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September 1994

EXE

The Software Developers' Magazine

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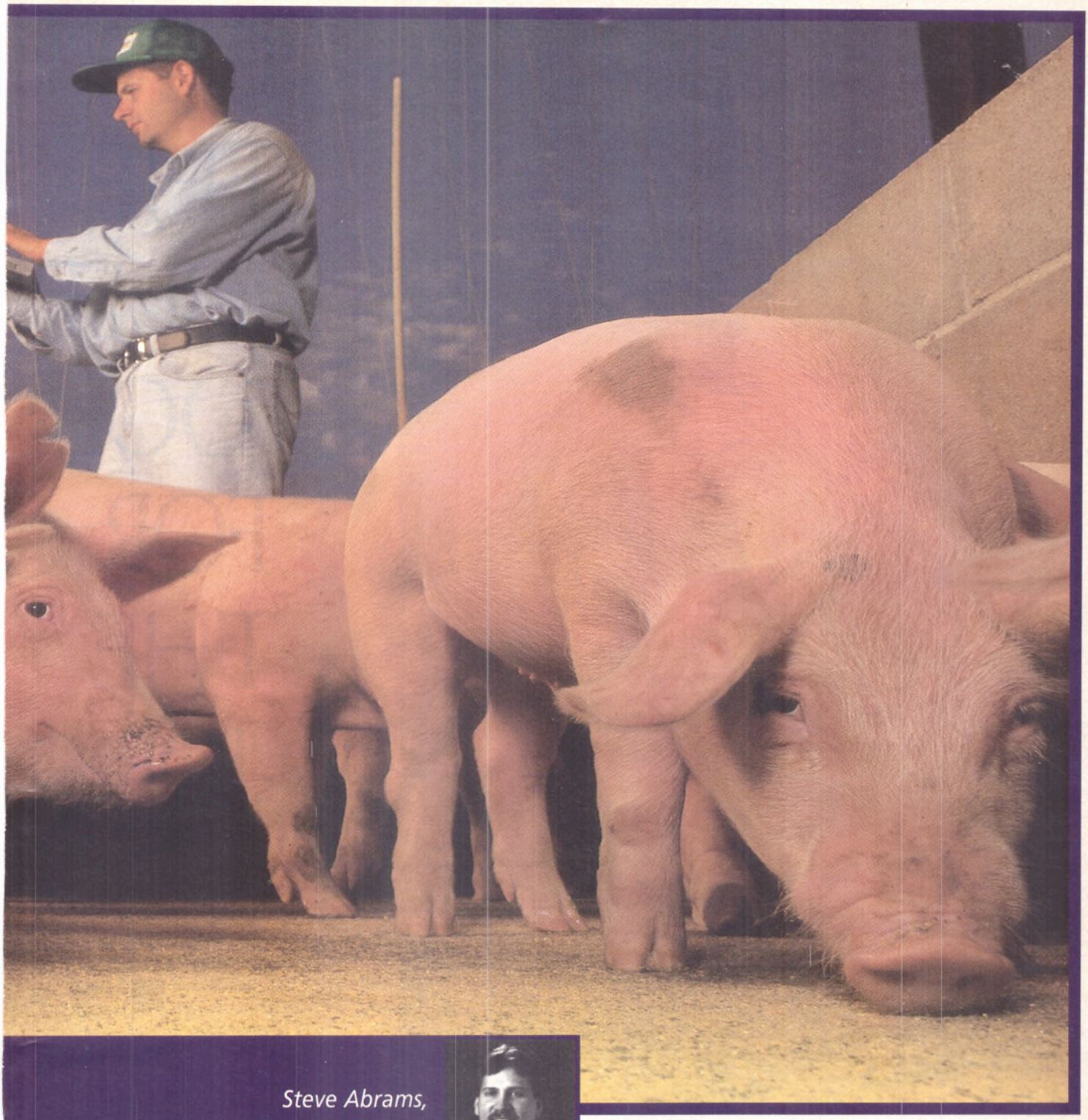

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EXE
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CONTENTS

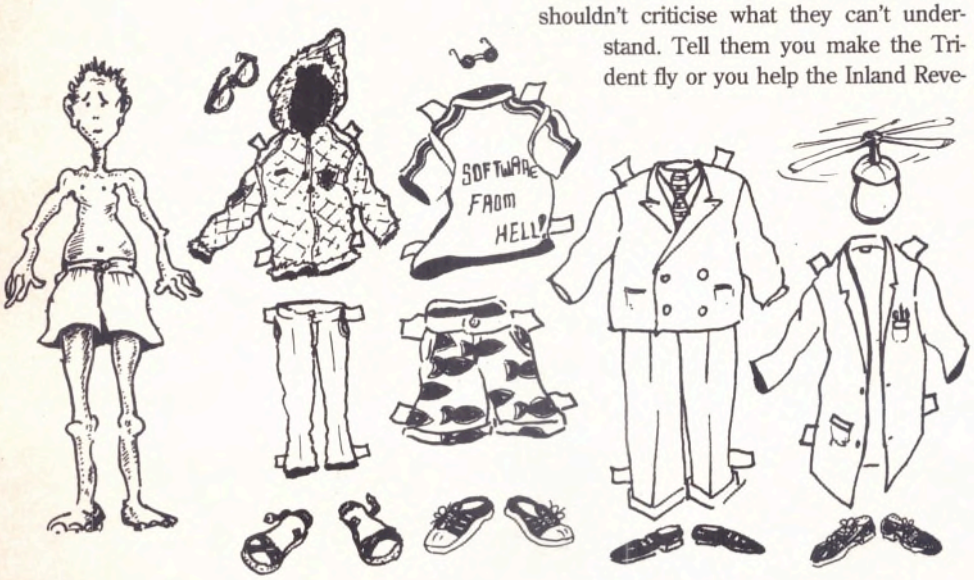
A day in the life

Woke up, fell out of bed. Plugged the PC into my head. Is that really the way people who develop software for computers conduct their lives? Hollywood, popular fiction and the media would have us believe it is.

