

October 1994

# EXE

The Software Developers' Magazine

£3.20

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Not when you're modem  
sharing on NTAS



**WINDOWS 95**  
How will it affect  
you next year?

**Desqview as a viable  
Motif platform**

**New  
Opportunities  
See Page 96**

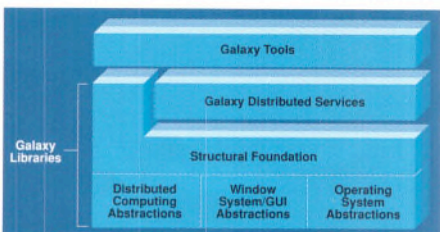




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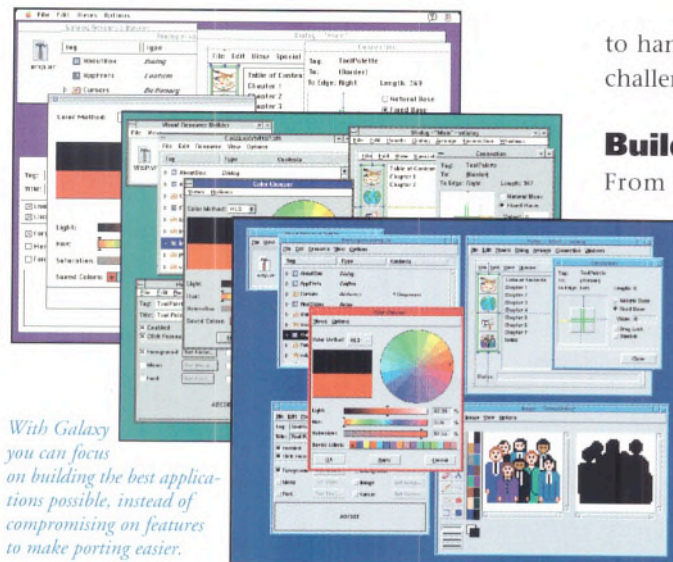
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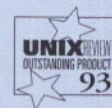
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When things go wrong blame the tools, say the fools in their glass houses. More often than not it's the users themselves who don't understand their software.

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The goal was seamless access to modems across the network. But, as David Mery discovered, things don't always go to plan when working with NTAS.

**Chicago. Can you handle it? .....20**

The constraints of Windows 3.x is putting severe restrictions on Win16 programming. With Chicago, all that should change. Cliff Saran explains the changes you will have to make to your applications.

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If you are still struggling to port DOS applications to Windows, Michael Covington has some advice.

**OBJECTIVE****New age, VisualAge .....36**

Alan Flower discovered he could build a DB2 client for OS/2 in 20 minutes. With C++ it would have taken four days. How did he do it?

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The Windows for Workgroups API can be used to build powerful network applications and fabulous games. Bruce Forman explains how to write two-player Battleships.

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One day we will have machines to cut the lawn and put on the 'barby'. Science fiction? Not really, explains Kevin Yeandel. Fuzzy logic will enable such machines to work.

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After much heated debate and a spate of letters, Francis Glassborow returns to the subject of objects and their values in C and C++.

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After last month's success on the virtual highway we 'hit the hut' and try a revengeful recipe for choc-chip cookies. Plus another Eric Deeson cracker...

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SMTP is pretty restrictive. It can only send ASCII and even that's limited by file size. Paul Richardson introduces MIME, multimedia email to complement it.

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Something for those of you who are fed up of hearing the gospel according to Unix gurus, reviewed by David Mery.

**Career Development..... 96**

Fairness for the fairer sex.

**COMMENT****Soapbox ..... 12**

While Client/Server may be the buzzword of the 90s, Alan Hambrook of the Dodge Group believes it cannot simply be treated as Meccano and strapped onto existing legacy code.

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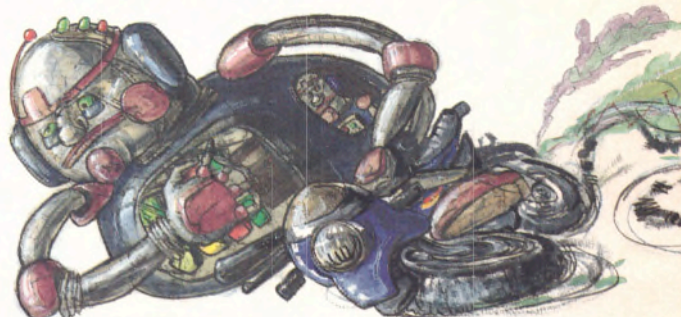
Jules contemplates a drive-by-wire motorbike and finds it's far too easy to fall off...

**Letters ..... 94**

Unlike C/C++, some languages can return multiple values. MS replies to 'disappointment' with VC++.

**EXEnders ..... 104**

Top EXEnders celeb' Bob Baud chats to Jim, a really important person at Spangle Software, about the christening of its new product.





# User Unfriendliness

If you'd never driven before, would you get into a car and assume you could? Thousands of users each year make the same naive presumptions about Windows. They are equally stupid and equally dangerous



It's the end of the month and your salary is due. Inevitably *they*, that is, the people who are responsible for doing the payroll, will get some of it wrong, they always do. They're only human after all. The problem for them is that they use computers. Computers shouldn't make mistakes. Yet, by some mishap, the payslip at the end of the month is completely screwed. A quick call affirms the worst: 'It's on the system. No one told us you were supposed to be *paid* this month.' Their first reaction is to blame the computer. 'Oh the system went down...' That particular excuse seems to be wearing thin now.

Nine times out of ten it is the user himself who is at fault. Computers only do what they are told. Okay, nothing in life is 100% guaranteed, the process of developing quality software has significantly reduced the likelihood of actual program error.

The problem lies with the users themselves. They assume that because they can't make the software do what they want, this must be the fault of the software. It never occurs to them that *they* may be in the wrong. They press DEL and wonder why their file has disappeared. They organise all their work in one directory, the ROOT directory, don't back up and scream and shout when they lose something or the network crashes. They'll press the big red button and wonder why the world has disappeared. Without a moment's thought they dial Tech Support, hassle the guy at the end of the line, wasting his valuable time for something which could be gleaned

from a casual peruse of the manual.

Such people, these, the ignorant user community, are the cause of software companies charging for technical support. They expend valuable resources, sit vegetatively in front of their terminal or PC, mistakenly believing that the only job of a Tech support person is as their personal servant, helping them get on with their own job.

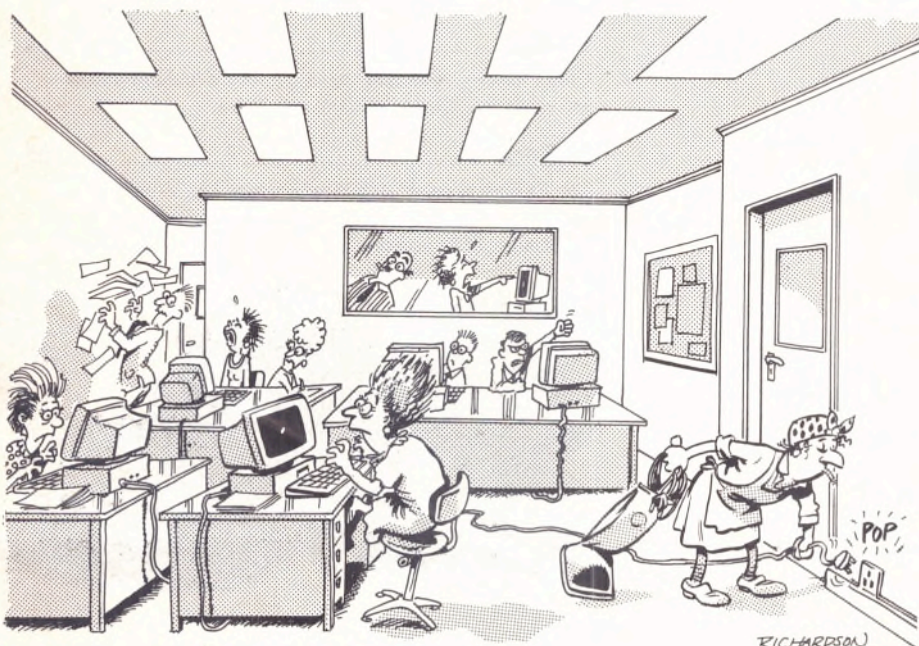
Unfortunately for the commercial software developers, such users are on the increase, spreading cancerously as more and more people become computerised. Ease of use, the GUI, Windows, Mac, have made the phenomena grow to almost epidemic proportions.

In fact, it is the GUI which is at the root of the problem. People are sold the idea on the pretence that it is easy to use. The Mac is easy to use; Windows is easy to use: so long as you know how to use them... That's the point. Without adequate training no one can be expected to master an environment as complex as Windows. It is far easier for a developer to teach the intricacies of a bespoke software system than attempt to explain Windows to a new user.

Let's face it, for people who haven't used a computer before, five or so DOS commands will be all they'll ever need. That, and the keystrokes for working the bespoke software, should keep them happy for years... Or until they happen to see a copy of Windows running.

Training is the key. Without effective training, software may as well be useless, still shrink wrapped, gathering dust on someone's bookshelf. The GUI has reduced the emphasis on training. Almost every PC today comes with Windows preinstalled. Almost anyone can run Windows. The situation is akin to driving a Volvo... The user is given a false level of security, pushing Windows harder, driving faster and faster until... Crash. When something does go wrong, when the Volvo crashes, the chance of serious damage is increased greatly. The user is given enough rope to hang himself.

It's time for companies adopting computer systems to take effective training seriously. Only then can they see a return on their investment. Good training will reduce the strain on overworked Tech support staff. Perhaps, one day, software companies will stop charging for their support services. The onus is on the user community to adopt a more mature attitude to software.



RICHARDSON

Cliff Saran



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## News & Views

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### Access speaks

Those of you who are considering undertaking software development in MS Access should visit the Access Developers' course being held at Windows Expo at Olympia II, London from 1st to 3rd November. There will be an Access Developers' conference and a 'live', on going demonstration in which a 'serious' business application is built using Access together with several third party development tools such as InfoModeller. Along with discussions of the MS Jet engine and ODBC, the demo will also show how to 'upsized' to SQL Server and master the final code on a CD-ROM. Subscribers to EXE can obtain a 20% discount on the conference fee of £395. Phone IT Events on 0256 381583 for details.

### Commuter heaven take II

Spikes Cavell has reported that teleworking in the UK is on the increase. Of course, every EXE reader is already well aware of this fact having read the Commuter Heaven editorial in our August issue. BT estimates over 2.5 million people work from home, rising to 4 million by next year. People who spend four out of five working days at home are £15 per week better off according to Spikes Cavell. Additional benefits include more leisure/family time and less exposure to stress and illness. In fact, Spikes Cavell has revealed that the UK government is in the process of conducting surveys into teleworking to reduce urban traffic congestion. Spikes Cavell can be reached on 0635 550449.

### GUI Builders hit \$1 billion

Ovum just reported that sales of GUI-building tools, in Europe and the US, will approach \$1 billion this year. Rosemary Rock-Evans writes about these tools in the report 'Without them most people would not have the skill to build GUI-based applications'. The study describes the market for these tools as not only including 'the estimated 2 million serious software developers' but also an increasing number of power users. In another study, Ovum has defined application adaptability as a very important criteria for 4GLs and client/server tools evaluations. Ovum is on 0171 2552670

### Very large database lab

Sybase and HP have just formed a VLDB, a very large database, engineering laboratory. The aim of the lab is to create environments capable of handling databases of several terabytes. Unix based HP 9000 T500 servers will run Sybase SQL Server. Parallel multiple taped are used for backups, speeds in excess of 20 gigabytes per hour have been reached. Sybase is on 01628 597100

## Do you feel lucky...



Take a break from the relentless pursuit of creating fabulous software. EXE is giving you, the software developer, a chance to compete for your rightful place at the top. The EXE Software Developers' challenge will bring together the cream of UK software developers to compete head-to-head against the best in Europe. The venue for this new and important event will be the Sandown Exhibition Centre in Surrey during the Software Developer's Forum taking place between February 8th and 9th.

The challenge will comprise a substantial software development project to be undertaken by a two or three person team which must be completed within the allotted time, probably eight hours. The project itself will form a real

world solution for a charity or other non profit making organisation to be nominated by the organiser at a later date.

Teams wishing to enter the challenge will be able to obtain sponsorship from suppliers of development tools. They will be required to select a development tool of their choice with which to complete the project. A fee of £1,000 will be required by each participating team, although this should be offset by sponsorship. Please note, in the name of 'fair play' employees of sponsoring companies will be unable to compete.

It is hoped that the EXE Software Developers' Challenge will attract a diverse range of teams and development tools. The challenge is intended to demonstrate the skills of independent teams and the flexibility of the software tools they use. Each team will be provided with identical PC hardware which will be connected via a standard LAN to a back-end SQL database. The project is expected to test the ability of the team and its preferred development tool at producing GUI-independent and database independent code. Speed of the finished application, ease of use and extent of documentation will play an important role in judging the overall winner.

Visitors to the show will be able to witness first hand the way in which comparable development tools perform under the pressures and restrictions of the competition. At the end, the team with the best completed or near-completed project, as judged by the panel of leading figures from the world of academia and commerce, will be crowned in glory and receive the respect due to Europe's most talented software developers. The development tool used by the winning team will also be recognised.

So, if you like a challenge, speak to EXE. We have prepared a detailed information pack complete with application form and everything you need to know about the EXE Software Developers' Challenge. This can be obtained by phoning Suzanne Chamberlain at the EXE office on 071 2875000.

## Hope for IT industry

In a recent report, Dataquest has predicted the end of the recession for IT companies. Its annual *Executive Spectrum* report estimates growth in the European market of 0.7% during 1993 representing revenue of \$141 billion. Dataquest predicts that as more and more countries emerge from recession, growth in IT will settle around 5%, taking into account the recent price wars that have been occurring. Sustained growth of between 5% and 6% is expected until the turn of the century.

Lucy Docherty, the report's author commented, 'Although the major players are continuing to build on their market share, the traditional IT markets are collectively declining in revenue terms.' She warned of lost opportunity for those companies who do not react to emerging technologies. 'Those companies that are not already involved in emerging markets, which will see the most growth in the next few years, will have lost a major opportunity to boost their IT revenues.'

The report pinpointed several such areas including Access networks, video conferencing, handheld computing, high speed networks and digital signal processing. In decline are fax machines (-20.9%), printers (-20.6%), desktop PCs (-14.6%), modems (-11.0%) and midrange systems (-9.9%). Dataquest is on 0494 422722.







### London, Internet free zone

Several UK Internet providers have agreed to open a neutral point of interconnect code-named LINX (London Internet Exchange). Located at the London Telehouse, it will provide a single line which then interconnects each provider's router. LINX is hosted at PIPEX's main London POP, but other members include BT, Demon, EUnet and UK-ERNA/JANET. PIPEX is on 01223 250120.

### BIPS

DEC is poised and ready to blast once again into the world of the 'hot chip' with a new generation of DEC Alpha processor. The AXP 21164 is, according to DEC, the world's fastest microprocessor. It can achieve instruction throughput of up to 1 billion instructions per second. The 300 MHz version has a SPECint92 estimated at 330 and 500 for SPECfp92. DEC claims it's up to three times as fast at integer operations as the 100 MHz Pentium and floating point performance is three times as fast as the 100 MHz PowerPC 604.

### Paradox conference in London

The European Paradox conference is scheduled for the 28th and 29th November in London. It will cover both Windows and DOS versions of Paradox and also focus on client/server technology. Philippe Kahn has recently been re-elected for another three year as director of Borland, so he may drop by. The £495 price includes a code disk and... a T-shirt. The organisers are Paradox Users Group (0181 7881454) and Richplum (01980 630032).

### Delphi in UK

Delphi is not a Greek city, neither a Borland product (where have you read that, I wonder?) but the name of a big US Internet provider that arrives in the UK. For the launch, David 'Wavey Davey' Winder, an 'Online Jockey' or OJ (a brand new acronym) will animate the Delphi Treasure Hunt game. To join Delphi costs a minimum of £10 but there's no surcharge for 14.4 Kbps modems. Delphi Internet is on 0171 7577080 or can be emailed at uk@delphi.com.

### Windows 3.5 is 94

Microsoft stated that the official name of Chicago will be Windows 95. Just a few days later, it announced Windows NT 3.5, formerly known as Daytona. So to make things clear: NT 3.1 was in fact only a first release, the second release's complete name is Windows NT Workstation v3.5 and Windows NT Server v3.5, and Windows 4.0 is no more. Microsoft is on 01734 270001

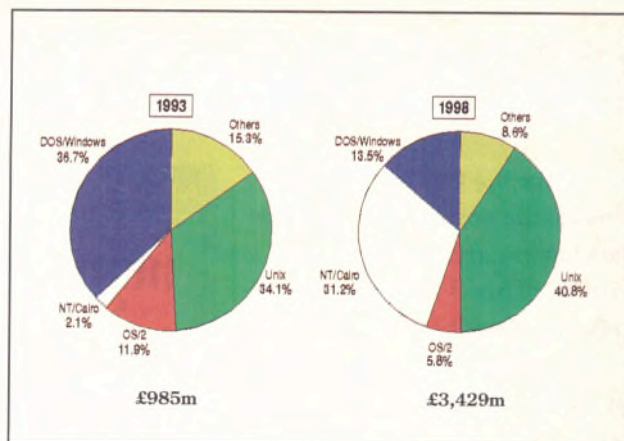
## What's driving Client/Server?

IDC predicts that client/server technology will be the 'most important trend for the rest of the decade and beyond year 2000'. Between 1993 and 1998, the European market will more than triple from US\$985 to US\$3,429m (see graph alongside). This year 60% of European IT users believed that they have a client/server strategy compared to 35% in 1992. The figures vary from country to country. Germany has the lead with 63%, UK follows closely with 62%, France (54%) and Italy (45%) are at the bottom of the list.

The problem with trend analysis concerning new technologies is that words are often loosely defined. As soon as a technology becomes fashionable, new names become buzzwords that are used for every new commercial offer. Look at what happened to object oriented over the last few years; now it's happening to client/server.

IDC fights some common myths generated by all the hype. First, only some companies use client/server. According to IDC, all users are in the process of going to client/server technology. They are at one stage or another, somewhere between having loosely connected clients and servers up to distributed application and finally to a '100% client/server way of computing'. So if only 60% of users *think* they are in the process, 40% are somewhere on the path but haven't realised it yet! Another myth is expecting a cost reduction by moving from traditional software architecture to client/server. IDC believes it will reduce hardware and software costs but at the same time the IT staffing and support will account for half the overall cost.

So, what is pushing user towards client/server or what is making them realise that were already using this technology? What is the real drive beside obvious reasons such as having more flexible solutions and using the power now available on each desk? IDC's answer is: 'psychology'! People consider that having a number of independent components (clients and servers) cooperating exactly match the ideal of human relationships. Since reaching the ideal communication between humans doesn't seem possible for the majority of us, maybe IT users are trying to achieve an ideal in their IT solution? The flexibility of networked client/server solutions is also considered best to follow the evolution of the organisation. People are moving a lot in companies today, and a software system 'should support this trend of organisational behaviour'. IDC Client/Server Software Centre is on 010 45 31 18 63 44



Market for Client/Server software in Europe by OS  
(source: IDC)

## Software Development '94

The Software Development 94 exhibition will move this year to Birmingham. The show is being held at the NEC from the 22nd to the 24th of November. It will focus on development products and software services for multi-platform environments. Bleinheim, the organiser, expects a 'high level of senior managers' as well as the traditional crown of specifiers, project managers and developers.

Over 100 exhibitors are expected to show their latest software tools. Some of them will take this opportunity to launch new products. For instance, Clarion will present its new development tool for Windows; Hitachi will announce a system dedicated to develop and exploit libraries of reusable software components and Mercury Interactive will launch Test Director, a QA management tool that fit in its automated software testing suite.

During the three days, EXE will sponsor a programme of seminars about technical and strategic issues of software development. The technical ones will cover topics such as OS, interoperability, QA, database technology and Visual Basic. The strategic ones will concentrate on development issues such as rapid application development, business benefits of OOT and how to maintain software quality. Bleinheim Online is on 0181 7422828



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We have been using the pre-release for a few weeks, it looks like a truly great product and is certainly everything Computer Associates promised it would be. The language is a natural extension to the CA-Clipper language so you don't need to throw away years of xBase knowledge.

## CA-Visual Objects and CA-Clipper Training Courses

As the only current Computer Associates Training Partner for CA-Clipper and CA-Visual Objects in the UK we are pleased to announce five new courses. **Rhino Publishing** runs all of the **CA-Clipper** and **CA-Visual Objects** scheduled courses at **Computer Associates** training offices throughout the UK. Each delegate has a machine and printer (except for seminar style courses), in addition, the trainer has a machine with a barco projector. All courses are given in a friendly, and lively manner where delegates are encouraged to ask questions and interact.

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## The UK Visual Objects User Group

We have recently launched the UK Visual Objects User Group. Members get a monthly newsletter, access to the User Groups BBS, technical support (via the BBS) and a discount on add-ons. Membership costs £95 per year. First three months free if you purchase Visual Objects from Rhino Publishing.

## VBX Support for CA-Visual Objects™

News from the US CA-Technicon: Two companies have announced products that allow CA-Visual Objects to use VBX libraries. This will enable the ease of porting from visual basic over to visual objects. Call us for further details.

## Advantage xBase Server Version 3

We have just been appointed a direct distributor for Extended Systems. You may purchase upgrades through us. Ask for our article on "Client Server" for more on xBase Advantage or call us for more details on Version 3.

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#### Free Mag - Database News

We are giving away a free mag called Database News. It is full of product announcements, tricks, tips and work arounds for database products. Our September Issue was the first mag to announce the Launch of Visual Objects. Articles included: How to TBrowse a two dimensional array, Reducing Memory Requirements with a Library Manager, explanation of Query Optimisers, Clipper Memory Management, Interactive Voice Programming using Clipper, Foxpro and a discussion of Client Server using the Advantage xBase Server.

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## NT tools for PowerPC

Motorola's RISC Microprocessor Division has announced its suite of Daytona development tools for the PowerPC. The SDK includes the OS, the DDK and a native PowerPC development environment (native C/C++ compiler, x86 cross compiler, linker, assembler and Win32-based debugger). The NT Firmware kit is for porting NT boot-compliant firmware to the PowerPC. The HAL Kit enables a single shrink-wrapped version of Daytona kernel to run on all 32-bit PowerPC platforms. The SDK costs \$195 until November 30 1994. Motorola can be reached by fax on 01908 618650

## Scaling up to SQL

Borland has enhanced SQL Links, its converter utility which enables developers who use Paradox 5.0 for Windows or dBASE 5.0 for Windows to translate their scripts into SQL dialect. Support for Interbase, Informix, Oracle and Sybase/Microsoft SQL Server is available. The converter gives SQL applications bi-directional navigation in a result set or answer table, data ordering by index, book marks, reusability and dynamic manipulation of SQL data via 'live' data source access. SQL Links 2.0 is being shipped both with Paradox 5.0 for Windows and dBASE 5.0 for Windows. Developers with earlier copies of these products can obtain upgrade to SQL Link 2.0 for £20.

## Speedier distributed Smalltalk

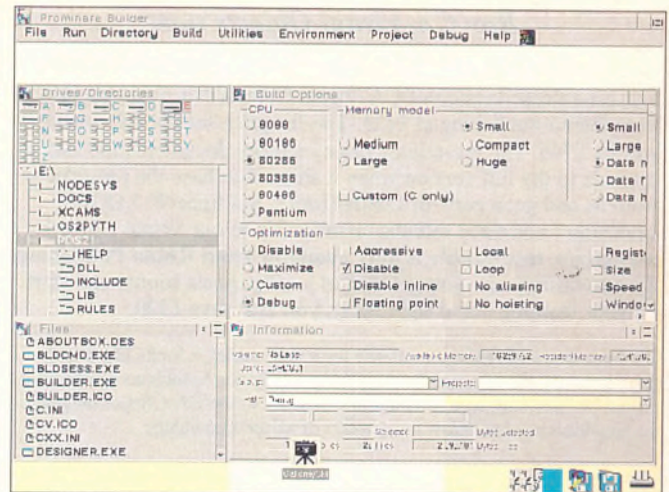
Release 3.0 of HP's distributed Smalltalk extends ParcPlace's VisualWorks to create a distributed development environment. DST Release 3.0 is compliant with OMG's CORBA 1.1 spec. Several new tools are provided such as a shared interface repository, a distributed debugger and more application samples. The speed has been increased, especially the messaging speed. HP DST release 3.0 costs £5,000 for a single user (£10,490 when bundled with VisualWorks). HP is on 01344 369369.

## Mainframe connectivity with VAB

Attachmate has developed AppWare Loadable Modules for 3270 and 5250 connectivity that will be included in Novell's Visual AppWare Builder. These ALMs provide host navigation, host mapping and file transfer. To be used they require the Extra! or Rally! products. Mike Wilk, director of toolkits and host automation at Attachmate regards these new ALMs as objects which can be connected to other third-party objects. Attachmate is on 01734 890390

# Code cranker for Windows and OS/2

A 32-bit version of the Prominare Development System (PDS) is now available for OS/2 2.1, Windows 3.1 and NT. Prominare is an application development tool that generates C++ source as its output. As well as producing code for the native APIs of these platforms, it additionally supports two GUI class libraries: IBM User Interface and CommonView from Computer Associates.



Compiler options can be set on a per project basis in Prominare

PDS comprises three main components. Prominare Designer is, in effect, a resource editor for visually creating menus, accelerators, strings, dialog boxes, custom resources and help tables. In addition to building resource scripts it generates source code for the main client window, secondary window and menus and dialogs. It is also able to import Windows .RES files and convert them to OS/2 equivalents.

Prominare Builder is an IDE which provides access to compilers, editors and debuggers. Most of the major compilers are supported including Borland C++ for OS/2, Watcom C/C++ and IBM C Set++. Compiler characteristics such as memory models, optimisations, target CPU can be set on a per project basis.

Prominare Editor links in with the rest of the environment. As with many IDEs, it is capable of detecting and moving the cursor to source code that failed compilation. Prominare Development System 2.1 is available in the UK from Microtransfer (0869 350340) at a cost of £695.

## Chicago help now

If you've seen Microsoft's *Books Online* in Visual C++ and can't wait 'til Chicago for a better Windows help system, then Help Browser may be for you. As in *Books Online*, this provides a browser window with collapsible tree nodes for navigation of a help file. The help page is displayed by double clicking on a node. Another improvement over Windows Help is a text Tool which scans the entire file rather than just the keywords. Printing is also simpler than for Windows help as multiple pages can be selected in one go. Help Browser is compatible with Windows 3.1 help files. When it is launched it replaces the Windows help engine. Help Browser 2 costs £49 from Oxford Computer Consultants (0865 793077).

## Embedded images for R&R

Version 6 of R&R Report Writer for DOS is now available. 11 new functions have been added. Support for embedding bitmaps in BMP, TIF and PCX format into R&R reports is now possible. R&R has also improved the Instant Report feature of the previous version to allow users to select which fields to include. Several new report templates have been added and there are over 170 built-in standard Avery label templates. Enhancements to printing include the ability to scroll backwards through the data set in Print To Screen and Print Preview modes. Existing users can upgrade to R&R ReportWriter Version 6 for xBASE, DOS Edition for 85. A competitive upgrade is also available at £129.

R&R is also planning a new Windows version which is expected to be launched at Windows Expo in November. It will offer all the features new to DOS Version 6 plus a new Report Wizard for designing reports interactively. Two versions of the software will be available. The xBASE Edition will support dBASE, Clipper, Fox and compatible file and index formats. The SQL Edition will provide support for over 25 database formats including ODBC. R&R is on 0628 788181.



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## Low cost SQL

EXE has organised a technical workshop for Gupta's SQLWindows client/server development tool which was reviewed last month. The workshop will be taking place on 22nd of November. For details phone Suzanne Chamberlain at EXE magazine (071 2875000). Gupta is on 0800 834399.

## Start faxing

Async professional for C/C++ communications library has been extended with a fax toolkit. Routines are available to convert text, PCX or TIFF into compressed fax format. Applications developed with Async are able to send and receive multi page faxes in Class 1, Class 2 format or from Intel CAS fax modems at data rates up to 14.4 K bps. Other features include the ability to insert a fax header on each page and conversion of fax files into PCX for displaying on screen. Sample applications shipped with the library include a TSR for receiving faxes in the background. The cost is \$249 which includes source code. It is available from Turbo Power (0101 719 2609136).

## Hop on the bug,

Abacus Systems P/L has released a bug tracking tool called BugTrak (for a feature on competing products check EXE September 1994). It's designed as a multi-user database with a central repository holding all information. BugTrak includes a word processor and Note-It, a Post-It like feature. Network users can send each user Note-It(s). BugTrak costs £135 for one user and £359 for five. It is available from QBS Software (0181 9944842)

## C the video

Silicon River has kindly extended its offer to EXE subscribers who wish to purchase the *C Video Course* reviewed last month. The normal retail price is £199.95, but EXE subscribers can obtain it for £50. If you are interested please phone Silicon River on 081 3167777.

## From C to MFC

MS and Symantec have teamed up to announce an MFC Migration Kit. This kit is made of tools which will help C developers to move their code to C++ and MFC. Applications converted from C to MFC will benefit from the 16/32 bit compatibility of MFC and so should be easy to port to other architectures such as Macintosh and Unix. The kit works with MS Visual C++, MetaWare High C/C++, Symantec C++ and Watcom C/C++. It should be available on this month edition of the MSDN and on CompuServe.

# Easy revamping

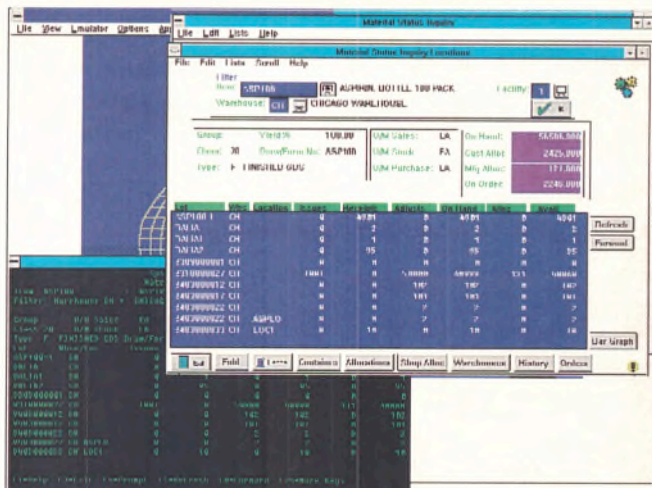
Client/Server Technology (CST) is launching GUI Sys/400 and GUI Sys/3270: two software tools which automatically translate 5250 and 3270 screens to Windows. The two products are based on the same kernel developed in bespoke Smalltalk. They both use an expert system called KnowledgeBase.

To convert a mainframe application, the first step is to install a module that will sit in the background and log every interaction

the user is having with the mainframe application. Then with the help of the expert system, the application will analyse the way in which screens are presented to the user. With its knowledge base and the information that was gathered about the look and feel of each screen, GUI Sys/400 or GUI Sys/3270 will generate a complete Windows runtime.

General information such as company style guides for a screen's presentation is kept in the knowledge base to speed up conversion time of future screens. The software learns as it is used. In addition thanks to Windows, 3270 or 5250 application are also enhanced by automatic type checking or selection in Combo boxes etc. If any aspect of the automated conversion needs to be changed, users have full access to rules stored in the knowledge base. These can be added or modified.

CST is an Israeli company founded in 1990 and backed by the Israeli government and Star, an Israeli-German venture capital firm. For the launch of these products, a European office has been opened in the UK. CST Europe can be reached on 0171 4048081



*A host screen in the background with the new automatically created window in the foreground.*

# The WARP factor

IBM will release WARP on October 11th. This is the codename of the next version of OS/2 for Windows. The final name is not yet known... OS/2.2, OS/3, OS/94. Who knows? It's apparently faster and smaller than OS/2 2.1. The most important new feature of this version is the support of Win32s, ie WARP can be installed on top of any current version of Windows (though it will not move the network configuration from Windows for Workgroups).

IBM states that it requires only 4 MB of RAM. True, it *works* in 4 MB but it is *usable* with at least 6 or 8 MB. When there is enough memory, response time is near immediate as there's a much better use of multi-threading. Several other improvements have been made on the usability of the OS. First, the installation can be completely automatic, the tutorial gives many hints and even shows how to use the OS and the icons are nicer. The number of drivers has been increased with priorities for multimedia devices through integration of MMPM/2 into OS/2.

There's a comet cursor which leaves bubbles on its trail, so it's easy to see where the mouse is. Another little feature which could be useful on a laptop is the lazy drag. With this it's possible to drag and drop without having to keep the button pressed on the mouse all the time. A launchpad, similar to the many Windows shareware tools, allows users to launch applications with just a mouse click. PCMCIA devices are automatically recognised by PlayAtWill: a utility conforming to the Plug-and-Play standard.

The package will include two CD-ROMs (or a lot of disks), one containing WARP itself and the other the BonusPak. This last one contains ten OS/2 applications. Some written by IBM, such as Works, Personal Information Manager (a SOM enabled PIM) and Person to Person (which allows several machine on a network to work on the same document) and some by third parties such as CompuServe Information Manager for OS/2 from CompuServe or FaxWorks from SofNet. The price is not yet fixed but should be between £50 and £100. IBM Software is on 01329 242728



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- POP UP MENU
- TOOL BAR
- STATUS BAR
- SPINNER
- SLIDER
- SCROLL BAR
- ICON

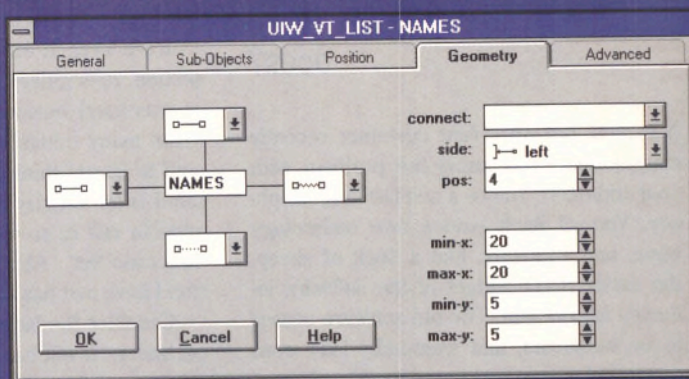
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# SOAPBOX

'Does Client/Server work?' asks Alan 

**Hambrook.** More to the point is the change worth it even if it does?

A cynical but observant customer recently commented: 'You know the problem with your industry? You're a self-fulfilling prophecy. You all latch onto a new technology wave, and suddenly, like a flock of sheep, the entire R&D budget of the software industry follows suit. The old software ceases to be enhanced, and eventually isn't even supported, so we end users have to change, whether we like it or not.'

This may be an over-simplification, but it's understandable given the current rush to develop applications based on Client/Server, Open Systems, Windows and networks. As you read the major IT magazines, count the number of new product announcements that are based on these technologies. They will outnumber anything else by at least 10 to 1: it's pretty obvious where the investment is going.

The ongoing problem is that software packages, particularly the larger, core applications, tend to lag at least two years behind the technology hype, for the simple reason that it takes that long to develop, test, bed in and prove applications of this type.

Basically, packages for Client/Server seemed to progress in three stages within the software development world. In 1992 the software development community talked, promised and developed like crazy. In 1993 it started installing and getting it to work. And in 1994 the live, production strength systems were delivered.

In short, major workable Client/Server packages have only now arrived.

Many users with PCs on their desks currently spend a great deal of time re-keying data from their mainframe into Excel or Lotus. Dumb terminal enquiry screens and printed reports have their uses, but for

many users, the old proprietary applications deliver the data to the wrong place. Most want to see it on their PC via their favourite application, not on a piece of paper. Client/Server based applications, if properly structured, can do this *par excellence*.

If we were in America we would call this section 're-engineering'. However, like a lot of over-used buzzwords, this has come to mean many things, ranging from laying off staff to lateral thinking. The point I have in mind is far simpler than this. I am not sure what to call it, so we will refer to it as the 'Meccano Set'. Almost every large corporation I have met has at least one of these.

Consider the large, corporate finance department. It will have a set of mainframe or mini based financial systems producing the usual range of functionality: Purchase Ledgers, General Ledgers etc. However, these will rarely produce the finished product. Rather, an army of management accountants will draw data from the mainframe plus a whole range of other sources and spend significant time and effort, duplicating and restructuring it in various spreadsheets, EIS tools etc. So a large Meccano Set of local applications and surrogate databases grows around the mainframe to cope with its shortfalls in functionality and information management.

I am not criticising spreadsheets and EIS tools, they are extremely valuable. But, in the case of finance systems, they are just that: tools with which to view and manipulate data, not the means to create it in the first place.

We could spend a great deal of time debating why we have evolved to Meccano Sets. However, the short answer is that the majority of the large applications packages were built at a time when there existed some very rigid ideas about their boundaries; a purchase ledger should start with an invoice and finish with a payment; a general ledger should start with a journal and finish with a Trial Balance...

Consequently we have pigeon-holed data and functionality into tight compartments, leaving the user forced to build a Meccano

Set to break these down.

Client/Server gives us a chance to change this. First, it offers us an opportunity to start again, to throw away all of the old code and design with the benefit of hindsight. Second, it presents us with a lot more power, particularly at the user interface, so we can develop far greater functionality and push out the boundaries.

'Pushing out the boundaries' is the key message of the new wave of Client/Server based, core applications. Those applications that have been developed and designed from scratch have the potential to exploit fully the old limitations, to break the boundaries set by the previous generation - at last there is an opportunity to get rid of the Meccano Set and its attendant problems.

Client/Server has the potential to allow us to combine PCs; high powered Unix servers; mainframe strength applications; PC based tools; a common GUI/user interface and relational databases in a more imaginative design that from the start is intended to eliminate the 'Meccano set' tendency.

Unfortunately, the bad news is that the 'evolution' from old mainframe products to Client/Server doesn't work. You cannot leverage properly all of the benefits from this technology by simply putting a PC front-end onto the old system or by trying to evolve the old code into a new architecture.

The only way to do it properly seems to be to throw away the old package and start again. This is always a difficult, heartrending process.

Most companies, (be they developer or end user), have a huge investment in the old system. Letting go is often viewed as wasteful and risky. However, if there is one thing that this industry has taught us, it has to be that you can't hang onto the past forever: even if all the other deciding factors leave you untouched, the 'self fulfilling prophecy' will eventually catch up with you. Why follow the herd when you can lead the pack? ■

*Alan Hambrook is Vice President of the Dodge Group.*







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# Serial killer

There was a time when modems were used only by a happy few. Now everybody wants to send a file or a fax from his desk. Why not share a modem on the network? **David Mery** shares his experience with EXE's NTAS...



Communication is supposed to be simple but have you ever tried to install a modem and connect to any BBS at maximum speed? It certainly looks simple but there are so many things that can go wrong. Murphy's law is very effective in telecomms. When connecting a modem directly to the back of a workstation the list of things that can fail is relatively limited: modem, serial cable, serial port, operating system, serial driver, communication software. That's about it! So imagine trying to connect over a network.

