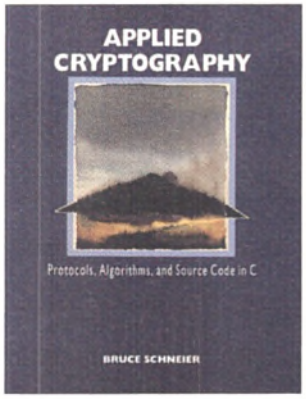
There are also many good tips on security for system administrators and users alike. The publicly available tools for system security monitoring are pointed out and there's a good discussion on the basic methods of making your network and system secure.

Printing, how to control the devices, news and how to run the various news servers are also discussed. There's more, but this article is rapidly becoming a list of topics. The book is a good starting point for anyone who is involved in running UNIX systems. It gives the basic requirements and a considerable amount of good advice. It's possibly a little SunOS oriented, but tries hard not to be.

Pretty Good Read

If you're interested in sending secure data across the Net then the book *PGP, Pretty Good Privacy* by Simon Garfinkel is for you. PGP is a public key encryption system developed by Phil Zimmerman (see EXE January and EXE February 1995).

PGP covers the basics of cryptography, giving you a background to the techniques that PGP uses. There's also a considerable amount of history of both cryptography and PGP. The history of PGP is interesting and somewhat controversial as Phil Zimmerman is presently under federal investigation, accused of exporting PGP from the USA. The US government prohibits the export of computer encryption algorithms as they are classified under their law as munitions. For this reason, the current versions of PGP are available in two forms: one for internal USA use and one for outside the USA.



Over half the book discusses how to use PGP, how to manage cryptographic keys, how to create digital signatures and more. If you feel the need to use encryption, then this book should be on your reading list. It's also a good read for anyone interested in the politics and history of cryptography.

If you are slightly mathematically minded and interested in cryptography, then I would recommend *Applied Cryptography* by Bruce Schneier. It is the definitive book on the subject and includes plenty of C code to implement the algorithms. Incidentally, the export of the book from the US is not illegal. You can print algorithms in a book in C and export in from the USA. To use the code, you'll have to type it or maybe scan it into a machine.

Pretty good pictures

The *Encyclopaedia of Graphics File Formats* by James D Murray and William VanRyper is not strictly new since it was first printed in the USA in July of 1994. I am including it because it's not the type of book that your local bookshop is likely to stock and it's an invaluable aid if you have anything to do with image display and storage. The storage and display of graphic images is something that seems to have been done again and again by different groups of people. I guess that one of the messages of the book is 'please don't create your own graphic file format, it's been done'. A CD containing

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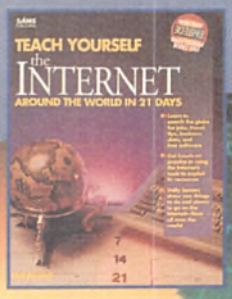

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software is included that allows you to display and convert different formats.

The book starts with a general discussion on the techniques used to store images, the problems that the methods attempt to solve, and quite a lot on data compression techniques. I liked the layout for the alphabetic listing of different storage techniques. Each section has an short introduction with a set of standard headings giving the name, the usual file names, whether there is information on the CD about the format. The introduction is half a page and is sufficient to give you an idea of what the format does, how it is used and by what. If the description interests you, then you can read on.

The remainder of the entry is broken down into a number of sections. The 'Overview' discusses the history and usage of the format, who developed it and why. Sections on File Organisation and File Details will tell you what you are looking at if you dump the file in hex. There's information about encoding and compression here too. Finally, there are pointers to Further Information for the format, where to get documentation and what references you need.

It must have been a strange book for someone to write, but it's very useful if you are interested in the topic. ■

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

Publishers and ISBN numbers

Title	Author	Publisher	ISBN
Spinning the Web	Andrew Ford	International Thomson Publishing	ISBN 1-850-32141-8.
Managing Internet Information Services	Cricket Liu, Jerry Peek, Russ Jones & Adrian Nye	O'Reilly (distributed in the UK by International Thomson Publishing)	ISBN 1-56592-051-1.
TCP/IP Illustrated, The Implementation	Gary Wright & W Richard Stevens	Addison-Wesley	ISBN 0-201-63354-X.
4.4BSD-Lite CD-ROM Companion	The Usenix Association & O'Reilly & Associates Inc.	(Part of a 6 vol. set)	ISBN 1-56592-092-9
UNIX System Administration Handbook	Evi Nemeth, Garth Snyder, Scott Seebass & Trent Hein	Prentice Hall	ISBN 0-13-151051-7.
PGP, Pretty Good Privacy	Simon Garfinkel	O`Reilly and Associates	ISBN 1-56592-098-8.
Applied Cryptography	Bruce Schneier	John Wiley and Sons	ISBN 0-471-59756-2.
Encyclopaedia of Graphics File Formats	James D Murray & William VanRyper	O'Reilly and Associates	ISBN 1-56592-058-9.