Own up. It's happened to you, hasn't it? The summer season; garden parties, barbecues and you're making polite conversation with a pretty stranger. Finally the question arises. 'So what do you do then?' A momentary hesitation; quick, quick. Your mind buzzes almost audibly as you whirl through a carefully prepared, alphabetically ordered list of glamorous occupations. You've got up to 'S': surgeon; stockbroker. No, she'll never believe you. It's no good; time has run out. And the truth is, you really are only a Systems Analyst.

If you're lucky she'll pick up on the 'analyst' bit first. 'That's kinda like business analyst isn't it...' But invariably the reply will be: 'a Systems what?' Rather than bore the poor girl with data flows and state diagrams you decide at that moment it would be better to summarise: a gross oversimplification. 'So you're in computers?' Recital of that innocuous little phrase is a deadly blow to your confidence. Is she impressed. Hell no. Your esteem free falls to new depths. You're in the underworld of cyberpunks, hackers, nerds and geeks, exhibiting anti social habits and eating pizza with garlic bread and onions.

It'll be the same with whosoever you speak to, of course. It always is. They just can't accept that the lovely Elaine is in your arms and not theirs. The media and books like Cringley's *Accidental Empires* are largely to blame, depicting computer people as socially inept, heavy metal headbangers whose idea of high fashion is soiled t-shirts, trainers past their wear-by date and naturally faded denims; whose idea of a good time is sitting in front of a terminal 'til the early hours of the morning sipping cocoa, playing *Doom*. Who are they to judge? They shouldn't criticise what they can't understand. Tell them you make the Trident fly or you help the Inland Revenue weed out the tax dodgers. Tell them it's your software that issues their speeding tickets; it's your software that tots up the 'Amount' in the brown envelopes they so hate.



People's misconception of computer folk is bewildering. Either you are a teenage weirdo pumped full of Jolt Cola or you're a boffin, bespectacled and in a white lab coat. And God help you if you are of the latter variety. Next thing you know they'll be phoning up, day and night, with dire questions and brainless problems. 'Why do I get the Insert System Diskette in Drive A: message when I insert a disk in the drive and switch on?' 'I've lost all my files!' It's all right helping them out once. But once they know you can fix it, they'll be round again and again and again. 'Can you spare a moment? I've a little problem.' How do they know how long it will take? How big is this 'little' problem?

How stupid can these people be? Perhaps as ill-informed as the lady who confused computers with typewriters; who thought that software developers were responsible for manufacturing the floppy disk to insert into these typewriters... Hmmn, these software developers must have huge industrial machines for stamping out those disks. No doubt a refugee from planet Jupiter where computers and typewriters have yet to be invented. But there really are people you will come across who genuinely have no idea of computing: they live their cosy lifestyles, their minds never venturing far from the safety of their doormat. These are the people who would have been the last to descend from the horse and cart. These are the people who eye you with mockery at the garden parties: a veil for their arrogance. Secretly they know they have the most to lose from technology, from your knowledge.

So the Computer Industry has its share of eccentrics but so has every other. That doesn't mean we are all like that though. If we were we'd all be billionaires. Some hope... Today the Computer Industry is being moulded by each and every one of us. Differing backgrounds. Differing lifestyles. There's no such thing as the 'computer type', not any more. But the 80's stereotype still remains. It is the mass media which has popularised these images of people who work with computers. No doubt a middle aged Systems Analyst in a grey suite has less visual impact that the kid hacking into the US DoD. In the movies computer scientists wear white lab coats...

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Developers go Solo

Gupta will give away SQL Windows Solo to all attendees of the training seminars, which it will sponsor throughout UK and Ireland from September to November. The package is a fully functional copy of SQL Windows which can build standalone, single user SQL applications. A limited single user deployment licence will also be included (see the article Taking the Fifth' in this issue, for more details on SQLWindows 5.0). Paul Salmon, Gupta's UK director states 'our goal is to have at least 2,000 new developers seriously evaluating SQLWindows 5.0 in the UK by the end of 1994.' Details of the seminars can be obtained from Gupta (0628 478333)

Unix backing for UK

As a boost to the UK Unix marketplace, Novell has begun a new initiative to support UnixWare developers and resellers. Strategic partners will be encouraged to market their products alongside UnixWare. During the campaign Novell will be running a series of technical seminars with its resellers and ISVs. Furthermore, UnixWare modules have now been included into Novell's Certified NetWare Engineer (CNE) courses, available through Novell Authorised Education Centres in the UK. Novell is on 0344 724000.

dBASE potential

A recent report from Computer Intelligence InfoCorp estimates that there's over 15 million users of dBASE worldwide. In the US, dBASE is ranked fifth on the company's Consumer technology Index which lists the 10 most popular software packages used in businesses with over a thousand employees. 'Borland is in a position to be very successful with the recent release of dBASE for DOS and soon-to-be-released dBASE for Windows,' commented Chris Le Tocq, director of microsystems software research at Computer Intelligence InfoCorp.