The situation at EXE was that we had a few modems, each of a different generation: a 2,400 bps internal card, a 14,400 external US Robotics and a new 28.8 Kbps V.FC US Robotics. Only one of the two external modems was connected to a fast serial card. The software configuration was not perfect either. True to Murphy's Law, the one spending the most time online, had the slowest modem.

## In an ideal world...

So we fixed ourselves a challenge: to set up a modem on the server, which would be accessible from every workstation for either fax or data communication.

So that everyone could send a fax or download a file without moving from his or her chair: without having to interrupt the work of the person lucky enough to have

the fastest modem or walk to the printer to get the printed fax and then to the fax machine.

Initially we thought of sharing a US Robotics as a send fax server using MAW (Microsoft At Work). However, we soon abandoned this idea mainly because of the unreliability of the software. The other reason was that the modem is connected to a workstation which is not always switched on.

You probably remember from EXE's May issue, that our server, a 486DX-33, is running Windows NT 3.1 Advanced Server (Daytona might eventually be available in its final form when you read this). The fact that we're running NT created the first difficulty. How do you share a serial port under NTAS? With OS/2, Lan Manager or Lan Server provides sharing but there's nothing similar that will enable you to do this on NTAS.

We eventually located what seems to be the only product that can do it for NT. It's called SAPS. It has been written by the French company, Spartacom, and is used by companies such as Microsoft! SAPS stands for Spartacom Asynchronous Port Sharing. The theory is very simple: on the client machine, a driver intercepts all the asynchronous communications with serial ports that are declared redirected. These dialogues are then given back to the real ports on the server.

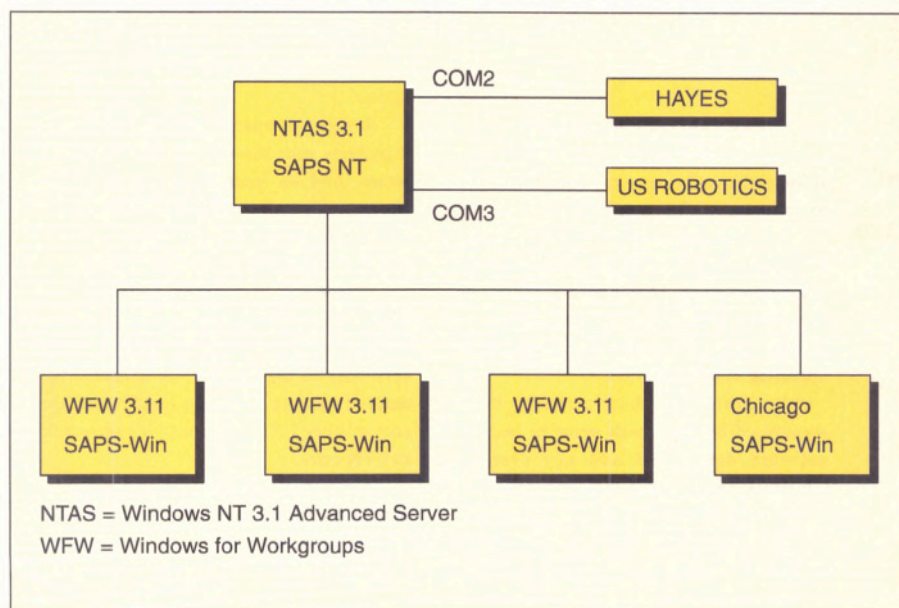


Figure 1 - EXE's network

If you ever have to do the same, be careful, one error and NT won't work anymore



## Nuts and bolts

To do the thing right, we needed a fast serial card in the server. We chose an Enhanced Serial Port ESP2 dual port card from Hayes with a Hayes 'SmartModem Optima 288 V.FC Fax' soon to be complemented by the US Robotics 'Courier Dual Standard V.34-Ready Fax' we already had. V.34 will be available for download, but it's currently only a V.FC modem. I found the ESP2 quite an impressive serial card, with the right drivers it can go up to 921,600 bps. But of course there isn't yet any driver for NT, so we were driving it like a 16550 FIFO chip card. If you're interested in developing one, check out the box on the ESP2.

Figure 1 shows the general setup. What's missing on the figure and in the beginning of this article is the communication software used on each workstation. Choosing which software to use was a lot more difficult since there is so much competition: especially for fax drivers for Windows. And according to their users *none* of them work reliably in all types of configuration, 100% of the time. So, for fax and direct communication we chose Trans-Send for Windows. I was very impressed by the DOS version that I had used previously. It's a very complete package. We also opted for Trumpet Winsock and Mosaic to connect directly to the Internet and the World Wide Web.

## Struck by lightning

Set-up was far from easy. We started with the Windows SAPS client software on a Windows for Workgroups 3.11 client station. The installation procedure didn't work! Fortunately after calling Spartacom and

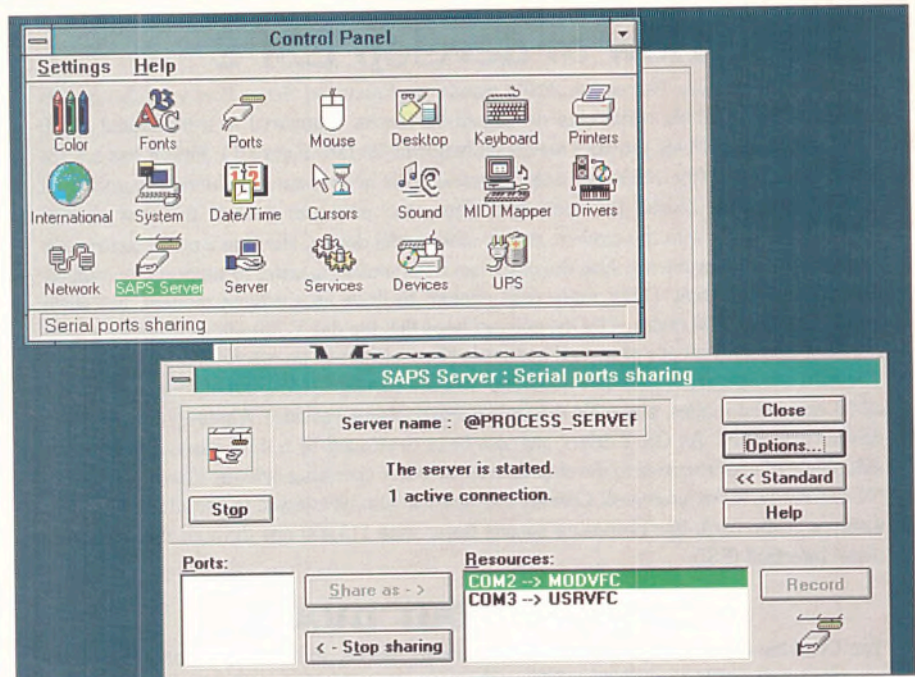


Figure 2 - Configuration of SAPS for NT

downloading a new build everything went fine. We had apparently suffered the software equivalent of an act of God. The SCSI cable linking their internal hard drive with the SCSI card was losing some bits. Luckily, the external backup unit was connected through another cable, to the same SCSI card. So most of the files on their hard disk was corrupted but backups were okay.

The second step was installing the ESP2 card in the server and connecting the Hayes V.FC modem on COM2. We set up the serial card on COM2 and COM3. The first problem was with the multi I/O IDE card which was already there. It's a Unique UN-

1051. We started by deactivating the second COM port, which would have conflicted, and the game port, which is not used. When rebooting the machine, there was no video! After trial and error, we eventually discovered that the game port had to be kept activated. Don't ask why. But since there was no conflict, we left it on. The first serial port on the multi I/O card is a slow one (8250 compatible) but there is only a mouse connected to it. We then tried to access the modem with the NT terminal program. This simple connection test was working.

## The hardest is over

Then, it was the turn of SAPS for NT. As with SAPS for Windows, another version had to be downloaded. After that, the installation went relatively smoothly. We configured both ends of SAPS. On the server, it involved selecting a COM port to the network and giving it a name. On the client, after redirecting one COM port to the network address defined previously, we ticked the two boxes: quiet automatic reconnection and automatic disconnection. So when a comms application is launched the reconnection to the distant port is done transparently. When the application frees the local port, the remote port on the server also become free for another user.

On firing up Trans-Send and setting it up to the COM port defined as 'redirected', we issued an AT command. The answer was 'OK! Complete success? Unfortunately our troubles were still not over. I moved on to my next favourite test. Connect to CIX, join the texts conference and download, with Z-Modem, dracula.zip (327,539 bytes): the book by Bram Stoker. A bad CRC was gen-

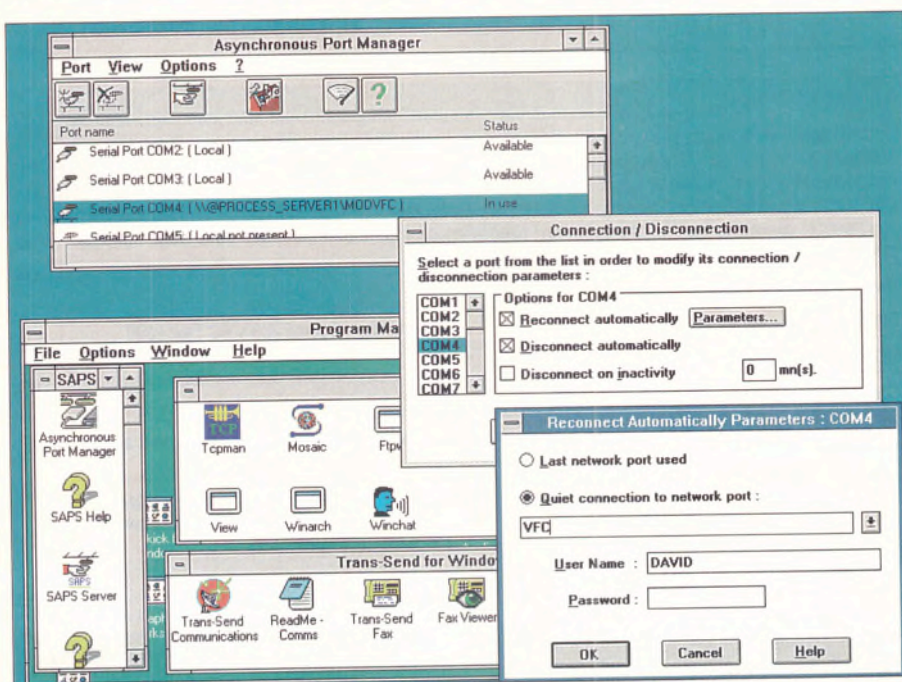


Figure 3 - Configuration of SAPS for Windows



## How to develop ESP2

Forget Extra Sensory Perception, ESP2 stands for Enhanced Serial Port v.2. The card is based on the COM-bic serial chip developed by Hayes. Compared to a traditional 16550 FIFO chip, the COM-bic provides several enhancements (see Figure 6). First it has a 1,024 bytes FIFO buffer (the 16550 has only 16 bytes). This improvement reduces the amount of context switching caused by interrupts. Then, the card can control the flow control (RTS/CTS) locally with the modem, or any other serial device, allowing a much faster reaction to contention problems. Also the clock can be prescaled in order to support communication up to 921.6 Kbps. That's more than enough to drive an analogue modem, but when going into the digital realm of ISDN, one can hope that the day V.120 will incorporate a compression standard, speeds of several hundreds Kbps will at last be reachable.

The card can operate in a mode compatible with the standard 16550, but of course, to exploit all its enhanced modes, a specific driver is needed. Hayes provides Windows and NetWare drivers with ESP2. An OS/2 driver has also been developed by a third party. So, there are still plenty of opportunities to develop drivers for other operating systems. If anybody has an NT one ready, we're interested. Comms software can also be adapted to use all the advanced features of the card, like proposing speeds faster than 115,200 bps through the Enhanced Serial Interface (ESI).

## Choose your mode

The COM-bic can be programmed in five operating modes. In the simplest one, the COM-bic appears as a 16450 or 16550 serial port. In the next mode, the serial chip still presents itself like a 16550 but with the larger FIFO buffer and the automatic flow control (CTS/RTS or DTR/DSR) enabled. That's the mode, I set the ESP2, so the card would be recognised by NT standard serial driver and reliability would be enhanced.

The three other modes are all concerned with enhanced access to the chip which offers high speed and low software overhead. In the programmed I/O mode, 8-or 16-bit data is transferred between the computer and the COM-bic chip through enhanced data registers located in the host I/O address space. In the memory-mapped I/O mode, data is still transferred 8-or 16-bits at a time but directly into a 1,024 byte block in the computer address space. The last one, the DMA mode allows transfer of data directly between the COM-bic and the host memory using the DMA channel.

According to Hayes, at speeds of up to 28.8 Kbps, the maximum allowable interrupt latency time of the host when interfacing with a COM-bic is about 64 times greater than when a 16550 is used. At 144 Kbps the ratio goes down to 28 times.

Currently the COM-bic is used by Hayes in single and dual port, ISA and MCA cards. But up to 8 chips can coexist on one card sharing interrupts and presenting one unique interface.

*Developers can call Hayes on 01252 775500. Some files documenting the ESP2 card can be found in the hayes conference on CIX. Developers can also email Bill Pechey, Hayes European Technical Director at [bpechey@cix.compulink.co.uk](mailto:bpechey@cix.compulink.co.uk)*

nected on the first attempt. We were using the v.2 alpha 2, so we took this opportunity to download the alpha 6 which of course required a more recent version of Win32s than the one we had installed. If you're still using one of the first alphas of version 2, I recommend the alpha 6; it's much faster and doesn't cause GPF anymore.

When using Mosaic, there are quite a few layers of software running. On the client Windows machine, Mosaic 2.0 needs the 32 bits subsystem Win32s. It accesses Winsock which thinks it is communicating with a local modem. The communication is intercepted by SAPS for Windows and transferred across the local network to SAPS-NT which then establishes a local communication with the modem using the NT serial driver. That's just the beginning. Over the SAPS link, Winsock establishes a SLIP link with an Internet provider, then Mosaic connects to a WWW server using several other machines on the way (a Domain Name Server for instance).

When you're on the Web you can spend your time hopping from one part of the world to the other... it's quite impressive. In fact both Hayes and Spartacom asked for more details on this setup.

At this point everything was working quite well. It was time to install the client software on a couple of machines running Windows for Workgroups 3.1 and 3.11, and also one with a beta of Chicago. It worked fine on all machines including Chicago. Spartacom was surprised: SAPS wasn't supposed to work on Chicago. However, neither we, the machine or the OS were aware of that fact: it did work and still does! What probably doesn't work on Chicago is the server part of SAPS, but we didn't try that.

erated every 20 KB or so. We checked everything again. The flow control was set to CTS/RTS both in Trans-Send and in the modem.

When everybody stopped accessing the NT server, we ran the ESP2 setup after booting DOS from a floppy. We had setup the card to use the large 1024 FIFO buffer but had forgotten to activate the automatic hardware flow control. After rebooting the server and testing again there were still a few CRC errors, but now they were less than five for a file of more than 300 KB.

### The fascination of the Web

The fax from Word of the standard EXE letter page worked first time. The next thing we wanted to use was Mosaic, the Web browser. After modifying the COM port setting, increasing the connection speed in Winsock and changing the modem initialisation string in the login script we con-

### Contacts and Prices

Detailed below are contacts and prices for all the hardware and software used for this article. Shared communication on a network is not cheap. The total figure for 5 users adds up to just under £2,700 without taking into account the installation of two phone lines. If you want to browse the WWW, you'll also need an Internet direct connection. We used Demon which costs £10 a month. Of course the overall cost can be reduced a little. If you don't want to connect to the Web then you don't need Winsock. Also, we chose to get Trans-Send, but both modems come with communication and fax softwares.

Hayes is on 01252 775577

ESP2 dual port card: £119

SmartModem Optima 288 V.FC Fax: £599

US Robotics is on 01753 811180

Courier Dual Standard V.34-Ready Fax: £499

Spartacom is on 010 33 1 69 07 17 80 Its softwares are distributed in the UK by Dynamic Communications System (0117 9255465)

SAPS for NT: £600

SAPS for Windows: £370 for a 5 users licence. The Windows software also includes a Windows comms server which we didn't use.

Trans-Send International is on 0181 2075165

Trans-Send for Windows: £79.95

Trumpet Software International on 010 61 02 487049

Winsock is a shareware available by ftp. To find a host near you do an archie search with the name twsk10a.zip. For 1 to 99 users the registration costs \$20 US per user

Figure 4 - Contacts and prices





## NO CLEAR PATH

An overabundance of  
complex options threaten  
your ability to forge a  
clear development path.





### One good, two better

Now to install the second modem. The USR was moved to the server. Then the first step was to share this new modem in SAPS-NT. No luck! The COM port just didn't show in the SAPS configuration. After spending some time in the Control Panel, it appeared that there was a problem in the serial port configuration of NT. With the help of Spartacom on the phone, we dived into NT's registry, deleted the bogus serial port definitions and recreated all the existing serial ports by entering new keys and values. If you ever have to do the same, be careful, one error and NT just won't work anymore. So, after this low-level experience, the two serial ports were available and both modems could be accessed from the NT Terminal program. So as not to risk any conflict we changed the IRQ of the second port on the card (COM3) to IRQ9.

When we then shared the second port and tried to access it, SAPS returned a Net-Bios error. It took both Spartacom and us quite some time to find the cause of this problem. Eventually we found that it originated in the installation of SAPS-NT. During the first installation, the SAPS-NT executable was limited to only one shared device. When we reinstalled the software, SAPS was probably open and the executable file locked. So either no error message was displayed or we were too fast and the installation finished but was incomplete. It worked fine as long as only one modem was shared. After closing SAPS-NT and reinstalling for the third time, both modems were accessible without any more problems.

The current setting on the workstation was that one COM port was redirected to one specific modem. Since both modems had about the same specifications, we de-

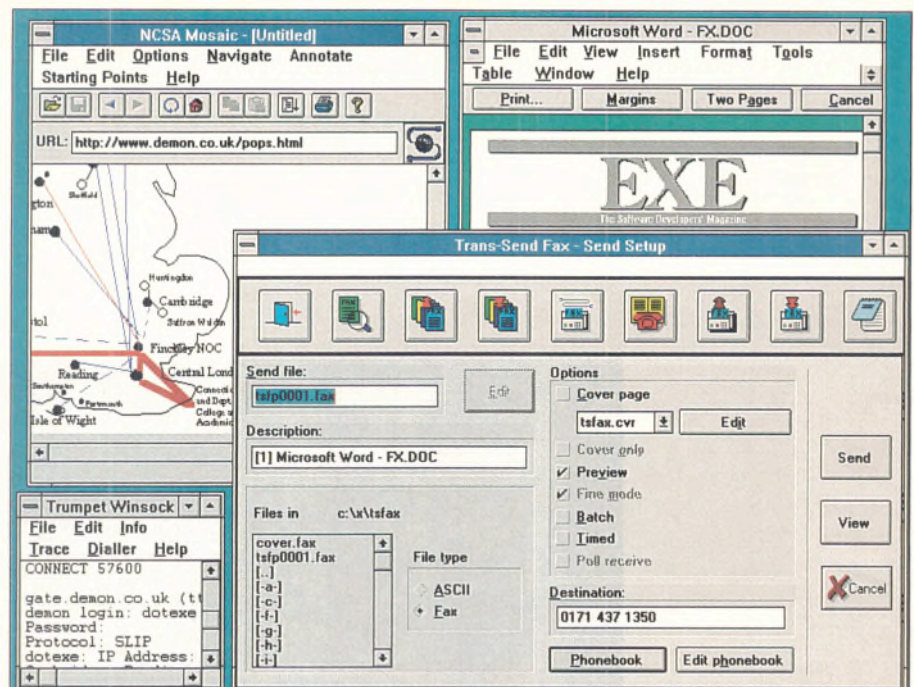


Figure 5 - Sending a fax on one modem while browsing the Web on the other

cided it would be better to use them as a pool of two V.FC fax/modems. That's an op-

**Once it is working, it's relatively trouble free and probably even easier to maintain than offering a modem to every user of the network**

tion in the configuration of SAPS for Windows. So now, with the definitive configura-

tion, any machine that has the software installed can use any Windows communications software. When a connection is tried the first available modem is used.

### Worth the trouble?

If you go for a similar solution, you might not encounter all the pitfalls that I described but don't expect the setup of a shared communication service to be simple. Once it is working, it's relatively trouble free and probably even easier to maintain than offering a modem to every user of the network. There is still room, however, for developers to find a way to offer products which integrate serial and network communication in a seamless way.

Once everything was working, I was very impressed by the simplicity and the performance of SAPS. It transparently connects and disconnects comms softwares that were not written to be used with anything else than a local serial port. Network users do not even have to know that the modem is not local to their station. They really can use any software.

We detailed what we've been through and how it's currently working, so what's left to do? We are still using a few DOS communication applications. Since currently SAPS is only available for NT (as a server) and for Windows (as a server and a client) we need to move the remaining DOS comms to Windows. Spartacom is currently working on a DOS client, a Chicago server and an NT client. The main remaining application is the mail reader for our demon account. So if you have any good experience in that domain, don't hesitate to write to EXE.

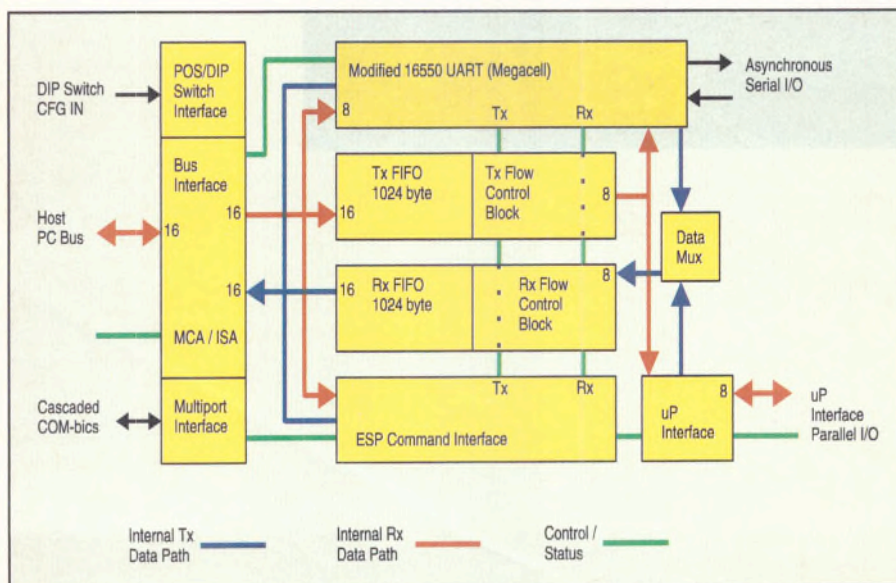


Figure 6 - Functional diagram of the ESP card



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# Chicago. Can you handle it?

Promises of better resource management, more handles, flat address space... Isn't it time the development community started writing for Microsoft's forthcoming Windows successor? **Cliff Saran** takes a look at the problems of moving 'legacy' Windows 3.x code.

I expect by now everyone has read of Chicago. And I bet you all thought it would end up as Windows 4.0: no chance. Microsoft has just announced that it's going to be called Windows 95. Presumably there'll be a Windows 96 and a Windows 97... And at the turn of the century it will fallover spectacularly. In true Microsoft tradition the shipping date of Windows 95 has slipped back yet again. The word from Seattle is 'first half of 95.' With a six month window on Windows, Microsoft looks set to lose its momentum. Ultimately, however, it is the software development community which will spell success or failure for Chicago. Unless we write software to run on the platform, to take advantage of the features it offers, why would a user want to upgrade to it? At the moment Windows 3.11 is fine. Although arguably, end users would have said the same thing of DOS until they came across Windows.

Still, Microsoft promises to provide a compatibility path so that the user community won't have to rush out and upgrade all

their Windows 3.x software to Windows 95 when it finally arrives. Microsoft is courting the user community, first and foremost. Well, who can blame Bill? Let's face it, there are over 40 million *users* out there, some of whom are developers. But the majority of Windows users acquired Windows preinstalled on their hardware. They didn't actually *buy* a retail copy. Tell me, how many users do you think will want to purchase an upgrade for a piece of software they didn't buy in the first place? The burden rests with us, the developer community to explore and conquer the new market for Windows 95 software which Microsoft has created.

## Where's PROGMAN?

It's common knowledge that Microsoft has dropped Program Manager from Windows 95: its replacement is a new user interface and a host of new terminology for us PC types. Of course those of us with a fetish for the Mac or OS/2 or NeXTstep will already be familiar with the concept of the desktop and the folder. Well, when Windows 95 arrives, the PC will have these features too. That means we'll be able to drag and drop files from one place to another, copy them, create shadows or shortcuts without ever having to open File Manager. Better, we'll never need to worry about directories again. Creating a new folder (ie a new directory) is simply a matter of pressing the right mouse button, selecting **New** from the popup menu and choosing the **Folder** option from the sub menu. If you're on the desktop, Windows 95 will create a new directory, sorry 'folder', in `WINDOWS\DESKTOP`. If you create a directory while browsing a given sub directory on your hard disk, the folder will be placed there instead. All that's missing is a waste paper bin...

Navigation of the hard disk is accomplished by double-clicking on the **My Computer** icon on the desktop and then double clicking on the appropriate drive in the **My Computer** window that is displayed. This brings up a window containing the contents of the root directory, ordered alphabetically. Double clicking on a folder will open a new

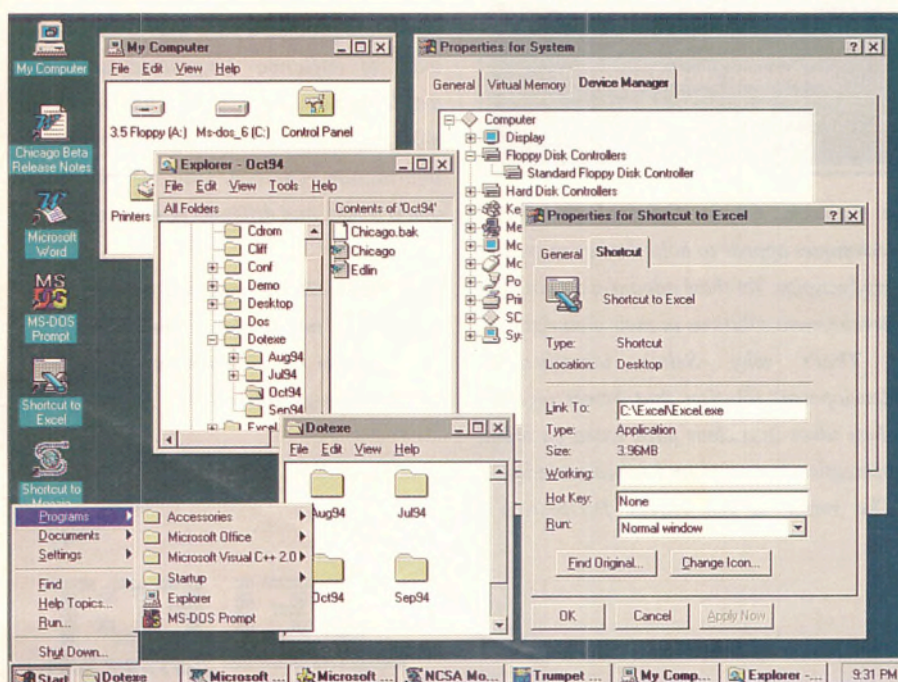


Figure 1 - The 'cluttered' Windows 95 desktop



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Platform feature	Win32c	Win32	Win32s
<b>General</b>			
Separate address space	yes	yes	no
Asynchronous input model	yes	yes	no
Preemptive multi-tasking	yes	yes	no
User and GDI resources	expanded	unlimited	Win 3.1 limits
3D look	yes	2D	2D
Property sheet exposed by shell	yes	won't appear	won't appear
Long filenames	yes	yes	won't appear
Simple MAPI/CMC	yes	yes	universal thunk
Network API	yes	yes	universal thunk
Named pipes	yes (client)	yes	no (stubs)
Remote procedure calls	yes	yes	no
Threads	yes	yes	no (stubs)
Paths/beziers	yes	yes	no (stubs)
Win32 COMM API	yes	yes	no (stubs)
Console support	yes	yes	no (stubs)
Print APIs	yes (no forms)	yes	no (stubs)
Multimedia API	yes	yes	Windows 3.1 level
Remote access services	yes	yes	no
Enhanced metafiles	yes	yes	no
<b>Specific to Windows 95</b>			
Plug and play event aware	yes	won't get events	won't get events
Viewers	yes	not used	not used
Chicago style help	yes	won't appear	won't appear
Context menu help	yes	won't appear	won't appear
New authoritative buttons	yes	write own code	write own code
Mapi 1.0	yes	yes	no
Multimedia (ACM/VCR/VFW1.1)	yes	yes	no
Telephony API/Unimodem API	yes	no	no
File merge/reconciliation	yes	no (Cairo)	no
Image colour matching API	yes	no (Cairo)	no
Pen	yes	no (Cairo)	no
Chicago help cue cards	yes	no (Cairo)	no
Container namespace in Explore	yes	no (Cairo)	no
<b>Specific to Windows NT 3.5</b>			
Unicode Win32 API	no (stubs)	yes	no (stubs)
Event logging	no (stubs)	yes	no (stubs)
Service control manager API	no (stubs)	yes	no (stubs)
World transforms	scaling only	yes	no (stubs)
Async file I/O	no	yes	no (stubs)
Security API	no (stubs)	yes	no (stubs)
32-bit coordinate system	no	yes	no
Security (C2 certificate)	no	yes	no
Portable to non-Intel platforms	no	yes	no
Scalable to symmetric multiprocessors	no	yes	no

Figure 2 - Highlights of the problems facing developers writing portable Win32 apps

window with the contents of that being displayed inside. Obviously there is a problem with this approach to browsing the hard disk. When there were more than two levels of sub directory open at the same time I

found my desktop cluttered with windows (see Figure 1). And that was at 1280 by 1024 screen mode! Time to ask for a 21" monitor I think...

Missing File Manager already? Never

mind. Explorer may be just the remedy. It's File Manager, Jim, but not as we know it. It displays the filename along with its icon rather than an extension. The tree browser is far more complex.

A final note on the user interface itself is the *Property Dialog*. Any file is represented as an icon with associated properties. By right clicking on this icon we can view and change these properties via a tabbed dialog box. Now that really sounds familiar. Perhaps IBM should take a look.

To compliment the new GUI, Microsoft has redesigned its common dialogs. The **Save As** dialog box will have the option to create a new folder; **Open** will provide a Tree list for browsing the disk. There will also be **Property** dialogs. New Windows controls available will include tool bars, status bars, column headings, tabs, sliders, progress indicators, rich text controls, list views and tree views. Sounds suspiciously like the UI for Excel. I wondered when the guys in Applications would get round to following the MS style guide. As expected, the new controls and common dialogs will be available to our own applications through calls to the Win32c API.

## From 3.x to 95

The biggest obstacle for developers with the move is the change in APIs from Win16 to Win32c. Those using C++ or other object oriented languages will be shielded by the application framework. For instance, they should encounter no problems porting 16-bit MFC 2.5 to 32-bit MFC 3.0 - obviously the application will need to be rewritten to take full advantage of the 32-bit programming environment. Nevertheless, the source should be compatible. In the Visual C++ family of tools, Microsoft suggest all that will be required is a recompile. Borland has a similar strategy. It will offer a version of OWL for Windows 95 - again OWL 2.0 should be upwardly compatible.

The main problem will lie with developers who make calls directly to the Win16 API. As well as those people programming in C, developers who, say, call the Windows API from within Visual Basic, or MFC or an OWL application, will be affected. To write applications for Windows 95 these calls will need to be substituted for their Win32c equivalents. Of course, there is no developer today, who will risk writing to the Win32c API given Microsoft's track record on shipment dates. That will only occur when Windows 95 is ready in shrink wrap. The solution which Microsoft has proposed is a kludge: it's the Win32s API. It recommends we write our applications today in Win32s, suffer all the performance penalties from thinking down from a 32-bit API to a



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16-bit API and pray that our code will be more or less compatible with Win32c (see Figure 2). Again, to take advantage of features of the new platform, such as multi-threading, the source code will have to be modified.

To make matters worse, Microsoft has a third option up its sleeve: write to the Win32 API, the full blown 32-bit Windows API for NT. Consider it a superset of Win32c, although some of Windows 95's functionality is missing. What this will mean is that you can happily create applications that will run under Win32 and hence Windows NT. If you avoid using any special API calls, the source *should* run under Windows 95 - however it will still be necessary to modify it to make the most of the new features that this platform has to offer. Microsoft claims that in the meantime, we could target a base, albeit a small base, of Windows NT users. Somehow I think not... Anyone contemplating a move NT is looking for a robust operating system available on multiple hardware platforms which is fully capable of delivering outstanding performance to run their complex, mission critical application. Why would anyone write software for NT unless it specifically makes the best use of the operating system? Developers still interested in writing portable applications across the Win32 platforms should look at Figure 2 which lists the minefield of incompatibilities.

The best solution for developers is an application framework: and either MFC or OWL will be available for Windows 95. So it's hard luck to those of you who have laboured with C all this time. So long C, it's been nice knowing you... It seems, with the introduction of Windows 95, the most straightforward way to port code across will

be via an application framework. Perhaps it's all a ploy by Microsoft to rid the world of C programmers and, at the same time, deviously increase the sales of Visual C++.

### Best use of the API

Writing to the Win32c API will enable applications to take advantage of Windows 95's preemptive multi-tasking capability, flat address space, memory protection and long file name support. Unlike Windows 3.x, where a single message queue was used by the whole environment, each Win32c application has its own message queue and so is unaffected when another crashes. In Figure 3 messages are routed from the *Input Queue* to the message queue of the appropriate application.

Another feature of Win32 available in Windows 95 is *Structured Exception Handling*. Developers can protect a particular block of code so that if an exception occurs during execution of the block, the specified termination code will be executed.

Microsoft has also been working at eliminating the notorious 'Out of Memory' error common in Windows 3.x when it ran out of system resources. In Windows 3.x, when an application called the API, it would store necessary data structures to complete the call in two 64 KB heaps, GDI and USER. The error would occur if the amount of free memory in these dropped below a determined low threshold. In Windows 95 some of the data structure have been moved from these 16-bit heaps into their 32-bit equivalents. For instance memory hungry region objects which are used to create complex images for screen and hard copy, have been moved into the 32-bit GDI. The USER heap has also benefited by moving menu and window handles into the 32-bit USER heap.

Immediately this removes the 200 handle limit of Windows 3.x so that now it is possible to create a total of 32,767 menu handles and 32,767 window handles *per* process rather than system wide as was previously the case.

In NT there are no INI files; the same is true for Windows 95, although they are still supported for backwards compatibility. INIs have been replaced by the *Registry*, which serves as a central configuration store for user, application and computer specific information. It is a hierarchical database which extends the *Registration Database* for OLE in Windows 3.1 by adding keys that can take more than one value. Both textual and binary data can be stored including information contained within the WIN.INI, SYSTEM.INI and PROTOCOL.INI files. The registry comprises a number of files with the .DAT extension. For instance, SYSTEM.DAT stores device drivers that would have been in SYSTEM.INI; USER.INI contains information specific to a given user. In Windows 95 user profiles are stored allowing preferences such as desktop colours and folders present to be configured on a per user basis.

### The fate of DOS

While Microsoft will proclaim proudly that there are over 40 million copies of Windows in the world, the world of DOS is embarrassingly greater. 150 million users of DOS today. What will they do when Windows 95 attempts to supplant the world's favourite operating system. In the Beta 1 release of Chicago, MS-DOS is integrated into Windows. When the machine boots, it boots into Windows 95, although users have the option of loading DOS instead. Worse, the version of DOS, is a 32-bit version, intended for 386/486/Pentium class machines. What will happen to all the legacy hardware and software that's still being used today?

The fate of the hardware is simple. Eventually it will end up as scrap metal as less and less software is capable of running on it. The trend began with Windows 3.1 which upped the minimum processor requirements to that of a 286, killing off Real Mode and the 8086/88. Now with Windows 95, Standard Mode goes; so to has the 286. These were architectural decisions. The 386 was the first in the x86 family to offer demand page memory management, multi-tasking and true 32-bit processing. But now we have 32-bits. Soon raw processor performance will be the limiting factor. Already the 16 Mhz 386 is gone. It won't be long before the entire 386 family is retired.

But Microsoft will still face a problem in trying to convince users to abandon their investment in DOS software for shiny new

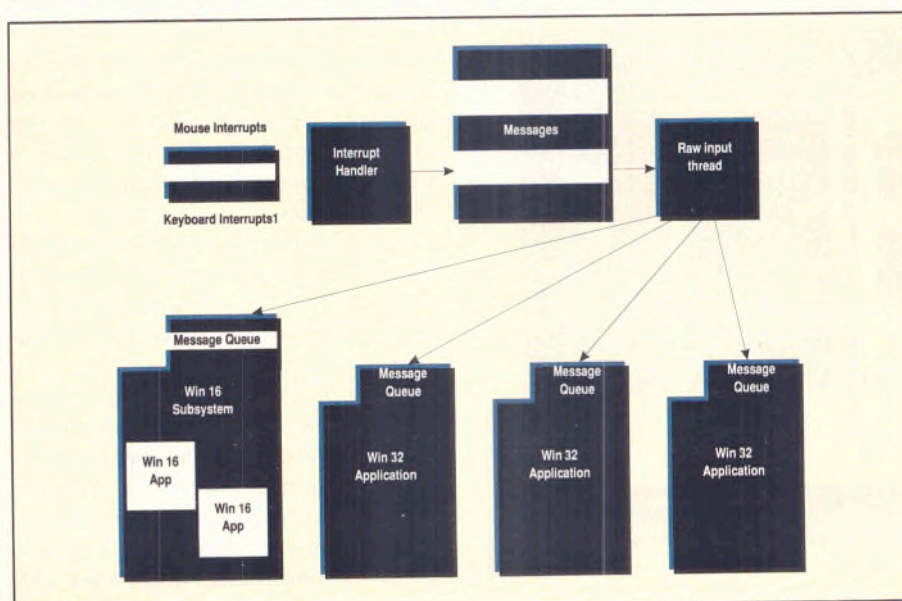


Figure 3 - Separate message queues should mean there are less UAs...



Windows, notorious for its sluggishness. The answer has been improved support for DOS within Chicago. Microsoft claims it has achieved better performance in terms of speed and available conventional memory, than Windows 3.x's DOS box. The aim is to reduce to zero the footprint required by Windows 95 to run a DOS box. To achieve this goal Microsoft has rewritten many of the commonly used DOS device drivers such as those for mouse, Novell/MS network clients and CD-ROM support, as 32-bit VxDs, which means they should, in theory, occupy no space in conventional memory. At one level the Chicago release provides a mechanism to hand over control exclusively to a running MS-DOS application. All that remains is a stub. In effect, this process entails unloading Chicago, firing up DOS and the application then reloading Chicago when the application ends. However, it is performed automatically. In Windows 3.x the user would be required to exit Windows himself. Well, there we have it: if it doesn't run under Windows 95 then dump Windows 95 and run DOS instead.