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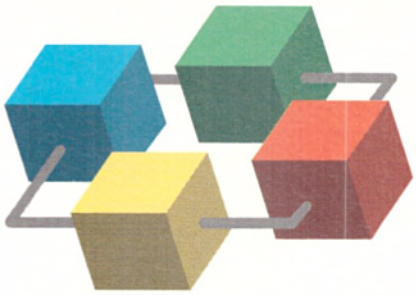

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IT EVENTS

CIRCLE NO. 125

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COMPUTERWEEKLY

pas le Real Thing

Will Watts has been reading a new UK edition of the cult American magazine *Wired*.

Here's a suspect situation: one monthly computer magazine reviewing another monthly computer magazine. However *Wired*, the stridently coloured, over-designed, opinionated, idealistic, witty, weird, campaigning, sour, foul mouthed, stylish, Net cultured, cult, runaway roller-coastingly successful US magazine, has been launched in a British version in a whirlwind of blipverts and hoardings and dayglo orange adjectives, all explaining how it will change our lives. In short, it's begging for a good smack on the jaw; and it would take more than mere considerations of hypocrisy or laying oneself open to unfavourable comparison to prevent us from stepping forward to deliver the blow.

For the benefit of those who have not encountered it, I should explain that *Wired* the US Original is not your standard 'let's review another 20 Pentiums for the small business user's rag. Rather it is the organ of record of the information revolution. In a grating style somehow reminiscent of Janet Street-Porter's yoof TV, *Wired* champions techie causes from kill the Clipper chip to Net access for the homeless, never bothering to stop and explain what an ftp site or a WIN.INI file is. If you don't know, if you haven't got an email address for your upstairs toilet, you shouldn't be here.

When a British version was first announced, to contain the best of the US stuff plus extra native editorial, meejah types put in a lot of bar propping up time wondering how the publishers were going to avoid the 'brewed in the UK by Danes' effect, the feeling that the British edition was nothing but a toy version of something better. If you've ever compared UK and US editions of *Mad* magazine, you'll understand.

It was a tough assignment... And, to huge sighs of relief from jealous journos not asked to join the *Wired UK* team, the boys have flunked it.

Wired UK 1.01 has been made by dismantling the US version into its component pieces, dividing by 1.6 to convert dollars to sterling, and gluing back together. No color has been left uncoloured: out goes the *X Files* video in Street Cred, in comes an amateur production of *Dr Who*. The Drugs of Choice on the Colophon are not Gummi Trolls but Trebor Extra Strong Mints. There is a one-to-one mapping of every part of the US original to its British equivalent.

Except there aren't always British equivalents. Try this experiment. Here is a passage from the opening pages of *Wired UK*:

'The medium, or process, of our time - electric technology - is reshaping and restructuring patterns of social interdependence and every aspect of our personal life. It is forcing us to reconsider and re-evaluate practically every thought, every action, and every institution formerly taken for granted.'

There: did not the print-to-thought algorithm in your mind automatically kick in with an American accent? Now try to imagine the text being read by a British actor. I can just about manage it with Norman Lovett from *Red Dwarf* doing the voice, provided he blows a sustained raspberry at the end of the first sentence.

The trouble is that this sort of thing is as Yankee as a greenish NTSC-converted news footage of The President hugging Gerry Adams. By all means let the *Wired* folk in San Fran dig out their dog-eared old copies of *The Gutenberg Galaxy* and *The Medium is the Message*; but over here we sussed Marshall McLuhan (for the quote was his) yonks ago: a wordy, old hippy-type who would be entirely forgotten but for the fact that he once had a walk-on part in a Woody Allen movie. In *Wired US*, sixties slop is fine; one shrugs one's shoulders and smiles an indulgent smile: tut! Those Californians. In *Wired Farringdon Rd* they get the raspberry.

At least the MM quote is the real thing. When Brits attempt New Age of Computer kind stuff off their own bats, it really jars. Take an indigenous piece by one Sadie Plant, 'Lecturer in Cultural Studies at the University of Birmingham and a keen explorer of the implications of the digital revolution.' Ms Plant's explorations of the implications are articulate and well-enough reasoned. And she even manages to mention the Open University without doing the kipper tie and sideburns joke. But by the end of the article we are wallowing in pissant IT metaphors (which she wildly claims aren't metaphors) where '...traditional teaching methods ... are in effect serial processors, centralised means of guiding development in the right order and one step at a time... The emergence of parallel processing is, not surprisingly, a parallel event, which never happens in one place or time' etc etc. Uh-oh, Chungo - Pseud's Corner looms large...

Wired UK is caught in a hideous double bind. If it breaks away from the US original, it betrays its roots, and probably violates its contractual obligations. If it tries to imitate, it must be but a pale imitation, so why bother? A glance at the masthead will show old-time *.EXE* readers that some of the finest minds in the kingdom are wrestling with this problem, and I for one wish them luck and will be emailing £37.80 of used electrowonga to subscribe@wired.co.uk to see how they get on. *Mais ce n'est pas la chose véritable.*

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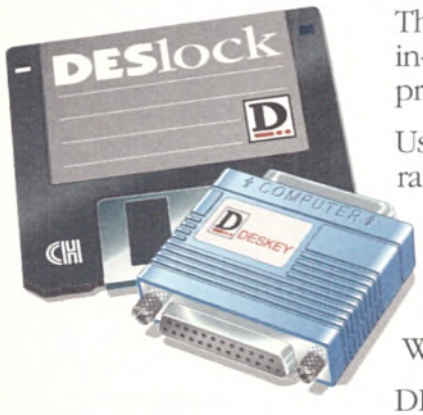