Integration tightens

Cadre has joined forces with Object Design, Rogue Wave Software and Visix Software to ease tools integration with its ObjectTeam. According to Cadre, integration will mean that ObjectStore OODBMS from Object Design can be specified and created from within ObjectTeam. For developers using Rogue Wave's Tools.h++ class library, it will be possible to reuse the classes during OO application development with ObjectTeam Rumbaugh. And ObjectTeam for Shalaer-Mellor will work in conjunction with the Visix Galaxy application development environment. Reach Cadre on 0344 300 003.

Another first for MS!

After settling with Stac Electronics (see EXE, August 1994), Microsoft has reached an agreement with the European Commission (DG IV) and the US Department of Justice. According to a Commission official: 'It's the first time that a company has faced both American and European anti-trust authorities at the same time.' MS agreed on the 15th of July to stop requiring payment of a royalty 'per processor' and 'per system', ie for every machine containing a specific processor or of a certain model. What it means is that OEMs won't have to pay anymore for MS' operating systems when they ship computers without them. The bottom line is that OEMs will pay only for the OS they bundle, ie if they bundle OS/2 for example they won't have to pay also for Windows as was the current practice.

MS also accepted to stop using 'minimum commitments' and duration clauses in its contracts with OEMs forcing them to buy a minimum number of copies for a certain time. The Commission estimates that 150 million computers are in use worldwide, ie 150 millions Windows machines. Even as impressive as these figures are, system software represented only 33% of MS' 'channel and product group percentages' in the financial year ending June 30, 1994.

The Commission investigation was launched last year after a complaint from Novell, the world's second largest PC software company. If MS 'complies with its commitments', the agreement should be valid for six and half year. It is applicable immediately in the Union. Legal issues take more time in the US. The Department of Justice took over the investigation early 1993 after a long unsuccessful attempt by the Federal Trade Commission. And it's not even completely finished yet. For the agreement to be valid in the US, it has to be confirmed before a US judge, this can take up as long as 90 days.

Bill Gates, happy with the verdict

Bill Gates is happy with the ending of the story: 'many of our customers do business on a global basis and we are pleased that we have resolved this in a manner that will enable them to continue to license software from us easily and inexpensively throughout the world.' Novell was expecting a tougher action, such as the breaking of MS in two companies: a system software one and an OS one. David Bradford, Novell's general counsel considers that the agreement was 'not as broad as we may have liked.'

For Apple, go apltil

Apple is now officially providing information on Compuserve. So in addition to participating in the several independent forums about Apple products and technology, it will now be possible to exchange electronic messages and files directly with Apple. Of special interest to developers is the Apple Technical Information Library, or in Compuserve jargon 'GO APLTIL'. This will provide a subset of the database used by Apple support. It should contain more than 4,300 articles covering FAQs and product specifications.

In the APLNEW forum, the latest software updates can be downloaded; for patches and fixes the right forum is APLSUP. This will provide support 24 hours a day... as long as you have a Compuserve account of course.

If that's not enough, to ease your communication with Apple, you can write your comments and suggestions in APLFBK. Apple is supposed to enhance its support services according to the feedback it receives. If you're not one of the current 60,000 Compuserve's UK members, then a special offer including a Mac offline reader and £10 worth of credit is available free until the end of September. With that credit either you'll have enough time to enjoy the Compuserve forums and subscribe more permanently or voice your dissatisfaction in APLFBK. Compuserve is on 0734 391064.

Borland C++ 4.0 and PowerPack for DOS

NEW

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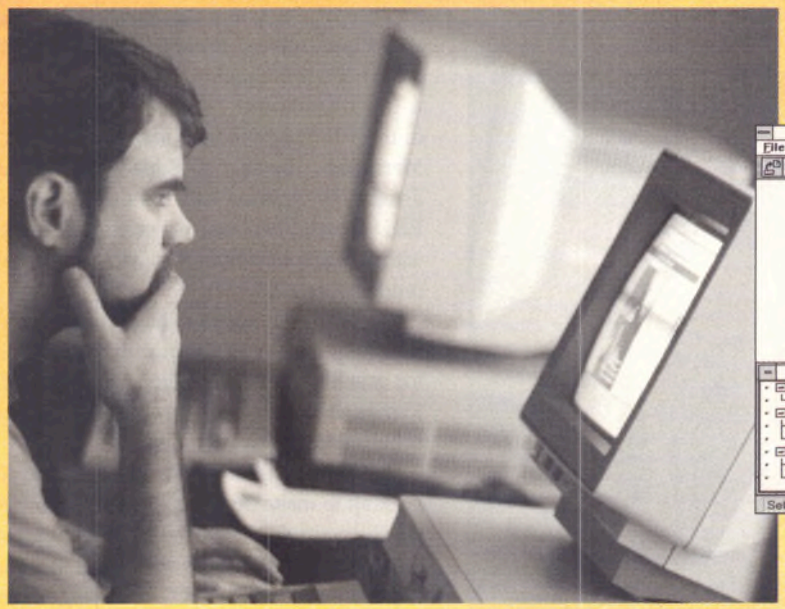

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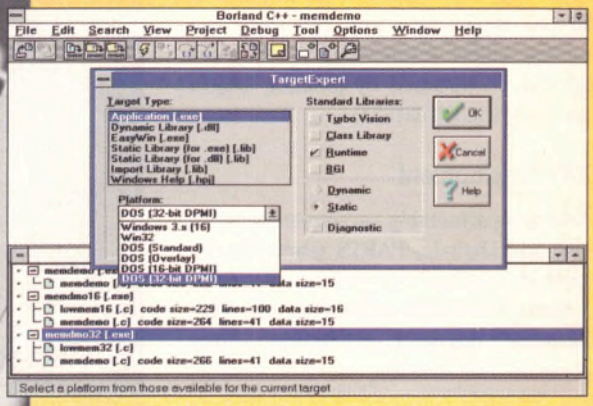