Support for DOS is achievable without taking such drastic measures though. Along with rewriting DOS device drivers, Microsoft has additionally provided virtual interfaces to devices such as timers and audio chips. Every games writer knows how to turn Windows 3.x to jelly: they run their games under it. But Microsoft wants Windows 95 to be a viable platform on which to run computer games. Routing direct access to the underlying hardware through virtual devices is one step, one barricade to prevent errant software or, to use MS' own words 'bad, MS-DOS based applications,' from thrashing the system. At least it has

agreed there's a problem: 'games are the most notorious class of MS-DOS application that don't get along well with Windows 3.1.' Now it has proposed a possible solution.

Further support for DOS is available through the *Real Mode Mapper* which provides an interface between a DOS device driver and the protected mode file system. The RMM is a kind of back door, a communication layer which takes requests from the real mode device driver and promotes them into protected mode and *vice versa*. It is useful for running software disk compression when a protected mode driver is unavailable.

### Win16 ever present

Now, all those Windows 3.x users out there, won't want to discard their existing 16-bit Windows software when they move to 32-bit. For a start, there may be some applications which are not ready when Windows 95 ships, although the likelihood of anyone not porting an application to Windows 95 in time is diminishing as the shipment date sails into mid '95. But not everyone will want to *buy* the new software. After all, they already have a word processor which works fine under their existing copy of Windows. So why change it?

To combat this Microsoft has opted to provide complete support in Windows 95 for the Win16 API. The way it works is illustrated in Figure 4. Here the Win32 and MS-DOS application run as individual virtual machines, with all Win16 applications grouped together in one unified address space.

This is unlike emulation of Windows 3.x in NT or OS/2. Under NT, the Win16 API is emulated in Win32; under OS/2 the entire

Windows 3.1 kernel sits on top of the operating system. The advantage, according to Microsoft, with the approach it has taken in Windows 95, is less burden on the system, both in terms of performance and in terms of memory requirements. Running separate Win16 virtual machines would have incurred an additional penalty of 2 MB for GDI, USER and KERNEL code *per* application.

The system deposits all Win16 applications into one virtual machine, rather like dirty laundry in a basket, so that when one crashes the most it can do is soil the address space of itself or the others. The virtual Windows 3.x machine will freeze, but, with any luck, the system should remain unaffected. Microsoft goes further. Not only do Windows 3.x applications have a separate virtual machine for themselves, there is also a separate message queue as well. When a Win16 application hangs, the system keeps running. Could this be an attempt by MS to conceal the fact that there's something seriously wrong with Windows 3.x multi-tasking, I wonder?

Since they run in a separate unified address space, when a Win16 application disgraces itself, leaving system resources allocated in memory, Windows 95 is not affected. System performance is not degraded. Instead, Windows 95 keeps track of when a Win16 application requests system resources. When the application aborts, this information is used to deallocate any resources that had not been freed.

### Why move?

For the commercial software developer who has prospered under the Windows 3.x umbrella, there is a dire need to venture to a fresh playing field. Competition is hot. The whole industry is spinning on the momentum of the upgrade philosophy. Put simply this means the long term financial success of a given software product relies more on the sale of upgrades to existing users than on new and original sales. The market is saturated; more and more companies are selling upgrades.

The drive for new and innovative technologies is being suffocated as the umbilical cord of software development, the R & D budget, is squandered increasingly on 'improving' existing product lines.

So Windows 95 will offer the software developer a new platform; a new opportunity to explore. At its birth, the market will be small; almost niche. While the WordPerfects, the Lotus of this world battle with their massive user base, smaller software houses will have a chance to get in first with their products and so create a following before the heavyweights get on board. ■

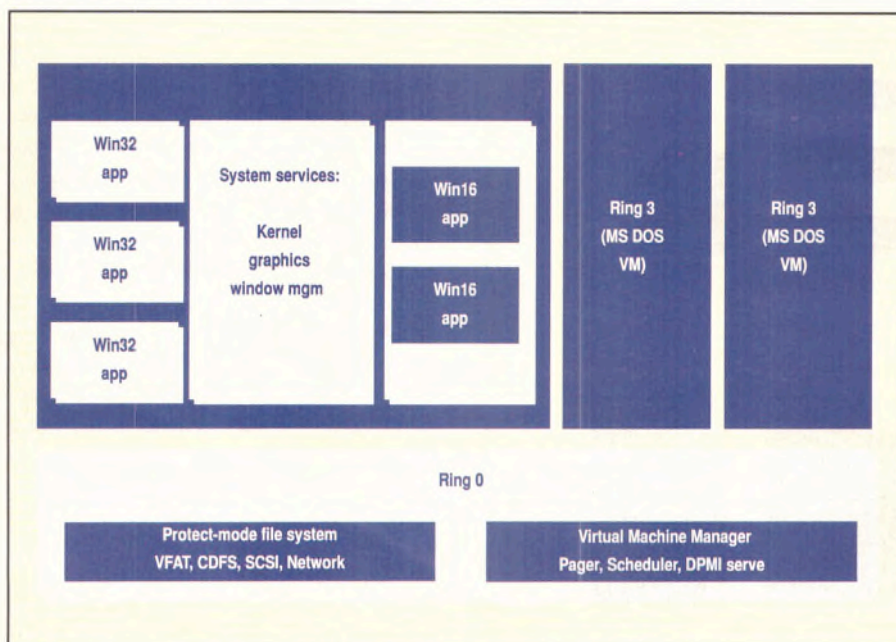


Figure 4 - Even Microsoft doesn't trust Win 16 apps



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# Windows for the faint-hearted

The easiest way to port a non-Windows program to Windows is to use Turbo Pascal's WinCrt or Turbo C++'s EasyWin. These are libraries that let you take an ordinary non-windowed program and run it in a window with practically no changes. Michael Covington explains how...



Take a standard DOS text-mode application and compile it for Windows. What you get when you run it is a text window - that is, a window that acts like a plain old DOS text screen (or traditional computer terminal) except that it has scroll bars so that you can look back at several screenfuls of previous output. But a text window does have its limitations. In this article I'll show you how to reach beyond it and access other features of Windows, such as message boxes and file dialogs, without restructuring your text-oriented code. My examples will be in Pascal; at the end I'll describe briefly how to convert them to C. I'll assume you have access to Windows documentation (after all, it's online in both Borland Pascal and Borland C++) and that you can look up further details once I point you in the right direction.

## Windows basics

Figure 1 shows how to control the text window itself. The crucial procedures are in the units WinProcs, WinTypes and of course, WinCrt. First consider the title of the main window when the program is running. By default, the title is the name of the program file (such as MYPROG.EXE). To select a dif-

ferent title, perform the system calls StrCopy

```
(
  WindowTitle,
  'Your Name Here'
);
```

InitWinCrt;

before performing any screen input or output (Figure 1). Here WindowTitle is the variable in which WinCrt keeps the window title before initialisation. If you don't call InitWinCrt explicitly, the first screen I/O operation will do so automatically. To change the title after the program starts up you call the function SetWindowText() as follows.

```
SetWindowText
(
  GetActiveWindow,
  'New Title Here'
);
```

Here the first argument, GetActiveWindow represents a function that returns the handle of the main window. To make the window visible call ShowWindow(). The second parameter determines the size. ShowWindow

```
(
  GetActiveWindow,
```

```
PROGRAM wincontrol;
{ Control of the main window under WinCrt. }

USES WinCrt, WinProcs, WinTypes, Strings;

VAR saved_cursor:  HCursor;
    i:              integer;

BEGIN
  { Set the window title. Must do before
    any output. }
  StrCopy(WindowTitle, 'A Sample Program');
  InitWinCrt;
  write('Press Return...'); readln;

  { Change the window title. }
  SetWindowText(GetActiveWindow, 'An Example');
  write('Press Return...'); readln;

  { Maximize the window. }
```

```
ShowWindow(GetActiveWindow, SW_SHOWMAXIMIZED);
write('Press Return...'); readln;

{ Back to normal size. }
ShowWindow(GetActiveWindow, SW_SHOWNORMAL);

{ Change mouse cursor to hourglass. }
write('Wait a moment, I'm thinking...');
saved_cursor := SetCursor
  (LoadCursor(0, IDC_WAIT));

{ Sleep a moment, }
{ then put cursor back to normal. }
FOR i:= -32767 TO 32767 DO Yield;
SetCursor(saved_cursor);
write('Finished. Press Return...'); readln;

{ Make the window disappear. }
DoneWinCrt;
END.
```

Figure 1 - Controlling the main window



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```

PROGRAM popups;
{ How to use message boxes}
{and WinExec      under WinCrt. }

USES WinCrt, WinTypes, WinProcs;

VAR result: word;

BEGIN
{ How to put up a message box }
writeln('Hello, this is ordinary output.');
```

```

  MessageBox(GetActiveWindow,
    'Look!', 'This is a message box',
    MB_OK);
  writeln('Press Return...'); readln;

{ Message box with a choice of responses }
CASE MessageBox(GetActiveWindow, 'Look at this',
  'In this box you make a choice', MB_YESNOCAN-
CEL) OF
  ID_YES: writeln('You said YES');
  ID_NO:  writeln('You said NO');
  ELSE   writeln('You said CANCEL');
END;
```

```

{ How to run any .COM, .EXE, .BAT, or}
{.PIF program }
writeln('Next we''ll run the Notepad for a
  moment...');
write('Press Return...');
readln;
result := WinExec('notepad
  myfile.txt', SW_SHOWNORMAL);
{ Other program runs CONCURRENTLY}
  this one! }
{ Execution continues here as soon as}
{ the WinExec'd process STARTS.}
```

```

IF result < 32 THEN
  writeln('Couldn''t run it, return code=',
    result)
ELSE
  writeln('Running it successfully, thanks');
  writeln('Back to the main window. Press
    Return...');
  readln;
END.
```

Figure 2 - Adding a message box and spawning NOTEPAD

```

  SW_SHOWMAXIMIZED
);
```

This maximises the main window. As you might guess, `SW_SHOWNORMAL` returns it to normal size.

It is often useful to alter the mouse cursor for instance to switch between a pointer and an hourglass.

```

var saved_cursor: HCursor;
saved_cursor :=
  SetCursor
  (
    LoadCursor(0, IDC_WAIT)
  );
```

Here `IDC_WAIT` is the code for the hourglass shape. The documentation for `LoadCursor()` lists the other predefined cursors that are available. Since the return variable `saved_cursor` stores the original cursor, all you have to do to get it back is call `SetCursor` again.

```
SetCursor(saved_cursor);
```

### Getting the msg across

Message boxes are the easiest kind of window to create, because they aren't event-driven (at least not from the programmer's point of view). Figure 2 lists the code to display pop-up message boxes and shell out to another Windows application. To display one only requires a single call to `MessageBox()`.

```

MessageBox
(
  GetActiveWindow,
  'Look!',
  'This is a message box',
  MB_OK
);
```

The `MB_OK` parameter says that the message box should have a single OK button. The return value is used to determine the ID of the button which was pressed when the dialogue contains more than one eg:

```

CASE MessageBox
  (
    GetActiveWindow,
    'Your Title',
    'Your Message Here',
    MB_YESNOCANCEL
  )
OF
  ID_YES: {...};
  ID_NO:  {...};
  ELSE   {...};
END;
```

Here `MB_YESNOCANCEL` identifies the kind of box (alternatives include `MB_OKCANCEL` and `MB_ABORTRETRYIGNORE`). `ID_YES` and `ID_NO` are predefined constants containing return codes. By default, message boxes are application modal, which means that the calling program stops in its tracks to await a response, but the user can still switch to other concurrently running programs and continue working.

The option `MB_SYSTEMMODAL` makes the message box system modal, so that the user can't switch tasks until he has dealt with the message box. Use `MB_SYSTEMMODAL` sparingly and only for situations that justify bringing the whole system to a halt. The various flags can be combined with the + operator or OR.

### Running other applications

As I explained briefly above, the listing in Figure 2 can be broken down into two func-

tions: display a popup message box and spawn another Windows application. The function `WinExec()` performs the latter task. So, to run NOTEPAD and load MYFILE.TXT use:

```

WinExec
(
  'notepad myfile.txt',
  SW_SHOWNORMAL
);
```

Here the string contains the name of any DOS or Windows .COM, .EXE, .BAT, or .PIF file, followed by any command line arguments to be passed to it. `WinExec()` is what Program Manager and File Manager use to implement their Run... option. Its requirements are much the same. As you may have figured out, `SW_SHOWNORMAL` means that the window should start out normal-sized rather than maximised.

Unlike similar operations in DOS, `WinExec()` multi-tasks. That is, it will return control to the calling program as soon as the other program has started, without waiting for it to finish. So if the calling program needs to wait for some kind of result from the `WinExec'd` process, it will have to pause somehow and wait; a simple kludge is to make it wait for keyboard input. This is what I have done in Figure 2. What we really need is a Windows genius to write `WinExecAndWait()`. Any volunteers?

### As common as dialogs

As every good software developer knows one of the virtues of Windows is the common dialog boxes which provide instant, built in routines to open and save files,



```

PROGRAM filedialogs;

USES WinCrt, CommDlg, WinProcs, Strings;

VAR infilename, outfilename: ARRAY[0..63] OF
char; {=PChar}
    infile, outfile:      text;
    filedata:            TOpenFileName;
    junk:                STRING;

BEGIN

writeln('Demonstrating how to select files...');

{ Select a file to READ. }
StrCopy(infilename,'junk.txt'); { put default
name here }
FillChar(filedata,sizeof(filedata),0);
WITH filedata DO
    BEGIN
        lStructSize      := sizeof(filedata);
        hWndOwner        := GetActiveWindow;
        lpstrFile         := infilename;
        nMaxFile          := sizeof(infilename);
        lpstrInitialDir   := 'C:\JUNK'; { default
directory, if any }
        lpstrTitle        := 'File to read';
        lpstrFilter        := 'All Files' #0'*.txt' #0;
        { can be omitted }
        Flags              := OFN_FILEMUSTEXIST +
                                OFN_PATHMUSTEXIST +
                                OFN_READONLY;
    END;
IF NOT GetOpenFileName(filedata) THEN
    writeln('You were supposed to choose a
file name!');

{ Now infilename contains the file name. }
writeln('The input will be read from: ',
infilename);

{ Select a file to WRITE. Insist that it not
already exist. }
StrCopy(outfilename,'unnamed.txt'); { Put
default name here }
FillChar(filedata,sizeof(filedata),0);
WITH filedata DO
    BEGIN
        lStructSize      := sizeof(filedata);
        hWndOwner        := GetActiveWindow;
        lpstrFile         := outfilename;
        nMaxFile          := sizeof(outfilename);
        lpstrInitialDir   := 'D:\junk';
        lpstrTitle        := 'File to create';
        lpstrFilter        := 'Text File' #0'*.txt' #0'
                                ASCII File' #0'*.asc' #0;
        Flags              := OFN_OVERWRITEPROMPT +
                                OFN_PATHMUSTEXIST +
                                OFN_HIDEREADONLY +
                                OFN_NOREADONLYRETURN;
        lpstrDefExt        := 'txt'
    END;
IF NOT GetSaveFileName(filedata) THEN
    writeln('You were supposed to choose a
file name!');

{ Now outfilename contains the file name. }
writeln('The output will be written on: ',
outfilename);

{ Trivial demo: copy 1 line from 1 file to
the other }
assign(infile,infilename); reset(infile);
assign(outfile,outfilename); rewrite(outfile);
readln(infile,junk);
writeln(outfile,'First line was:',junk);
close(infile);
close(outfile);
writeln('All done.');
```

Figure 3 - Using common file open and save dialogs

change the palette and print.

For the file dialogs the routines are named `GetOpenFileName()` and `GetSaveFileName()` respectively. Each of them returns `true` if the user chooses a file and `false` if the user cancels out or the procedure fails for some other reason. Additionally, a successful file dialog stores the full name of the file (including path) in a character array of type `PChar` but does not actually open the file.

The common file dialogs are controlled by a large data structure of type `TOpenFileName`; the easiest way to create such a structure is to fill it with zero bytes, then set non-default values in appropriate places. Figure 3 shows two examples. The most important fields are listed in Figure 4.

The way the file name is stored deserves a moment's thought. It's a null-terminated string. That is, it's an array of characters, and the file name will be stored in it, termi-

nated by a zero byte. This is the usual kind of string in C but not in Pascal. Accordingly, Listing 3 declares

```

infilename, outfilename:
    ARRAY[0..63] OF CHAR
```

### One of the greatest inventions in all of computer programming was the text file

(not `string[64]`). Further, Turbo Pascal's extended syntax allows you to use the names `infilename` and `outfilename`, without subscripts, to denote pointers to the beginning of the array. Thus, `infilename` and `outfilename` are effectively of type `PChar`, ie pointers to null-terminated

strings, even though they aren't declared that way.

Finally, note that every file dialog includes a set of templates, such as `*.*`, `*.TXT`, or the like, to control which file names are visible on the menu. Each template has a name, such as 'All files' as well as a pattern, such as `*.*`.

If more than one template is provided, the user can choose among them by popping up the `List files of type...` submenu. The list of templates is placed in the `TOpenFileName` structure as a sequence of zero-byte-terminated strings ending with a double zero byte ( ie `lpstrFilter := 'Text Files' #0'*.txt' #0'Batch Files' #0'*.bat' #0`). Here a Pascal string constant, adorned with several zero bytes, is being assigned to a `PChar` variable, which means that an extra zero byte gets appended at the end.



Istructsize	the size of the structure itself (for memory protection)
hWndOwner	the handle of the parent window (which you can obtain using GetActiveWindow)
lpStrFile	a pointer to a character array (not Pascal string) where the file name is to be placed
nMaxFile	the number of characters available there; and Flags, various options such as OFN_FILEMUSTEXIST, OFN_PATHMUSTEXIST, and OFN_READONLY (true if it's OK to choose a file that can only be read, not written).

Figure 4 - Description of important fields in TOpenFileName structure

### What about C?

Everything that I've described here has a direct counterpart in Borland C++. The program should begin with the following includes:

```
#include <windows.h>
#include <dos.h>
#include <stdio.h>
#include <conio.h>
```

You'll also need a few declarations, which should have been in CONIO.H but aren't:

```
void _Cdecl
_DoneEasyWin(void);
extern char _Cdecl
_WindowTitle[80];
```

To initialise the window, first strcpy the appropriate title string into \_WindowTitle, then call \_InitEasyWin(). To close the main window at the end, call \_DoneEasyWin(). The other system calls

work in much the same way as in Pascal, except of course that function names begin with underscores and data types are suitably adjusted. The Windows API documentation tells the whole story.

### Microsoft's Big Omission?

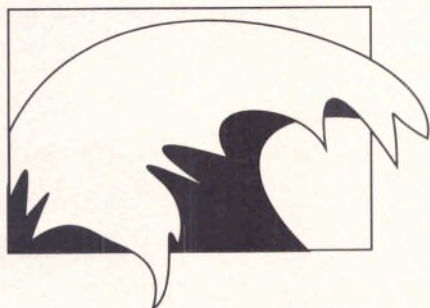
In my opinion, a serious limitation of Microsoft Windows (and the Macintosh OS too) is that text windows aren't built in; Borland had to implement them specially for Turbo Pascal and Turbo C++. One of the greatest inventions in all of computer programming was the text file. Its key insight is that a disk or tape file can record exactly the same data that would be displayed on the screen or read from the keyboard. A program can decide at run time whether to use the console or the disk. Its data-formatting requirements don't change. Indeed, with

Unix-style redirection, the program might not even know whether it's using the disk, the console, or some other device.

Windowing originated on Lisp machines, where all windows are, by default, textual. It's easy to write a program that conducts its main user interaction in one window while writing debugging information in another and keeping up a graphical display in a third. Each window is an I/O stream, and most can display text and read from the keyboard. Not so for the Macintosh or Microsoft Windows where text windows are banished. The goal was to force all software to use a menu-driven interface (as if all programs were editors). The sad side effect is that there is no way to record program output on a text file, nor can an ordinary program write on the screen without elaborate system calls. Is this progress?

The rumour mill says that Chicago might support text windows; OS/2 already does (clumsily), and so does AmigaDOS. *Viva la revolucion.*

*This article first appeared in PC Techniques. Michael Covington does artificial intelligence research at the University of Georgia. He can be reached on email as mcovingt@i.uga.edu.*



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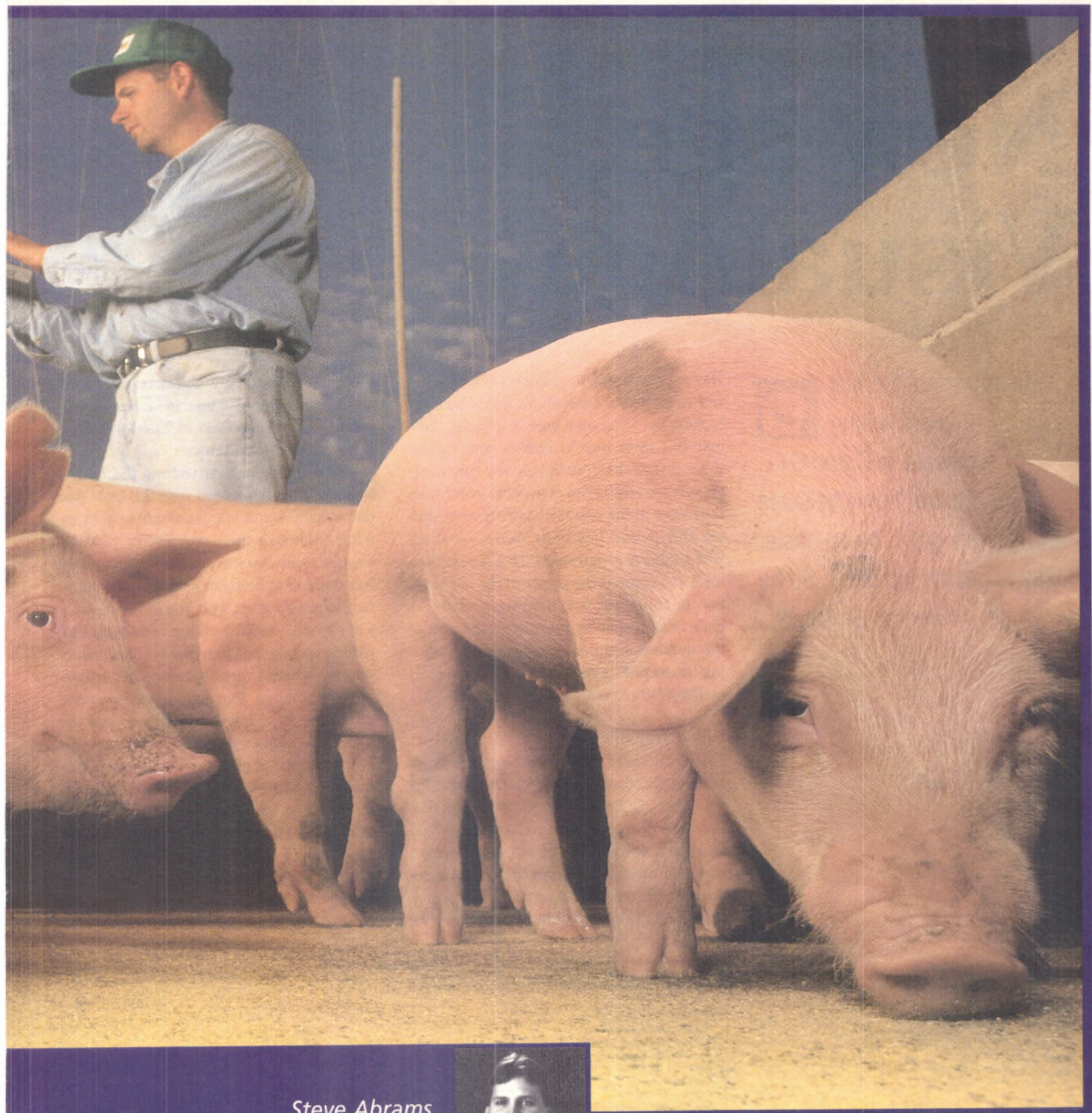
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# New age, VisualAge

Having spent the last 12 years writing software in C and C++,



**Alan Flower** firmly believes that there's got to be an easier way to get the job done. So he went to Smalltalk...

Having converted to Object Technology a few years back I must admit that things are looking up. I can save time by reusing code and can even buy in classes and extend them myself. I can definitely say that applications are rolling out somewhat faster than they were in the past. Most of my work during this period has been with C++ which was a natural progression for a C programmer. I've enjoyed the power of the language but, to be honest, it is hard work. Bad C++ code is as cryptic as ever. I've lost count of the number of times I've given up on reusing someone else's classes because I couldn't fathom out what was going on.

## Better way than C++

I need an easier way of building object oriented applications. Not only that, I need to develop for OS/2 and other platforms besides. I've looked at tools such as Visual C++ and have, well, written them off as falling far short of what I want. A few years back I was introduced to the Smalltalk language which struck me with its flexibility and the pureness of its

implementation of key object oriented concepts. Moreover it came in a neatly integrated environment that included a built in debugger and class browser.

Although impressed with its flexibility I was less than impressed with the tools that one usually found in a Smalltalk implementation. Although there was always good debugging and class browsing support there was nothing to help put a decent user interface together. Even with one of the new object based visual editing environments putting an interface together is still a pain in the proverbial. I wish there was better integration between the editing environment, the elements of my user interface and the underlying classes within my application. So here we are, the object revolution is underway yet I still find that I haven't quite discovered that ultimate tool that will bring it all together. However, I've recently been using VisualAge which IBM claims is the tool that will satisfy the demands of people like myself and make object technology viable for many developers.

VisualAge allows you to build applications rather quickly when compared to traditional 3GLs

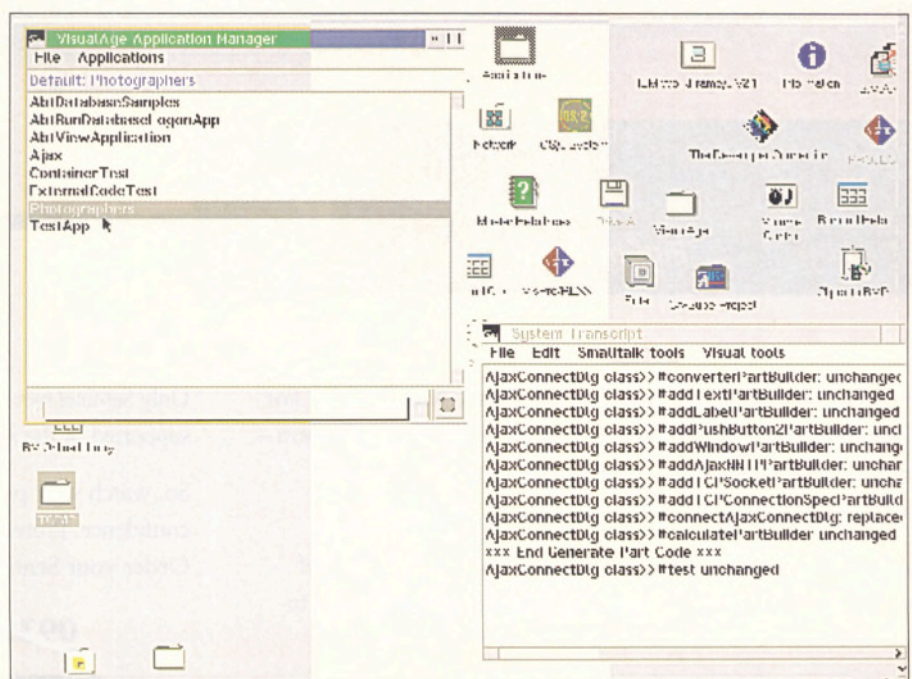


Figure 1 - VisualAge Application manager



## Just a scripting language

VisualAge is a new product that aims to pull a lot of IBM's object technology together under one roof and make it far easier to implement object oriented applications. In a nutshell, VisualAge is Smalltalk with a pretty face. Having said that, it is interesting to note that the presence of Smalltalk within this product is not exactly shouted from the hoardings by IBM. There is good reason for this, for VisualAge is a lot more than just Smalltalk. Smalltalk is relegated to the function of a 'simple scripting language' in IBM parlance. The key feature of VisualAge is its ability to allow developers to build Smalltalk applications easily and quickly using its built in visual tools.

So, what exactly can it do? Well, as its name suggests, this is very much a 'visual' tool. Figure 1 illustrates a simple application that I built around a DB2/2 database containing the names and addresses of photographers in my area. The application allows me to enter search criteria, step backwards and forwards through the results table and update individual records. You will be relieved to hear that VisualAge can also support other relational databases such as Oracle and SQL Server through the use of the *Multi-Database Feature*.

The VisualAge 'code' that produced this mini-app is shown in Figure 2. In fact, there isn't any code because I didn't need to write a single line. The entire application was produced from standard parts using the *Composition Editor* (see Figure 3). VisualAge comes complete with masses of ready assembled classes aggregated into 'parts' that can be utilised in any application you build. Using the Composition Editor you simply connect parts together.

The complete application shown in diagram 1 took me all of 16 minutes to build and test. Packaging this application into a standalone .EXE file, not an easy task in a Smalltalk environment, took another 4 minutes. So, in 20 minutes I built an app that would have taken me, say, the best part of three or even four days using a more traditional combination of C, Presentation Manager, OS/2 Toolkit, a dialog editor and the DB2/2 API. This dramatic improvement in productivity illustrates not only the universal benefits of object technology but more specifically, the ease with which applications can be assembled using VisualAge.

## Built for speed

So VisualAge allows you to build applications rather quickly, especially when compared to traditional 3GLs. But why? First, we need to look in more detail at what is in the standard VisualAge software. This includes a complete Smalltalk environment

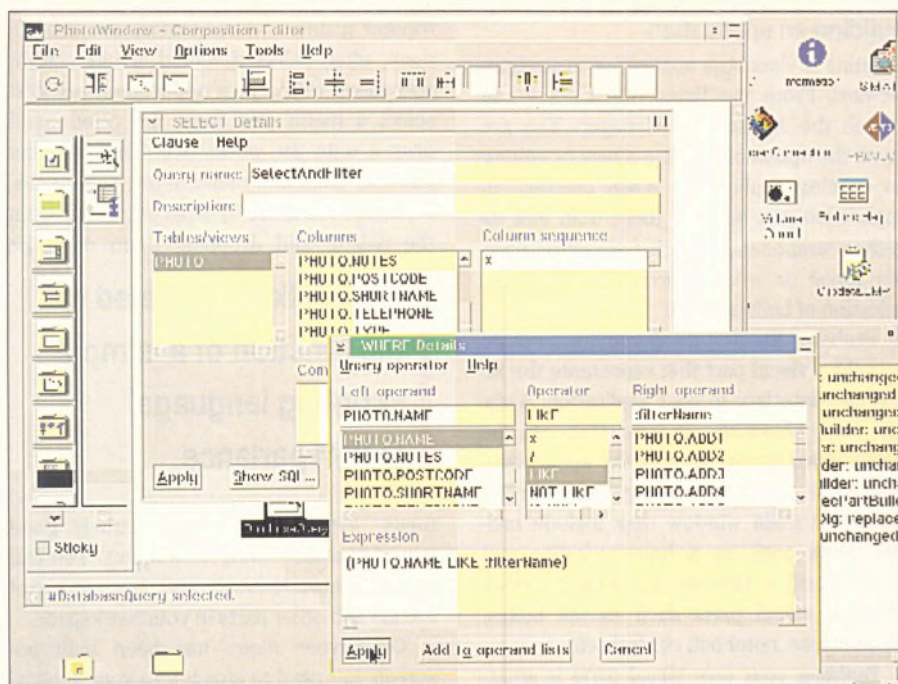


Figure 2 - Photographers' database 'code'

(debugger, browser, etc); a visual editor consisting of Composition, Interface and Script editors; a large library of parts and support for interfacing to C code. It is the combination of Smalltalk and the associated visual tools that form the basis of this product's attraction. When used with the large

## What makes the visual tools particularly powerful is the integration between them

selection of supplied parts it is very easy to avoid having to write large amounts of new code.

Any Smalltalk user should feel at home with VisualAge. In fact, when you start it up, it gives the familiar look and feel of a Smalltalk implementation. As you would expect, the Transcript window, class browser and debugger are all there. However, because VisualAge is based around a standard Smalltalk environment initially it does not look too promising to the newcomer: the omnipresent Transcript window (see Figure 4) may cause some initial confusion. However, any experienced Smalltalk user will be able to dive straight in and get working with this product.

## Talking big...

VisualAge is a big product. Depending on what add-ons you opt for you need to bank on giving upwards of 40 MB of disk space to it. This figure will keep on growing as you add your own parts to the system. Fortunately, the software is supplied on both CD

and diskette. Installation from CD is painless and only takes a few minutes.

Additional products available for VisualAge include Multi-database, Communications, Multi-media, and Cobol support. All of these features are supplied on their own CDs. There is a two-stage installation process for loading up these add-ons. After the files have been physically installed on the target disk the components have to be integrated into the VisualAge/Smalltalk environment. There is an additional Installation option available from the Transcript window from which you select those components that you require. This second stage can be quite tedious as it can take several minutes for the Smalltalk image to be updated with all of the new parts from these components.

Once you have installed all of the features that you wish to use you can begin developing applications using VisualAge. It is at this point that you are likely to encounter one of the fundamental disadvantages of any Smalltalk environment and, in particular, VisualAge. It is slow, indeed frustratingly slow, on anything less than a powerful 486 machine. This is because most of the VisualAge environment is written in Smalltalk and constantly encounters the classic Smalltalk trade-off: flexibility versus performance. If you plan on using the visual tools extensively then I would certainly recommend having at least 24 MB of RAM on your development machine. Of course, these are the requirements for VisualAge itself. The applications you create run within their own slimmed-down Smalltalk image and will run on any 486 with 8 MB which, fortunately, is probably the amount of storage a typical OS/2 machine has these days.



## Building an application

Creating a VisualAge application is straightforward. From the Transcript window you launch the Application Manager. You are given the option of creating a new or editing an existing application. When creating an application you do little more than link together component parts that are either user-developed or selected from the extensive selection of built-in parts.

Probably the first thing you'll want to do is build a visual part that represents the initial user-interface to your application. A visual part, obviously, is one that can be manipulated by the user of the application. The visual part representing, say, your application's main window may include control items such as a frame window and menu together with any of a wide selection of other visual parts such as list boxes, pushbuttons, notebook controls etc.

Building your own visual parts is amazingly simple with the Composition Editor. This is probably the best user interface editor I have ever encountered. It gives you various on-screen palettes of parts and an application workspace area onto which you position your chosen parts. From the parts palette you select the part you require, then simply drop it at the required on-screen location. There is also the usual selection of layout tools that will ensure your controls are aligned correctly within your window.

The Composition Editor is much more than just a good interface editor. It is also the main tool for specifying the behaviour of your application allowing you to create relationships between the parts of your application. For example, if you wanted to give a

window a menu whose sub-menus and options, when selected, would invoke certain operations within your application, you first select a menu part from the palette and drop it onto the workspace. To this menu you may then add menu items, sub-menus, separator bars, etc by selecting them from the palette and dropping them onto the

## Smalltalk is relegated to the function of a 'simple scripting language' in IBM parlance

menu. VisualAge makes extremely good use of in-place editing techniques. You can easily change the text and appearance of menus and other parts in your workspace.

Once your menu has been built on-screen you need to attach it to your application's window. A click on the second mouse button will give you a pop-up menu for the selected part. From this you may connect the part to any other part. Parts are connected by drawing a line between them that represents the chosen type of connection.

There are four kinds of connections that define how parts interact with each other. The *Event-to-Action* connection is most common. This will invoke a method (action) in response to certain events. For example, in response to the `clicked` event that occurs when a push button is depressed a connection might invoke the `closeWidget` action on an application's frame window and thereby close the window whenever the button is pressed.

The *Attribute-to-Attribute* connection links two data values together to ensure they always have the same value. For example, you could connect the `fontName` attribute of a listbox to the `title` attribute of a window to ensure the window title always displays the name of the listbox's font.

The *Attribute-to-Script* connection will invoke a piece of Smalltalk code to calculate the value of an attribute. A typical example would be to use such a connection to calculate an account balance whenever the balance was referenced.

The final connection type is *Event-to-Script*. This will run some Smalltalk code whenever a certain event occurs. For example, if you wanted to initialise certain fields within a dialog prior to use you could make an *Event-to-Script* connection from the `aboutToOpenWidget` event of your window to your own Smalltalk code that would perform the initialisation.

## Adding code

The Smalltalk code for your own parts is typically written using the Script Editor. Once you have the relevant part loaded in the Composition Editor you can move to the Script Editor. The Script Editor knows about the definition of your part and, when you need to reference a component of the part, can save time by giving you the code to get/set attributes or invoke actions on the component. Also, whenever you need to write a new method it will supply you with a basic template which you can build on.

If you need it, there is also a feature that will drop in a code template for basic Smalltalk language features such as that required for `ifTrue:` or `do:` statements. I didn't find this very useful as it took too many key/mouse strokes to use and would be far better if it was hotkey enabled so that you could insert a code template immediately just by hitting the correct sequence.

The editor itself is little more than a basic MLE and is therefore very limited in its text editing capabilities. Unfortunately, it is not possible to configure VisualAge to use an alternative editor so you are stuck with this one. However VisualAge, like most Smalltalk environments, does offer the lengthy alternative of being able to import code from an ASCII file that you may have created using your own favourite editor.

## Small talking to the public

Once your part is complete you might like to ensure that it can be reused in future. For this you need to switch to the Public Interface Editor. From here you can specify the attributes, actions and events which form the interface of your part. This editor is implemented as a notebook control with each

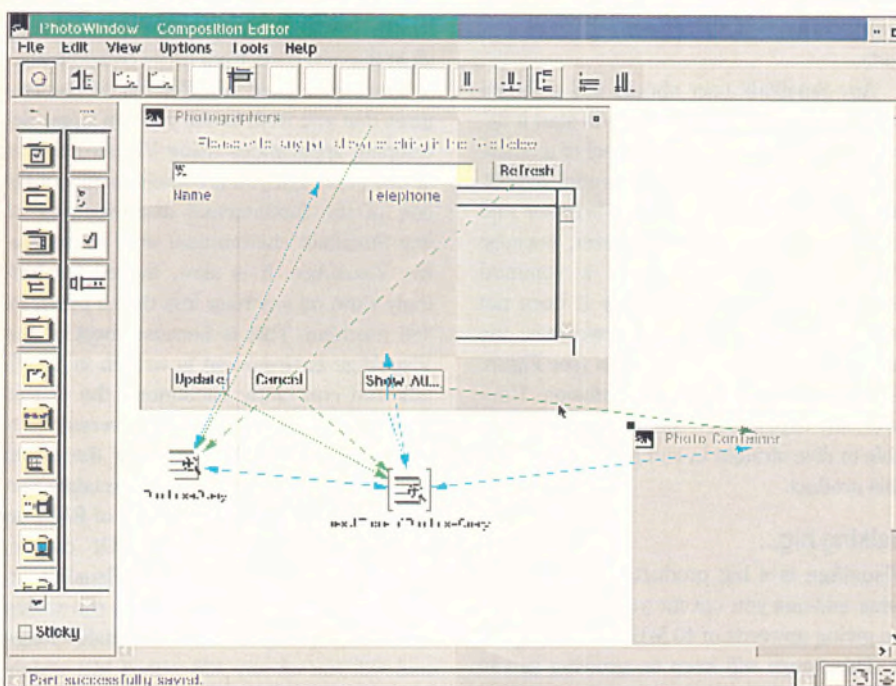


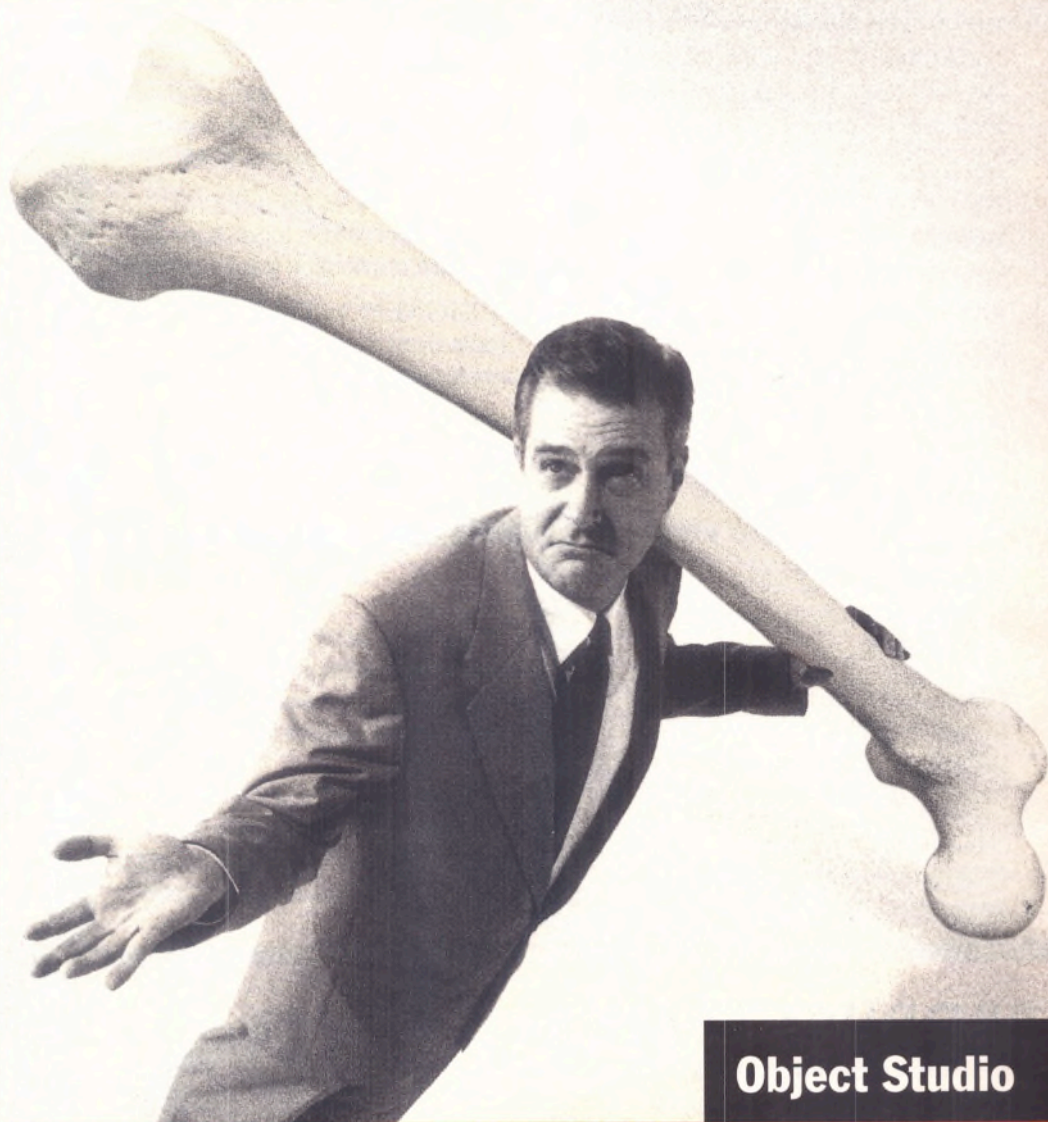
Figure 3 - Composing parts with the Composition Editor



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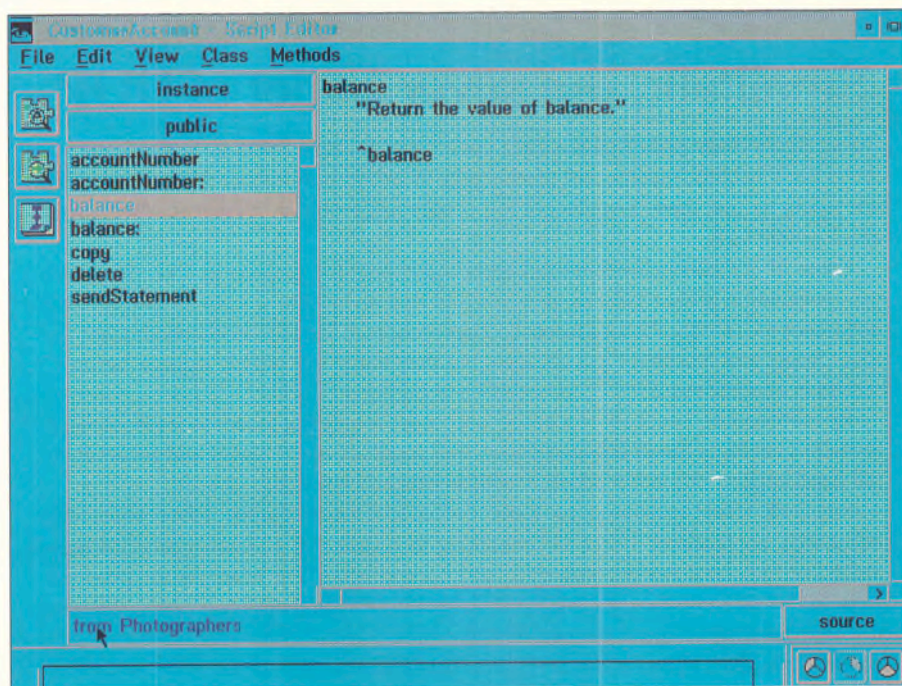


Figure 4 - The omnipresent transcript window

page used to edit one aspect of the part's interface.

Specifying attributes is easy. You simply enter each attribute's name and type. As each attribute is specified you can tell the Public Interface Editor to generate default `get` and `set` code that can be used to access the attribute.

The Event page of the editor is where you define the messages that your part uses to communicate events to other parts. For example, a `CustomerAccount` part might use a `creditLimitExceeded` event to inform other parts when a customer has over-spent.

The Actions page defines the actions that can be invoked on your part by others. An action is synonymous to a function call in procedural languages. When defining each action you also specify the name and types of any parameters that might be passed to the action.

What makes the visual tools particularly powerful is the integration between them. For example, once a part has been defined in the Public Interface Editor, the Composition Editor automatically gets to know the details of the part's public interface. Thus, you may add a part you have written yourself to the Composition Editor's workspace and make connections to it just as you would do with the built-in parts. An example of this might be in the use of a `CustomerAccount` part that you may have created. When added to the Composition Editor it becomes very easy to start using it from other parts. You might want to have a push button whose `clicked` event is connected

to the `sendStatement` action of the `CustomerAccount` part, for instance.

### Reuse tricky

Parts you write yourself can be placed in the Composition Editor in two ways. First, you

**Most of the VisualAge is written in Smalltalk and constantly encounters the classic Smalltalk trade-off: flexibility versus performance**

may simply select the `Add Part...` menu option and key in the name of the part. This can be error-prone because there is no facility to browse or search on names. Trying to recall the name of a class/part you built several weeks earlier can be a hit and miss affair. I often found myself calling up the Smalltalk class browser just to search for the name I wanted.

Second, you may wish to add your own parts to the Composition Editor's parts palette. This would be the best way of packaging many parts that you intend to reuse repeatedly. The only drawback with this approach is that should you decide to use your own unique icons to represent your parts then you have to build your own DLL containing the icon resources. Then for each part specify both the name of the DLL and ID of the icon which will represent the part in the palette.

### Calling others

Of course, IBM correctly recognised that there is no way that many established developers can drop their existing procedural code and replace it overnight with shiny new Smalltalk code. VisualAge has the ability to call C routines that are held in DLLs. These are accessed via *C External Routine* parts. To configure this type of part requires the names of both the DLL and the function to be called. Then, to obtain the correct parameter information for the function call VisualAge can parse either the header or source files.

If you have the source code it is easier to let VisualAge trawl through it and present you with a list of functions from which to select the one that you want. However, there is one flaw with this approach that makes this feature almost unusable. The file parsing code is written in Smalltalk and the performance is abysmal, especially on large files.

I wanted to call a function that happened to reside in a large C file which also included many header files. It took VisualAge 30 minutes to get through that lot. I found it far easier to produce a trimmed down source file that included only the essential header files and contained empty definitions for the exportable functions.

IBM also offer the *COBOL Feature* which provides similar functionality and allows existing legacy code to be brought into the present. This is a very good move and counters a common barrier that prevents the migration to object technology in many corporates.

### Talking Multimedia

There are also *Multimedia* and *Communication* features available that are likely to become essential to any serious VisualAge developer. The Multimedia feature, which I didn't use myself, gives you parts that provide easy access to the powerful multimedia Presentation Manager APIs.

The Communication features include support for NetBios, TCP/IP, EHLLAPI and APPC communications. For simple transactions these parts will do almost everything for you. What's more, if you are communicating with a program written in C or COBOL you can parse the packet/record definitions straight out of a header file and into VisualAge. The relevant communication parts will automatically pick up and use the right packet definition.

### Runs like a slug...

I experimented with the TCP/IP support and decided to use it to build a tool to test



an Internet news server. Using the socket classes couldn't have been easier. I was talking to the news server within minutes.

The entire application was built in less than a week. This was a project that I had anticipated taking three or four weeks using C++, and the IBM TCP/IP Toolkit. The only drawback was the performance. It wasn't nearly as fast as using C++ but at least the communications parts, which I assume use a large amount of non-Smalltalk code, performed adequately.

The relatively slow performance of some VisualAge applications has to be balanced with the time savings available. I'm sure many companies would rather accept slightly slower run time performance in return for getting the application built in less than half the time using VisualAge.

Of course, with hardware getting cheaper all the time the performance of Smalltalk applications become less of an issue. But rather than upgrade to 100 MHz Pentium a more practical solution to the performance issue is to write your speed critical code using another language and call it from within VisualAge.

Better still, SOM (IBM's implementation of the OMG CORBA standard) support has recently been included with VisualAge. Thus, a VisualAge application can now utilise objects implemented in other languages such as C++, opening up many interesting possibilities.

### Getting up to speed

I'd recommend any newcomer to read the excellent *Introduction to Object-Oriented Programming with IBM Smalltalk* as supplied with VisualAge. It will give you the essentials you need in order to understand why the Smalltalk environment works the way it does.

IBM is very keen for developers to distribute and resell a wide selection of parts for use by VisualAge developers. The generally excellent documentation also includes *Construction from Parts Architecture: Building Parts for Fun and Profit* which I would recommend to anyone who wishes to get into the objects business. Further to this, IBM has also announced the *Object Connection for VisualAge* programme to support and encourage the market for VisualAge parts.

### Every developers dream...

For a 1.0 release VisualAge is surprisingly competent. Version 2 is due later this year and will include even more parts. More importantly, it should be significantly faster. I suspect that many corporate development shops will, quite rightly, recognise VisualAge as offering a viable introduction to ob-

## Smalltalk, the silver bullet of OOP

Object Technology promised the user community a silver bullet to dramatically improve the flexibility, quality, and productivity in software development. But our users are telling us that these benefits are not readily achievable with current object-based development tools.

Some of our clients implemented early object-oriented projects in C++. After they witnessed some project failures, they realised that about 80% of current C++ development uses a C++ compiler as a better C. They were surprised because they thought the silver bullet was reusable class libraries, but they found that simply using a 'better C' results in minimal reuse.

By comparison, Smalltalk is a better language for building business applications. It is easier to enforce object-oriented design in a Smalltalk environment and successfully put small applications into production with as little as a few weeks of work.

Smalltalk visual programming tools are an answer to another silver bullet that failed, 4GL applications. Users are beginning to realise that 4GL tools sacrifice reusability, architectural design, scalability, and encapsulation. For example, the pixel 'objects' in the user interface are too tightly linked to relational database tables, violating the basic principles of good systems design.

Smalltalk gives higher productivity, real business objects in applications, and an opportunity for significant improvements in flexibility, quality and productivity if users can overcome the barriers to building reusable class libraries that support scalable production systems, maintainable by large development teams.

To support reusable, scalable, and maintainable large systems, some object technologists are telling users to retrain and reorganise their COBOL programmers and invest in object CASE tools. But the users are much too smart for that. They know that CASE is a silver bullet that failed.

With current CASE and OOA/D tools, there is a fundamental disconnection between the code in a running system and the requirements, analysis, and design that preceded it. Even in the few companies that have a well-implemented spiral development methodology, there is no easy way to feed code changes in a running system back into requirements, analysis, and design documents. This breakdown in the evolutionary prototyping process severely limits the reuse of software components.

Even when we can fire the silver bullet, marksmanship training is required to hit the target. A unified approach to analysis, design, and implementation must dramatically shorten the learning curve for business application programmers, assist them in design of reusable groups of collaborating classes, and guide them in architecting large systems environments. Our users can't wait six months for a COBOL programmer to learn Smalltalk, or 12-18 months for some of them to learn C++.

As object technology vendors deliver unified tools that solve these basic problems, we will significantly exceed users expectations by delivering more than we currently promise. This will be good for users and good for vendors. It will validate long-term investment in object technology and dramatically expand market opportunities.

*Forbes Cook, Easel UK Ltd*

ject technology and an almost unbeatable development environment. There is also a Team version of VisualAge which allows for the versioning and distribution of parts in a team environment.

This, together with the support for advanced communication protocols and access to relational databases will, for many of them, offset both the cost of VisualAge and the performance of the run time applications.

What about those developers who don't work in a corporate development shop? I still think VisualAge is worth a good look. But what about the cost? Compared to your

existing compiler and other tools VisualAge probably looks expensive. I suspect if my experience is anything to go by then VisualAge would probably pay for itself within the first month. With it you can build true object oriented applications very, very quickly. The absence of run time licencing fees plus the imminent availability of a Windows version makes this a tool especially useful to any bespoke developer.

*Alan Flower is a developer of client/server applications and can be contacted at Remora on 0272-328528.*



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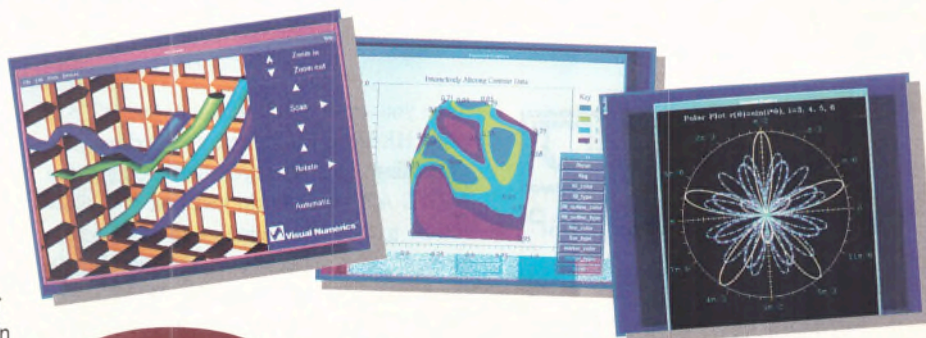
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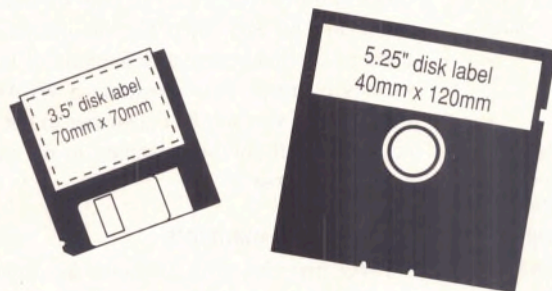
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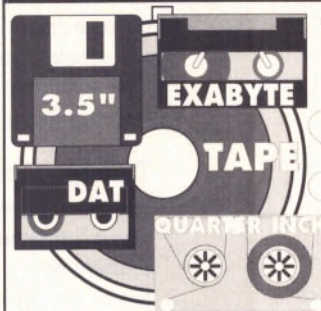
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# The Cruel C

Bruce Forman fires a  
broadside at the  
Windows for Workgroups API  
and shows you how to play  
Battleship in Visual Basic.



Have you ever wondered how the WFWG game HEARTS works and yearned to write something like that yourself? Using the WFWG API you can do just that and allow users to communicate and co-operate through your applications. This article will show you how to access the WFWG API functions and build workgroup aware applications.

The example I have chosen to present is a simple version of the perennial game of battleships. Two players place their complement of ships on their own board which is unseen by the enemy and then take it in turns to fire shots at each other until one player has sunk all the other player's ships. This seemed an ideal game to program for Workgroups as the fundamental rules and procedures of the game are widely understood and the simple communication needs illustrate the use of the WFWG API calls at a basic level.

The program itself is just a 'bare bones' approach to the problem used to demonstrate the various techniques involved in using the WFWG API calls. The full source code is available to readers by sending in a diskette and SAE as instructed at the end of the article. You can apply or extend the code contained therein to your own particular programming needs.

## Talking peers

WFWG is a peer-to-peer networking system which lets users share files, directories and printers with users working at other computers in a network. In addition to this there

are a number of communications facilities which allow users to 'talk' to each other and share information via the network.

The WFWG API provides a series of functions which allow programmers to include the network functionality of WFWG in their applications. Details of these functions are provided

by the WFWG Software Development Kit which is available through Microsoft and downloadable from a number of sources such as CompuServe.

The WFWG SDK consists of a number of files including utilities and example source code primarily aimed at C programmers with a few examples for VB programmers. The main source of information is the SDK help file which gives full details of every function which is available in the WFWG API with textual examples. This, again, is aimed at C programmers so it helps tremendously if you have at least a passing knowledge of C including data types and use of pointers so that you can root around C listings and help files such as these to be able to translate the information into that usable in VB programs. Hopefully the calls and techniques that I describe in this article will help those of you less certain in this area to do likewise and extend the range of what is possible with the standard VB language on its own.

The calls that I do use here are obviously only a small part of the total available in the WFWG API but the basic principles are covered in enough detail to allow you to extend them to other calls that you may be interested in. The SDK help file has introductions to the fundamental definitions of the various elements that constitute a WFWG network and you should endeavour to get a copy of this if you are planning to do any work in this area.

## Comms with mailslots

WFWG provides two methods for inter-process communications: mailslots and named pipes. In WFWG we can open, read and write to named pipes as if they were files but named pipes can only be created on servers running LAN Manager or other client/server based networks. This makes it impossible for WFWG only LANs to use this form of communication process which means that the best method to achieve our aims is to use mailslots.

A mailslot is an application-defined buffer that receives and holds messages. Applications create mailslots so that they can receive text or data from other applications running on one or more computers in a network. An application creates a mailslot to receive messages and waits for a message to

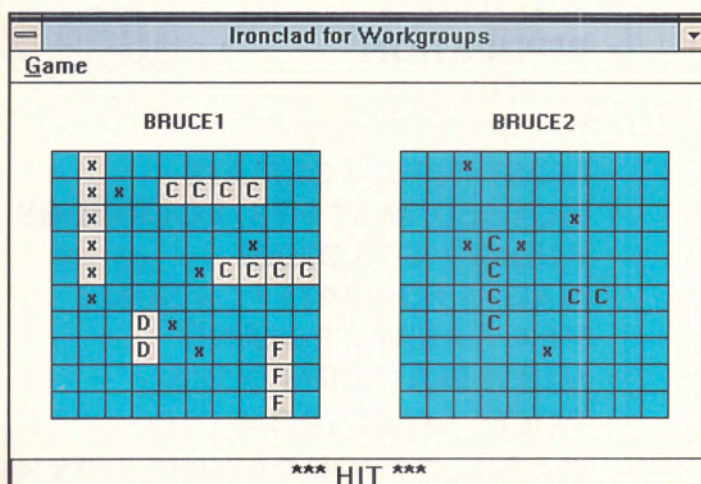


Figure 1 - Play battleships...





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<b>WNetGetCaps</b> Used to return the network type being run. In our case we can check to see if WFWG is actually running.	
ByVal nIndex%	Specifies the capabilities to retrieve
<b>NetWkstaGetInfo</b> An application can retrieve information about the computer it is running on. This will include the computer name on the network, the name of the workgroup to which the computer belongs and the name of the user (if any) who has logged onto the network. In this API function call, the buffer which returns information about the computer actually returns a structure of pointers to the data concerned. When using VB this then requires the use of a further Windows API call lstrcpv to return the actual data	
ByVal pszServer\$	name of the server to check
ByVal slevel%	level of detail to retrieve
ByVal pbBuffer\$	buffer to receive information
ByVal cbBuffer%	size of buffer, in bytes
pcbTotalAvail%	receives size of information, in bytes
<b>NetServerEnum</b> This call will retrieve a list of computers in the network and other information about those computers in a specified workgroup.	
ByVal pszServer\$	reserved; must be null
ByVal slevel%	level of detail to retrieve
ByVal pbBuffer\$	buffer to receive information
ByVal cbBuffer%	size of buffer, in bytes
pcEntriesRead%	receives number of computers returned
pcTotalAvail%	receives total number of computers available
ByVal flServerType%	type of computer
ByVal pszDomain\$	name of workgroup for which to search
<b>DOSMakeMailslot</b> Creates a mailslot on the local computer.	
ByVal pszName\$	name of mailslot to create
ByVal cbMessageSize%	maximum message size, in bytes
ByVal cbMailslotSize%	mailslot size, in bytes
phMailslot%	receives mailslot handle
<b>DOSMailslotInfo</b> Retrieves the status of a mailslot including the number of messages waiting to be read.	
<b>Parameters:</b>	
ByVal hMailslot%	handle identifies mailslot
pcbMessageSize%	receives maximum message size, in bytes
pcbMailslotSize%	receives mailslot size, in bytes
pcbNextSize%	receives size of next message, in bytes
pusNextPriority%	receives priority of next message
pcMessages%	receives number of messages in mailslot
<b>DOSReadMailslot</b> Reads a message from the mailslot and removes it from the mailslot buffer.	
ByVal hMailslot%	handle identifies mailslot
ByVal pbBuffer\$	buffer to receive message
pcbReturned%	receives size of message, in bytes
pcbNextSize%	receives size of next message
pusNextPriority%	receives priority of next message
ByVal cTimeOut%	time-out value
<b>DOSWriteMailslot</b> Sends a message to a mailslot.	
ByVal pszname\$	name of mailslot
ByVal pbBuffer\$	buffer containing message to write
ByVal cbBufferSize%	size of message, in bytes
ByVal usPriority%	priority of message
ByVal usClass%	class of message
ByVal cTimeOut%	time-out value
Note : From VB this call appears to send two copies of each message to the receiving mailslot. Therefore in the procedure SendMessage which reads messages from a mailslot using the DOSReadMailslot API call, I have made the call twice to read the message	

Figure 2 - Description of WFWG API calls used in IRONCLAD

arrive. Another application then writes messages to that mailslot which are stored in the mailslot buffer. Each message is sent independently and can be given a priority level which determines the order in which it is stored in the receiving mailslot buffer. Messages are stored in the mailslot sorted first by priority and then by time of arrival.

Mailslots can be classified as either local or remote. A local mailslot is on the creating computer and the mailslot name is of the form:

`MAILSLOT\mailslot_name.`

When sending to a remote mailslot the computer name must be added to the mailslot name, such as `\\computer_name\MAILSLOT\mailslot_name.` You can write messages to any mailslot on the same computer, on any computer in a network and to all computers in a workgroup.

## WFWG API from VB

The principles involved in calling the WFWG API are the same as calling any other external routines in DLLs such as the Windows API. First we tell VB about the procedure using the **DECLARE** statement. This must include the calling parameters matching the DLL procedure parameters exactly in number and data type. Then we make the call to the procedure supplying the correct parameters

I do not propose to give a full explanation of the process of declaring and calling DLL procedures as these have been dealt with in detail in several previous articles in various magazines. For an excellent introduction to the topic and using the Windows API functions refer to Dan Appleman's book *VB Programmers Guide to the Windows API*. By examining the declarations for each API call and the use of each function in the example code, you should be able to get a good feel for the procedure involved.

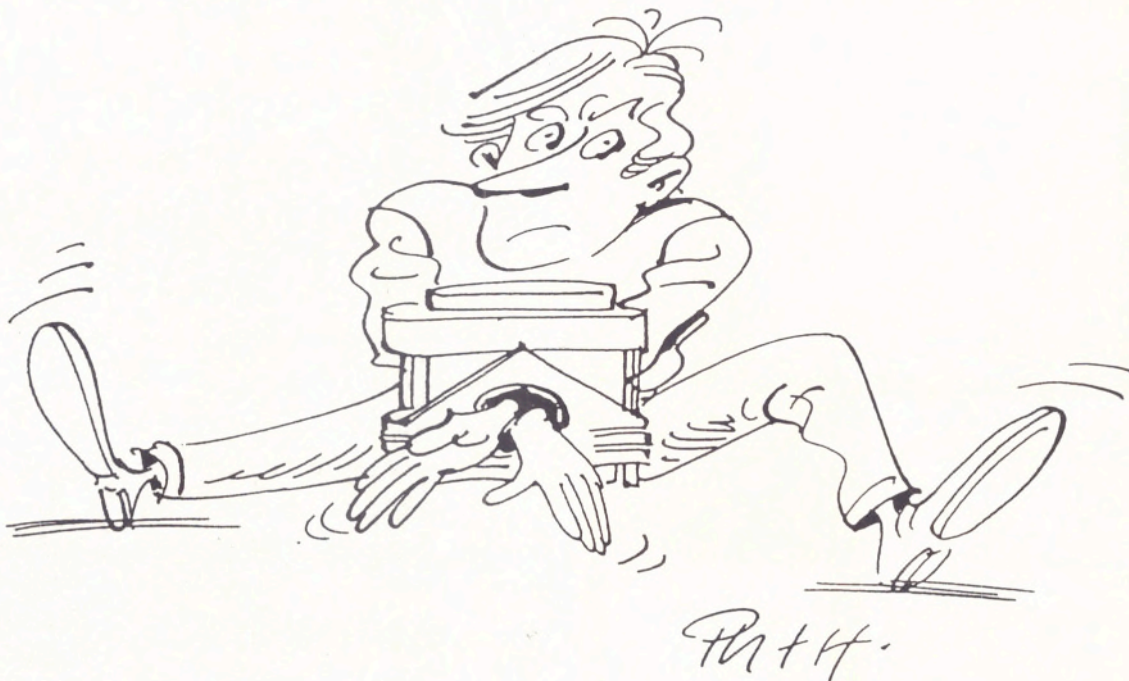
The WFWG API which we use in the example are listed in Figure 2. For a full explanation of the function of each parameter supplied to these API calls please refer to the SDK help file. In the example program, I have created a number of 'wrapper' procedures which are used to call the various WFWG API functions used. I have not always utilised every piece of information returned by the calls. The user should refer to the SDK help file for details of the *extra* information which is available from each call in case they wish to make use of it in their own applications.

## Play the game

As I said in the introduction, the example program IRONCLAD.EXE is a version of the traditional battleships game normally



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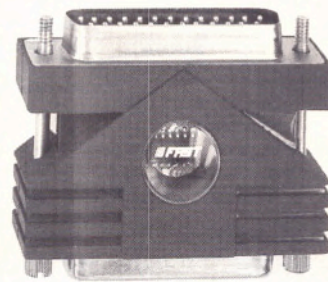
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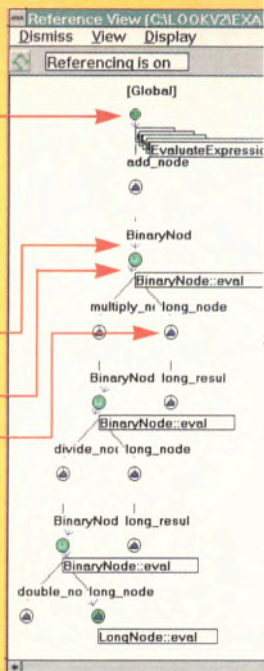
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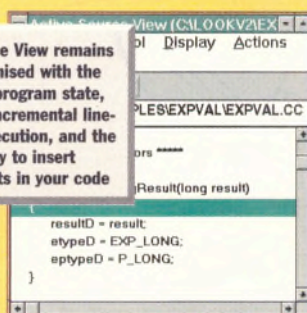
The Reference View tracks dynamic reassignment of pointers between objects. This allows you to visualise graphically all of the complex C++ structures, such as trees, lists and queues, within your program. Here, for example, we can see the animated creation of a typical parse tree used in an expression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

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

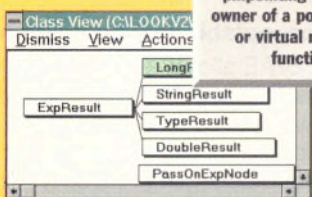
And sending one here

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

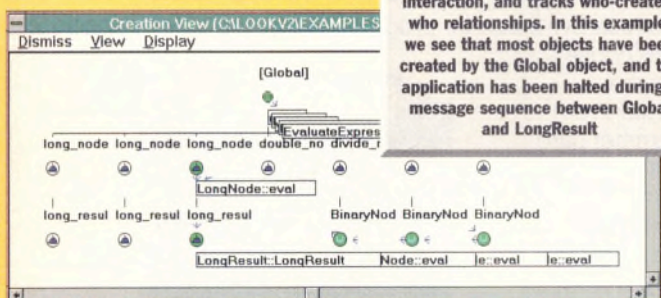


The Source View remains synchronised with the current program state, allowing incremental line-by-line execution, and the ability to insert stop-points in your code

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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```

Declare Function WNetGetCaps% Lib "user" (ByVal nIndex%)
Declare Function DosMakeMailslot% Lib "netapi.dll" _
    (ByVal pszName$, ByVal cbMessageSize%, _
    ByVal cbMailslotSize%, phMailslot%)
Declare Function DosDeleteMailslotInfo% Lib "netapi.dll" _
    (ByVal hMailslot%, pcbMessageSize%, _
    pcbMailslotSize%, pcbNextSize%, _
    pusNextPriority%, pcMessages%)
Declare Function DosDeleteMailslot% Lib "netapi.dll" _
    (ByVal hMailslot%)
Declare Function DosReadmailSlot% Lib "netapi.dll" _
    (ByVal hMailslot%, ByVal pbBuffer$, _
    pcbReturned%, pcbNextSize%, pusNextPriority%, _
    ByVal cTimeOut%)
Declare Function DosWriteMailSlot% Lib "netapi.dll" _
    (ByVal pszName$, ByVal pbBuffer$, _
    ByVal cbBufferSize%, ByVal usPriority%, _
    ByVal usClass%, ByVal cTimeOut%)
Declare Function NetWkstaGetInfo% Lib "netapi.dll" _
    (ByVal pszServer$, ByVal slevel%, _
    ByVal pbBuffer$, ByVal cbbuffer%, numbytes%)
Declare Function NetServerEnum2% Lib "netapi.dll" _
    (ByVal pszServer$, ByVal slevel%, _
    ByVal pbBuffer$, ByVal cbbuffer%, _
    pcEntriesRead%, pcTotalAvail%, _
    ByVal flServerType%, ByVal pszDomain%)
Declare Function lstrcpy% Lib "Kernel" _
    (ByVal lpString1 As Any, ByVal lpString2 As Any)

Global Const WNNC_NET_TYPE% = &H2
Global Const WNNC_NET_MultiNet% = &H8000
Global Const WNNC_SUBNET_WinWorkgroups% = &H4
Global Const SV_TYPE_ALL# = &HFFFFFF
Global Const MAILSLOT_NAME$ = "\\MAILSLOT\IRONCLAD"

'Local player's computer name
Global g_MyName As String
'Flag controlling if application running as Gamemaster
Global g_GameMaster As Integer
'Remote player's computer name
Global g_Opponent As String
'Flag displaying if remote player is set-up and ready
Global g_OpponentReady As Integer
'Handle of local mailslot
Dim g_hMailslotIn As Integer

Sub CloseMailslot ()

    retval% = DosDeleteMailslot(g_hMailslotIn)
    If retval% Then
        MsgBox "Could not close mailslot" & " Error" _
            & Str$(retval%), 48, "Mailslot Error"
    End
End If
End Sub

Sub CreateMailslot ()
    retval% = DosMakeMailslot(MAILSLOT_NAME, 256, _
        0, g_hMailslotIn)
    If retval% Then
        MsgBox "Cannot create mailslot" & " Error" _
            & Str$(retval%), 48, "Mailslot Error"
    End
End If

End Sub

Sub Delay (delaytime As Single)
    Dim Start As Single
    Dim Check As Single
    Start = Timer
    Do Until Check >= Start + delaytime
        Check = Timer
    Loop
End Sub

Function GetComputerName (computername$) As Integer
    Dim server As String
    Dim buffer As String * 256
    Dim total As Integer
    If computername = "" Then
        server = Chr$(0)
    Else
        server = workstation
    End If
    retval% = NetWkstaGetInfo(server, 10, buffer, _
        len(buffer), total)

    If retval% = 0 Then
        'buffer returns a structure containing pointers to
        'workstation info strings decode address from pointer
        'and copy to VB string using lstrcpy API function
        Dim stringaddress As Long
        For i = 1 To 4
            stringaddress = stringaddress + _
                Asc(Mid$(buffer, i, 1)) * 256 ^ (i - 1)
        Next
        returnvalue% = lstrcpy(computername, stringaddress)
    End If
    GetComputerName = retval%
End Function

Function GetComputersInCurrentWG
    (computername() As String * 16) As Integer
    'Length of each entry in NetServerEnum2 buffer
    Const CNLEN% = 16
    Dim lenbuffer As Integer
    Dim buffer As String * 512
    lenbuffer = Len(buffer)
    Dim EntriesRead As Integer
    Dim TotalAvail As Integer
    Dim slevel As Integer
    slevel = 0
    Dim pszServer As String * 1
    pszServer = Chr$(0)
    Dim pszDomain As String * 1
    pszDomain = Chr$(0)
    retval% = NetServerEnum2(Chr$(0), slevel, buffer, _
        lenbuffer, EntriesRead, _
        TotalAvail, SV_TYPE_ALL, pszDo-
        main)
    If retval% = 0 Then
        'we have success
        For i = 1 To TotalAvail
            computername(i) = _
                Mid$(buffer, (i - 1) * CNLEN + 1, CNLEN)
        Next
        GetComputersInCurrentWG = 0
    End If
    GetComputersInCurrentWG = retval%
End Function

```

Figure 3a - IRONCLAD.BAS module with VB wrappers for WFWG API

played between two players. The first user runs the program on his computer by selecting the **Start a new game** option from the **Welcome** form.

This version of the program acts as the controlling program for the game. I'll refer to this program in the article as the *Game-Master*.

On the GameMaster's computer the user will be prompted to set-up his home board by positioning their complement of ships. This is done by clicking with the mouse on the start and finish squares for the following ships:

<b>1 Battleship</b>	<b>5 squares long</b>
<b>2 Cruisers</b>	<b>4 squares long (each)</b>

<b>1 Frigate</b>	<b>3 squares long</b>
<b>1 Destroyer</b>	<b>2 squares long</b>

Ships cannot cross or overlap. If an invalid selection is made, the user will be required to try again.

The second user now runs the same program on his computer and selects the **Connect to another game** option from the



```

End Function

Sub Main ()
If WFWG_Running() Then
    frmWelcome.Show
Else
    MsgBox "You need Windows for Workgroups to run this
program", _
        48, "Ironclad"
    End
End If

End Sub

Function PollMailslot ()

Dim MessageSize As Integer
Dim MailslotSize As Integer
Dim NextSize As Integer
Dim NextPriority As Integer
Dim messages As Integer
retval% = DosMailslotInfo(g_hMailslotIn, MessageSize, _
        MailslotSize, NextSize,
        NextPriority, messages)

If retval% Then
    MsgBox "Could not read mailslot info" & _
        " Error" & Str$(retval%), 48, "Mailslot Error"
    CloseMailslot
End
Else
    PollMailslot = messages
End If

End Function

Function ReadMessage$ ()

Dim ReadBuffer As String * 256
Dim ReadSize As Integer
Dim ReadNextSize As Integer
Dim ReadNextPriority As Integer
Dim ReadTimeOut As Long
ReadTimeOut = 0
'For some reason messages appear twice in mailslot
'so read twice to clear buffer
retval% = DosReadmailSlot(g_hMailslotIn, ReadBuffer, _
        ReadSize, ReadNextSize, _
        ReadNextPriority, ReadTimeOut)
retval% = DosReadmailSlot(g_hMailslotIn, ReadBuffer, _
        ReadSize, ReadNextSize, _
        ReadNextPriority, ReadTimeOut)

If retval% Then
    MsgBox "Could not read message" & " Error" & _
        Str$(retval%), 48, "Mailslot Error"
    CloseMailslot
End
Else
    ReadMessage$ = RTrim$(ReadBuffer)
End If

End Function

Sub SendMessage (message$)

Dim buffer As String
buffer = message$
Dim BufferSize As Integer
BufferSize = Len(buffer)
Dim MessagePriority As Integer
MessagePriority = 0
Dim MessageClass As Integer
MessageClass = 2
Dim timeout As Long
timeout = 0
Dim MailslotNameOut As String
MailslotNameOut = "\\\" & g_Opponent & MAILSLOT_NAME

retval% = DosWriteMailSlot(MailslotNameOut, buffer, _
        BufferSize, MessagePriority,
        _
        MessageClass, timeout)

If retval% Then
    MsgBox "Could not send message" & " Error" & _
        Str$(retval%), 48, "Mailslot Error"
    CloseMailslot
End
End If

End Sub

Function TotalComputersInWG () As Integer
Dim lenbuffer As Integer
Dim buffer As String * 32
lenbuffer = Len(buffer)
Dim EntriesRead As Integer
Dim TotalAvail As Integer
Dim slevel As Integer
slevel = 0
Dim pszServer As String * 1
pszServer = Chr$(0)
Dim pszDomain As String * 1
pszDomain = Chr$(0)
retval% = NetServerEnum2(Chr$(0), slevel, buffer, _
        lenbuffer, EntriesRead, _
        TotalAvail, SV_TYPE_ALL, pszDo-
main)
If retval% = 0 Then
    TotalComputersInWG = TotalAvail
End If
End Function

Function WFWG_Running () As Integer
'Function to say if WFWG is running or not;
'returns true or false
WFWG_Running = False
uCaps% = WNetGetCaps(WNNC_NET_TYPE)
If (uCaps% And WNNC_NET_MultiNet) Then
    If ((uCaps% And &HFF) And WNNC_SUBNET_WinWorkgroups)
    Then
        WFWG_Running = True
    End If
End Ifd Function

```

Figure 3b - IRONCLAD.BAS module with VB wrappers for WFWG API

Welcome form. He is then presented with a form which contains a list box listing computers in the current workgroup which can be attached to.