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CIRCLE NO. 126

Internet Navigator

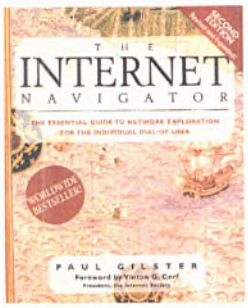
Reviewed by **Cliff Saran**

There is more to the Internet than the World Wide Web. So it was quite a relief to come across the second edition of *Internet Navigator* by Paul Gilster. He gives little space to the WWW, concentrating instead on the Internets main applications: email, ftp and telnet, which he refers to as the 'big three'.

Gilster discusses email in its entirety, including its use as a means of performing many common tasks on the Internet such as ftp, finger, gopher, wais and posting and viewing UseNet messages are all covered with genuine example sessions. There is even advice on sending email to places like CompuServe or MCI Mail.

Hand in hand with email are BitNet and list servers. Gilster feels that mailing lists are an underused resource because they pose too many difficult questions for the average user. How does one subscribe? How does one unsubscribe? What happens if something goes wrong?

Newsgroups are covered with a basic definition of what they are and what they can provide. There is also a description of the



trn news program and how to send and receive binary information with UUENCODE/UUDECODE.

No discussion of the Internet would be complete without a run down of searching tools. Gopher, Veronica, JugHead and WAIS are all covered with listings of sample Gopher and WAIS sessions. Plus, of course, a few final words on the World Wide Web. *Internet Navigator* ends with a directory of useful Internet resources, and an appendix of service providers.

The major problem with most of the Internet material appearing in print today in that it is out of date as soon as it is published. John Wiley, the publisher of *Internet Navigator*, therefore aims to keep in step with progress by bringing out new editions of the book every 10 months. I think that *Internet Navigator* has what it takes to be a continuing bestseller.

Verdict: Highly recommended

Title:	*Internet Navigator*
Pages:	*590*
Price:	*£21.95*
Author:	*Paul Gilster*
Publisher:	*John Wiley*
ISBN:	*0-471-05260-4*

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For Thursday.

So what do you do? You could start hacking away at the App, to try and get something that compresses into a meg and half, and makes some sort of sense. Or you could get out the ancient screen capturers and the creaky macro recorders, and poodle fake something. Or you can insist that you're too tied up with V1.1 fixes for this sort of nonsense.

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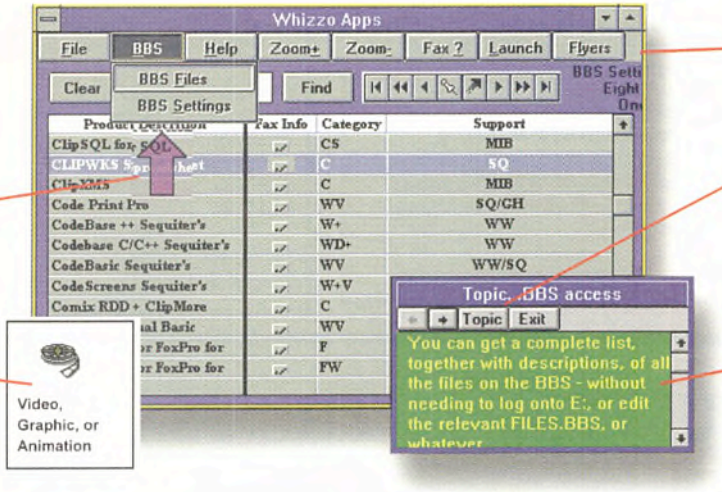

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Demo Demo thyself

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CIRCLE NO. 127

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LOCATION	SALARY
Sussex	To £25k

Our client has a niche in the financial market designing and manufacturing digital voice recorders. They are searching for a highly professional Software Engineer skilled in Borland C++/MS Windows development, with particular emphasis on OO design skills. Experience of a client-server environment and database design would be of interest. In the last few years our client has experienced sustained growth and is seeking the right candidate to progress with the company and become a key player within the organisation.

REF: DE/EXE/2

JOB
DELPHI DEVELOPERS

LOCATION	SALARY
S.London	To £25K + Bens

Our client, a highly successful consultancy and product development group specialising in the financial sector has seen rapid growth in recent years. As a result, five development consultants are required to assist in new development and existing product migration. Applicants should have at least eighteen months Borland Pascal and SQL experience - excellent commun ication skills are also necessary. Successful candidates can not only expect a highly competitive salary package, but will be trained to use Borland's Delphi client/server product.

REF : PP/EXE/3

JOB
LOW-LEVEL WINDOWS

LOCATION	SALARY
Oxon	£17k - £25k

This young, fast-growing company with an international client-base is currently seeking an additional Software Engineer. Suitable applicants will have at least twelve months experience programming in 'C' or C++ in an MS Windows environment. Solid Assembler along with experience of device drivers (particularly Windows printer drivers) are also sought for this exciting new position. The successful candidate will work on new product development in a dynamic environment using the latest Windows technology.