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Look out for objects

Remember, Object Expo is taking place this month between 26th and 30th at the Queen Elizabeth II Conference Centre, Westminster. There will be eight conference streams offering over 60 classes. For the novice to object technology a two day tutorial has been organised which introduces OO methods and tools. As well as the conference itself, Object Expo will also have an exhibition of object systems, methods and tools running on 28th and 29th. In addition, NeXT will be presenting an OpenStep Developers Day on the 28th to explain how to build OO applications with NeXTstep and OpenStep object frameworks. Conference detail can be obtained by phoning Object Expo Europe (0306 631331).

OO Redevelopment

Following a partnership agreement between Softlab and Digitalk, PARTS (Parts Assembly and Re-use Tool Set) will be integrated into Softlab's Maestro II product set. This will provide a migration path to bring legacy systems to the desktop, in LAN environments. Reusable components of existing application, which can be isolated, can then be migrated to OO client/server environment. Softlab is on 081 7422277

Personal conferencing

Lotus and Intel will develop, in partnership, integrated data and video personal products for Lotus Notes, based on Intel's ProShare conferencing technology. The first results should be a video conferencing program for Notes and a data conferencing product where users will be able to work simultaneously on a shared whiteboard and on the same applications. The developments will support the Personal Conferencing Specifications (PCS) to provide interoperability with other conferencing applications. Intel can be contacted on 0793 696000.

ORBs at Object World

Object World, held in San Francisco, between July 27 and 29 featured the 'Network World Live Distributed Application Showcase'. Chris Stone, OMG's President, says, 'it displayed some of the best ORBs on the market'. Sixteen companies participated in this live demonstration which included a banking application, an online travel expense report system and a distributed trading card game. Object Worlds events are scheduled all around the world, the next in London is planned for June 20-22 1995.

Ray of hope for Superbase developers

Computer Concepts, the new owner of SuperBase (see *EXE* June 1994) has established SuperBase Ltd, based in London to oversee development of the product. Already, the original UK development team has been re-hired. The company is in the process of planning a number of worldwide programmes to kick off with a developer conference in the autumn. Robert Savett, the president of Superbase openly invites developers to suggest what they'd like to see in the product: '...we want to hear what they have to say and we will respond to it.'

Expect to see a 'major' maintenance upgrade to the software this month which SuperBase says will contain enhanced image handling and a copy of Computer Concepts' dbExpress. Superbase Edition, a mulit-dimensional data access and presentation tool.

Ray Scott and Robert Savette of SuperBase promise a 'major' upgrade this month

As regards the company's commitment to the UK and European market, Ray Scott, Managing director of Superbase Ltd affirmed: 'we've hired back all of the original R&D team and are actively seeking dialogue with European customers to help us take the product forward.'

In October it hopes to have ready Superbase SuperSuites, a suite of database tools for graphical data modelling, GIS and SQL. Reporting and data browsing will be achieved through dbExpress.

Looking further ahead, the company is seeking to make Superbase file format more widely available to developers. For instance, there's talk of ODBC. By the end of the year Superbase 3.0 will be out, according to Superbase Ltd, that is. This will offer VBA-style development environment with objects, properties and mullet database support via ODBC data source.

Ready to go online to the virtual object market?

Information Brokerage is a new service formed through an alliance between Connect and the OMG. It represents an online marketplace for buying and selling software components. The way it works in practice is that subscribers or purchasers install Connect client software on their desktop and dial into the network. Once online, the user can 'test drive' individual objects, or purchase and download them onto the subscriber's system. In addition to being a point of call for software, the Information Brokerage additionally provides a forum for sharing information between the users of software components and the vendors. Products are listed together with descriptive information and specifications.

Commenting on the technology, John Slitz, vice president and managing director of Information Brokerage said: 'our role is to create a virtual market where developers of any size can sell their products and where buyers can see up to the second what is available.'

The OMG is hoping Information Brokerage will become a self-supporting market for Object technologies. Prices have yet to be announced for the service but Information Brokerage plans it to be affordable both for developers and end users, with low cost subscriptions and placement fees and time and transaction fees to 'purchase' objects from the brokerage.

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Not just a pretty face

A new version of Aardvark's Pretty Printer for Visual Basic is now available. Among the new features is *Connection Lines*, a technique for emphasising the calling structure of a program. Effectively, it automatically draws a vertical line between the two ends of a given control block. Other features include selective printing of functions or subroutines and automatic formatting of source code for printing. Pretty Printer v2.0 is available at the introductory price of $59.99 from Aardvark (0101 8334355).