If the user successfully selects the computer name corresponding to the GameMaster above, the program will send a connect message to the mailslot on the GameMaster's computer. On receipt of this connect message the GameMaster's computer will send an acknowledge message to

say that the connection has been successful.

Note, connecting to the GameMaster machine does not depend on the GameMaster having set up the host board. The connection process will proceed whilst this action is in progress. When the second player has successfully connected to the Gamemaster's computer they will be prompted to set-up their own home board as the GameMaster above.

Once the second player has successfully

completed setting up their ships a message is sent to the GameMaster to say that the player is ready. If the GameMaster has not yet completed setting up his own ships then the program will loop until this is the case.

Once both players have set up their ships the GameMaster's computer selects using a random function who is to take the first shot. If it is the second player, a message is sent inviting that player to shoot, if not the GameMaster's machine invites the



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player operating there to select a shot on his *away* board. A message is sent to the second player's computer with details of the shot square.

When a *shot* message is sent, the receiver's computer will check for the results of that shot whether a hit or miss. If it is a hit, further checks are made about what type of ship was hit and whether the ship has been sunk. Details of the result are then passed to the shooter's computer using a *result* message. The shooter will wait for the result message and display that result on his computer. The players will take turns in selecting shots until all of one player's ships have been sunk. When this occurs the losing player will send a 'You win' message and both programs will terminate.

At any time within the proceedings, when both machines are connected, either player can stop the game by choosing the Exit option from the Game menu. If this occurs the exiting player's machine will send a disconnect message to their opponent which will cause the other player's computer to terminate the game.

## Structure of IRONCLAD

The first form displayed (WELCOME.FRM) allows users to select which type of game they wish to play. Either to start a new game as the GameMaster or connect to an existing game in the workgroup.

If the second option is chosen to the **Welcome** form then the **Locate** form is displayed which includes a list box containing the names of all computers in the current workgroup which can be connected to (see Figure 4). Successful connection depends on the user knowing which computer is currently running IRONCLAD as a GameMaster waiting for a connection.

The **Main** form of the game displays the home and away boards displaying ship and shots fired information. This form also controls the connection process between the two computers prior to the actual game commencing.

The code module IRONCLAD.BAS listed in Figure 3 contains various global variable and constant declarations and the declaration statements associated with the WFWG API calls. Also there are several procedures included here which are gen-

eral procedures for use throughout the program including the 'wrapper' routines for the WFWG API calls.

## Limitations

For the purposes of coding brevity I have kept the code at a bare workable minimum in order to demonstrate the use of the WFWG API calls in a clearer light. Because of this, the program has several limitations to its functionality. First, if any errors occur with the WFWG API calls, the calling procedure will only provide a very terse message box detailing the error code returned which will then terminate the program. No facility is provided for non-human players ie you cannot play against the computer. No multiple game facilities are provided or any scoring routines. Once the game is completed both versions will terminate and if the players wish to play again they will have to go through the whole connection procedure once more. No precautions have been taken to ensure that messages to the mailslots come from the expected players' computers. If another player started IRONCLAD for instance at the same time and tried to connect to the GameMaster's computer then multiple conflicting messages would arrive which could cause problems.

## Conclusion

We can see that it is possible to enhance the functionality of our VB programs by using the routines provided by an API. In this case it is using WFWG to allow our applications to communicate with each other and extend the range of programming possibilities using VB.

At times it might seem like jumping through hoops of fire whilst juggling four balls and balancing a glass of water on your head as some of the functions are uncalled for from VB. Maybe one day Microsoft will wake up to the needs of VB programmers and provide an API with a series of functions which are designed to be called from VB along with devoted documentation. To paraphrase Doctor Johnson, it's not perfect but maybe we should be grateful that it can be done at all.

## References

*Visual Basic Programmer's Guide to the Windows API*, Daniel Appleman, Ziff-Davis Press, ISBN 1-56276-073-4  
*WFWG SDK*, Microsoft Development Corp.

*Bruce Forman is a Visual Basic programmer for Pinstripe Software Ltd and runs an independent consultancy offering programming and support services. He can be reached via CompuServe ID 100046, 2513*

```
Sub cmdCancel_Click ()
Unload frmLocate
End Sub

Sub cmdOK_Click ()
g_Opponent = cmbOpponent.Text
Unload frmLocate
End Sub

Sub Form_Load ()

'Fill list box with available
'computer names
totalcomputers% = TotalComputersInWG()
If totalcomputers% > 1 Then
ReDim computername(1 To totalcomputers%) As String * 16
retval% = GetComputersInCurrentWG(computername())
For i = 1 To totalcomputers%
If g_MyName <> Left$(computername(i), Len(g_MyName)) _
Then
cmbOpponent.AddItem computername(i)
End If
Next
cmbOpponent.ListIndex = 0
Else
MsgBox "There are no other computers to connect to ", _
48, "Ironclad"
End
End If

End Sub
```

Figure 4 - LOCATE.FRM module to list computer names available on the network



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# Mayhem!

If you think Virtual Reality is cool, you should try the real thing on a motorbike. Guess what **Jules** has been up to recently.



For all the concentration of most journals on applications programming, comparatively little commercial programming is of this form. The majority of code ends up inside other machines, driving embedded controllers. Almost every household gadget, from microwave ovens to central heating controllers and washing machines, has an embedded processor in it. Though many of them are not real-time, practically all have a *sense* of time in them, which is why so many gadgets have clocks.

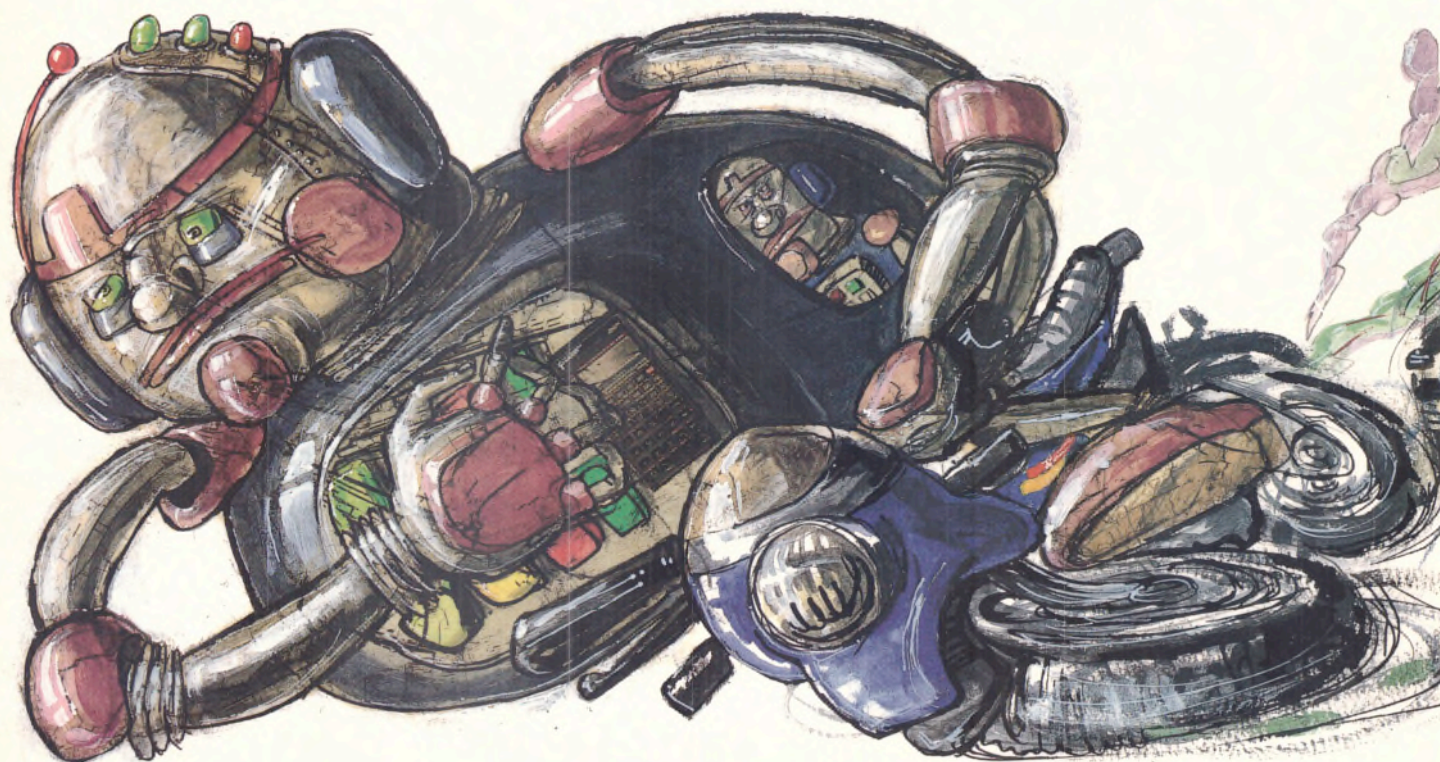
However, even domestic equipment represents only a small proportion of embedded code. Most code goes into rather more interesting equipment, where the processors have no user-interface at all. This is the field of process control, or cybernetics.

Modern aeroplanes are kept aloft using this equipment, factories are kept running and supplied with raw materials using more of the same. Cars are a particularly rich field: racing cars have experimented with active suspension; mass-market cars routinely use fuel injection, engine management, and braking control. These devices are particularly elegant because not only do

they do a control job better than mechanical controllers or humans, they are also completely invisible whilst doing so.

This is what is so interesting about this field. It may be possible to model a system concisely using well-understood maths, but solving such a system can be very hard indeed. Suspension is a case in point; mechanical suspension is not very good at what it does, but other parts of automotive technology have developed to compensate for the inadequacies. Even if we could invent a perfect suspension program, putting that onto modern cars would make them almost undrivable. Process control involves, alongside fearful theory, a great deal of compromise and black art.

In order to try to get a handle on this complexity, embedded designers are increasingly turning towards Artificial Intelligence to solve their problems. The fuel injection on my car, for example, not only readjusts itself for complex environments as it runs, it also tries to guess what sort of drive I want, and can select different programmes from moment to moment. Most of the time it works very well; once in a while





it guesses wrong and suddenly it becomes visible again.

Artificial Intelligence is not the homogeneous study it's portrayed as. Rather it's a grab-bag of techniques that no one really understands well enough to build self-sustaining theories from. That's in its favour; if you can't be inventive in AI, then where? And inventive is certainly what AI people are. Some amazing problems have been attempted (and, if truth be told, some amazingly stupid ones too), with varying degrees of success.

Some results, particularly those concerned with process control, are quite outstanding, which is why the embedded engineers are looking there for inspiration. People have built neural nets which can back an articulated lorry into a loading bay, and rule-based systems which can keep one-legged hopping robots in balance. Many of these results generalise into process control very well.

What has brought this on is that I have recently bought a motorbike. While belting through the countryside at breakneck speed (well, OK, about 40mph for most of my training), I was trying to understand how I was able to control this machine, and how a computer could help and I have to admit, it stumped me.

Take, as one example, steering. When you're travelling slowly, you steer by turning the handlebars in the direction you want to go. When you're going a bit faster, you don't turn the handlebars at all, you lean,

and at higher speeds, or with a loaded machine, you actually turn the handlebars backwards! There are even conditions under which you can choose any of these methods. Another example is tyre grip; I can't see any way to recover a front-wheel skid, but I think any back wheel skid is recoverable, if you can act fast enough and if you don't care what direction you go afterwards. But some experts can drive a bike like a rally car, keeping the back wheel sliding all the time and I just can't figure out how they do that.

Keeping a bike upright, at speed, and on course, while accounting for differing road conditions, wind, and all the other complications that two wheels are heir to is a fascinating problem. There are hundreds of separate control problems all bouncing off each other. And what intrigues me is that most of these problems could be solved, in isolation, by AI, but there's nothing that can bind them all together.

The truck backer-upper, for example, worked, but not the way a human driver does it. It would always attempt the manoeuvre in one movement; it would never move forward a bit to get a better angle. Take as another case the hopping machine; results from that showed that eight legs is the easiest number to control, one is hard, but hardest of all is two. So, it may just be possible to keep a bike upright and on course, so long as the program didn't have to decide which steering mode to use. It may be possible to stabilise a bike in the

wake from a high-speed lorry, but not if manhole covers and spilled oil on the road have to be avoided or accounted for.

It has been proposed that one solution to the fragmenting of AI is to create systems where several experts separately contribute to a solution - so-called blackboard systems.

## If you can make a drive-by-wire motorbike, you've probably cracked the single most difficult problem in control theory

In cars and factories this can work, but on a bike it won't, because the constraints are all solved using the same controls. A compromise solution is no solution. A solution which beats out other solutions will undoubtedly destroy the machine. Yet, even with these dozens of conflicting constraints acting through few controls, a vehicle as simple as a motorbike is eminently controllable and highly manoeuvrable.

There's a big hole in AI and I'm not even sure I can explain what it is. But I can point to it. If you can make a drive-by-wire motorbike, you've probably cracked the single most difficult problem in control theory. Controlling a motorbike demands lots of strategies handling lots of sub-problems, but you've got to get those strategies working together, rather than competing.

Drive-by-wire bikes aren't the issue. A bike is a very efficient mode of transport, with a very concise control system. High-energy vehicles which are on the drawing board now share these properties; satellite and space vehicle launchers, hypersonic aircraft and lots of deep-sea vehicles are just like bikes in these respects. The ideas are great, but are unimplementable because the control theory just doesn't exist. It's not reasonable to expect a person to try to acquire skill in a trillion dollars of research prototype, particularly when there's no guarantee that people will ever be able to. We need to solve the AI problem. We need to program skill. ■

*Driving a bike requires more skill than even Jules has got; in the course of researching this article he drove his bike at 50mph head-on into a brick wall while on a safe driving course. He now has a broken thumb, a trashed bike, and a terrible pain in the wallet. I bet you think that's funny. You can laugh at him in person on 0707 644185, or electronically at jules@cix. Just don't expect a civil response.*

JAKE ABRAMS



# The fuzzymen cometh...

The black and white world of logic is blending into shades of grey as the dawn of 'Fuzzy Logic' breaks. **Kevin Yeandel** bids goodbye to the dreams of science fiction and welcomes in a new generation of computing...



Computers deal exclusively with yes or no, true or false, on or off, one or zero. This logic of building computers from what amounts to no more than microscopic switches, has been a convenient way for electronic designers to construct such machines and will, without doubt, continue to be well into the future. However, this article is concerned with an important layer built on these foundations. Don't switch off. It's not just programmers who need to know about fuzzy and neural computing: every company, from whatever field, should know, if they don't already, that *another way exists*.

This article is about fuzzy logic: not neural networks. However, at times it is hard to distinguish between the two and I will therefore mention neural networks nearer the end. Fuzzy logic is also a primer for neural network theory and is widespread throughout Korea and Japan where it has been for a number of years. Unfortunately the UK and USA are quicker at noticing the *returns* on Japanese investment in this field than they are at *developing* it themselves.

## Easy-peasy with fuzzy

'Convenience' is a word which loosely describes the world in which we wish to live. A world of convenience would ideally mean machines carrying out our daily tasks. The better the machine, the more it can do to make life more convenient. The ultimate goal, therefore, being the machine which can cut the lawn and put on the 'barby'. A sci-fi movie dream? No, specialist companies exist today that are laying the path,

slowly but surely, leading to the fulfilment of such 'fiction'.

The machines referred to will, in some way, be controlled by the microchip, either a chip dedicated to fuzzy processing or an ordinary computer running a fuzzy program. The principle of operation is the same: they both use rules and make decisions. In most cases, they adapt, gain knowledge and get better as time goes on.

Who uses fuzzy logic? Canon, Epson, Hitachi, Matsushita, Minolta, Nissan, Omron, Samsung, Sanyo, Sharp, Toshiba to name but a few, all of which come from the super wealth of Japan or South Korea. The Japanese take fuzzy logic very seriously: their Government has provided \$70 million (US \$) through the creation of LIFE (Laboratory for International Fuzzy Engineering).

Not long after the first quarter of this century fuzzy logic was being toyed with by logicians thanks to a publication by Max Black back in 1937 when the concept was called *vagueness*. In 1965 Lotfi Zadeh, an Iranian born professor applied the theory electronically and called it Fuzzy Logic.

## Equally logical

Generally speaking, there are two types of fuzzy logic. The first (and simplest) is a form which must be told what to do by means of rules given through the media of a program. Then there is the more complex system which can learn rules from observations. Known as *Adaptive Fuzzy Logic* or *Neural Networks*, it's the difference between being told how to make a cup of tea and learning to make one from observing others.

Fuzziness today enables car engines to tune themselves hundreds of times a minute; provides washing machines that know how much powder, water and time to use to get 'whiter than white' results and air conditioners which realise the sun has gone behind a rather large cloud and that they ought to stop blowing cold for a while.

Fuzziness means efficiency, safety, convenience and environment friendliness. Put a Fuzzy micro in that air conditioner and save 40% of the running costs. A gear box

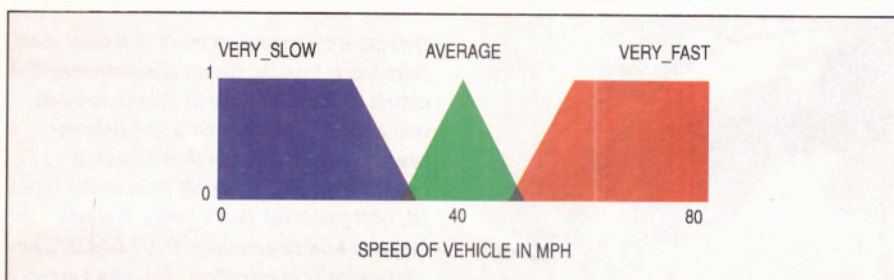


Figure 1 - Three ranges of driving speed





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knows the exact time to change gear by looking at the speed, gradient and weight of vehicle. In fact, VTT - the Technological Research Centre of Finland is using fuzzy logic in four wheel drive off-road vehicles. This has resulted in improved grip, reduced soil damage and consumption of fuel. The system comprises independent breaking mechanisms on each hydraulically powered wheel.

Fuzzy logic can be found inside spreadsheets and database packages, although, it has to be said that at present these are not always a success. However, coming to England soon is NeuralWare's *FuzzySP*, a Windows package for the decision-making company with a desire to save a little time during their management activities.

Company meetings draw together various departments to discuss a range of issues. Future planning and unforeseen circumstances may require Gantt charts and priority lists to provide delivery dates and utilisation of resources. A couple of hours soon pass. 10 people sit round a table and declare a united strategy to meet the requirements of all concerned as best they can. Not an easy task, but nevertheless a task which must be done. Fuzzy logic could possibly help to achieve these aims quicker and more effectively with a special piece of software which could well pay for itself in a couple of months.

As mentioned, fuzzy logic needs programming. Prior to looking at how this is achieved, we must first get to grips with the *Fuzzy Concept*.

## Fuzzy thinking

The concept is not new and actually dates back to around 500 BC although we are not so familiar with it in computing and electronics. To apply fuzzy principles, 'experts' often use the tall people analogy: 'How do you define a tall person? Are they 5 feet... 6 feet - how high?'

We all have differing views. A combination of answers exist all of which will be partly right and partly wrong. Garden gnomes think children are tall. If you can see who is on the top deck of a bus without stretching then, chances are, your fellow human appears short. Because you consider someone is short it does not *make* them short - someone else may believe that person is of average height - there is relevance in all this.

This principle applies to, say, the air conditioner. You may be cold but someone else could feel comfortable. By now you should have grasped the idea. We are dealing with partial truths, degrees of the truth. 'It is, to some degree, quite warm.'

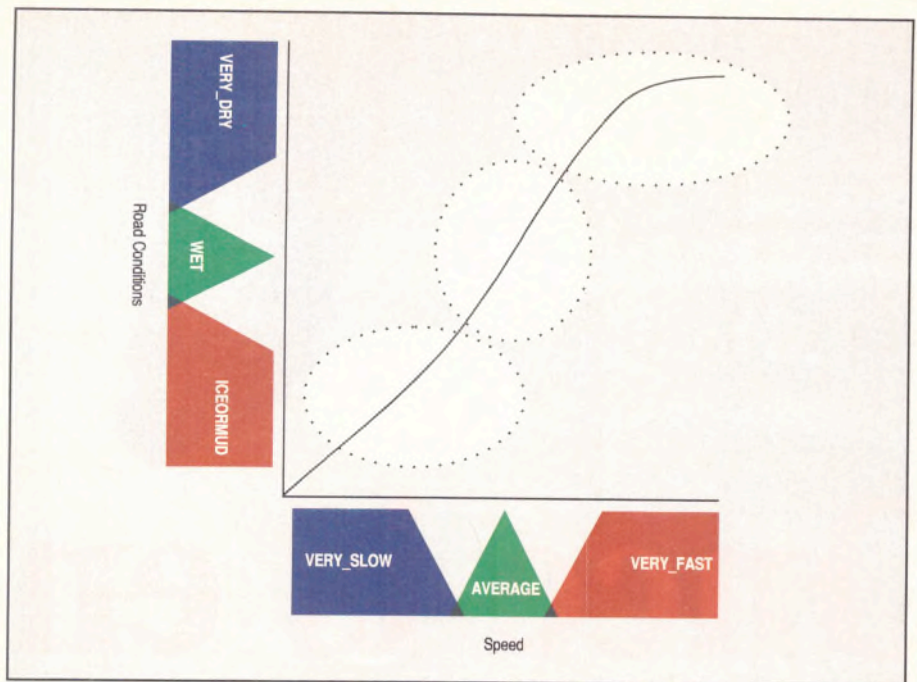


Figure 2 - Constraints on driving speed

## The program

It can be written in any language. AI experts tell us that Prolog is perfect for emulating fuzzy systems because of the way it handles set theory and symbolic logic. You could use C. Often, when programming fuzzy microprocessors (fuzzy systems work faster in hardware), it is possible that a CASE tool (Computer Aided Software Engineering) has been used to generate the source code for you.

Fuzzy programs have two kinds of data: 'fuzzy' data and 'crisp' data. These data types are known as *terms*. Terms can be thought of as *variables* in a conventional program. Pure logic, ie 100% true or 100% false is offered as a special case.

Crisp data is a clearly defined piece of information, ie no compromise. We could use a word to represent, say, the minimum age to drive a car in the UK, by defining a variable as a crisp data object:

```
MIN_AGE_TO_DRIVE = 17
```

for instance. Then we have Fuzzy variables, the more common information which generally represents *real-life* data. A fuzzy variable can also be thought of as the mathematical set.

```
SPEED AVERAGE 40 15 in
```

The line has five parts. **SPEED** is the subject and **AVERAGE** is the variable which is valid between the range 25 and 55. Why? See Figure 1: 'in' means 'inclusive' ie. members of the set **AVERAGE**, 'ex' is the opposite - 'exclusive' ie. members that are not in the set **AVERAGE**.

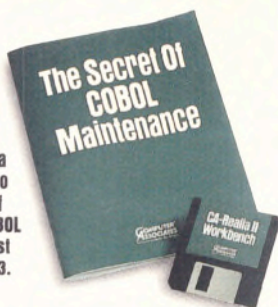
## Include me out

Figure 1 shows three variables or sets used to represent levels of speed. You can have as many sets as you wish. In fact, the more the better. The blue *set* is known as a 'left inclusive'. In this case any value below 35 belongs to the blue set. The red represents the 'right inclusive' and tells us that any value of 50 or over belongs to this set. Green shows a set of type 'inclusive'. This time green represents a fuzzy variable called **AVERAGE** with a 'Singleton' (centre) value of 40 mph. It has a width of 15 making it cover the range 25 to 55 mph. Figure 1 demonstrates three of the special fuzzy data-types.

In the interest of simplicity Figure 1 is far from complex, which diminishes its practical use. Speed has been separated into three sets from low to high. So what? What about road conditions? Icy roads, wet roads and dry roads may have some influence on your speed (unless, of course, you are under 17). Figure 2 shows possible conditions. They are placed at 90 degrees to the speed diagram in Figure 1 resulting in a 2D graph. The bubbles show the fuzzy sets on the 2-dimensional graph. Any part of the graph falling within these bubbles belongs to the sets labelled in the vertical and horizontal planes. We could add a third dimension too, say, **traffic\_density** and find it still fairly easy to understand. Often we see 3D graphs. With three dimensions we have  $2^3$  Boolean combinations (see Figure 3). The problems come when we need to add a fourth and fifth dimension - often in programs we experience these conditions. If we were to model a large problem many dimensions would be required.



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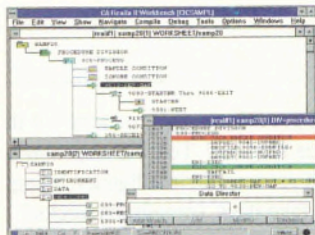


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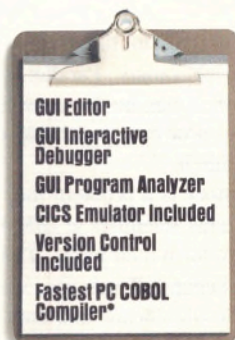
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## It's quicker by cube

Bart Kosko can only be described as the 1990's prophet of Fuzzy Logic. His name frequently appears in books and magazines dedicated to artificial intelligence. Having taught the subject in the highest educational capacity, his research has led him to devise analogies such as the fuzzy cube shown in Figure 3. Each corner of the cube represents a binary extreme.

For example, the vertical 000-001 represents dryness of the road where the LSB (Least Significant Bit) is true or false. Speed is represented as the MSB (Most Significant Bit) and the binary 111 represents quiet traffic, dry road and fast speed. Anywhere along a perpendicular will represent a case where something is both true and false - to various degrees.

Using the road/vehicle analogy, a *pseudo-code* program line could read:

```
if ROAD is VERY_WET
  and SPEED is VERY_FAST
then MEDIUM_SLOW
```

A fuzzy program is very easy to design. You do not have to be an expert to understand what this line is saying. However, you may be wondering how fast is *VERY\_FAST* - You're back to the tall people problem!

## Duzzy need fuzzy?

Do *you* need fuzzy logic? Once the concept is understood you will know. For instance, do you use look-up tables?

*Look-up* tables are common solutions in software (often in control processes) providing fast, pre-calculated, results in (normally) two dimensions, such as arrays. You can have arrays of three or more dimensions. Complexity increases exponentially with increasing dimensions. Regardless,

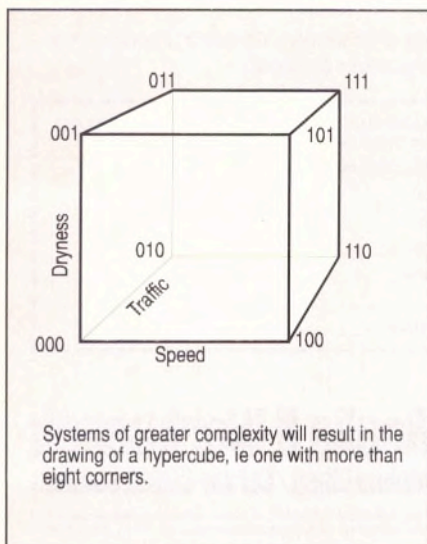


Figure 3 - Bart Kosko's Fuzzy Cube

## Get fuzz-wise

There is an assured way to get to grips with fuzzy logic. Get a copy of a rather modern fuzzy bible. Bart Kosko's *Fuzzy Thinking* is a three hundred page hard-back which clarifies the fuzzy principle. It's incidental that you also get an insight into the theory of Zen. How *deja vu* works, the future of the world and many other interesting topics which don't actually have a great deal to do with computers. Kosko sits on the fence about most things, except suspended animation and the existence of God, but his explanations of the fuzzy theory provide mainly unbiased material which could additionally change your views on all manner of things. Kosko has degrees in philosophy, economics, mathematics and electrical engineering and explains the fuzzy concept from its Buddhist roots to modern day Japanese and Western technology. This book has a wealth of information humorously presented with the occasional risqué analogy.

you are still left with a finite number of combinations resulting in an answer which is *near as damn it* right.

Fuzzy logic offers fast solutions with the added advantage of infinite input combinations resulting in a more accurate output. Programs which learn and get better, incorporate a *feedback loop* which enables them to train themselves. The feedback tells the system how well it is doing. Positive feedback rewards the circuit/program and negative punishes it.

You may feel that you have a use for fuzzy/neural systems. To investigate the subject, talk to the DTL.

The DTL recognises the importance of this kind of technology and has launched a multi-million pound awareness campaign. I went to the DTL's advisors based in Petersfield to speak with Nick Ryman-Tubb, the Technical Director of Neural Technologies, to ascertain the exact state of fuzzy and neural technology.

## Logical action

Nick explained: 'Fuzzy Logic leads to quicker product development. These products 'appear' to be clever and require less skilled personnel. I feel that fuzzy logic has a place in the development lab as well as being used as a marketing tool. Any technology which allows non-experts to interact with the real world has to be positive.'

Neural Technologies have developed *personality* related software for companies the size of and including Thomas Cook Holidays. They are also currently involved in a top secret 'lager' related system. I asked Nick exactly *where* fuzzy logic and neural networks come together. 'It's hard to define a clear line between the two,' he explained. 'Neural networks are intrinsically fuzzy and therefore fuzzy logic is a subset of neural computing...'

So what is preventing us from creating systems which can learn, grow and simulate our human-scale intelligence? 'Computers

are just not fast enough to carry out the calculations required. To train a system to do a job with reasonable intelligence using a 486 PC can take days, sometimes weeks.'

## Gimme speed

Today's computers can clock up to 100 MHz. The Japanese have used superconductor technology to create a microprocessor operating in the GHz (1 gigahertz = 1000MHz) range. Parallel or distributed processing may be the answer, a single micro chip now exists with 256 CPUs embedded within it.

Memory is a problem too. We need lots of it. Today scientists at IBM line up Xenon atoms to form their name. The long term effect of Xenon billiards may well be to make available significant amounts of super-fast memory: binary words created through the presence or non-presence of an atom.

Will electronics be the answer? Nick Ryman-Tubb feels that it might. On the other hand organically grown computers may provide the solutions required to solve the speed/intelligence problem.

'Intelligent' cyber-people will still remain a concept within the minds of the science fiction writers for a number of years to come. EXE's *youngest* readers will be in the autumn of their lives before the spectrum of united technological advances provide us with androids and machines which can work *with* us instead of *for* us. However, from traffic lights to lager tasting, fuzzy and neural technology is becoming recognised and will be realised thanks to the DTL and experts like Neural Technologies.

*Neural Technology is prepared to supply information about joining the DTL's Awareness Campaign and answer questions about fuzzy/neural computing. For information about the DTL's efforts, telephone (0730) 260256.*



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# Objects of value

Francis Glassborow's recent column on  parameter passing caused more reaction than all his previous 12 put together. Because various interesting points have arisen we have persuaded him to return to the subject of objects and values...

Essentially the C view of the world is a value based one. To understand this it is vital to comprehend what is meant by a value as opposed to an object. 'Red' is a value while 'red paint' is an object. 'Red' is one of the values of the attribute 'colour'. Whether we view colour as an abstract object is getting too far into philosophy. So let me narrow my terms to those that seem appropriate to the context of computer programming.

An object in a computer program is some form of storage combined with a purpose. A value is a specific bit-pattern that can be stored in some memory.

All the identifiers of C have a value associated with them, many of them also store values and some of them return values by some mechanism other than extraction from storage. Some such as `enums` only have value without a location (address).

The values associated with identifiers such as function names and array names belong to an abstraction whose values are called addresses. Pointers are objects that store values of address type. Many programmers seem to assume that addresses come from some linear range of integers but I can find little justification for such a belief - it is based on confusing an implementation detail with the underlying concept. C is very careful to keep as close as possible to the pure concept of address values.

Even two addresses composed of identical bit-patterns may be different if one is a function-address and the other is a data-address. You have no reason to expect data pointers to store function addresses nor vice-versa. Two different addresses could convert to the same integer. C does not authorise arithmetic nor any form of logical operation on an address except in the very restricted domain of addresses within the same data object.

The values of array and function identifiers are addresses and so can be stored in appropriate pointers. The value of an identifier for a scalar object is also an address but often the context results in the return of the value stored at that address.

So far all is fine. We have address values that can be stored in pointers; we have other scalar values of the various built-in types that can, if relevant, be stored in suitable storage; we have functions that have

addresses and return values of some kind (including of a special type, void). Functions also have a property of accepting a list of values (arguments) to initialise some local storage (parameters). Some of these local stores may be of a pointer type to store an address.

## Spaghetti strings

Now we hit a small problem, that of representing strings. C has granted some special privileges to NULL-terminated arrays of `char`. And now it has a problem with representing the values of these strings as distinct from the string itself. Consider:

```
char mess[]="Hello";
```

The value of `mess` is an address for which there is some internal representation (about which we should not be making assumptions, though most of us do). The value of the string contained in `mess` is 'Hello'. We should avoid making assumptions about the internal representation of 'Hello'. In fact our program needs some way of storing the 'literal' bit pattern so that it can copy it into `mess` when required. We also need some shorthand mechanism for referring to this string value. For excellent reasons an address is used to reference such string values. This leads to code such as:

```
char *strval="Hello";
```

This use has confused generations of students of C and, incidentally, rather too many professional programmers. All too often `mess` and `strval` are treated as objects of the same kind when they are quite different. The storage associated with `mess` is for some `chars`. The storage associated with `strval` contains an address. Worse still, the specific address that we initialised `strval` to was a shorthand name for a string value. Unfortunately the rules of the language allow you to store this special address in a simple, unqualified pointer to `char`. You have no more right to assume that you can change a string value than you have to change any other value but the mechanisms of the language lead you into thinking you can. Worse still, the language fails to protect you from the dire consequences of such assumptions. For example if you write:

If you pass an address to provide read-only access, it is your job as a programmer to specify your intent



```
strcpy (strval, mess);
```

when you meant:

```
strcpy (mess, strval);
```

It will compile, but your program has undefined behaviour if `strval` still contains the address of a literal.

We use string literals (effectively string values) all over our programs, yet we barely have any protection from their abuse. Can any of those who served on the original ANSI X3J11 explain why I am mistaken in believing that allowing a non-`const char` pointer to contain the address of a string literal was an error. I have to phrase it in that round-about fashion because some of them get terribly upset when I claim that, despite all their hard work, the C standard is wrong.

### Passing Addresses

Clearly there are more than a few programmers out there in the real world who believe that passing an address is like a C++ reference. Of course you check when passing the address of a large data object for read only access to make sure that the receiving parameter is declared `const` in the prototype. Well that is plain inadequate. If you pass an address to provide read-only access, it is your job as a programmer to specify your intent by casting the address to 'address of `const` type'.

I find surprisingly few programmers doing this. Perhaps nobody ever drew their attention to it, or perhaps typing the extra words is too much bother.

Writing quality code includes taking care to ensure that your intentions are clearly declared to the compiler and future maintenance programmers, where possible, in the body of the code. Read only access can always be declared.

### Where's the object?

In addition to the value based programming that C supports, C++ also supports various other paradigms, among these is the family of object styles (based, oriented etc). The built in types that C++ inherits from C together with all the pointer types are essentially value based. I could argue strongly that such should always be passed by value - addresses used where access to storage is desired. The values of the built in types are attributes of objects and not objects in themselves.

Those on the extremities of OOP who feel comfortable with the Smalltalk view of the world would probably take a different view. It's not worth fighting over.

When we move on to the complications of user defined types with their internal structures and carefully defined behaviours we have arrived in the world of objects. In such a world I must keep a clear view of what I am intending to do. If I want to make a copy available, while keeping the original intact I have mechanisms for doing so. If I want to let you have the original as long as you do not change it, I can do so by marking the original with `const` at the point of dispatch.

**We use string literals all over our programs, yet we barely have any protection from their abuse**

Some readers have argued strongly that references are only hidden pointers so why make so much fuss over using overt ones? This view is at the heart of the debate between value-based and object-based styles. Not least is the fact that the argument hinges on a knowledge of the most usual mechanism for implementing references in C++. Anyone who has managed to switch to an object view of programming would feel uncomfortable with an argument based on an implementation detail.

### Decide on a view

At root, the problem is one of the view you take of your programming. In an object based view, messages are passed to objects, and objects are passed to be used - and use normally changes the object used, if only that it wears out or is consumed. A value based view expects values to be passed back and forth, some of which may be locations where values can be found or changed.

One of the outstanding strengths of C++ is that it can support both views as well as many others. That leaves the programmer with the problem of deciding which view to take. Using a C++ compiler and writing your own classes does not make you an object based programmer. It is the way in which you use your C++ compiler that determines that. The choice is yours. Whatever your choice, do not pretend that it is something that it is not.

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**Paul Smith** for object  
orientation, Mac style...

When it comes to development environments, Macintosh developers can hardly be said to have been spoiled for choice. Until recently, developers wanting to create applications in C or C++ have had just two tools to choose from: the Macintosh Programmer's Workshop (MPW) - Apple's own environment - and Symantec/Think C & C++. Both these environments have their drawbacks: MPW is almost as old as the Macintosh itself and has changed little over the years. The Symantec product, while easy to use, has suffered from recent buggy compiler releases and the confusion surrounding the cancelled Bedrock application framework, which, until recently, it was developing with Apple. MPW has the reputation of being the grand old lady of development tools. It is powerful and can be extended by users writing tools and scripts. It also provides an architecture in which third party developers can add their own compilers. Apple's own PowerPC compilers run under MPW. MPW is slow and requires huge amounts of RAM and disk space. Symantec/Think C and C++ also provide a native PowerPC compiler but this does not integrate well with the Symantec environment, is slow and takes up a lot of RAM.

Now enters a new player in the Macintosh development tools arena: CodeWarrior

from Metrowerks. CodeWarrior promises an environment as easy to use as Think C, with links to the power and extensibility provided by MPW, giving a C, C++ and Pascal compiler, together with a debugger and a powerful class library. CodeWarrior allows developers to create applications for both 68K and PowerPC based Macintoshes. So what does CodeWarrior have to offer for experienced developers seeking to port their applications to the PowerPC, perhaps moving an application from another environment, or those just starting Macintosh development? Will CodeWarrior replace Symantec/Think C & C++ and MPW as the development tool of choice for Macintosh developers?