REF : DE/EXE/4

JOB
REALTIME C S'WARE ENGINEER

LOCATION	SALARY
Cambs	£20K - £30K

Our client is searching for highly professioal and committed Software Engineers with a minimum of two years experience of developing embedded 'C' software under Unix. Experience of C++ and Object Oriented techniques would be an advantage. The ideal candidate will have some telecommunications experience across a split site. Experience of working in a large, well structured development environment would also be of interest. However the most important factors are a sense of humour, team spirit and a strong commitment to the production of quality systems.

REF: DE/EXE/5

JOB
VISUAL BASIC DEVELOPER

LOCATION	SALARY
Herts/Middx	£20K - £25K

Our client is a Software Consultancy providing development services to a wide variety of clients. Since 1980 they have achieved steady and continuous growth. Due to their success in the market place, they are now searching for professional PC developers with a minimum of one year's Visual Basic, as well as solid experience of a structured programming language. The successful candidate will be developing systems for a range of clients from blue chip finance houses to hi-tech communications companies. If you want to be part of a professional organisation offering a top quality service, then apply now and give your career a head start!

REF : DE/EXE/6

CONTRACT VACANCIES - UK WIDE

Herts	**Visual C++ Analyst/Programmers**	3 months
London	**VIsual C++ Programmers**	6 months
Cambs	**Visual C++ Programmers**	6 months
Berks	**Visual Basic Programmer**	4 months
London	**VC++/SDK Multimedia Developers**	3 months
Cambs	**VB/OLE Developers**	3 months
Surrey	**Windows/Financial Appls. All levels**	6 months
W. London	**Windows SDK/ C'Programmers**	5 months
City	**Windows SDK/ C'Developers**	4 months

REF: EXE7

City	**Mac/Windows Text Handling Programmers**	6 months
City	**Text Processing**	6 months
Cambs	**Text Handling Processing**	4 months
City	**Apple Mac Multimedia Developers**	6 months
Cambs	**Apple Mac CD-ROM Developers**	6 months
Cambs	**Multimedia/CD-ROM Developer**	4 months
London	**Sybase/SQL Server Software Engineer**	4 months
Surrey	**Visual C++/MFC Finance Developer**	6 months
London	**MS_Windows System Tester**	**3 months**

REF: EXE8

London	**Visual C++/MFC Developers**	6 months
Surrey	**Visual C++/MFC Programmers**	6 months
Oxford	**Visual C++/MFC Programmers**	3 months
City	**Visual C++/SDK Multimedia Developers**	3 months
W. London	**`C'/C++ Progs x 2**	6 months
City	**C++/Banking Programmers**	6 months
London	**Oracle, SQL, Forms Developers**	3+ months
London	**Windows/C++ Programmers**	6 months
City	**Windows NT Senior Programmer**	3 months

REF: EXE/9

Logistix Recruitment Limited
Lamb House, Church Street
Chiswick Mall, London W4 2PD
Tel: 0181-742 3060
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email: logistix@atlas.co.uk

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DISCOUNT BOOKS

THE BOOK PAGE

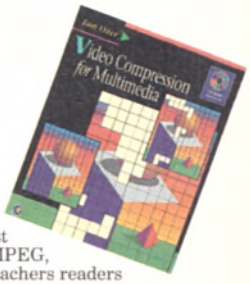
Here is a new selection of leading edge titles from the publisher AP Professional - covering C++, graphics, fuzzy logic and software agents. All at 25% cheaper than shop prices.

Object-Oriented Graphics Programming in C++

by Roger T Stevens
498 pages

Normal Price: £29.95
Price to You: £22.50

This handbook is designed to provide programmers with the information needed to produce realistic images on the PC. It focuses on Borland's C++ compilers and covers a variety of techniques. Beginners and more advanced programmers will benefit from the topics covered, and all of the program code is provided on the 3.5" diskette included with the book.

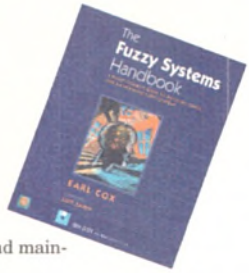


Video Compression for Multimedia

by Jan Ozer
300 pages

Normal Price: £29.95
Price to You: £22.50

Thoroughly covers and demonstrates the latest compression technologies including JPEG, MPEG, Fractals, Vector Quantization, and Wavelets. Teachers readers how to apply compression theory during filming to create footage that compresses well on a digital platform. Explains how to optimize compression settings to achieve the highest possible video quality. Enclosed CD-ROM includes a custom version of the author's program which allows readers to see different compression tools at work, and learn more about compression technology.



The Fuzzy Systems Handbook

by Earl Cox
615 pages

Normal Price: £34.95
Price to You: £26.25

A practitioner's guide to building, using, and maintaining fuzzy systems.