Zip your softs

The Zip family has been extended with PKZip/Mac a PKZip 2.04g compatible software for the Macintosh. The program makes use of the Finder. For distributing large bits of software for the Mac, it is something worth considering. Of more direct appeal to developers, Dynazip a Windows toolkit that allows files in the ZIP format to be read or written without having to shell to a DOS session. The DLLs can be interfaced with C/C++ and VB. Additional DLLs should provide interface to more languages and even to database's languages. Atlantic Coast is on 0297 552222

CM for Windows

SQL Software is well known in the Unix world for its comprehensive configuration management suite of products based on an Oracle database. The PCMS, or Product Configuration Management Software, product line helps manage and build different versions of product components, tracking changes, locations, status and relationships during the complete life cycle. In the last quarter of 1994, SQL Software will launch PCMS*PCwin, a subset of PCMS for the Windows. SQL Software is on 0992 501414

$(OS/2)^n$

OS/2 can now be scaled upward to SMP system. IBM released OS/2 for Symmetrical Multiprocessing V2.11. This version is compatible with OS/2 2.11. It increases application performance by distributing processes or threads among processors. OS/2 for SMP is compatible with the Multiprocessor Specification Version 1.1, so any compliant MP machines should support it right out of the box. Up to 16 processors on a single system are supported by this version of OS/2. Depending on the number of processors, OS/2 for SMP costs from £258 to £521. IBM is on 0329 242728.

Putting C++ in sight

Spotting a leak, of memory that is, can be a tricky affair in C. In C++ it's downright impossible. To make the life of a developer a little easier, though, specialist tools are available which analyse program source. Insight is one such tool available for Unix, which analyses C code. Up until now a C++ version had not been available. But with v2.0 has come Insight++, targetted at the growing numbers of developers who require an automatic debugging tool for C++ programs.

Insight works on two levels: for source code analysis and for runtime. At the source code level Insight can report on mismatched variable types, argument types or function declarations. It can also detect out of range, or otherwise, invalid arguments in library calls and errors returned by library calls.

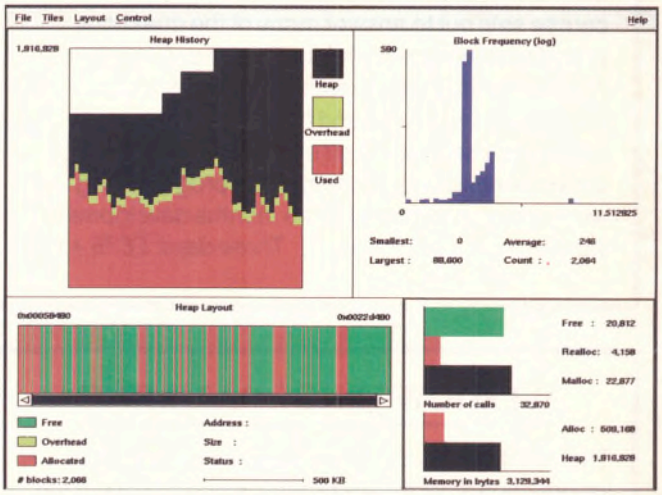
During compilation Insight adds calls to analysis and test functions to every line of source code and builds a database of program elements such as data structures, memory usage and pointer usage. At runtime this database is updated whenever memory is allocated or deallocated. Through this technique the manufacturer claims Insight is able to spot every type of memory reference error as well as a number of program execution errors.

In addition to the facility for detecting memory errors using a database of memory operations, Insight can also be made to keep a log which records the program's actual execution using the Invision module. Later, this recording can be 'played back' by animation through the source code. Using this technique developers can visualise the execution path of the program which can help when tracking down algorithmic errors or spotting potential areas for optimisation.

An alternative view of a program's execution is available via the Inuse module. This is a graphical utility that enables a developer to watch in real time how the program allocates and frees memory. It is used for detecting memory leaks. This utility also helps to illustrate the amount of system memory a program needs during its execution.

User Interface Technologies (0223 302041) is distributing Insight++ for popular Unix workstations including Sun, IBM, DEC, HP and SGI.

The cost is £1,199 for a three user licence on one platform.



Inuse displays graphically, memory usage in real time

Catch the Clipper bug

MrDebug, from Dark Black Software, is a replacement for CLD, the Clipper 5.2 debugger. The debugger works in Protected and Real Mode and is compatible with Blinker, Exospace and Causeway. Consequently there is no limit on the size of application that can be debugged. Typical debugger features such as breakpoints and watchpoints are available. There is also a Pass Point which is a sort of counter attached to a particular line of source code. Each time this bit of source code is executed the Pass point counter increments. For program analysis MrDebug can time speed of execution.

Other features include a source code window which offers colour syntax highlighting; an enhanced Object Browser for viewing class hierarchies for Clipper or Class(y) objects; ability to run in 132 by 60 text screen mode; a facility for tracing the call-stack and a system error window. Dark Black Software (0480 403104) is offering MrDebug for £99.

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NOVELL The Past, Present and Future of Network Computing

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➢ CIRCLE NO. 659

Ed's now softer

Soft As It Gets has brought out a new version of Ed for Windows. Enhancements include language syntax support for six more languages, bringing the total to 28. The spell check offers an improved filter for checking the spelling of strings and comments in source; there is a search filter and new toolbar support. Excel-style ToolTips is available and toolbar buttons can be configured through a Customisation dialog box. Compiler support has also been improved. DOS program output is displayed in real time within the Editor's DOS window. User input may be captured from this window and passed into the DOS program directly. Ed for Windows costs £149 from QBS (081 994 4842).

On the case...

CaseWise has developed a new Window design and analysis tool called Genie. Designs can be validated against Information Engineering, Yourdon, DeMarco, Mellor, Gane & Sarson and Merise methodologies. It features a repository which may be queried through SQL and DDE links. There is support for Entity Relationships, Function Decomposition, Matrix and Data Flow. For new users, it also includes cue cards. CaseWise is on 071 722 4000.