## Everything in one box

One of the first things you notice when you get the CodeWarrior CD-ROM is the comprehensive nature of the package. The CodeWarrior Gold edition used for this review contains C and C++ compilers for 68K and PowerPC development; Pascal compilers for both platforms and versions of the C and C++ compilers which run under MPW. Also included in the package is PowerPlant, an object oriented application framework, similar to Apple's MacApp or Symantec's Think Class Library (TCL). This provides a

**You create, edit,  
compile, link, run and  
debug applications all  
from one place**

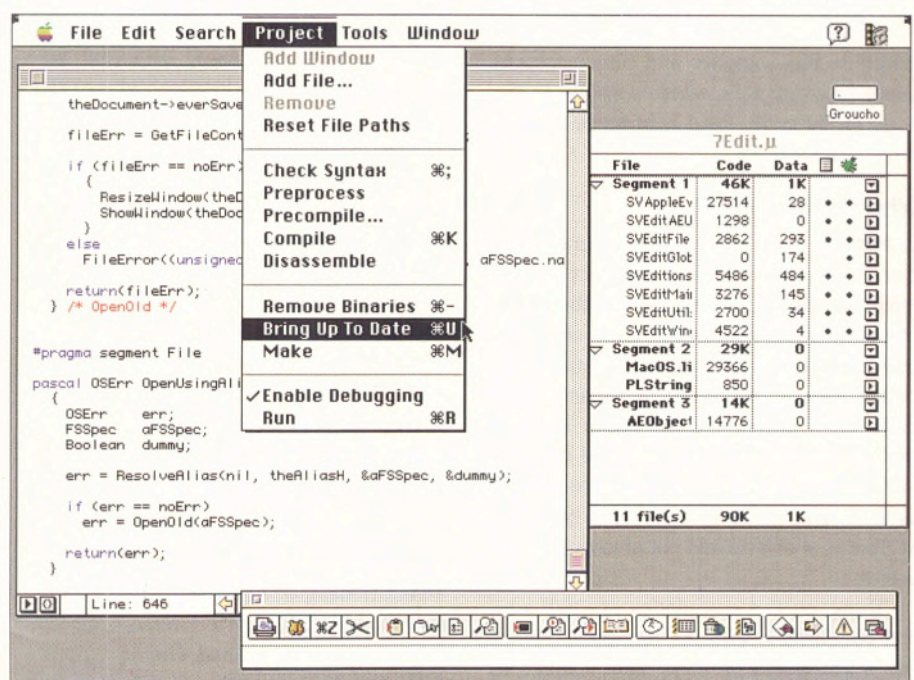


Figure 1 - Editing, compiling, linking and executing all within CodeWarrior



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set of classes which can be used as building blocks to create applications, allowing developers to concentrate on the detail of their application rather than writing the same old code for windows, menus and other elements of the interface. PowerPlant includes some features not found in MacApp and TCL, such as support for AppleScript (the system wide macro language found in System 7.5, allowing developers to create scriptable and recordable applications). On top of all this, there is a user interface building tool for PowerPlant, a full version of MPW, a number of examples and many other utilities, over 3,000 pages of detailed electronic documentation (available in printed form at additional cost) and Apple PowerPC documentation. So, it's not surprising Metrowerks doesn't distribute it on floppy disk.

### Speaking native

In terms of user interface, the environment for each of the compilers is the same, whether you are using Pascal, C or C++ on a 68K Macintosh or using the PowerPC versions of the compilers. So, for example, to create a 68K application, you launch the MW C/C++ 68K 1.1 application. This will then compile the code to run on a 68K Macintosh and you can use the 68K version of the debugger to debug it (see below). To create a PowerPC native application you just run the PowerPC version of the compiler. 'Fat' binaries contain Macintosh 68K 'CODE' resources in the resource fork and PowerPC code in the data fork. They will run native on both PowerPC Macintosh and 68K Macintosh. To create them you use both compilers and copy the 'CODE' resources from the 68K version to the Pow-

erPC application. Since CodeWarrior is scriptable this process can be automated using AppleScript. CodeWarrior offers the only complete PowerPC native development environment for the Macintosh. All the other PowerPC development tools are run

## CodeWarrior offers the only completely PowerPC native development environment for the Macintosh

on a 68K Macintosh or on a Power Macintosh under emulation. Even with native compilers and linkers for MPW, the MPW environment itself is not entirely native yet, so compiling and linking is much slower than CodeWarrior. This would explain why CodeWarrior is particularly popular amongst those developers writing PowerPC applications.

### Working with the warrior

As an environment, CodeWarrior is similar in look and feel to Symantec/Think C & C++, which is perhaps not surprising given that many of the original team from Symantec worked on CodeWarrior. You create, edit, compile, link, run and debug applications all from one place, which is a great deal faster than the edit/compile/link cycle imposed by environments such as MPW. Applications are divided into projects, which contain all the source files used for the projects, as well as the libraries the application

needs to link. One of the advantages of this approach to creating applications is that there is no need for you to write a make file, complete with its complex dependency rules. The order of compilation is determined by the order in which the source files appear in the project window. CodeWarrior also provides a fast compiler and incremental linker, so that only the files affected by a change in the source get recompiled and linked. This again makes it faster than environments like MPW. Segmentation is also controlled using the project window: all you need to do is select and drag a file to move it to another segment. When you build an application, every time a compiler error or warning is encountered, it is written out to the error log window. From here you can go directly to the line of source that caused the error, make the change(s), and recompile. Since recompilation is so fast, you can correct an error at a time if you choose, rather than a batch of errors, without the need to go off and have a coffee break while you wait to discover if your changed code compiles correctly.

### Developer desktop

All of the commonly used features of the environment - printing, file building and running applications - are available both from menu items and by selecting an icon in a floating tool palette (see Figure 1). Figuring out what each of the icons represents can be confusing to start off with, although on-line help is available. The toolbar may be easier to use than selecting the menu items as you become more familiar with the environment. If you are familiar with an environment such as Think C, then you can be up and compiling with CodeWarrior in under 10 minutes. The way that files are added to projects, the building and running of applications, is all very straightforward and even those who have not used Macintosh development tools before should find their way around CodeWarrior just by working through a few of the example programs.

Porting C and C++ code from other environments is also very simple. For example, I took an application written using MPW C, created a CodeWarrior project, added the necessary library files and compiled the application in under 10 minutes. If your application is written to use the Universal Interfaces, the standard set of header files used to allow you to keep the same source for PowerPC and 68K development, then you should not need to make any changes to your source code. Symantec Think C and C++ applications should also move across to CodeWarrior without too much work. There is even a utility for converting Think C projects to CodeWarrior projects.

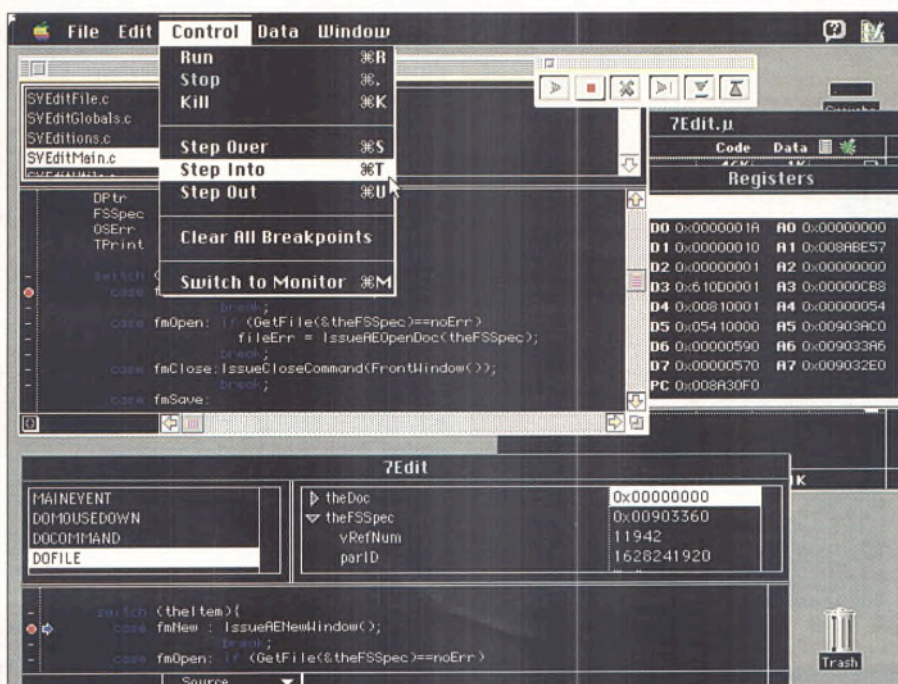


Figure 2 - A debugging session



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1. Robert B. Grady, Practical Software Metrics for Project Management and Process Improvement, ©1992. Prentice-Hall, Englewood Cliffs, NJ

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As for the C++ compiler itself, since it is tracking the emerging C++ standard and support features such as templates and exceptions, porting C++ code from other platforms should not be a problem. Also, there are a number of options which can be used for C and C++ code, such as ensuring ANSI compliance in C code. These options are all configurable in the CodeWarrior environment.

### When the worst happens

It is very rare to come across developers whose applications work first time and not being one of those fortunate souls, the debugging features of an environment are particularly important to me. Fortunately, CodeWarrior offers excellent debugging facilities for both PowerPC and 68K applications. All you have to do to use the debuggers is select the 'enable debugging' menu command. Then you recompile the application, which generates the symbol file that is used by the debugger. When you run the application, the 68K or PowerPC version of the CodeWarrior debugger is launched, depending on which environment you are running. The CodeWarrior debugger is not unlike the debugger found in Symantec/Think C & C++. It also bears similarity to other source level debuggers such as Apple's SourceBug and SADE. You can set breakpoints in the source code, step through the code line by line, inspect the value of local or global variables (including complex structures) and if that isn't enough to solve the problem, then you can invoke the services of a low level debugger such as MacsBug. CodeWarrior is also compatible with third party debuggers such as The Debugger from Jasik Designs.

The CodeWarrior debugger is very easy to use; it is also useful at times as a source code browser, since the windows used to display the code and set breakpoints divide the source code into each unit, which makes it easy to find your way around the code. Using the debugger developers should be able to track down most common errors. You can also use it to debug CODE resources and PowerPC shared libraries. Again CodeWarrior gets one over on the Apple PowerPC developer tools, since the CodeWarrior debugger works in native mode on the same machine, whereas Apple's Debugger for PowerPC is a two machine debugger requiring a 68K Macintosh and a Power Macintosh connected via a serial cable.

A one machine version of the Apple debugger is available in a pre-release version and the symbol files created by the CodeWarrior compiler are also compatible with this debugger. So developers could use this instead if they wanted to.

## Master of OOP

Over the last few years I have done a lot of C++ programming. Four months ago I discovered Object Master (OM). Unlike programming environments like Apple's Macintosh Programmer's Workshop (MPW), Symantec and CodeWarrior OM is a front end to an external compiling and linking system: OM doesn't compile or build programs itself. What it does is organise projects, helping you create and maintain the source code. It also controls a back-end compiler and linker via Apple events. I have used OM in conjunction with MPW and CodeWarrior; I could equally have used Symantec C++ as the compilation system.

So, if OM can't compile, what does it do that's so wonderful? Above all, it's an excellent environment for organising projects and editing C++ source code. A key interface element is a project window, a kind of souped up version of the project window in the Symantec or CodeWarrior environments. Behind this, however, is a data dictionary that keeps track of all the classes, variables and other elements of the program that is being built. The data dictionary is constructed by parsing all the program source code that goes into the project, including (in the case of projects built on top of a framework like MacApp) the source code of the framework itself. Browser windows can be opened up for editing. Class definitions and function bodies can be maintained.

Navigation tools are provided in the browsers for quick access to classes and their functions and data fields. Changes made to function definitions automatically update the class header and new classes and functions can be created using templates. All the grunt work of maintaining the C++ source code is handled for you: this is one of the areas in which OM has saved me a lot of time. The templates can be customised easily, too, coping with the different style idioms of systems like MacApp, TCL, PowerPlant and OpenDoc.

The source code editors used in the browsers and for file editing are syntax aware, highlighting keywords and other syntactic elements in the colours and styles of your choice. Source code is syntax checked when you press the <enter> key, so basic errors can be fixed before the program is compiled. Macros assist the rapid entry of syntactic elements. A class tree window lets you navigate directly to any class and function. OM hooks into external resource compilers like AdLib (for user interface view editing), ResEdit, and Resourcerer using Apple events. The only real problem I've noticed is that the Apple event integration between OM and CodeWarrior isn't as good as the integration between OM and MPW or Symantec. As well as being so helpful to C++ developers, the Universal edition of OM also supports object-oriented programming in Modula-2 and Object Pascal.

There are two versions of Object Master: the Universal edition (the one that I use), and a version that is specific to C and C++ programming. The Universal edition costs £295; the other costs approximately £195. The products are available from ACI, 0625 536178, and from other distributors of developer tools.

*Paul Smith*

### The one to choose ?

CodeWarrior is a very impressive development environment, which offers an easy to use integrated environment, so that you can edit, compile, link, run and debug code all from one place. You can build and debug applications and code resources, such as drivers and system extensions (INITs). It offers a number of features for making the creation of these code resources: support for global variables in stand alone code, for example. In terms of performance and code generation, CodeWarrior is faster than MPW or Think C and the code it generates is reasonably tight. I found no real problems with it, even with large projects, during testing.

One of my main criticisms of the integrated environments such as Think C and CodeWarrior has always been that they do not lend themselves to multi-person projects. While MPW offers built-in tools, like the Projector source code management system, and is possibly more flexible for some multi-person projects, CodeWarrior can access MPW tools using the ToolServer and performs MPW-compatible source code management using the MPW SourceServer and AppleEvents.

With the gold edition of CodeWarrior you get the 68K and PowerPC compilers, together with a complete version of MPW. In fact you get everything you might need



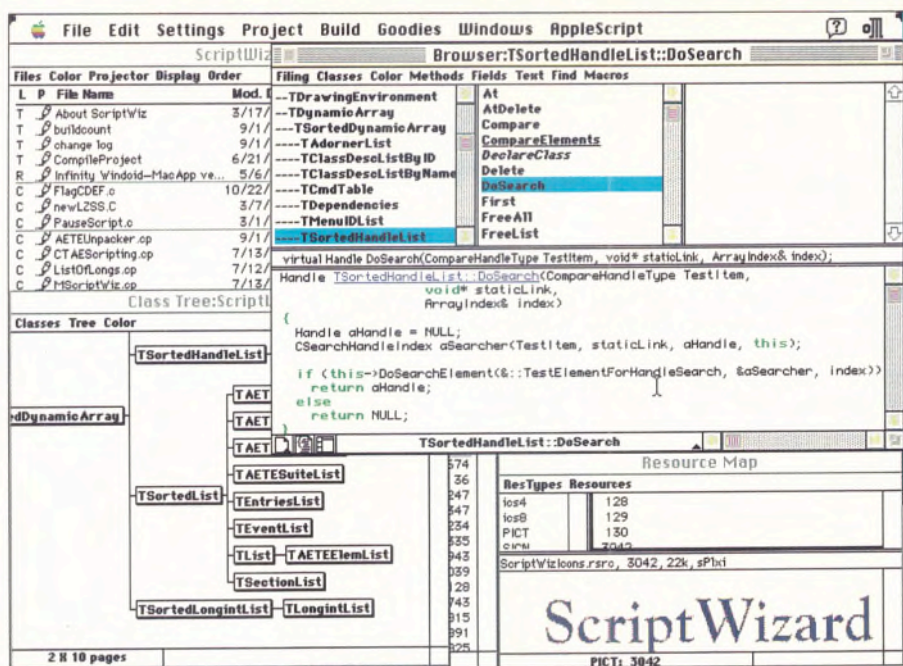


Figure 3 - The ObjectMaster environment

apart from Apple's MacApp class library. PowerPlant has an impressive list of features, but it is not yet as mature as MacApp. Many developers will have existing MacApp code that they want to move to the CodeWarrior environment. Fortunately, CodeWarrior comes with a set of instructions for building MacApp applications, so the proc-

ess for moving code across is relatively painless and you end up with faster compilations than is possible under MPW. CodeWarrior is also more efficient in terms of memory requirements than either Think C or MPW. The only criticisms of CodeWarrior are that it is not yet as open or flexible as MPW or Think C - with its translator ar-

chitecture - and also it would be useful if there were more programming examples on the CD (although the number of examples increases with each release). CodeWarrior is an excellent product, well designed, easy to use, fast and efficient. Developers do become attached to development environments and some may not want to move existing projects from Think C or MPW, but CodeWarrior should find its way into every developers tool chest.

Jon Lansell

CodeWarrior is distributed in the UK by Full Moon Software on Tel: 0727 827146 and 0628 660242. Prices for the Gold edition is £275. The Bronze Edition which has the same contents as Gold edition, but does not create PowerPC-native applications costs £69. If you purchase the current release CW4, then you will get free upgrades to CW5 and CW6 during 1995.

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Paul G Smith is a consultant, software developer, and writer, and can be contacted at the email address paul@ctalk.exnet.com, or by telephone at (0727) 844232.

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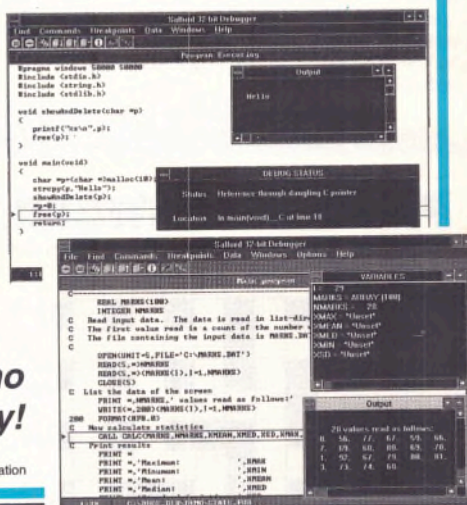
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5. strap two to your feet for a radical new mode of ecologically sound transport
6. therapeutic art session: fill your mice collection with different coloured paints and use as a set of rollerball inks
7. strap your mouse to a stick for the ultimate in new-age back massagers (Body Shop style)
8. for that relaxing drive to work, weave your mouse cords together to create a beaded car seat extra-ordinaire

Control/Break is completely moused out now, so we'd be deeply grateful for any inspirational help: one-offs, top tens (not just mice!)... The most dazzling missive will win an **EXE Magic Mug** (as judged by the keeper of the stationary and mouse cupboard). Mark your envelopes EXE: Magic Mug and send to the address alongside.

## Reader of the Month

As if that wasn't enough this issue sees the launch of **EXE Reader of the Month**. That's right, we want you to nominate a colleague for this venerable position. All you need to do is send in a photograph of the nominee, plus a few words on what they're like, what they do and why you feel they deserve to win.

The prize will be a rather special all-weather, multi-purpose body-covering article of the polyester persuasion. For many years these handy garments have been the much vaunted objects of derision and scorn. But we here at EXE feel that the day of the an... (you know what we're talking about) has finally arrived. And having completed our very successful survey of you, our beloved readers, we've finally proved what we always knew: that you're a bunch of thoroughly rugged outgoing, outdoor types.

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## GARBAGE COLLECTOR

```
...
i = NO_KEY
...
/* Wait for user to depress key */
while (i = NO_KEY)
{
    /* if no key is pressed then */
    /* perform next task */
    State = (*(Task[State]))();
    i = ReadKey();
}
...
```

This one had Mr P Richards stumped. 'I spent ages trying to figure out why the code wouldn't wait for a keypress. It was only when I looked at the compiler warning messages that I noticed I had assigned *i* rather than compared it to the value of *NO\_KEY* which happens to be zero.'

Why not submit your own program hiccups to Garbage Collector. If we publish them, you'll receive an EXE t-shirt, mug and pen as commiseration. Please keep listings short (about 10 lines) and include a brief word or two on what went wrong.

## Tales from the Internet: The Cookies of Wrath?

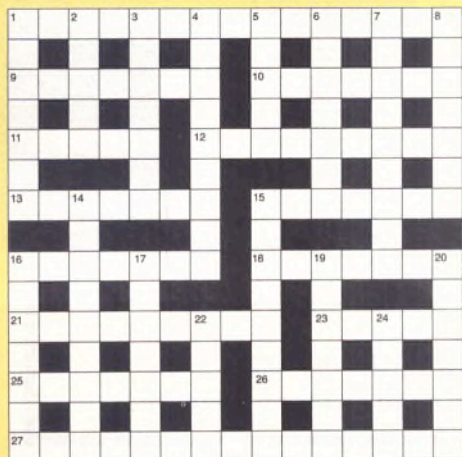
Taking a stroll down the information superhighway the other day our erstwhile Editor was intrigued to find a recipe for choc-chip cookies. 'Intrigued?' You query. 'On an information system as comprehensive as the net, cookies (choc-chip or otherwise) are surely a little tame?'

Well, normally we'd agree with you, but this is no ordinary dessert: these morsels have a mission. The lady who originally posted the letter paid a rather large American catering company for the recipe: she paid for it because it wasn't until her Visa Bill had arrived that she realised that the waitress who had told her the recipe cost 'two-fifty' meant \$250 not \$2.50.

The company cordially, but firmly, declined the lady's offer to exchange the recipe for the 'two-fifty' and war was declared. A vow was taken to spread the word (and the recipe) far and wide. Why it is that anyone would initially suppose that a large American company would sell an arguable asset for \$2.50 is as yet unexplained but Control/Break is pleased to report that the cookies are good. Revenge in this case if very, very sweet.

- 2 cups butter
- 2 tsp. soda
- 5 cups blended oatmeal
- 2 cups brown sugar
- 1 8oz Hershey Bar
- 2 tsp. baking powder
- 2 tsp. vanilla
- 4 cups flour

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18. Make a transposition error (7)
21. They oppose current change (9)
23. Peripheral to the sound sensor, for instance (5)
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27. Apparently unnecessary test on parity, say (10,5)

### DOWN

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2. Sounds for discontent (5)
3. Journeyman from Homer to Joyce (7)
4. N-type or P-type (9)
5. Capital charge on chip (5)
6. Suitability of fast train crossing loch... (7)
7. ...as I train rye to make a long journey (9)
8. Neutralises gas on logic circuits (7)
14. Gave up sailor and individual note (9)
15. Re-starts work with a full instruction set (5,4)
16. Schmitt made one but not for his gun (7)
17. Font chip I broke up in a story... (7)
19. ...and the way oily acid took a chip (7)
20. Put down for yourself sound sensor on omr input (7)
22. Final character of old (5)
24. Program name and state reward (5)

### ANSWERS TO SEPTEMBER'S EXE:

- ACROSS:** 1. COMPILE 5. AMSTRAD 9. NOISE 10. OPERATING  
11. OUSTING 12. TRIDENT 13. ERODE 14. TECHNICAL 17. PRECURSOR  
19. DONOR 21. OUTLINE 24. UPDATES 25. ELIMINATE 26. LOOTS  
27. STRAYED 28. SPRITES  
**DOWN:** 1. CONSOLE 2. MAINSTORE 3. ITEMISE 4. ELONGATE 5. AGENT  
6. STATION 7. RAISE 8. DIGITAL 15. CAROUSELS 16. CONSTRUCT  
17. PROCESS 18. UTILITY 19. DIDDLER 20. RESISTS 22. TRIER 23. ELAND

This month's crossword prize is BugTrak from Soft As It Gets, provided by QBS Software. August's winner was Mr Chris Nash. Please send your entries to the address above.



# Break

## Tales from the Internet II: Hit the Net

Stereotypes of computer users, net surfers, software developers et al plumbed new depths in the USA as SCO and Pizza Hut announced the launch of their PizzaNet scheme. Yes I'm afraid you've guessed already: order your tuna, prawns and anchovies on the Internet. The scheme is presently based in the Santa Cruz area but Pizza Hut are apparently testing the waters before going global. Users need Internet access any version of Mosaic to access the centralised PizzaNet server at Pizza Hut Headquarters in Wichita, Kansas. They are then presented with a customised menu page for ordering pizza and beverages.

Tired cliché's of cyberhackers programming the night away with their box of pizza did tend tend to spring to mind upon first reading of the Pizza Superhighway, but hey, it's OK: SCO provided us with some lovely photographs of apple pie Americans ordering their fave snack. This is good, clean fun for all the family folks.

Pizza Hut is already the world's largest pizza company, in an industry worth \$17 billion dollars per annum. Presumably they feel that this just isn't enough as they prepare to take on the virtual globe as well. Is nowhere safe?

## Caption Competition

Our Sub Editor Melanie (still hard working, still poor) was, quite frankly, baffled and bemused by the diversity of captions you came up with for our photograph from last month. The winner was Mr David Ross from West Yorkshire, who decided that he would rather have an EXE T-shirt than a £10 music voucher: clearly a man of good taste.

However there was one other letter which caught our attention. The caption was pretty grim (no offence), but 'John', the sender, asked us to donate his prize to the Royal Surrey Hospital in Guildford. We're just a bunch of old softies at heart y'know: so we thought we'd do that anyway.

But don't get over-excited about the prize-swapping idea. Unfortunately we can't allow exchanges of EXE mugs with software products: the magic mugs are more valuable.

For this month's Caption Competition we've planted a subtle hint somewhere else in the magazine... Another glorious prize (negotiable as ever) is again up for grabs, so whisk off those entries today!



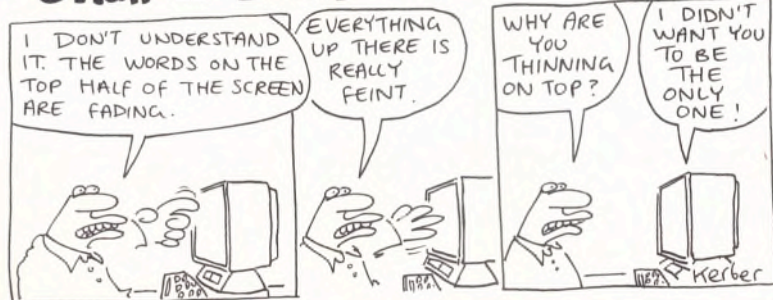
"I'd heard about spaghetti code, but this is ridiculous."



Your Caption Here!

## Brian and Betty

by Neil Kerber



## EXE Readers Club

As the leading software developers' magazine you'd be forgiven for thinking that here at EXE we would have little time left over from making sure that you stay at the cutting edge of technology. Yet it is exactly because we're always so busy that we know how you must feel. We already know how hard you have to work to stay at the top. Which is why we've started the EXE Readers Club. No doubt you already spotted the token in last month's issue: send in three of these and you'll receive your EXE Reader Club pack.

But we already have an impressive list of offers, discounts and bargains that we have specially negotiated for you. Watch this space every month for details of our ever-changing list of offers:

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Following on from last month, *Silicon River* is offering its *C Video Course* (Verdict: Recommended) to EXE readers for the amazing discounted price of £49.95, plus £8 delivery (retail price £199.95). Telephone Silicon River on 081 317 7777 or fax 081 316 7778 for details.

The *Access Developers Conference* is being held at *Windows Expo '94* from November 1st to the 3rd, Olympia II. EXE readers can claim a 20% discount off the usual price of £395 for two days. Complete the booking form insert in this magazine or call IT Seminars on 0256 381583.

The EXE Gupta 'SQL Windows Developers Day' will be held in London on November 22nd. The cost will be £50 inc VAT and EXE will add an extra year to your existing subscriber accounts. Non subscribers will receive a free one year subscription (normal price £35 for a one year sub). Ring Suzanne Chamberlain for details.

Coming in the November issue, a preview of EXE's comprehensive and detailed C++ report. Ring us now for more details of how you can receive the full publication at a discounted price.

We firmly believe that UK developers are the best in the world, which is why we are launching the *EXE Software Developer's Challenge*. This will take place at the *Software Developers Forum* on the 8th and 9th of February. Don't miss this exciting opportunity to compete with the cream of Europe's development community. Dare you phone us now to accept the challenge? For further information on the *Software Developers Forum*, call Interactive on 081 541 5040.

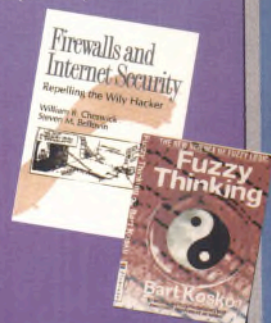
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## Free Books

Our reviewers have been singing the praises of certain software classics rather loudly of late. So much so that we just couldn't resist grabbing hold of some copies for your entertainment, education and delight.

*Firewalls and Internet Security: Repelling the Willy Hacker* is a particularly desirable little tome. It's been penned by Cheswick and Bellovin who currently reside at AT&T's Bell Labs. We have five copies of this book to give away in return for nothing more than your name and address: pop them on a postcard marked 'Cheswick and Bellovin' and send to the address on the top of the page opposite.

*Fuzzy Thinking* by Bart Kosko 'the 1990's prophet of Fuzzy Logic' has been hailed by Kevin Yeandel in his article on fuzzy logic as the 'modern fuzzy bible'. As it also includes views on Zen, 'deja vu', suspended animation and the existence of God we feel that it's rather a bargain. Particularly as we have five copies available to the first readers to get their postcards with name, address to 'Bart Kosko' at the address on the opposite page.



EXE  
TOKEN  
No2  
October



# Mounting NFS

**Peter Collinson**  
discusses NFS, the  
glue which holds his network  
together and the major  
changes of version 3.



In the July Edition of *.EXE* last year, I talked about the evolution of network file systems. I guess that if you work on a Unix workstation then NFS is not too far away. It certainly provides me with the glue to hold my network together. My Unix machines access each other via NFS and my MS-DOS box tends to get and put files from the Unix machines using NFS.

Version 1 of NFS was only used internally within Sun, it was never released. Version 2 was implemented in 1984 and was first released with SunOS 2.0. It formed the basis of RFC 1094, dated March 1989. RFCs also exist for the underlying protocols: the Remote Procedure Call interface (RPC) and XDR (eXternal Data Representation) which is the method used to transport complex data between different machine architectures.

The idea of a Version 3 NFS protocol is not new, there have been proposals for enhancements popping up from Sun for some number of years. What is new is that a group of people from several companies got together in July 1992 to firm up the draft. The plan was to implement the new protocol. The results of that implementation effort were presented at the last Usenix: June, Boston, Massachusetts. This is a completely new 'Version 3', beware that descriptions of old Version 3 proposals are still lying around the Internet.

## NFS basics

For the uninitiated, I'll start off with a little background so that this article is not complete gobbledygook. The basic idea

of NFS is simple. When you add a disk to the system on Unix, you join it into the existing file system tree by the `mount` system call. The new disk forms a new branch of the tree structure. You can move into it using the `cd` command and access its files. With NFS, you do the same thing. You, as the client, issue a `mount` command that is sent to a remote server and part of the file system tree on the server is joined to your local filestore.

The server will have a list of machines that are permitted to access its filestore and will validate your request before passing back a 'file handle'. This value is used in all further requests from the client to the server. Now, when a process on the client accesses a remote file with a `read` system call, for example, that system call is turned into a remote procedure call using the NFS protocol. The server checks the validity of the request, performs the desired operation and returns the result.

The NFS protocol assumes that the server does not retain any state about the client. For example, a normal Unix read system call remembers how far a particular process has got in reading or writing a file. A sequence of `read` calls can be used to scan a file from beginning to end: there is no need to reposition file pointers before every read. NFS will store the 'where we are now' state in the client. When scanning a file, it's the job of the client to send appropriate `read` primitives, each containing position and size information.

So the server is not clever. It knows nothing about what the client is doing. Clients *do* tend to be clever, for efficiency reasons. They remember file positioning information so that they may present Unix file semantics to the user process. They will also cache information so that it doesn't have to travel the network again.

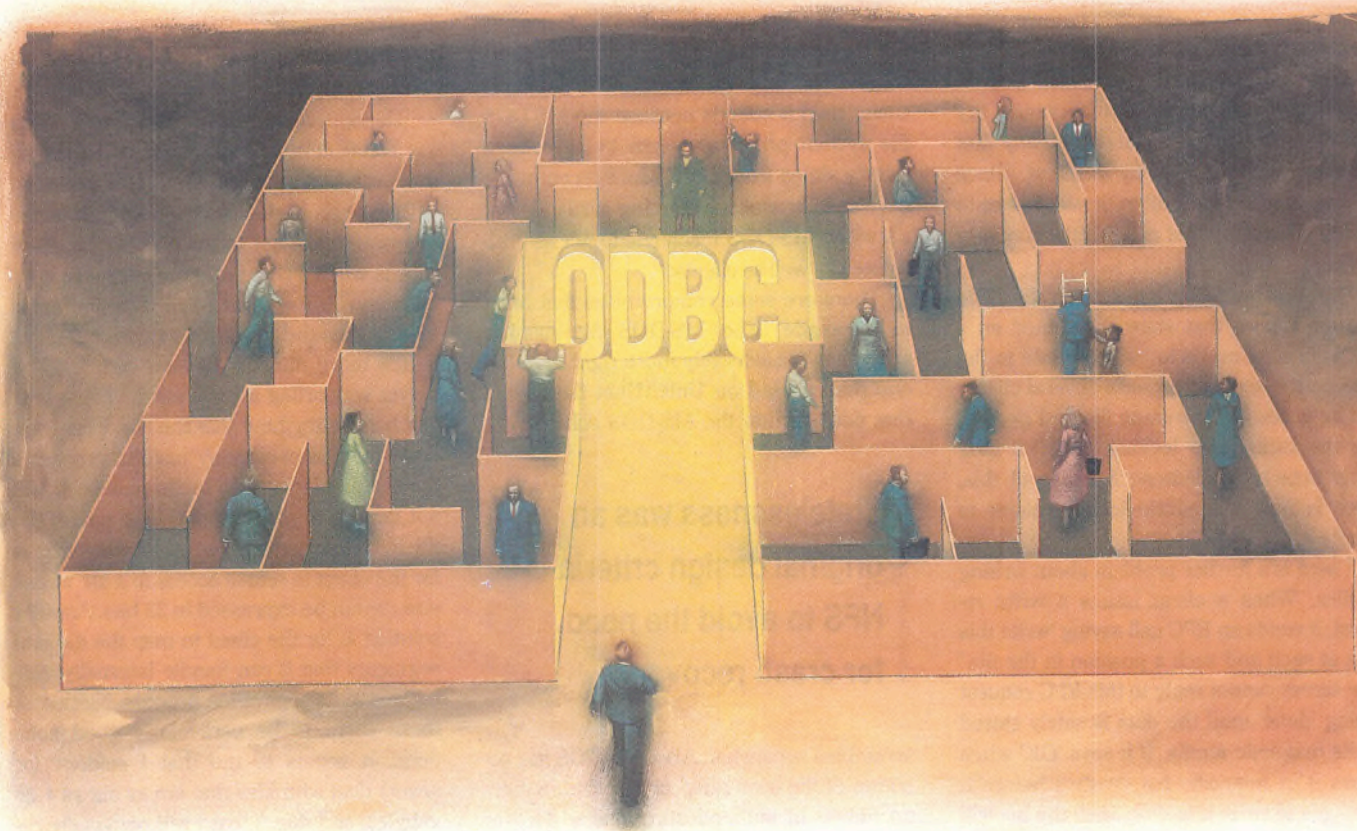
## Age of statelessness

Statelessness was an original design criteria in NFS to avoid the need for crash recovery.

When a server crashes, a client can just wait for it to come back and continue with







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operations as if nothing had happened. There is no state to be recovered and reloaded into the server. Cynics would say that it was a criteria because the early Sun systems were not exactly resilient. Since they tended to crash often, it was better to design something that avoided the recovery problem.

Stateless operation has a down side. File locking implies that state is retained on a file. This state needs to be kept close to the file - on the server - because several clients can be accessing the same file and need to see the locks. File locking on NFS took some time to implement; because of this, there is now a separate lock manager to handle it.

There is a further problem about writing to files. When a client issues a write request, it sends an RPC call saying 'write this data at such and such a position in the file.' The server cannot reply to this RPC request saying 'done' until the data is safely stored on its magnetic media. If it says 'OK' when it has it in memory, but crashes before it manages to write it to disk, then the file will be in an inconsistent state. The client thinks that it has written some data that is not actually present on the disk. The server must do a 'synchronous' write and not return any result until the data is safely stored on disk.

This has proved a huge bottleneck for NFS implementations. Some systems have provided an 'unsafe' write mode where the data is retained in the memory of the server and the users hope that crashes are infrequent. To date, the most common solution for NFS servers has been the Prestoserve system. This is kernel software using an NVRAM disk cache that sits in between the kernel and the disk. When the kernel initiates a write, the data is loaded into the cache and the kernel is told that the disk write has succeeded. The kernel tells the NFS server and the server tells the client.

In time, the data finds its way onto the disk. If the system crashes, the Prestoserve system will write any unwritten data onto the disk before allowing the system to bootstrap, so the file system is consistent. The Prestoserve system also helps with normal local file system operations that require synchronous writes, for example, creating files.

Stateless operation, good and bad, was an aim of the NFS design. Another strong aim was to provide a protocol that would work independently of the file structure used by the underlying operating system. There are now servers and clients that run on a wide variety of machine architectures and operating systems. So, for example, it's possible to write a client that runs on a MS-DOS machine and allows applications to see a standard MS-DOS file system that is actu-

ally located on a remote Unix system. Sun's PC-NFS has done this for some time. This is easier than it sounds because the MS-DOS file system primitives seem to have been largely stolen from Unix. More recently, we have seen products becoming available that allow the MS-DOS machines to act as NFS servers as well as clients.

There are some compromises that need to be made. The MS-DOS file naming scheme is considerably more rigid than the one that is used on Unix. Unix file names that don't fit into the MS-DOS scheme are

## Statelessness was an original design criteria in NFS to avoid the need for crash recovery

scrambled somewhat. Also, MS-DOS has no notion of file ownership or, for that matter, no notion of authenticating users. This is usually got round by making the PC user log into the remote server using their normal Unix login. This happens at mount time, and justifies the decision to make file system mounts use a protocol that is separate from the NFS protocol.

NFS has undoubtedly been a success. I suspect that one of the main contributory factors to this success is that Sun has always made the protocols 'open', or nearly; the locking protocol has not been widely available until recently. However, in general, it's been possible for anyone to implement NFS from the specifications. Sun made the XDR and RPC mechanisms freely available by posting them to the net.

### Major changes in Version 3

The main aims at the design meeting in 1992 were: to solve the write throughput bottleneck; to minimise the work needed to create a Version 3 implementation given existing Version 2 systems; to ensure that development of the new protocol is feasible on less capable clients and to document the result with annotations to help developers. The meeting decided to avoid anything controversial, leaving hard things to be done in subsequent protocol revisions. The main principles were to keep the changes simple and to get some trial implementations done in a year.

Version 3 is compatible with the design of Version 2. Clients and servers can easily support both protocols using the facilities for multiple versions provided by the underlying RPC. This allows inter working between old and new systems and means that

the original UDP port numbers can still be used.

The first change in Version 3 is to widen the file offset value from 32 bits to 64 allowing immense files to be accessed. This obviously will cause problems when new and old implementations attempt to inter work. The easy case is when a 64-bit client is talking to a 32-bit server. If the client requests a file that is too big, then the server just says no.

It's more difficult to cope with a 64-bit server supporting a 32-bit client. The server can handle anything that the client can generate but the client may have to process a file that is bigger than it can handle. It will not be able to store properly the size of the file in its internal structures. One solution is for the client to refuse access to a file whose size cannot be expressed in 32 bits. Another solution is for the client to map the file into segments that it can handle internally, telling lies to its application process. Neither of these seem to be particularly good solutions. It seems to me that I seldom (or never) deal with files that are as big as 4 gigabytes, so I doubt that I will personally encounter these problems.