"When it's time to roll up your sleeves and put fuzzy logic to work, Earl Cox can show you how to turn theory into practice. His excellent ***Fuzzy Systems Handbook*** *presents a complete fuzzy-modelling system (source code included) and explains how to use it."* - BYTE

*"****The Fuzzy Systems Handbook*** *is a true how-to book on constructing fuzzy systems from scratch."* - Dr Dobb's Journal

Leaping from BASIC to C++

by Robert J Traister
364 pages

Normal Price: £27.00
Price to You: £20.25

This is the first book that covers the transition from BASIC to C++. Designed for programmers with no prior knowledge of C++, this hands-on, no-nonsense primer guides the reader - using numerous realistic programming examples - through this seemingly difficult transition.

The GUI Style Guide

by Susan Fowler & Victor Stanwick
407 pages

Normal Price: £29.95
Price to You: £22.50

The GUI Style Guide provides the tools necessary for programmers to write interfaces for a variety of windowing environments. All of the guidelines are useful to programmers creating any type of windowed application, from IBM CUA mainframe to pen to Macintosh, Motif, NeXt, and Windows systems. It also explains how to take advantage of object-oriented programming and fourth generation languages.

Demonstrates similarities between various manufacturer' underlining windows environments. Covers numerous examples and contains hundreds of easy-to-use, easy-to-read guidelines.

Agents Unleashed

by Peter Warner
350 pages

Normal Price: £29.95
Price to You: £22.50

This brand new book describes a model agent system and promotes a public domain standard. All of the elements of a good agent system are examined. Agents Unleashed is an invaluable tool for anyone interested in implementing agent-based net protocols.

Key features: Includes software agent on the enclosed disk. Explains how to design a software agent using existing public domain tools. Examines security features - authentication and encryption. Introduces digital cash and the digital economy. Describes server features - opening shop on the net. Provides solutions to fundamental technological problems.

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Database Developer's Guide with Visual Basic 3	~~£41.67~~	£31.25	REFER EXE of FEB/MAR/APR
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Win 32 API - Desktop Reference	~~£46.30~~	£34.75	
Developing PowerBuilder 4 Applications	~~£35.50~~	£26.65	
Heavy Metal OLE2 Programming	~~£38.99~~	£31.20	
Unauthorised Windows 95 Developers Resource Kit	~~£38.99~~	£31.20	
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Unicom is one of the UK's premier IT conference organisers and is dedicated to supplying leading edge and industrially relevant technical seminars and conferences. In May they are holding a series of seminars on testing, including the MITs Method, Hands on GUI testing and testing Client/Server Systems. For further information on these and other seminars look up the UNICEF site on the World Wide Web (URL http://WWW.demon.co.uk/unicom) or look through the leaflet in this issue of EXE.

EXE subscribers are entitled to 5% off all these seminars. For a list of conferences coming up in the next few months fax your name and address to Alec McCutcheon on 01895 813095. You must quote EXE to qualify for the discount when booking places on a conference or seminar.

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Burgess Video Group have agreed to offer all EXE subscribers a discount of 20% on their OS/2 Warp Introduction PC0180 Training Video. The video includes full instructions and demonstrations on all a new user needs to know about getting started on OS/2 Warp, and is supplied complete with tutorial disk. Send a cheque to EXE made payable to Burgess Video Group for £22.05 (this includes shipping), or contact them directly on 01874 611633. Don't forget to quote EXE to get the discount.

The EXE Software Developers Show

Come to the Royal Horticultural Halls, Westminster, on 8 & 9 June and see an event that promises to be HOT. EXE will be there along with a number of key players in the software development business - including Borland, IBM, Powersoft, Computer Associates, Symantec, Gupta, Lotus, Select Software, Rhino, RT&M, Acucobol, Blink, NAT, Zinc, QBS and System Science to name a few.

Speakers in the workshop Programme include Matt Peitrek, Bertrand Meyer and Alan Blackwell. Sessions cost £10 and details can be obtained by calling the organisers on 0171 387 5678.

FREE ENTRY TICKET WORTH £10

EXE Readers can register now for a free ticket to attend the event. Fax your name and address to EXE on 0171 287 0710, using the coupon on page 28 or write to Tim Macpherson, Centaur Exhibitions, St Giles House, 50 Poland Street, W1V 4AX to guarantee your place. Alternatively call the EXE Show HOTline on 0181 710 2190.

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Ctrl Break

Got a light?

Credit to netster Buchanan Reed for his novel merchandising idea: the cigarette lighter for churlish Netizens. 'Just talk to it' he comments, 'and it flames'. Ctrl Break set to thinking of other similar products but unfortunately could only come up with an automated calender for MS spokespeople. For each query regarding the precise date of Windows 95's release it lengthens the year accordingly.

I wasn't doin' nothing

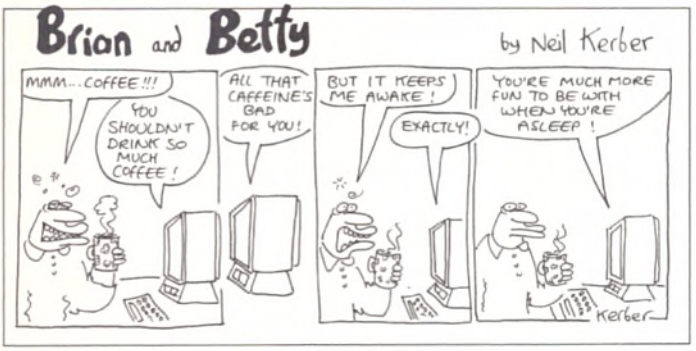
Those curious denizens of **comp.sys.mac.games** were having a chortle to themselves about the possibility of inventing a game entitled SimNothing. Simulating - ha,ha - a place where nothing happens. Maybe somebody should tell them that Apple has beaten everyone to it with EWorld.