All change to PVCS

The AllChange version control system, from IntaSoft now provides integration with the PVCS Version Control Package for Windows. Readmar Systems which distributes PVCS in the UK believes the two are not competing products. 'Our extensive search for a system to compliment the functionality provided by the PVCS series identified All Change as the ideal solution,' explained Mark Scott, managing director of Readmar Systems.' IntaSoft doesn't perceive any conflict in interest. Malindi Lamb, managing director of IntaSoft commented: 'All Change offers a level of functionality which is not available for any other configuration and change management system running under Windows, DOS or Unix.' AllChange will be distributed by Readmar (071 625 5255). It costs £1,990.

Soft-ICE/W 1.5 for 32 bit

Soft-ICE/W 1.5 can now support source line debugging of Win32s and mixed 16/32 bit applications. The debugger can step through Win32s thunks in one step. An application sheet is also available describing how to debug VBXs. Soft-ICE/W is available at £295 from System Science (071 833 1022)

UCSD Pascal for OS/2

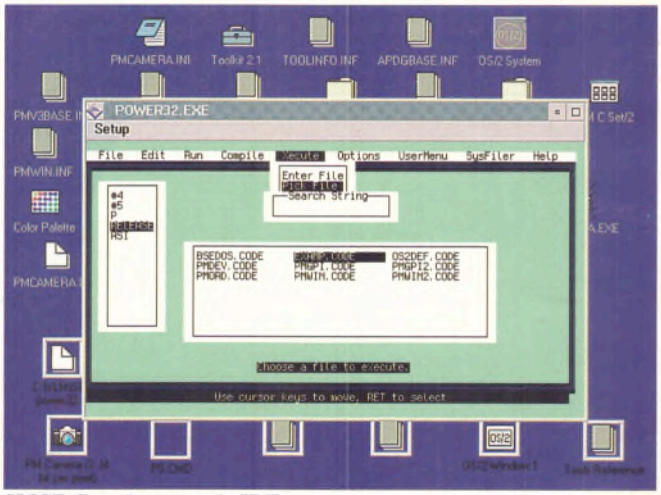
Cabot Software will release a complete UCSD Pascal development system for OS/2 this month. The system includes an OS/2 text mode IDE, a compiler, an editor, a library manager, a cross referencer and a library resource toolkit.

A library containing Pascal versions of most of the PM API is also part of the package. With it, developers can program Presentation Manager applications. But one of the main attraction of the UCSD Pascal is the ability to port a program without any modification between MS-DOS, Unix, Mac, Vax/VMS and now OS/2. For this you have to refrain from using any native call. To link with third party external C code, an optional C interface toolkit will be available.

The language supports object oriented programming and event driven multitasking with up to 255 concurrent tasks. The compiler can generate either P-Code or native code. In both instances, even when producing native code, the application will need a runtime. So to distribute software, licences for the runtime must be bought from Cabot Software.

To attract Turbo Pascal developers, Cabot Software publishes a conversion guide, that explains in details all the steps needed to port an application to either OS/2 or Unix versions of UCSD Pascal. Enhancements such as Turbo compatible OOP, new data types, new intrisics, longer variable name significance, `Else` option on `Case` statements, etc should ease porting.

The full Pascal system will cost £200. Cabot Software is on 0272 586644.



UCSD Pacal text mode IDE

Waiting for WinDOOM?

What are the best selling computer platforms today? Game machines, of course. MS got the message and is now doing its best to present Windows as a game platform attractive to game developers and players. The main problem lies in the speed of graphics, especially when compared to hardware engineered to display sprites at maximum speed. Another concern was to maintain Windows device independence. So MS cracked the problem by developing a library, with yet another API called WinG (Microsofties pronounce it Win 'Gee'). Id Software has already a working beta of WinDOOM, I enjoyed it!

Both 16 and 32 bits versions are available so it is compatible with Win 3.1, Chicago and NT. In addition, the libraries can be redistributed freely. WinG allows the creation of a GDI compatible HBITMAP with DIB as the drawing surface. To obtain performance similar to DOS, bit blitting is done directly from DIBs to the frame buffer in memory. On Windows 3.1, WinG is optimised to deliver performance similar to DOS for a 256 colour source animation. On Chicago and NT, WinG is optimised for all colours, depths and graphic resolutions.

But the definitive game platform from MS will be Chicago (at least for some time). When it becomes available, Chicago will feature 'on the fly' control of the screen resolution, some hardware-level video functions such as off screen buffering and device independent colour support. Chicago with WinSockets and its UniModem definition should also help the creation of multi-player games. Another API is worth looking at is the Plug and Play API. This will allow a game - or any other application - to control external devices such as CD-ROMs or sound cards. There are currently very few devices effectively supporting Plug and Play. 3D support is not forgotten but OpenGL compatibility for Chicago is planned to be included in a future version of the not yet released operating system!

WinG and a handbook entitled *Writing Hot Games for Microsoft Windows* can be downloaded from the WINM forum on Compuserve.