### Get committed

The big selling point of Version 3 is the ability to perform asynchronous writes. The client sends the file to the server using a number of asynchronous write calls. These will always return a value in RPC irrespective of whether the data has made it to the disk. When the client needs to ensure that the data is consistent, it issues a `commit` call, saying 'flush all your data to the disk and tell me when that is done.' This is a classical operation. It's surprising to me that it has taken so long for it to become part of the NFS protocol.

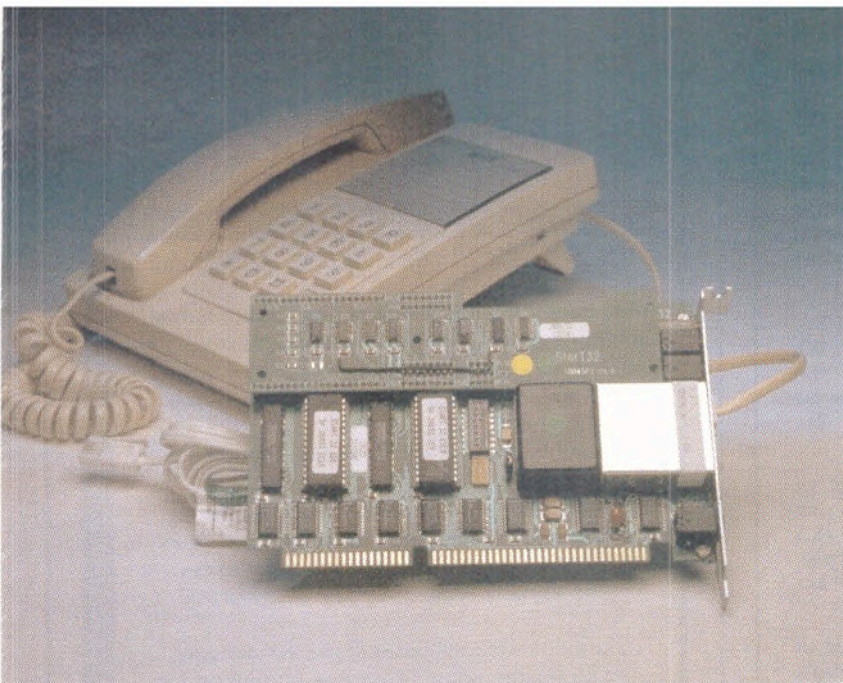
This mechanism does complicate the client somewhat. If the server goes away for some reason, it is up to the client to retry all the operations from the last commit to ensure data integrity.

To help with this, the server replies for the write and commit operations provide a 'write verified' value that is changed every time a server crashes. This is an 8-byte value. The intention is that servers will use their boot time as this value, because it is guaranteed to be unique (assuming, of course, that clocks go forward all the time). A client stores this value and compares any new value with the stored one to see whether the server has crashed. The client can now tell if a server has crashed, and can resend any stored uncommitted data.

Performance measurements contained in the Usenix paper show that write throughput using 10 MB writes is more than seven times that obtained with a raw



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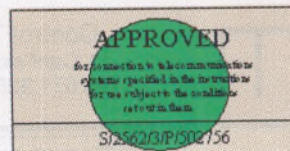
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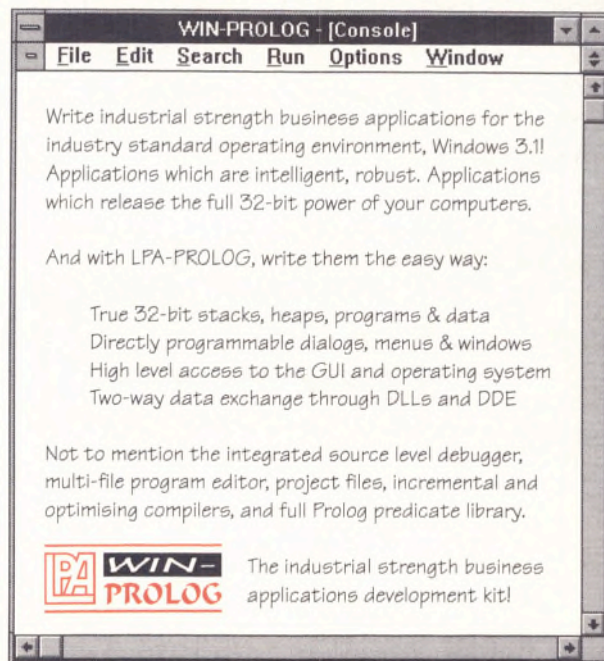
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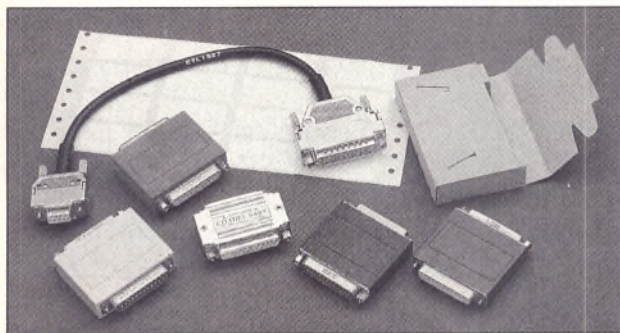
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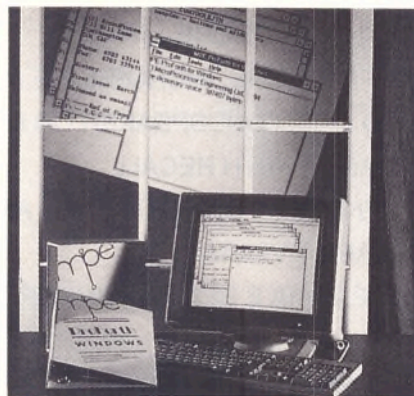
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# Problems with Version 2

So, why do we need a Version 3? Well, I have already mentioned the 'synchronous write' problem that slows NFS data writes considerably. There are also problems with the size of the file that can be dealt with using Version 2 NFS. Remember that every read and write needs to contain file positioning information, this is passed as a 32-bit offset and means that files are limited in size to 4 gigabytes. This seems big enough to me, but limits are meant to be pushed against and some people want to access bigger files over NFS.

Second, there are problems with maintaining a client-side data cache. Version 2 of the protocol anticipated that clients would do this but did not provide much help for its implementation. The current strategy is for the client to read a file into its cache. Then when the time comes for the client to check whether the cached data is still valid, it will send a request to get the attributes of the file from the server. These contain values like the owner of the file and its mode or permission bits.

They also contain the file modification time. If the newly retrieved modification time matches that in the client's cached attributes for the file, then the file data is still valid and the client proceeds assuming that the data is up-to-date. If the times don't match, then the cache is invalid and the client must retrieve the file again.

This method fails when the client itself changes the cached data. If the client changes one part of the file, the remaining parts may still be valid. But the client cannot be sure because the client's own write operation has changed the file's modification time. All of this increases the network usage of NFS. It needs to pull data that is perhaps correctly cached on the client.

Third, the Version 2 protocol could not be sure that an operation on a remote file system would succeed because access permission to the remote file might be denied. File access permissions in NFS are a problem and this actually hasn't changed much. A file is owned by a user who is represented in the system as a pair of numbers, a user id (uid) and a group id (gid). Permission is granted depending on mode bits that control whether the user, their group or everyone should have read, write or execute permission to a file. If this seems familiar, yes, this is the Unix model.

The uid/gid space needs to be the same for every system that is sharing a file tree. This has always been a huge limitation. I will remember the nastiness of the renumbering operation that I had

to perform on several machines when the prospect of NFS loomed into view. It is possible to provide some mapping scheme for the uid/gid pair and non-Unix servers sometimes do so. Sadly, Version 3 doesn't tackle this.

Then there is the problem of super-user access. Super-user is uid zero, but you may not necessarily want every person with super-user rights on their machine to be super-user on yours. The normal practice is to map requests for super-user access in the server to *nobody* unless special mount options are specified. This means that super-user often has less rights on a remote machine than you do. Naturally, this can sometimes produce counter-intuitive results.

Each RPC request contains the access rights of the emitter of the request, so a server can check the validity of the requested operation. Remember that the server has no state and each operation is regarded as a distinct event. The RPC request needs to carry enough bag and baggage to provide authentication.

Problems are caused when the server maps uids. A client can get the file attributes of a remote file and determine that its super-user can access it. But the client cannot be sure that a request passed into the server will actually succeed because of the uid mapping that takes place. The only course of action is to try the request and hope that it succeeds. This does not map well onto the semantics of the Unix file system that expects access permissions to be checked when the file is opened.

Finally, Version 2 of the protocol could not cope well with requests for unsupported features of a server file system. There was a kind of undocumented feature in Version 2 that servers were really Unix systems and provided all the semantics that the protocol requested.

For example, what happens when a Unix client asks for an operation that a MS-DOS server cannot handle? Unix file systems have capabilities that other file systems do not. For example, the Unix system has the notion of *hard links*, where more than one directory entry points to the same file. In Version 2, all a MS-DOS server could do was to fail a link request. The client had no knowledge that the request was failed because the operation was not supported by the underlying file system. However, given that knowledge, the client can take steps to fulfil the operation in a different way, at worst, perhaps copying the original file. Version 3 provides an error message that can be used to make the client do this.

Version 2 implementation. It's only a tiny bit slower than that obtained when a Prestoserve system is used with Version 2. The Prestoserve system adds a bit of performance, it still boosts speed with other synchronous operations, but in general the difference with and without is not so marked. Bad news for the makers of the Prestoserve system, I feel.

The write-verify value is an example of a number of subtle changes to the protocol that permit the client to deduce more about the state of the server. Help is provided to permit the client to maintain its data cache more accurately. Every reply for an operation that modifies data contains two sets of file attributes: a version taken before the operation was done and a set taken after the operation. If the modification time in the pre-operation attributes matches the client's copy, then the client knows that the local

cache is consistent. Only the client has modified the file. They replace their local copy of the attributes with the ones that existed after the operation and continue merrily along. If the pre-operation times are different, then the client knows that their cached data is incorrect and can take steps to flush and reload it.

Returning these times in the reply from the server is a step forward in reducing network usage too. Previously, a client had to ask explicitly for the attributes which imposed additional network load. Implementors are now strongly encouraged to make all replies contain this information. It's thought that most new implementations will. This adds a small load to the server, but should reduce network traffic considerably.

Some attempt has been made to tackle the problem of super-user uid mapping by

the provision of an *access* primitive where a client can ask the server at file open time whether one of its users has access to a particular file system object. This maps the Unix semantics of a file open more closely and gives the client a chance to say no at the time that the user application expects it, rather than later, when data has started to flow.

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*Grateful thanks are due to several people who read drafts of this article and suggested improvements: Jan-Simon Pendry from Sequent, Diane Lebel from DEC and David Hitz from Network Appliance.*



# No need for Unix: Motif for PC

There's no such thing  
as a Motif desktop for  
the PC... Or so **Niall  
Mansfield** thought before he  
tried Desqview/X on his.



When it comes to operating systems, I sometimes try to delude myself that I am broad-minded, but fundamentally I'm a bigot. Unix has drawbacks and some of them are serious. But without doubt, it provides the best general-purpose technical environment available. So when someone suggested that I might like to look at a DOS system, DesqView/X to be precise, with DOS's brain-damaged architecture and its ludicrous memory system, I chuckled inwardly and murmured 'sucker' sadistically under my breath. But to my amazement, I found it a very impressive package, with only a few reservations.

This is what happened. In my opening article about programming with Motif, I said that to write Motif programs the first thing you had to do was get hold of a Unix system. Quarterdeck sent me an email message pointing out that this wasn't strictly true: the latest release of DesqView/X had a Motif toolkit and lots of other goodies making it a reasonable Motif development environment. So we decided to give it a go and look at it from that particular perspective.

## DesqView/X for the user

At its most basic, DesqView/X gives you a multi-tasking window system on top of DOS running on a PC. In itself this is quite handy. With several different DOS windows running simultaneously you start to get the flexibility that people expect from workstations. When X Windows first came out, the thing that most people got excited about was the ability to run several terminal sessions on the one screen!

We'll look at this multi-tasking capability in more detail later, but the real benefit of DesqView, and for me its most useful feature, is that you can run MS-Windows within it. So what, you ask? Well, DesqView displays its windows using the standard X window system protocol, just like all the Motif programs we saw in the last few articles. The best part of X is that you can display a program's output on your machine, *or on any other X screen on your network*. The result is that you can run MS-Windows on your PC, but display it onto your Unix workstation elsewhere on the network. So, at last, sitting on my beloved Sun SPARCsta-

While Unix is good as a technical environment, the end-user applications are usually dreadful, apparently designed for octopuses with arthritis

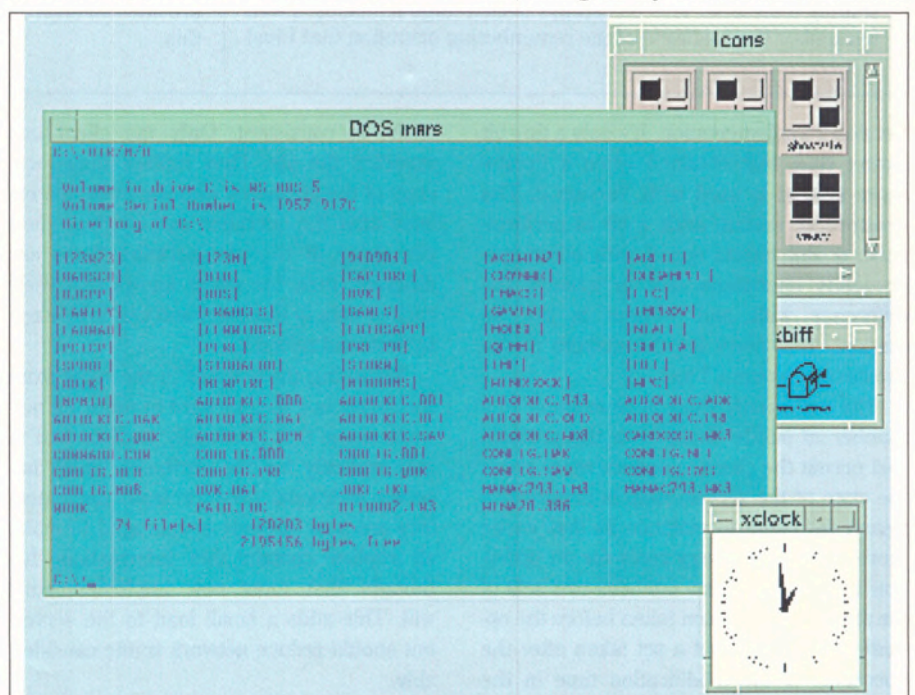


Figure 1 - Motif running on top of DOS



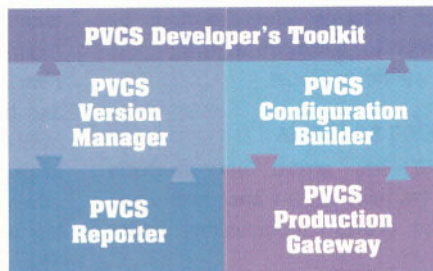


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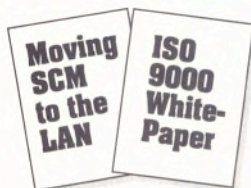
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tion, I can live in Unix-land, but without leaving my seat I can sneak off into PC-land to get at all the wonderful programs written for MS-Windows! And this really does work. Figure 1 shows my Unix/Motif screen, with MS-DOS in the middle (via DesqView).

Why is this so important? While Unix is good as a technical environment, the end-user applications are usually dreadful, apparently designed for octopuses with arthritis. And even if they aren't, they often cost about 10 times as much as equivalent MS-Windows packages. So being able to use a PC as an MS-Windows 'application server' to Unix machines elsewhere on the network makes a lot of sense, both economically and in terms of usability. Given that the user interface of Motif isn't much different from MS-Windows, a uniform overall environment can be presented to the user.

## The alternatives...

There are other ways of doing the same sort of thing, but each has its disadvantages. You can run a software-only PC-emulator on your Unix system. These usually behave fairly well except in the performance department. For example, your 30 MIPS workstation will behave like a 286 PC. (Why spend 750 quid on a PC when you can spend five grand on a big workstation?) Or, you can try the WABI system developed by Sun Microsystems (Windows Application Binary Interface). This translates the PC binary program into native workstation instructions and maps all the MS-Windows system calls into their Unix equivalents. The result is a program that runs fast on your Unix

box: unfortunately WABI isn't really 100% yet and it only works for a specified, small, set of PC applications.

By contrast, DesqView/X replaces the MS-Windows drivers, screen and mouse handling with X-Windows equivalents, but otherwise the application is running on its native hardware and has access to all its facilities. For example, within Windows on

## While DesqView is good, it is not a giant-killer

the Unix screen, we still have access to all the printer drivers, etc. In fact, we still have all the PC-based networking and other resources. Of course we have, because it's still running on the PC! All we have changed more or less is where the pixels are displayed.

You can do exactly the same with DOS programs too, serving them over the network to X machines elsewhere. As DOS is so much less consumptive than Windows, you can sensibly serve many DOS sessions from a single PC. But there are limitations on which programs can be served in this way; for example, if the program draws graphics or performs other functions by writing direct to hardware registers etc, then there will be problems.

## Multi-tasking and tools

DesqView/X has grown out of plain DesqView (without an X) whose main function was to provide multi-tasking under

DOS. DesqView/X is an extension of this: you can still use it just as a way of getting multiple DOS sessions and multiple windows. To manage all these windows, DesqView gives you a number of different tools of the usual sort - the Application Manager, similar in function to MS-Windows' Program Manager and a File Manager.

While these are perfectly reasonable tools, it is in this area that I have most misgivings about DesqView: simply, it is not a 'standard' system. In other words it's neither MS-Windows, nor Motif, nor Macintosh, nor any of the things you are used to. The result is that you have to re-learn how to do all the things you thought you knew already, like setting up the printer, or configuring menus, or even selecting an item from a menu. For instance, DesqView requires that you pull down a menu, then explicitly click on your selection. Cutting and pasting in a DOS window is about a five-step process which requires you to use an external popup menu; I found it so tedious it was easier to re-type things. Yes, this is a different user interface.

## Lacking standard practices

In one way it is unfair to criticise the package for not being something else, but unfortunately that is the way the real world is. Again we are seeing, as Vivaldi did in his *Four Seasons*, the contest between invention and harmony. In other words a desire for radical new technology making quantum leaps forward on the one hand, but on the other a desire for standardisation and sticking with what we know and understand. This paradox will always be with us, all the more so as particular packages become dominant in their area. The only way such market leaders are supplanted is when something new arrives which is so dramatically better that people will suffer the pain of moving to the new software. And while DesqView is good, it is not a giant-killer in this class. So it will remain a niche product. The rest of this article describes how good that niche really is and what useful things can be done in there!

## Menu, menu everywhere

The globally accessible menu is a small but useful feature which really speeds up navigation and invoking tools and programs. Press the <ALT> key anywhere and you get the DesqView popup menu. In much the same way as old Lotus-123's menus operate. You press single keys to move rapidly through nested menus. DesqView lets you rapidly select items from hierarchical menus, which you can of course customise to include your own programs. This feature alone makes DesqView much quicker for

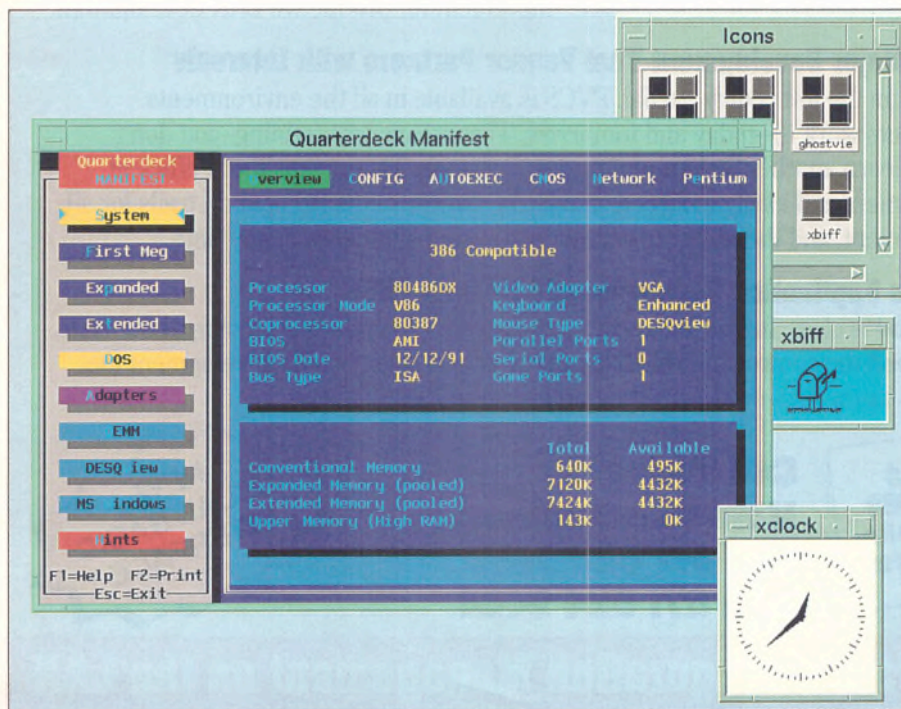


Figure 2 - Optimising memory with Manifest



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an expert user than MS-Windows.

Another good tool included is Quarterdeck's Manifest program which, as a DOSophobe, I particularly appreciated. Since I am blessed with being able to work on computers designed by rational people, the intricacies of high memory, moving only some parts of things from low to high, seem to me to be needlessly complicated. Manifest takes away a huge amount of pain and worry, by giving me all my hardware configuration information in an understandable and accessible format.

Also in the toolset provided is the Sysmon: the system monitor which provides information about all the tasks running under DesqView's control. For each task you can inquire about which files it has open, how much memory is used and which network sockets are in use. From this you can get a feel for the resources your programs are using and how to tune your system.

To make the most of DesqView/X's remote display features, you obviously need some form of TCP/IP networking to give you access to the remote X windows display machines. Rather neatly, DesqView/X bundles Novell's TCP/IP for DOS, so you don't have to buy any extras to get basic connectivity. The package includes support for both TCP/IP and IPX - simultaneously if desired - so you can connect to Unix or Novell machines as required. The TCP/IP module handles SLIP (serial line IP) or PPP (point-to-point protocol) so you can run over serial or modem lines and not just Ethernet or token ring links. However, you only get the TCP/IP 'kernel', ie the basic transport and a few management utilities; you do *not* get the remote-login applications such as

telnet or rlogin, nor the file-transfer program ftp.

Fortunately you are not forced to use the bundled TCP/IP. DesqView/X will work with all the usual TCP/IP packages for PCs (FTP Inc's PC/TCP, LAN Workplace for DOS, Wollongong, etc). We had FTP's soft-

## The intricacies of high memory, moving only some parts of things from low to high, seem to me to be needlessly complicated

ware installed already, so as soon as DesqView/X loaded it, we had full X access. Very pleasing indeed.

### Here be Dragons

Sadly, we did have quite a few problems actually getting things to work. In the worst case, we started a program, the disk whirled and rattled for a few seconds. Even before the window appeared, the bell went 'beep beep' and that was the end of that. No error message, no log, no nothing.

This happened as soon as we tried to use DesqView. I almost gave up. Somewhat resentfully I called QuarterDeck's technical support - I say resentfully because I assumed that the software was just buggy and that I'd be wasting my time. In fact, I got a lot of help, which was polite, patient, and knowledgeable. We worked through the memory settings, and the parameters for SmartDrive and for the QEMM memory manager which is bundled with DesqView. After about half an hour, we were up and running again.

Because of shortage of time, we were not able to get everything running perfectly. For example, getting more than one session to a remote machine was unreliable. But Technical Support had many suggestions on settings to check. Given half a day or so, I reckon all would be dandy. Even so, the lack of a 'console' window, or at least a log of problems, errors and warnings, is a considerable flaw.

Much more worrying though is the fact that the system suddenly failed after being used for a few days. The first indication was the highly informative 'beep beep' when a program was run but failed to appear. Thereafter, no programs could be run on remote X displays. And even telnet failed to connect to any machine on the network, when run within DesqView. However, as soon as we exited DesqView, all the net-

working was fine, without any reboot or re-initialising or anything else. At the time of writing this problem is unresolved, and we can think of no reason for it. Honest, guv, we didn't change a thing.

This trouble may be due to our ignorance. We may have inadvertently changed something and maybe our high memory stuff needs to be jiggled about a bit. However, this hyper-sensitivity and lack of stability would make me reluctant to use this system for mission-critical applications, at least not without a few weeks of fairly tough system testing. (But then, I say exactly the same about MS-Windows; our Unix systems stay up for months at a time, whereas our MS-Windows PCs each crash once or twice a week. Sigh.)

### Motif programming

Now let's look on the bright side again. Quarterdeck has done a really good job in making Motif available on the PC. The Motif Development Toolkit comes in three different flavours, depending on which C compiler you are using: GNU, Metaware, or Watcom. We chose the GNU version, because it also included the compiler itself, so once again no further expenditure was necessary.

The GNU C compiler is worth a mention in itself. This compiler was developed by the Free Software Foundation and can be distributed free. It's available on a wide range of Unix machines, on VAX VMS, and on DOS PCs where it's known as DJGPP (after the name of the person who ported it.) The compiler is of remarkably high quality, often better than many 'commercial' compilers. You can even get support for it from a number of third-party companies. It usually comes with the supporting tools you need for program development. The DesqView package included the header files, libraries, linker, archiver/librarian, high-memory loader, 'make' program, etc. Using these in conjunction with the excellent emacs editor, also from the Free Software Foundation, gave us a good, and familiar, development environment on the PC.

### Tick tock

So how easy was it to take a Motif program from a Unix system and get it running under DesqView? The answer is: very easy. The biggest difficulty was reading all the various manuals, release notes, updates to release notes, etc. We decided to start with the standard X program `xclock` which is included in the DesqView distribution. Starting in the `xclock` source directory we ran `DJGPP.BAT` which defined appropriate environment variables, `qmake` was then used to compile the program. We got an error during the linking phase, reporting 'Vir-

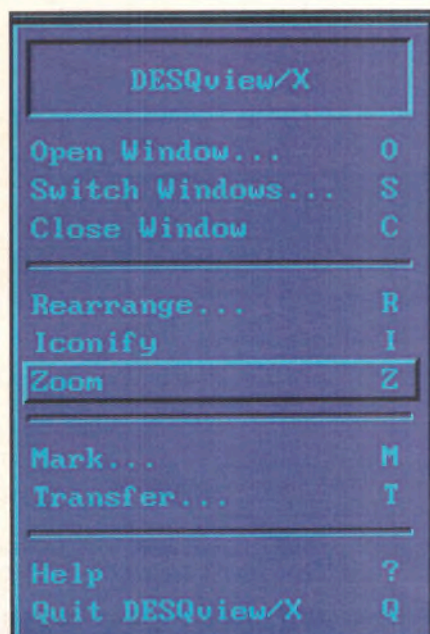
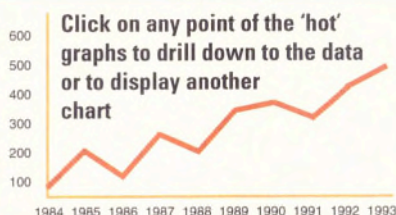


Figure 3 - MAINMENU from last month under Desqview



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## OPEN SYSTEMS

tual Memory Exhausted!'. The GNU software doesn't come with any printed documentation (you get what you pay for I suppose) but we rummaged through the plentiful docs on disk, which said that DJGPP uses up to 128 MB of real memory, plus another 128 MB of disk storage as virtual memory if it's available. We had only 8Mb of RAM and our disk was nearly full. Deleting a few megs of junk files solved the problem and the compilation went through perfectly. When run `xclock` gave us the usual display on our DesqView system. The command

```
xclock -display mars:0
```

really did work and threw up the X clock on our Unix system.

### Who's been cheating

The next phase was to compile one of our own Motif programs to test whether Quarterdeck hadn't cheated and changed the `xclock` source. We copied over the `menubar` program from last month's article, edited a makefile for it using `xclock's` makefile as a template, and ran `qmake`. Again to our astonishment, it ran through, with only one error at link time, because I'd forgotten to include an extra li-

brary. Once this was changed, the program compiled, and ran. Even more surprising, calls in `menubar` to the `system()` function, to run the `xsetroot` program to change to root window background, worked too!

### If all you really want is a Unix development environment, LINUX is better and cheaper

So the Motif toolkit far exceeded my cynical expectations. It worked well, it was complete, it was up-to-date (Motif 1.2 and X11R5) and was well integrated with the compiler. I personally had a few snags with some of the documentation, but this was only because we got a pre-release version where the docs were half-way between the older Motif 1.1/X11R4 version and the new one. However, the new release is now in production.

Other modules are available for DesqView/X. Instead of DesqView's own idiosyncratic window manager you can buy add-on standard ones. The Motif Window Manager costs about £190.00 the Open

Look Window Manager about £150.00, although why anyone would want to use the Open Look version these days beats me.

### Conclusion

I believe DesqView/X is a very good environment. Its Motif is good and straightforward to use. It's relatively cheap, though if all you really want is a Unix development environment, LINUX is better and cheaper. But DesqView/X does offer facilities that other systems can't better, in particular the ability to serve MS-Windows applications and multiple DOS sessions over the network. If only it didn't have to live on top of DOS's ghastly memory architecture and the instability that brings.

*Niall Mansfield is the managing director of User Interface Technologies Ltd. He can be reached on 0223 302041 or email: [niall@uit.co.uk](mailto:niall@uit.co.uk). DesqView/X itself, the end-user system, is priced at UK £229.00 The X Windows and Motif Development toolkit costs £170.*

*Source code for the Motif programming series which ran between July and September is available. Please send SAE and diskette to the EXE magazine office. Mark envelopes 'XWIN'.*

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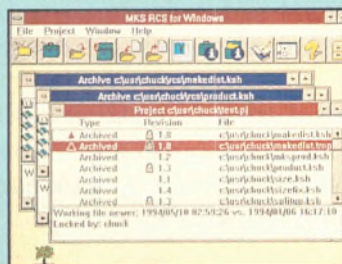


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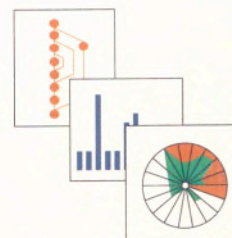
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# Talking MIME

Multi-purpose Internet Mail Extensions (MIME)  is an essential enhancement to basic RFC821/822 Internet mail. **Paul Richardson** explains why.

You may recall that a couple of issues back I made a reference to the Multi-purpose Internet Mail Extensions (MIME) standard for defining the content of Internet mail messages. As MIME is an accepted Internet standard and its use is growing rapidly, I have devoted this article to describing it and the impact it has had on the use and growth of electronic mail.

## What's wrong with SMTP

The fundamental standards that underpin Internet mail are RFC821 which defines the Simple Mail Transfer Protocol (SMTP), and RFC822 which describes the standard headers of a mail message. We need to look at the limitations of these standards in order to see why it was necessary to draw up a

new standard. There are four crippling limitations. First, the message is subject to a maximum size; lines can be no longer than 1000 characters; only 7-bit ASCII characters can be used and the message content is undefined.

The MIME standard, as defined in RFC1521, overcomes all these limitations while not placing any extra demands on the basic email infrastructure. By that, I mean it is based on the older standards: RFC821/822 messages and MIME messages can coexist happily on the Internet. Indeed, it is important to understand that MIME and the RFC822 standard do not cover the same ground; RFC822 defines little more than the structure of Internet message headers, while MIME is a means of

Type	Subtype	Description
Application		Used by mail-enabled applications
	Octet-stream	Arbitrary binary data
	Postscript	A postscript document
Audio		Digitised sound
	Basic	8-bit ISDN $\mu$ -law data, sampled @ 8KHz
Image		A still image
	Gif	GIF format
	Jpeg	JPEG format
Message		The content is another mail message
	External-body	The body is merely referenced. Details of how to retrieve the body are included.
	Partial	One part of a fragmented message, used when transporting large messages.
	RFC822	A single mail message, in RFC822 format.
Multipart		The message contains several parts, each part will be described by a further content type
	Alternative	There are several alternative representations of the same information. The recipient platform will utilise the most expressive format it is capable of.
	Digest	Each body part is a mail message
	Mixed	Several body parts, of various types that should be processed serially
	Parallel	As Mixed, but the body parts should be dealt with simultaneously
Text		Primarily textual in nature. Alternative character sets may be specified
	Plain	Unformatted text
	Richtext	A document in a simple HTML-like format
Video		Moving images, with optional soundtrack
	Mpeg	MPEG format
X-type		Any non-standard content type, used locally between consenting mail clients

Figure 1 - MIME Content-Types

**MIME is very much a part of the multi-media bandwagon.**





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defining the content and structure of the message body.

The need for a message content definition standard is vital. The whole credibility of electronic mail as a means of doing business across organisations is open to question if there is no universally adopted standard which allows the sending and receiving mail clients to exchange details of the message content. The lack of a standard has given rise to a host of incompatible, proprietary extensions, such as those employed by the Sun Mailtool, in order to allow attachments to messages. Such extensions make no sense to non-conformant mail clients. It is left to the human recipient to unravel the contents.

## The wonderful world of MIME

You may think that I am over-enthusiasing about the benefits that MIME brings. Well perhaps it's not going to bring about world peace, but it does lay the foundations for an

Type	Description
7-bit	This is the default type, if none is specified and it indicates that no encoding is necessary.
8-bit	The data has characters with the eighth bit set, but is organised in line lengths suitable for SMTP to transport.
BASE64	An encoding scheme which splits three consecutive bytes into four 6-bit quantities and then maps these on to 'safe, middle-of-the-road' characters.
BINARY	Like 8-bit, but with no concept of a line.
QUOTED-PRINTABLE	Used when the content is mainly 7-bit ASCII. Any 8-bit characters, the equals sign and trailing whitespace are escaped.
X-encoding-name	Local encoding methods.

Figure 2 - MIME Content-Transfer-Encoding Types

electronic mail system that can provide users with the power and transparency that they require. Let's face it, emailing anything other than plain text is a task fraught with problems.

A world full of MIME-capable mail clients will endow users with a mail system whereby to mail a WORD document, they

merely drop the corresponding icon onto the mail tool, type the address and click to send, confident in the capability of the recipient mail client to present the document as the identical WORD file.

The size of a message is no problem to MIME either. Mail messages are subject to truncation if their size exceeds a limit imposed by some link in the chain. However, a MIME client will split a large message transparently before transmitting and reassembling the parts upon receipt.

MIME is very much a part of the multimedia bandwagon, providing the technology whereby a message can have a video attachment which is viewed from the MIME client by launching the appropriate utility. Indeed a MIME mail client is configured in much the same way as a World Wide Web (WWW) browser, with a configuration file that maps message types to appropriate 'viewers'.

## Capability MIME

Of great importance to the universal acceptance of MIME is its capability to specify which character set to use when displaying the message, ie to accommodate umlauts, tildes, cedillas and other such foreign paraphernalia.

Another revolutionary feature of MIME is that of the 'external body' whereby the main content of the message is merely referred to in the message, along with details of how to retrieve it. Reading such a message would result in a prompt by the mail client: *Retrieve sales.dbf using FTP from hq.company.co.uk?*

The last feature of MIME that I will highlight before going into technical details is that of 'Richtext'. The designers wanted to define a simple formatted text content type that could be universally implemented, probably as part of the MIME mail client. They named it 'Richtext' and it is very similar in appearance to the HyperText Markup Language (HTML) used by the WWW. The sending mail client could automatically convert from, say WORD format, to Richtext in

```
From: Paul Richardson <paulr@Motiv.demon.co.uk>
To: cliffs@dotexe.demon.co.uk
Subject: Next month's article
MIME-Version: 1.0
Message-Id: <ABCD1234@motiv.demon.co.uk>
Content-Type: Text/richtext; charset=us-ascii
Content-Transfer-Encoding: 7-bit

<nl>
Dear Editor,<nl>
I've got the following idea for the title of next month's
article; how about<nl><nl>
<center><b>Great Personalities of the
Internet</b><nl>
Subtitled: <i>Subcultural Icons in
Cyberspace</i></center><nl>
<nl>
Let me know what you think.<nl><nl>
Regards,<nl>
Paul R.<nl><nl>
```

*When viewed using a MIME capable mail client, this message looks like:*

Hi Cliff,  
I've got the following idea for the title of next month's article; how about

**Great Personalities of the Internet**  
Subtitled: *Subcultural Icons in Cyberspace*

Let me know what you think.

Regards,  
Paul R.

Figure 3 - Text/richtext content type



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Standard Internet headers appear here....
<b>MIME-Version:</b> 1.0
<b>Content-Description:</b> Various interesting knickknacks
<b>Content-Type:</b> Multipart/mixed;boundary=Interpart-boundary-1
Textual preamble for the benefit of MIME-incapable mail clients.
--Interpart-boundary-1
<b>Content-Type:</b> Text/plain;charset=us-ascii
Some common-or-garden text of the variety that can be sent without indulging in the extravagance of MIME.
--Interpart-boundary-1
<b>Content-Type:</b> Video/mpeg
<b>Content-Transfer-Encoding:</b> BASE64
BASE64 encoded MPEG format data appears here
--Interpart-boundary-1
<b>Content-Type:</b> Message/external-body;access-type="anon-ftp" ;site="ftp.demon.co.uk" ;directory="/pub/rfc" ;name="rfc1521.ps" ;size="19241"
<b>Content-Type:</b> Application/postscript
--Interpart-boundary-1

Figure 4 - More complex multi-part example

order to be certain that the recipient user will see most of the original formatting regardless of which platform they are using.

### Head starters

You might expect, with such an impressive set of credentials, that the implementation specification would be nightmarishly complex. However, this is not the case. In addition to the standard header fields such as 'To:' and 'From:', the MIME standard introduces five new ones. The *MIME-Version* identifies which version of MIME the message conforms to: currently this should always be 1.0. The *Content-Transfer-Encoding* is used to specify how data that could not be transmitted as it stood has actually been encoded.

*Content-Type* is the single most important header as it defines the content of the message body. *Content-Description* is an optional header which can contain a textual description of the content.

The final standard: *Content-Id* is similar to the standard Message-Id header, but refers only to one part of a MIME message. *Content-Id* is usually optional.

### The heart of the matter

The syntax of the *Content-Type* header is:

*Content-Type:* type/subtype [:parameter]  
A common example is:

*Content-Type:* Application/octet-stream;  
name="invoices.xls"

which specifies that the content is arbitrary binary data, and suggests a filename of IN-

VOICES.XLS. Figure 1 is a table listing the type/subtype combinations. No mention is made of the parameters as they are specific to each type/subtype pair and are outside the scope of this article.