NT Call of the Month

```
InitiateSystemShutdown(IpszMachineName, IpszMessage,
dwTimeout,fForceAppsClosed,fReboot)
```

Initiates a shutdown and optional restart of the specified computer.

`fForceAppsClosed` specifies whether applications with unsaved changes are to be forcibly closed. If this parameter is TRUE, all such applications are closed. We *always* leave them on TRUE.



Pass Notes

(as seen in The Correspondent, Guardian etc etc)

James Cannavino

Appearance: IBM Executive.

Function: Ex-IBM Executive.

All right, who he? Cannavino was head of IBM's PC business from late 1988 until just the other day.

Has he left his mark on Medium Sized Blue? He is credited with introducing an exciting new dress code at IBM. Under his influence, IBMers got to wear colour coded sweaters at trade shows, instead of the traditional blue suit.

Hmmm, is that all? Well, there was this little matter of the relationship with Microsoft...

Not entirely a smooth ride, I hear. Cannavino's personal enmity for Gates was very influential in causing the great OS/2 rift, which has left us with a Microsoft oligarchy and Warp being given away with breakfast cereal.

Is that true, about Warp? Not yet, as far as we know.

Why didn't Jimbo and Bill hit it off? Cannavino thought Gates was a smart aleck geek with insufficient respect for the IBM Company. And failed to conceal this opinion.

And how did Bill find Jim? Gates disliked Cannavino's meandering paternalistic style. After one meeting Gates is reported to have said: 'That asshole Cannavino! He never did get around to saying anything meaningful.' Unsurprisingly, the relationship collapsed completely after a few years of this sort of stuff.

You seem suspiciously well informed. All gleaned from Paul Carroll's fine book 'Big Blues', an excellent read for anybody who wants to indulge in schadenfreude at IBM's expense.

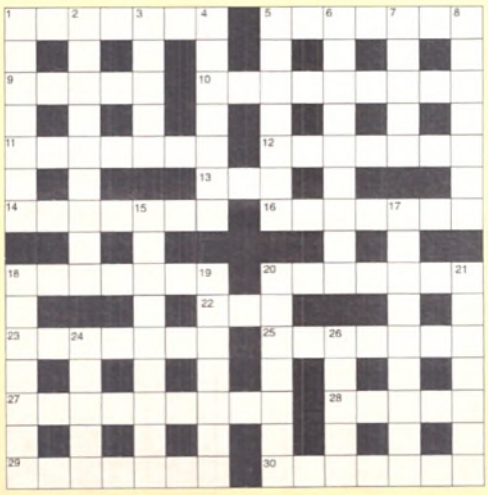
Wouldn't dream of it. Any other Cannavino achievements of note? Not really. Over the years he launched a whole succession of different machines intended to recapture IBM's 1984 PC market share, with, ermm, mixed success.

Most likely to say (until recently): We will leverage our long-term investment in Personal System technology by introducing enhanced hard files...

Unlikely to say: Bill's not just a business genius and a brilliant programmer - he's a great bloke too.

Even less likely to say: What's that silver disk thing doing in the corn flakes?

PRIZE CROSSWORD



ACROSS

1. Software unit for Latin mass (7)
5. Technologists work with its application (7)
9. Language on Ballantyne's island? (5)
10. Stranger hater (9)
11. Article debugged and changed (7)
12. Sudden attacks when I court applications (7)
13. Final pot in the turning place (3)
14. Become surrounded in the sound definition (7)
16. kM - hark - if it does this, it mayn't be gold (7)
18. What the chip layer does to the current (7)
20. Child with poor speech can set and reset (7)
22. Lovelace's palendromic lingo (3)
23. Our Roman remedy (7)
25. Hung about at the airport? (7)
27. Unreal product of i (9)
28. Hedgehog takes heir to the chip (5)
29. Strange sound board output with personal possessions (7)
30. Physical basis of 15 dn (7)

DOWN

1. Compact data for a long time of documented software (7)
2. We personally ... (9)
3. ... were in charge making straight lines (5)
4. Randomised like crazy kids (5,2)
5. Getting signals from other energy forms... (7)
6. ... and entering the data (9)
7. Rare indicators (5)
8. Ralph Waldo the poet (7)
15. Familiar large cd-rom (5,4)
17. Looking good at the monitor (9)
18. The moment of the software crunch (3,4)
19. US uncle with cooking pots and Pacrim skiffs (7)
20. "The target is in sight, my friends!" - but be brief (5-2)
21. Early socialist at the root (7)
24. Rod for the employees (5)
26. Switch back to 0 from 1 strictly (5)