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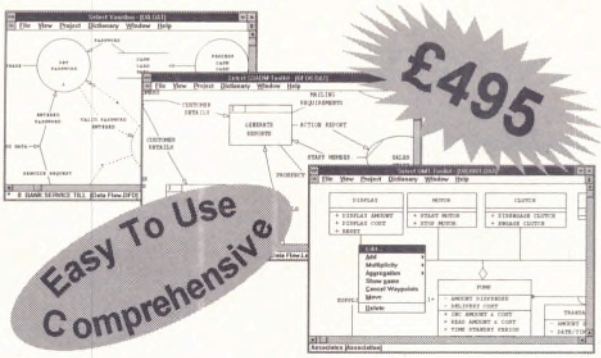

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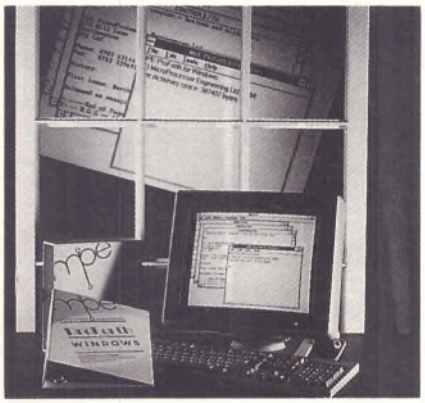

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➢ CIRCLE NO. 661

Zip along here to find out more.

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Specialists in networking education, Azlan Training offers a full range of UnixWare courses, as well as consultancy and support services for UnixWare installations. A free catalogue of courses and schedules may be obtained by calling Azlan Training on 0734 894400.

yes UnixWare

Barefoot Computer Training Ltd,
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Tel: 071 407 4074

Barefoot has been offering specialist technical computer training since 1981. As an NAEC and Drake Testing Centre, Barefoot offers the complete range of NetWare and UnixWare education and certification to ECNE level.

yes UnixWare

faculty

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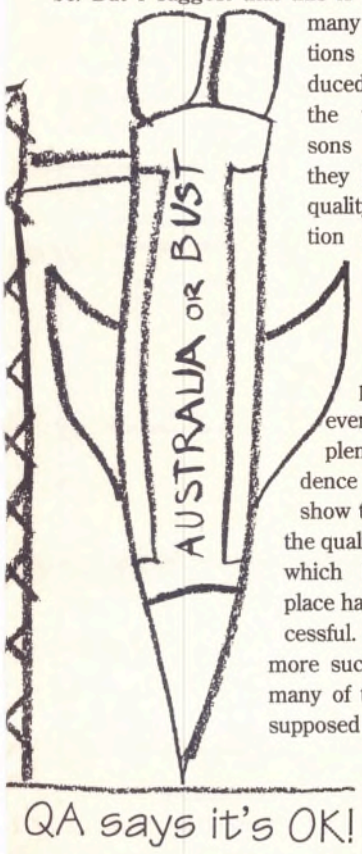
CIRCLE NO. 663

SOAPBOX

What'd'ya mean you want it to *work* as well? **Tracy Hall** cracks down on the poor quality of software

I am heartily sick of hearing people in the software industry whinging and carping about having to think about 'quality'. Many of them seem to think that software quality is just the latest fad. The current 'silver bullet'. Now I do realise that there has been a lot of hype surrounding quality, and that it is certainly a very fashionable topic at the moment, but let's not just dismiss the whole thing as an inconvenient distraction to the real work of software development. Something invented by QA people ('who probably can't cut good code anyway !') to keep themselves off the dole. It would be difficult to deny that the quality of software the industry is producing at present is rather poor: look at Wessex, London Ambulance System, Taurus etc etc...

OK - perhaps it is true that, to an extent, formal Quality Management Systems have not been the success they were supposed to be. But I suggest that this is because too many organisations have introduced a QMS for the wrong reasons - because they just wanted quality certification or because managers wanted a few extra brownie points. However, there is plenty of evidence around to show that many of the quality initiatives which have taken place have been successful. Probably more successful than many of the previous supposed silver bullets. After all, have CASE, formal methods or OO really delivered what they promised?



Far too many people seem content to wait for the development of some miraculous new, and preferably computer-based, tool or methodology which will solve the quality problems that the industry has. It's not going to happen. However much of a technophile you are, it is time to realise that it is not for want of technology that the industry is in its present state. The problem is lack of effective process management. And there seems to be little point in relying on technical innovation to solve today's software quality problems, as any technical innovation will be obsolete in five years time anyway.

It is becoming increasingly clear that the management of software development has not kept pace with technological advancement. It is software *management* that is the weak link where software quality is concerned. This proposition is supported by the recent Capers Jones study which suggests that whilst technical staff are, on the whole, performing well, their management are performing consistently less well. This is where Software Quality Management Systems come in.

Software Quality Management is about taking a step back from all of the technologies that now make up the software development environment. It focuses on how all these technologies are actually being used and managed in practice. Indeed modern software development environments are so complex that it is only by concentrating on improving the working and management practices used within these environments that software quality can be improved in the long term. SQM simply provides a framework with which to introduce and manage technologies in a controlled manner, rather than the current hap-hazard way.

Quality Management Systems have already been successfully used for many years by other industries. They have also been used for some time now by the Japanese software industry. Contrary to the belief of many people in the Western software industry, it is not a new idea to produce a product, even a software product, within a quality management framework.

But if Quality Systems are feasible, why do I hear so many whining excuses as to why they should not be introduced? Perhaps the following comments sound familiar? 'Defining quality is impossible - so what's the point?' 'We're too busy producing software to worry about quality!' 'Introducing a QMS would be far too expensive' 'A QMS is just an exercise in paper generation. A bureaucratic nightmare!' 'All these standards and procedures don't allow for developer creativity' 'There's nothing wrong with the quality of the software that we already produce!' 'My software engineers won't put up with all this 'quality' rigmarole...'

It is also interesting to note that managers seem to demand a very high level of quantitative evidence before introducing quality working practices. Significantly more quantitative evidence, I suggest, than they demand for the justification of an expensive new testing tool or a new PC network. How ironic, when it is just this kind of objective decision making that Quality Management Systems promote.