These standard types can be extended in two ways; the first by registering a new type with the Internet Assigned Numbers Authority (IANA). As an alternative, if a locally implemented extension is required then any type that begins with 'X-' can be used.

## The lack of a standard has given rise to a host of incompatible, proprietary extensions

MIME capable mail clients will interpret any message with no *Content-Type* header in the same manner as if that message had a *Content-Type* of *Text/plain;charset=US-ASCII*. An unknown *Content-Type* would be taken as *Application/octet-stream*.

### Encoding schemes

The *Content-Transfer-Encoding* header is also worthy of some discussion. Its purpose is to specify the means by which the message body has been manipulated so as to overcome the restrictions of the underlying transport. These restrictions can include,

limited line lengths, 7-bit characters and illegal control characters.

The *Content-Transfer-Encoding* header can be thought of as dealing with the syntax of the message body, as opposed to the semantics which are handled by the *Content-Type* header. The standard types are listed in Figure 2.

### Show me the way to go...

The first example, in Figure 3, is of the *Text/richtext* type/subtype pair. The second, in Figure 4, is a more complex multi-part example.

These figures actually need very little comment other than to say that the *Message/external-body* section is followed immediately by another *Content-Type* header. This second header defines the real type of the external body. I should also add that it is perfectly admissible to nest multi-part types. This practice can lead to a quite complicated structure. Consequently some MIME mail clients allow you to choose sections to view from a hierarchical table of contents.

### Signed, sealed, delivered...

So far I have only covered Part One of the MIME standard. RFC1522 contains Part Two and is entitled *Message Header Extensions for Non-ASCII Text*. It deals with the problem of using alternative character sets in the header lines, I feel that this doesn't carry the same degree of significance as Part One and hence I haven't tackled it this month.

I have a habit of eulogising about how the technology that I have described is transforming the future as I write. For this month, however, I prefer to encourage you to discover for yourself the elegant power of MIME. Next month I'll try to demystify HyperText Markup Language, for those of you who are interested in publishing material on the World Wide Web.

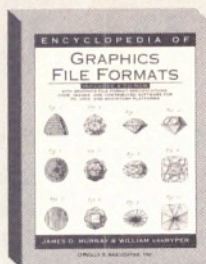
### Pretty Good Point

In my last article on mail, I suggested that if you wanted to know more about Pretty Good Privacy (PGP) that you send mail to [pgp-public-keys@demon.co.uk](mailto:pgp-public-keys@demon.co.uk). I regret that this service is no longer available, but more information can be obtained by subscribing to the *alt.sec.pgp* newsgroup. I would like to thank Marcus Milburn for pointing this problem out to me.

Paul Richardson is a Director of Motiv Systems Ltd, a consultancy specialising in Open Systems, interoperability and the Internet. He can be contacted on 0223 576318 or by Email at [PaulR@Motiv.demon.co.uk](mailto:PaulR@Motiv.demon.co.uk).

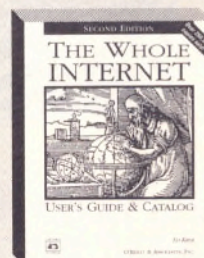


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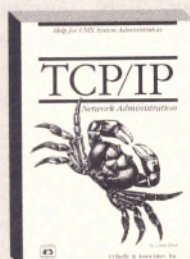
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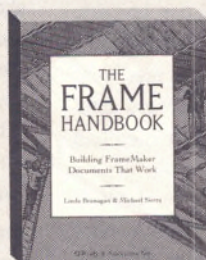
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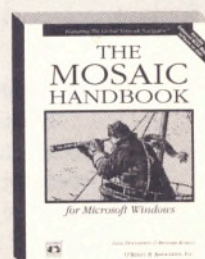
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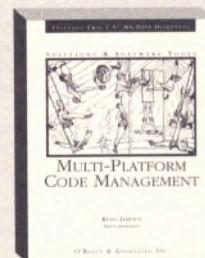
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# Book Review

The UNIX-HATERS Handbook reviewed by David Mery

What first struck me about The UNIX-HATERS Handbook was the cover: a rather free interpretation of The Scream, by Edward Munch, one of my favourite artists. I have to admit, most Unix books I've seen fall into one of two camps: tutorials or guides. This one, however, takes a more critical attitude. The name is derived from the UNIX-HATERS electronic mailing list, which sprung to life exactly seven years ago, on October 1st 1987. The best contributions from the mailing list were selected, organised and glued together.

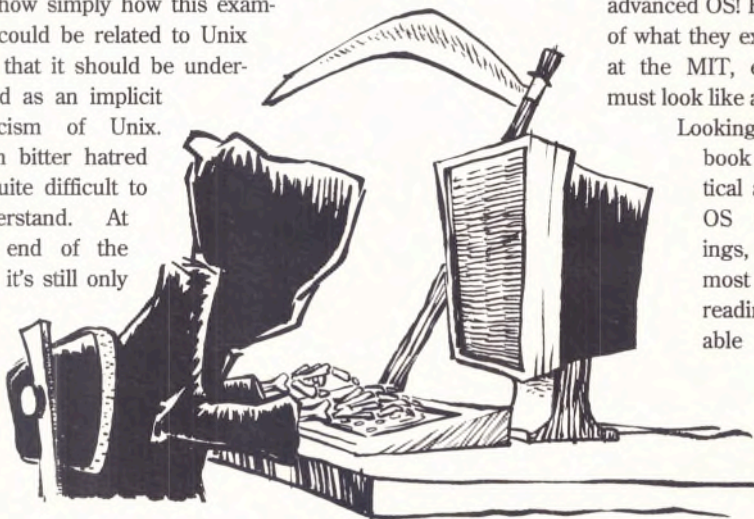
To hate something so much you must know it very well! So throughout the text the authors draw upon examples to illustrate the shortcomings. Often I found that even when an example was well explained and to the point, the comments were there to show simply how this example could be related to Unix and that it should be understood as an implicit criticism of Unix. Such bitter hatred is quite difficult to understand. At the end of the day, it's still only

so easy to port to a new hardware architecture. All that history is detailed in the book. So the authors are perfectly aware of the inherent simplicity of Unix but at the same time they seem to be frustrated that Unix wasn't, and still isn't, state of the art.

The backgrounds of two out of the three main authors go some way towards explaining the frustration that pervades the book throughout. Daniel Weise, after spending several years at the famous MIT's AI Lab, is now at Microsoft's research laboratory, while Steven Strassmann is a senior scientist at Apple Computer, he received his Ph.D. from MIT's Media Lab. Compared to DOS and its Windows kludge or to the Finder (that really needs true multi-tasking, if not multi-threading), Unix can legitimately be considered one of the most

advanced OS! But in view of what they experienced at the MIT, even Unix must look like a toy.

Looking at this book as a practical analysis of OS shortcomings, I found most of the reading enjoyable but was



an operating system.

The authors and most of the mailing list's contributors had of course experienced other operating systems before moving or being forced to move to Unix. This may be the cause of some of their resentment: it's only human to miss your favourite OS features. Some had worked on Multics: the predecessor of UNIX which, in many ways, was actually a more advanced system. Some even had the delight of using LISP Machines.

Operating system theory has evolved greatly in the last 25 years, the same is even more true of user interface theory but Unix is still being used. Even in 1969, when Unix was designed, other operating systems were implementing some much more advanced features such as automatic command line completion (TOPS-20), DLLs (Multics), ring protection (Multics)... The success of Unix is due to its simplicity. It's

imes exasperated by the fact that it is so picky about Unix. Computer history has shown that the most successful OS or software, are rarely the best on pure technical merit. OK, so this is true of Unix: is there any point in devoting an entire book to the subject. It even goes to the extreme of including a paper sachet labelled 'UNIX Barf Bag'. No guesses as to its purpose...

**Verdict: Recommended for ex-LISP users**

Title:	The UNIX-HATERS Handbook
Pages:	329
Price:	£15.99
Author:	Simson Garfinkel, Daniel Weise & Steven Strassmann
Publisher:	IDG Books Worldwide



## HANDS OFF MY EXE!

Annoying isn't it? You go to all the trouble of subscribing, thereby guaranteeing your own regular supply of the best information you can get, and Tom waitzes in and pinches it off your desk when you go to get a coffee. 'I was only gone for a minute' you cry. Don't worry, we understand. Because every day we get sackfuls of letters from people who, like yourself, are desperate for help. Still, however reassuring it may be to know that you are not the only one in this terrible plight, it doesn't solve your problem. 'What should I do?' We hear you ask.

The answer is so simple you'll kick your self.

### GET TOM TO TAKE OUT HIS OWN SUBSCRIPTION!

The brilliance of the plan lies in its simplicity. Slide over to Tom's desk and mention casually that you've noticed EXE is having a special 'Introduce A Friend' promotion. 'What an opportunity for you Tom. Look, you'll even get a free binder to keep your EXEs safe and all to your self'

Being smug and not able to understand sarcasm, even when it smacks him in the face, Tom will probably argue that this would be a waste of money because he is quite happy to read yours (the cheek of the man!). At which point you draw his attention to the Discount Token in 'ctrl/break' (the new and exciting double page spread) and say 'If we both collect these tokens we can get huge discounts on a huge range of software products - just think of the money we would save!' (which will appeal to Tom's fiscal instincts: he knows a bargain when he sees one). With a flourish Tom will ask you if he can borrow your biro (typical), fill out the subscription form in this very magazine and pop it in the post quick sharp!

'Hurrah!' you will say, picking up your copy of EXE and returning to your desk to get on with developing world class software.

### HAVE A MUG FOR YOUR TROUBLES

We know that there are many people like Tom lurking in your company, just waiting for the right moment to steal your EXE. That's why we'll send you a **FREE** 'magic' EXE mug when you get Tom to subscribe. So that the next time you go for a coffee you'll remember to take your EXE with you!

-----

Tom, staple this piece of paper to your subscriptions card (cunningly placed between pages 64 and 65) and send it off to those nice people at EXE. Then they'll send me a **free** 'magic' mug. Hurrah again!

My name is: \_\_\_\_\_

I would like my free EXE mug to be sent to: \_\_\_\_\_

My reader number is: \_\_\_\_\_



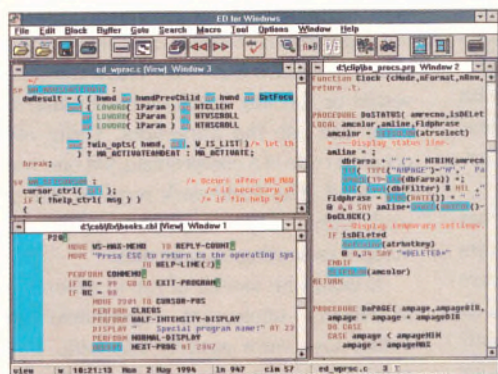
# Is your editor cramping your style?

IT'S SURPRISING how many programmers put up with those ho-hum editors bundled with their compilers. Or even DOS-hosted monsters which to be, erm, brief, haven't seen a proper upgrade since before Thatch left the throne. If you have ever found yourself picking through megabytes of material by hand to accomplish a task that you know should be a few keystrokes, then we have a suggestion for you.

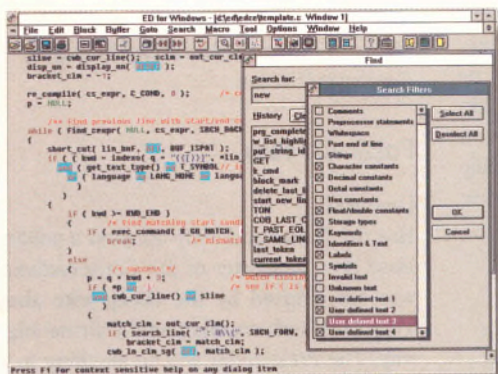


## ED it

Introducing the new *ED for Windows* programmer's editor. ED is intelligent and language-sensitive - it knows all about your compiler. So whether you use C++, Clipper, Smalltalk, Eiffel or one of the other 24 languages that ED supports, you can be enjoying the benefits of colour syntax highlighting and compiler error tracking within minutes.



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*ED's new advanced Search & Replace puts you in control*

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## Try it

The best way to find out what ED can do for you is to have a go. And you can. For free.

Just call us up, and we'll send you a full working demo\*. (If you are Wired, you can download it from any of the places listed at the bottom of this advertisement\*\*).

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# QBS SOFTWARE



*The programmer's editor*

\*Demo is fully functional, but won't let you save files > 2KB. \*\*The ED for Windows V3.0 demo ED3DEMO.ZIP can be downloaded from the QBS BBS (tel 081 747 1979, baud rate 2400-14400, connect 8 N 1, in the DEMO section), from CIX (topic qbs/files), from CompuServe (GO CLIPPER, library 8) and from ftp site CICA (demo directory) and its mirrors (eg src.doc.ic.ac.uk, computing/systems/ibmpe/windows3).

➤ CIRCLE NO. 760



# 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 [cliffs@dotexe.demon.co.uk](mailto:cliffs@dotexe.demon.co.uk). Unless your letter is marked 'Not for publication', it will be considered for inclusion in this section.



## It's not all C and C++

Dear EXE

In reply to Richard Prosser's letter (EXE September 1994), some languages already have the idea of multiple return values, as in

```
x, y := PolarToCartesian(r,
theta)
```

These include BCPL, occam and a number of other experimental languages. Although interesting and useful, such a facility could not easily be added to C and C++. For instance, the comma operator already has a meaning in both.

*Kevlin Henney  
Bristol*

## Won't work

Dear EXE

On the subject of the first letter in September's issue, the answer is very simply that Crosbie Fitch's suggestions do not work. Something that is quickly discovered by anyone who tries it.

The problem with Richard Prosser's idea for multivalued functions, also published in September's EXE, is that it actually requires quite a lot of change. Still, he could write it up as a paper and submit it to the UK C Panel for consideration in the next round of standardising C.

*Francis Glassborow  
Chairman, ACCU*

## A hard day's night

Dear EXE

After reading *A day in the life* (EXE September issue), I ask: 'how can you be so condescending about true hackers? Real hackers are craftsmen, artists. They're no more 'anti-social' than artists. And what's wrong with 'eating pizza with garlic bread and onions' or Chinese food? Hackers are software artists; they craft beautiful pieces of code.

That's what differentiates hackers from commercial software developers. Hackers won't release code that is not *nice*. 'Software developer' can be just a job title, such as director or policeman, but what's the point? Hacking is more a philosophy, a search for an ideal.

Hackers, like artists, create a world in which they have near total control, a perfect world, much better than the real one. That's why it's so tempting to break all links with reality.

So instead of criticising hackers and putting them in the same bag as 'nerds' or 'geeks', you should educate your readership to respect hackers as artists. Hackers have ethics and are probably much more socially responsible than quite a few of their critics: they just don't conform to stupid rules.

*Richard Pgazonga  
Cambridge*

## How disappointing

Dear EXE

In your August issue, you printed a letter from John McMillan outlining his disappointment with Microsoft Visual C++ and in particular AppWizard and MFC.

AppWizard is tuned to create the most common applications, ie document-based standard Windows applications. In Visual C++ 2.0, we've extended AppWizard to create dialog-based applications, another common style of application. AppWizard cannot magically know the type of application you wish to develop. As a result there are some kinds of applications for which it cannot generate starter code. But that does not invalidate MFC as a viable framework. Any application can be developed with MFC using the core classes such as `CWnd` or `CFrameWnd`. It is not necessary to use the richer portions of the framework (such as the document/view architecture) if your application does not need these features. The

goal is to pick the proper classes for your application.

While MFC is not for everyone, most of our customers do find MFC extremely valuable. MFC requires an investment of time in order to reap the benefits. It is not clear from John McMillan's letter how much time he invested or the way in which he attempted to learn and use the framework. Using other people's code is a compromise, yet one worth the effort. The framework requires that you work within it; you can't code in the same manner as starting from scratch.

It would be foolish of me to assume Mr McMillan's unpleasant experiences with Visual C++ were entirely his fault. I welcome the opportunity to hear directly ([andrewki@microsoft.com](mailto:andrewki@microsoft.com)) about what we could do specifically to address his concerns. We continually strive to make Visual C++ as usable, enjoyable and productive as possible for our customers.

*Andrew King,  
Microsoft European Marketing Manager,  
Developer Division*

## Politically okay

Dear EXE

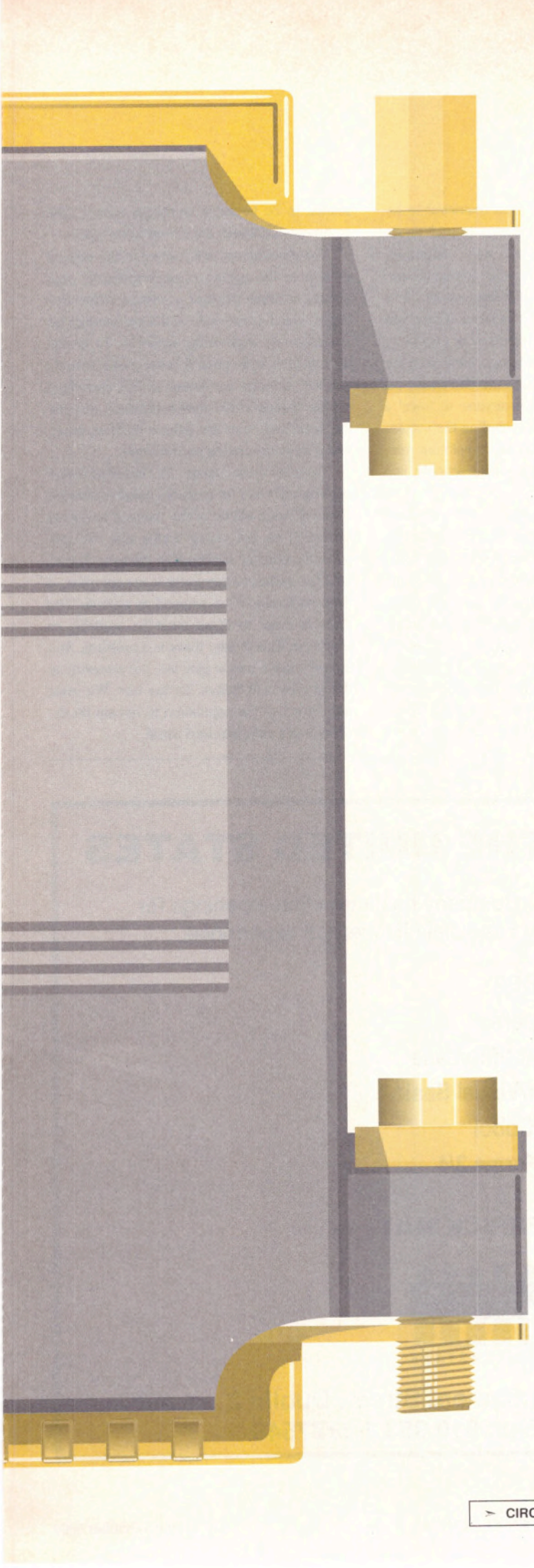
Has the Editor suddenly adopted a political bias? As a supporter of the Conservatives I was not amused by the cheap joke about Tory MPs kerb crawling on the virtual highway. The Press today will do anything to attack the government of this country. I certainly didn't expect a jibe at the expense of the government in a software magazine. Let's face it, they, that is the Cabinet, are doing a fine job of ruining the country all by themselves. There's was absolutely no need to fuel further satire and sarcasm with such stories.

*N Thomson  
Newbury*

## Letter of the Month

The writer of the best letter of the month, as judged by the Editor, will receive a £30 book voucher, courtesy of PC Bookshop, 21 Sicilian Avenue, London WC1A 2QH (071 8310022). The best letter is the one printed first. Please note that letters submitted to this page may be edited.





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# Fair play

Why is computing so often depicted as a male-dominated industry?



**Cliff Saran** reports on a worrying trend.

In an industry where technological barriers are being shattered daily through sheer creative energy it is surprising how few women decide to enter computing as a career. The fact is that those who do, actually perform as well, if not better than their male counterparts. The skill of the software developer is not a side effect of testosterone. Nevertheless women seem to be less attracted to computing as a career.

The root of the problem starts with the undergraduate. In the late 60s, when computing was in its youth, entry of women into the field was in the order of 30%. A quarter of a century on and the national average has fallen to between 15% and 20%. Why?

In their infancy, computers were large and

cumbersome. Their use was restricted to select postgraduates and industry. In such an environment, CPU time was extremely expensive. Consequently, the privileged few who had access to the mainframe would concentrate solely on the job in hand. There was no room to explore. With the rise in popularity of the personal computer and, in particular, the home computing market, in the mid 80s, it became possible for almost anyone to 'own' a computer. The barriers precluding the masses were felled; the computing revolution cascaded through industry down to schools, colleges and the home.

Here it was the schoolboy that monopolised the new technology first, playing computer games, writing Basic programs and hacking... With their limited resources, schools were unable to provide computing for all. Over time, computing earned a reputation of being 'macho'.

Margaret Cunningham, senior tutor at the Department of Computing, Imperial College, believes it is this prejudice that has aroused the stigma associated with computing. Since they spent more time on the machines, 'boys

tended to be better at computer games,' she comments. 'Hackers are almost never girls.'

The government has reacted to the general decline in the uptake of undergraduate engineering courses through a scheme called Top Flight which provides an additional bursary for the cream of engineering students. To qualify they need to attain good A Level grades (two As and a C at least) and study an IEE accredited course. However this does not address computing specifically, nor the unique problem facing young women entering such courses.

Attitudes must change. The industry is harnessing only half its potential creative energy. The well worn cliché of the teenage hacker is imprinted on the young brains that will prepare this country for the 21st century. Today, an office without a computer is not complete, a desk without a PC is as good as useless. The skills relevant to them must be available to everyone. This is why there is a problem. And industry has a role to play too: put pressure on the government before it's too late. We must not allow half the population to remain on the outside of a computerised world. ■

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REF: SC/05/EXE

### C/C++/VISUAL BASIC - UNIX OR MS-DOS

### DEVELOPERS

Software House and End Users in Finance, Banking, Manufacturing, Commercial, Scientific and Government application environments require excellent C skills. Both Windows development skills W/3, SDK, NT, X-Windows and Visual Basic or strong C, C++ solid operating systems and good application knowledge are again much in demand. Software development experience is the key, and being able to deliver high performance, high quality, well specified software in competitive time scales. Opportunities vary from small to large software companies involved in expert systems, GUIs, Image Processing, GIS, EIS, Communications, Networking and Object Oriented Databases. Graduates through to senior software engineers/team leaders are required. Please call to discuss.

£14-£35K + Benefits

REF: SC/06/EXE

### UNIX/VMS/MS WINDOWS/NT MFC

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REF: SC/07/EXE

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REF: SC/08/EXE

### SOFTWARE ENGINEERS-SENIOR SOFTWARE ENGINEERS

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

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INGRES, CESQL, ABF	ANALYST PROGRAMMER

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ID Number: 100070,134



JOB Multimedia Developers		JOB C/C++/MS Windows		JOB MS Windows/C++ Developers	
LOCATION City	SALARY To £30K	LOCATION Thames Valley	SALARY £18-£25K	LOCATION Berks	SALARY £20K-£25K
One of Europe's leading CD-ROM publishing companies is seeking to recruit Windows development staff at all levels of experience. They are building teams now to work on a number of new titles to be released next Spring. Ideally you will have worked in a multimedia environment developing software under either MS Windows or on the Apple Macintosh. Any experience of hypermedia, graphics, sound or animation would be useful but is not essential.		Our client is a leader in the development of advanced GUI development tools for client/server applications. The expansion of their R&D team has led to a requirement for five high calibre Software Engineers. Suitable candidates will be graduates with between one and five years experience developing software in 'C' or C++ under MS Windows or OS/2. These are exceptional opportunities for bright individuals to use their creative talents and work with like-minded individuals.		Established in 1968, our client has become one of the leading international players in the field of hand-held computers. They are well-known in the industry for being keen innovators which has ensured that they have kept well ahead of the game. Due to their consistent success in the international market they are now looking for Software Engineers with excellent MS Windows/C++ skills. Successful candidates will also have the opportunity to work with Visual Basic and Pen Pal.	
Ref: EXE/1		Ref: EXE/2		Ref: EXE/3	
JOB C++ Programmers		JOB Visual C++/NT		JOB X-Train to Visual C++	
LOCATION Herts	SALARY To £28K	LOCATION City	SALARY To £35K	LOCATION London	SALARY £17K-£25K
These vacancies will appeal to dynamic, young software engineers who enjoy working in a product development environment using the latest Windows technology. Our client, an expanding company, is currently developing its next generation of terminal emulation products and is therefore seeking high calibre Developers. Suitable applicants should have excellent MS Windows/SDK experience along with a fluency in C or C++ (Visual C++/MFC will be of particular interest) to work in this challenging development environment.		New development projects within this major City-based financial institution have led to a requirement for additional Analyst/Programmers. Candidates must be sound MS Windows developers with experience of Visual C++/MFC and/or Windows NT. Other skills of interest will be DDE/OLE, Communications (TCP/IP, Winsockets), Client/Server, SQL and Win32s. Successful candidates will work on the development of trading systems using the latest technologies. Consequently, experience in a financial/banking environment will be of particular interest.		These are exceptional opportunities for C Programmers to be cross-trained to Visual C++/MS Windows by one of the UK's leading financial software houses. Suitable candidates will have at least twelve months software development experience in C under DOS, UNIX or MS Windows. Our client is committed to the career development of its employees and offers excellent training. In return, they are seeking dedicated team-orientated individuals with a willingness to learn new skills and contribute to the success of the company.	
Ref: EXE/4		Ref: EXE/5		Ref: EXE/6	

## CONTRACT VACANCIES - UK WIDE

<b>Sybase/SQL Server</b>			<b>Apple</b>			<b>C++/Banking</b>		
London	Software Engineer	4 months	City	Developers	3 months	City	Programmers	6 months
<b>VB/Windows</b>			<b>Multimedia</b>			<b>C++/VB/Finance</b>		
Herts	Analyst/Programmers	2 months	Cambs	Developers	6 months	Manchester	Anal/Progs	6 months
<b>C/C++</b>			<b>Visual Basic</b>			London	System Tester	3 months
Oxford	Programmers	3 months	S. London	Anal/Progs	6 months	<b>Windows/C/SDK</b>		
<b>Visual C++/MFC</b>			<b>C/C++</b>			City	Developers	4 months
London	Developers	6 months	W. London	Progs x 2	6 months	<b>Windows NT</b>		
<b>C++</b>			<b>Oracle/Vista</b>			W. London	Senior Progs	3 months
London	Design/Development	3 months	Oxford	Soft. Eng.	4 months	<b>Hypermedia</b>		
<b>Oracle 6/Forms*3</b>			<b>Real Time C</b>			Cambs	Developers	4 months
Surrey	Programmers	2 months+	Berks	Developers	3 months	<b>VB/Finance</b>		
<b>VB/MS Access</b>			<b>Windows NT</b>			Cambs	Developers	3 months
Surrey	Developers	3 months	City	Senior Programmer	3 months	<b>Windows/C++</b>		
<b>Windows/Visual Basic</b>			<b>Windows/C/SDK</b>			London	Programmers	6 months
London	Programmers	6 months	Berks	Software Engineer	3 months	Manchester	System Tester	6 months
<b>Windows/Financial Appls.</b>			<b>Visual Basic</b>					
London	All Levels	6 months	Berks	Programmer	4 months			
Ref: EXE/7			Ref: EXE/8			Ref: EXE/9		

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Highly respected international Bank with total commitment to technology is seeking bright developers interested in delivering state of the art OO solutions to their traders. Ideally you will be a graduate with at least one years experience in an OO environment. C++ and Smalltalk are particularly desirable. No financial exp necessary.

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£20K CAR (BERKS) S/W Engineer, Degree, 2 yrs 'C' + Windows-SDK, GUI Design, H/W Interfacing.  
£20K (SW LONDON) S/W Engineer, Degree & 3yrs Pascal, C, Methodologies, Navigation & Control.  
£15K to £30K (W.LONDON) S/W Engineers, Degree + 1yr to 10yrs C, Windows-SDK, XVT, SQL, MAC  
£15K to £23K (N.LONDON) S/W Engrs, Degree 2. + 1 to 3 yrs C/DOS, Satellite Comms & GUI Design  
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£12K to £20K (BERKS) S/W Engineers, Degree + 1yrs Visual C++, Windows SDK, ORACLE & UNIX.  
£18K to £23K (OXFORD) Programmers, 2yrs + C, 1yr Windows/Visual Basic, SW House, Client Contact.  
£30K (HERTS) S/W Engr, Degree, 5yrs OS/2, Presentation Manager & C++, Major New Development.  
£22K (MIDDX) Analyst Programmer, Degree, 3yrs VAX/VMS, DEC FORMS, Fortran, C, Info Sysys.  
£15K (WILTS) S/W Engr, Degree, 1yrs Visual C++, Windows-SDK, Computer Interfacing, Telemetry.  
£22K (MIDDX) Programmers, Degree, 1yrs Visual C++, Windows-SDK, Graphics Applications.  
£23K (SURREY) S/W Engr, Degree, 5yrs C/C++, Unix, PC's, VME Systems, Methods, Team Lead.  
£25K (CAMBRIDGE) S/W Engineers, Degree, MSc, 3yrs+ C & Assembler, Signal Processing, H/W Appreciation.  
£25K (SURREY) Application Engineer, Degree, MSc, 3yrs+ C, 80X86, 2D/3D Graphics & H/W Design.  
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## C Developers + Project Managers

City

20-60K

One of the largest and most successful international banking and financial service organisations in the city seeks developers of all levels with C and C++ experience. A concerted recruitment campaign is currently underway to recruit suitable professionals. This will provide our client with the calibre of individual capable of taking it forward into the next decade. You will ideally have front office or back office banking experience. Of graduate calibre the right individual

will be a strong team player, able to assume a number of different roles throughout the project life-cycle. As well as experienced developers our client would be particularly interested in **Senior Project Managers** with excellent communication skills. **Earnings are not limited** by role and our client will consider candidates from a banking, consultancy or engineering background.

Ref: Si4058

## C & C++ Specialists

M3 / M4 Corridor

18-35K

Our client is one of the top networking manufacturers in the world. A **Fortune 500** company specialising in the fastest growing market in the world, LAN INTER-NETWORKING.

Due to unprecedented growth, a need has arisen for several outstanding software developers of varying levels. They seek individuals who are committed to working with the best, developing innovative application and system software for mission critical real time products.

You will have a minimum of 12 months C experience, developing real time software. Our client will provide you with the exposure and training to develop your skills further in a vibrant, dynamic environment. **C++ and Embedded Software Exposure** would be a definite bonus as would knowledge of Network Management.

Ref: Si4059

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To apply please quote the reference number and send your CV to our advising consultant, Simon Dean, at Silicon Executive, Aztec House, 6 Berners Road, Islington, London N1 8EH. Fax 071 226 3200. Alternatively call him on 071 226 5226.

## C++ Secure Systems

*With operations in over 80 countries world-wide our client is an independent provider of total solutions to specialist markets in both public and private sectors. One area of specialisation is secure systems where they are involved in the specification, development and integration of mission critical solutions. Tremendous opportunities exist for movement from one specialist division of the company to others, thus creating a high potential for career advancement. Experience of working within Defence projects would be advantageous. Our client is situated in rural England, accessible from the North or South. A comprehensive relocation package is available where required.*

### Oracle Developers 18-24K+

Having had exposure to secure databases and operating systems, you will have proven development ability with RDB exposure, particularly Oracle V.7. Working as part of a project team you will be responsible for extensive Oracle development. **Unix** and C knowledge would be desirable as would experience in evaluating text retrieval products for secure applications environments.

Ref: Si4060

### C++ Software Engineers 18-32K

You will have at least **6 - 12 months C++ experience** and a **good knowledge of C**. These roles would allow you to develop your existing skills further in a positive rewarding environment where you will be exposed to different roles throughout the lifecycle of each project. **Senior roles** exist for developers with **6-12 years experience**, preferably **Sybase, X Windows, or Secure Unix** exposure.

Ref: Si4061

### WAN ATM Consultant c.30K

A comms consultant with 4+ years of exposure to advising clients on WAN & ATM solutions and strategies in a secure environment. Exposure to Ungermann Bass equipment and Network Management, specifically Network Director software would be advantageous. This role will allow you to **influence strategic decisions** at the **highest levels**. The role requires an experienced individual with a proven track record.

Ref: Si4062

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If you would like further information please call our advising consultant, Simon Dean, on 071 226 5226 quoting the reference number or forward your CV to him at Silicon Executive, Aztec House, 6 Berners Road, Islington, London N1 8EH or Fax 071 226 3200.



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## A rose by any other name...

The EXEnders office, home to the hottest Software Development soap-opera in the Universe, has been floundering in turmoil this last month. *Behind the scenes*, you see, there have been murmurings of dissent. Rumours have been abounding that the big names on the board at MicroTelly are planning to spice up both plot and cast by adding a little extra something: a little extra cash. MicroTelly, the globe's largest Computer Channel is rumoured to be looking for new actors for its Soap. Joan Collins is said to be 'intrigued', Pauline Fowler (sick and tired of Arther and Auntie Nelly) is apparently 'actively pursuing a role'. Dirty Den, Blake Carrington, Ena Sharples and Benny are amongst the other interested parties. All of which has sent an air of discontent whistling through the present cast: you could cut the atmosphere with a keyboard, never mind a knife. None of which has been helped by the guest appearance of MicroTelly's biggest star, top newsreader and showbiz personality Bob Baud ('G'day, Bob Baud here with the big news on bug-tracking'). Could this be the thin end of the wedge? Well, as several of the cast have pointed out to each other, Bob has clear Antipodean leanings. What more is there to say? 'Are there any other jobs in Aus-

tralia?' the cast mutter crossly, 'He's got a clear head start'.

The official reason for Bob's appearance does, however, appear to be quite plausible. There have been some pretty big 'shake-ups', after all, in the world of computing just recently. Only last week Network News, Bob's twice daily update on the computer world, was granted a two hour extension after an emergency newflash revealed that top software company Spangle had decided on a name for it's hot new product previously only referred to as MK: Milton Keynes. Top software celebrities were rushed in to deliver their verdicts on the decision. As well as a specially appointed spokesman from Spangle. Heated debate arose as opinions clashed over whether the naming of the updated product as 'MK 2000' was apt. So we'll leave you with this little titbit from the battleground. Hold onto your hats, EXEnders is heading for the big time...

**Bob Baud:** Welcome back viewers, as you are no doubt aware by now. Spangle announced to the world today the official name of its soon-to-be-launched software product: MK 2000. Jim, some sources are saying that they do not feel that the naming has been treated with due gravity.

**'Jim' from Spangle:** That's right Bob, but we here at Spangle feel that 'MK 2000' is a name that carries both weight and longevity...

**Bob:** Until the year 2001 of course.

**Jim:** That's right, that's right: then we simply change the name to MK 2005. It's quite brilliant really, I'm amazed no-one's ever thought of it before.

**Bob:** So when will we be seeing MK III on the shelves then Jim? Some time soon we hope.

**Jim:** Ah. Yes. Well... there have been one or two minor glitches with the project, Bob. But I should imagine that we'll be hearing some definite news within... the next, well, the next five or six years...

**Bob:** Six years! You mean 2000 is the *launch* date? Have you even started it yet?

**Jim:** Oh yes, yes we've definitely started it: I mean, we've got a name haven't we? Begin at the beginning that's what I always say... (starts crying) 'Some people, I don't know, I mean we do our best. OK, OK, so the last version had even more bugs than the first but what do you expect for £200 a go? We've got helicopters to keep, executive hotels to buy out, this isn't an easy business you know...' (sob).

M

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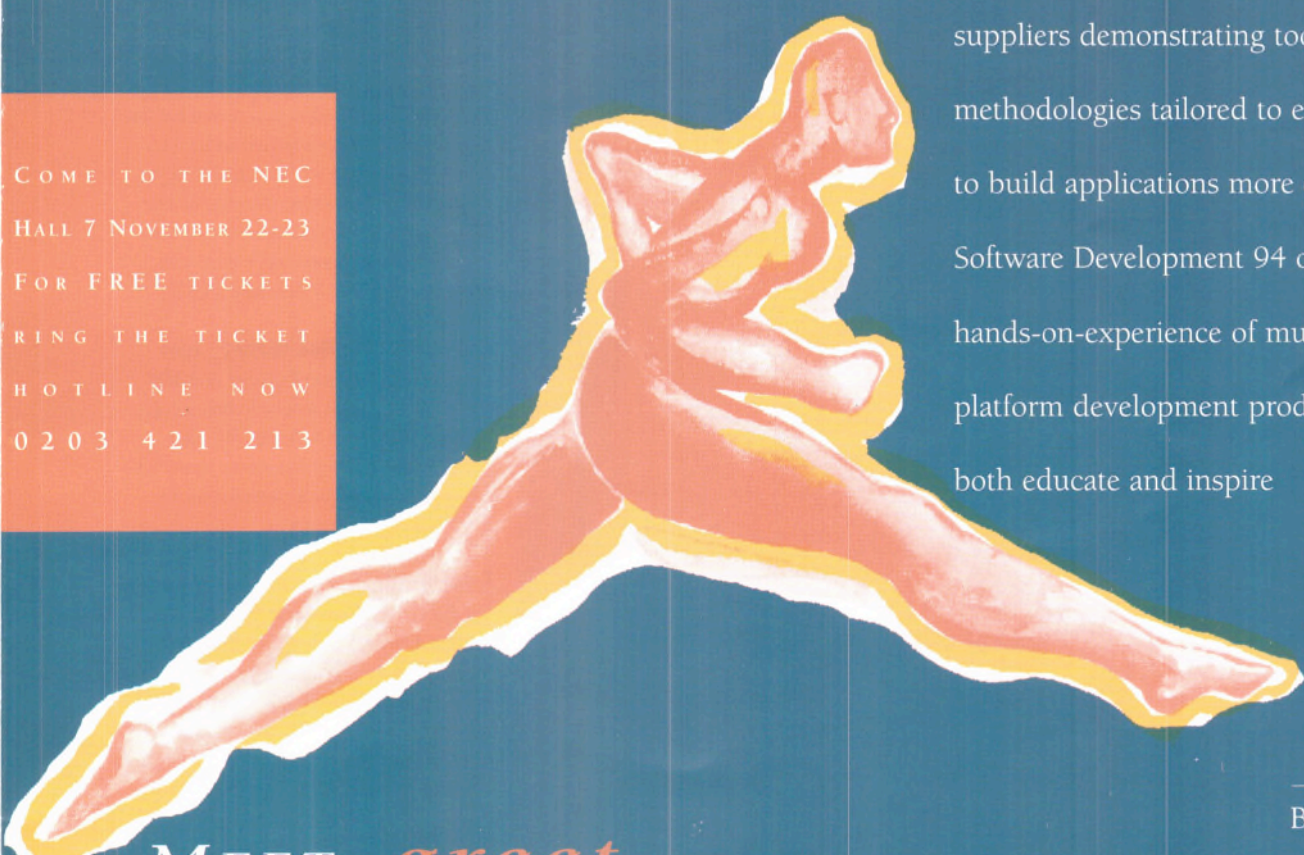
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