Solution to April's crossword

ACROSS: 1. HIGHWAYS 5. TRACED 9. ACTIVITY 10. LARRUP 12. EVENLY 13. BYTEWISE 15. UTILITY 16. OGRE 20. DATA 21. ITEMISE 25. PARALLEL 26. DEVICE 28. INTERN 29. AIRBRUSH 30. EPSONS 31. RECYCLES

DOWN: 1. HEADER 2. GATHER 3. WAVELETS 4. YETI 6. READER 7. CARRIAGE 8. DEPLETED 11. SYSTEMS 14. PLOTTER 17. ADAPTIVE 18. ITERATES 19. ASSEMBLY 22. FLORIN 23. VISUAL 24. MESHES 27. MICE

The prize for this month's crossword is a copy of Ed Krol's 'The Whole Internet Users Guide and Catalog'. Please send your entries to: EXE Magazine, St Giles House, 50 Poland Street, London W1V 4AX.

Welcome to EXE's new look Back End

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Ctrl Break

W4: WORST of the WORLD WIDE WEB

As an antedote to all those 'Cool Sites' pages out there we proudly bring you a selection of the Chelmsfords that mar the beautiful Essex countryside of the Web.

The Christmas Tree
http://www.cygnus.com/xmastree/
Avoid the pre-Christmas rush: send an Xmas card to your friends now with this thoughtfully provided service.

Joes amazing relationship problem solver
http://studsys.mscs.mu.edu/~carpent1/probsolv/rtlprob0.html/
EXE labs are even now working on a handy 'sister' program designed to create minor tiffs.

Two amusing anecdotes about my hair, by Dan Bornstein
http://www.milk.com/home/danfuzz/words/hair.html
A double helping of humour from laugh-meister Danny B.

Faucet Outlet Online
http://www.faucet.com/faucet/
Browse through a range of America's finest faucets. Includes quick tips on choosing a faucet and What's New in faucets.

Telephone number dialler
http://pluto.ulcc.ac.uk/Sound/dial.html
No need to tap in the number yourself. Just spend ten-or-so goes trying to get on to the Web, navigate your way to this page and have this handy little gadget do it for you.

The amazing Deep Space Nine Pun-o-matic
http://turnpike.net/metro/anomaly/oops.html
Now being patented for best man speeches.

The Amiga Users Group
http://phone.us.we/need.a.good/laugh. - *No really.*

Church of Spam
http://www.primenet.com/~swiggy/
Why think of a new joke when you can wring the last few drops out of something tried and tested?

Whatever happened to Quisp from Quaker?
http://www/eskimo.com/~irving/alt.cereal.faq.html/#1
Everything you ever wanted to know about the American breakfast cereal Quisp.

Pigs in Cyberspaaace...
http://www-leland.stanford.edu/~roseage/Muppet - *Kermit is King.*

Man under clear plastic shower curtain
http://clearplastic.com/npla18.html - *Tory politicians will love it.*

SlugWeb - The Banana Slug
http://www.slug.com/slugweb/
'Explore the strange history of, biology and trivia of the yellow spineless gastropod'.

The All-New Adventures of Verity* **STOB**

Tonstant Weader Fwows Up Again

Ms Stob, who has just been to see the new Dorothy Parker flick, wonders how the leading wit of 1920s New York would have fared in the IT-dominated 1990s.

Sayings

If all the COBOL programmers of all the mainframes in all the corporations were laid end to end, I should be extremely surprised.

There I was, trapped. Trapped like a trap in a trap. *(From Mrs Parker's seminal paper 'Dealing with cascading interrupts')*

I have nothing against the single button of a Mac mouse. There again, neither does the mouse. *(Shurely this is Mrs Peter Cook? - Ed)*

One more table and you'll be under the host. *(A warning not to make SQL databases too complicated lest the UNIX server should require a disk upgrade)*

He ran through the whole gamut of emotions from C to C+. *(Of Dan O'Brien's performance in 'Caught In The Net 2')*

Fiction

from *A Telephone Call*, 1995

.... know I shouldn't. I know you're not really supposed to, not after 6 o'clock in the evening. They don't like it, do they. Once I dared to complain that whenever I rang after 6 o'clock, I always got the engaged tone, or maybe no answer at all, and he got cross and said I was being selfish.

I only want to make a little call, though. That's not being selfish, wanting to make a teeny-weeny little phone call. I can't believe anybody would mind about that. It won't take five minutes. I promise, God, that if they answer this time, I won't be longer than five minutes on the line. Please, God, I know You must be very busy, it being after 6 o'clock, but that's not such a very big thing to ask.

Perhaps if I didn't think about it. That's what's making it worse, me sitting here brooding. I know, I'll count down from a really big number in 16s, and I promise I won't try again until I've finished. I'll count down from 336, that'll pass the time. Here I go: 150, 140, 130, 120, 110, 100, F0, E0...

I'll just try again quickly now. The other tries didn't really count, God; this is the real one. I'll just try the number once, and if that doesn't work I'll give up. All right, twice.

It's ringing! It's ringing! I think I'm through...

```
CONNECT 21600/ARQ
b.demon.co.uk (ttyc1a):
```

Poetry

Résumé

Pascal is dated;
VisBas is slow;
PowerBuilder's overrated;
Still better than VO.
C is too hairy
And so is Plus Plus;
Gupta's just scary.
That concludes the database front end implementation forward planning meeting.

The Programmer's Suicide

```
main()
{
  printf("Goodbye World!\n");
}
```

News Item

Girls seldom make passes
At nerds with fat asses.

**Ms Stob wishes to point out that the phrase 'All-New' is not used with the intention of provoking excitement or anticipation. The term is borrowed from the American TV industry, where it is a short code for 'we are reviving an old idea, already flogged to death, because we can't think of anything better', eg 'The All-New Pink Panther Show'.*

This way UP

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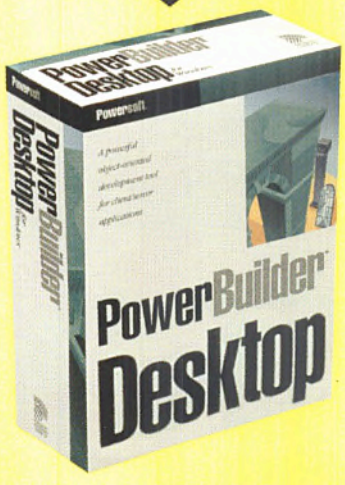

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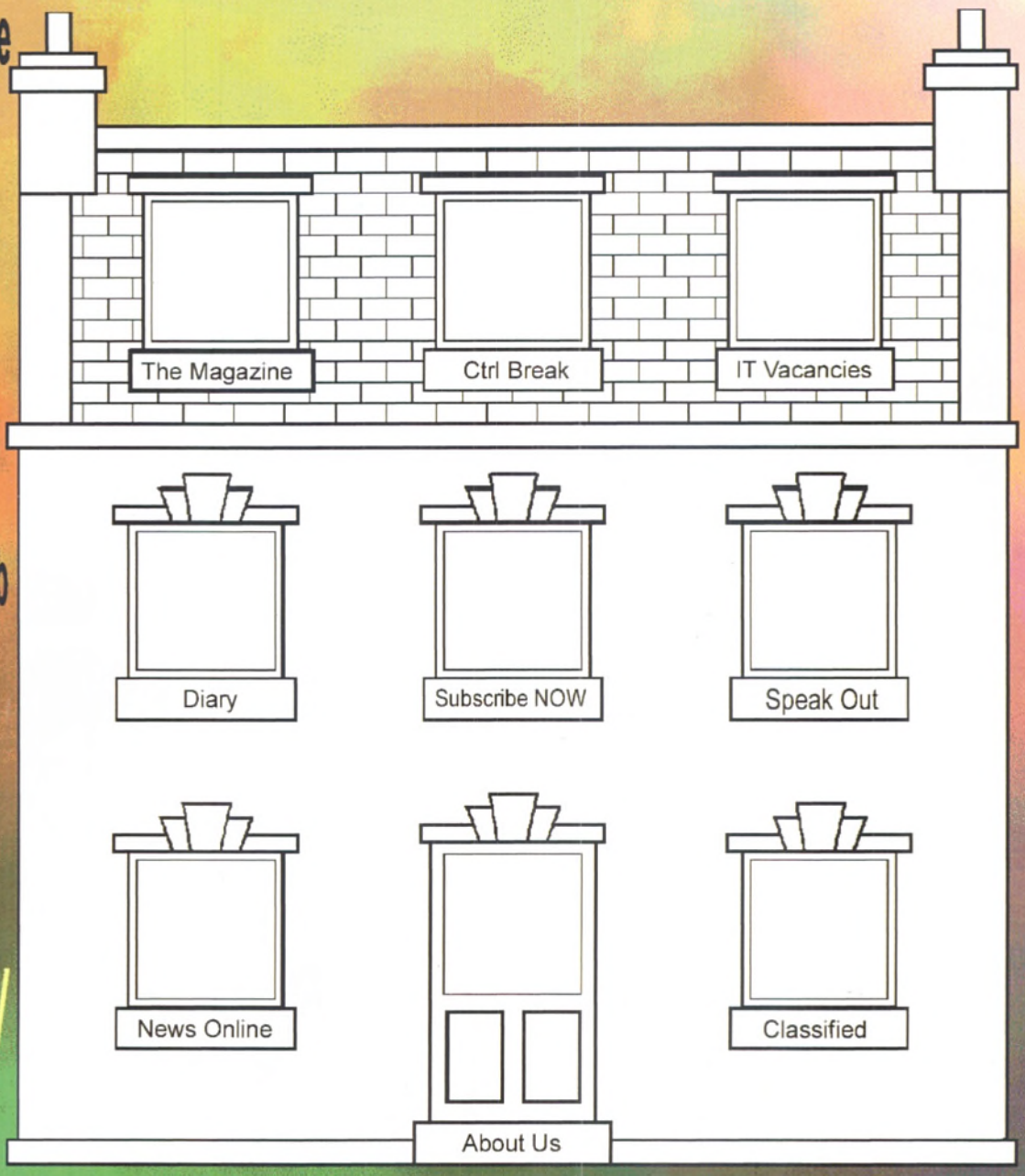

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