Maybe it is only now, as software engineering matures from a craft to an engineering discipline, that the industry is in a position to adopt what are actually standard business practices - whilst at the same time thinking it is being revolutionary. Or maybe, in an industry which is constantly changing to keep up with developments in technology, quality working practices are seen as expendable.

Whatever the reasons for the industry's lack of enthusiasm for quality, or should I say lack of enthusiasm for the means by which quality can be improved, it is about time the industry woke up to the quality imperative. There are answers to the perceived difficulties. Quality mechanisms can be integrated into the development process effectively. I'm not saying it's easy, but I am saying that, if done properly, it's worthwhile.

So let's stop waiting for some miraculous new software tool or methodology. Let's stop fooling ourselves that we *will* do it right next time anyway, or that with a bit more testing effort everything would be fine. There are some people who say that lack of quality in the Soviet Union's products contributed to its downfall. If quality, or the lack of it, can have such an effect on a whole State, we would do well to think about what effect it could have on the software industry!

Tracy Hall is a Senior Lecturer in Software Engineering at the University of Westminster.

Two processors, one box...

Having taken arguably the biggest risk in its history by moving to Risc, how has Apple manged to convince the masses that it got it right? **Cliff Saran** investigates

Since its launch in March this year Apple has sold more than 200,000 PowerMacs. Swapping the 68k brain for a PowerPC has been the most significant development in the Mac's history. Rather than market it as a completely new machine capable of running System 7.x, Apple chose instead to make the PowerMac a go-faster Mac. Key to its success would be the ability for it to run all existing Mac software written for the 68k. Obviously to benefit from the performance gains achievable through the Risc architecture of the PowerPC it would be necessary to write native applications. These would appear in time so long as Apple could convince people that the PowerMac was fully capable of running their existing investment in software. From the numbers sold it would appear that Apple's strategy is working. Given that, generally, emulation software is treated with scepticism, how has Apple managed to convince so many that it can do it right?

Bending over backwards

The short answer is that Apple has been extremely accommodating to the installed base of 68k software: so much so that issues relating to compatibility rest with the developer of native PowerMac applications. The onus is on them to write software which conforms to the runtime requirement of being able to switch between 68k emulation mode and native PowerPC mode 'on the fly'.

The emulation itself models the 68040 but lacks support for floating point instructions and paged memory management. In fact, it is often reported as a 68020 emulator. Even the emulation of the exception stack frame conforms to that of the 68020. Nevertheless Apple says it's a 68040 and it delivers roughly the same levels of performance as a 25 MHz 68040. While 68881 and 68882 floating point coprocessors are not supported, the PowerMac includes a native implementation of SANE, a library which provides hardware independent floating point arithmetic. Since it is written in native PowerPC code, emulated applications that use SANE should experience improved performance on the PowerMac compared with the native 680x0 environment.

Essentially the emulator is a program execution environment that mirrors that of a 680x0 based Mac (see Figure 1). 68k instructions are translated into PowerPC instructions which are then issued to the PowerPC. Upon returning to the emulated environment, results of the emulated instructions are propagated. For instance, changes to the emulated 680x0 registers will occur. When a 68k instruction is fetched, the opcode is used as a lookup into a dispatch table which comprises two PowerPC instructions per entry. If the 68k opcode can be mapped onto a single PowerPC instruction the first instruction in the dispatch table is executed. Otherwise this first instruction begins the emulation process. The second instruction in the dispatch table then contains a relative jump to the actual emulation code.

Making the switch

Obviously it would be grossly inefficient to emulate system calls made by a 68k application, so instead, the emulator makes calls to

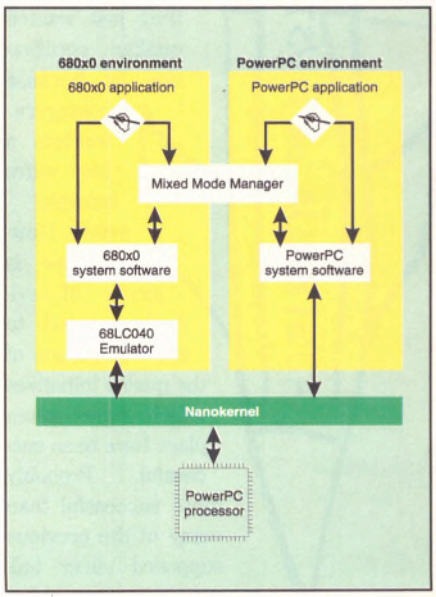


Figure 1 - Heterogenous runtime environments on the PowerMac

the native PowerMac system software. The implications of this are that the application effects a change from emulated 68k to PowerPC at runtime whenever it makes a system call. While this happens most of the time, it's not quite the whole story. Not all of System 7.1 for the PowerMac is written in native code. What this means is that there will be occasions when a native PowerMac call will need to make a call to code written for the 68k. The situation would also arise when using 68k device drivers and system extensions. Of course, calls from emulated 68k applications to emulated 68k system software and calls from native PowerPC applications to native PowerPC system software should run as fast as possible.

Apple uses the *Mixed Mode Manager* to look after the business of switching between instruction sets. Its aim is to hide as much as it can of the PowerMac's hybrid nature. Although it has been designed to operate as transparently as possible there will be times when an application developer will need to force a switch in instruction set. Since emulated 68k applications are supposed to run unmodified on the PowerMac, developers of native applications and system software are responsible for making these changes.

When a 68k application calls, say, a toolbox or memory management routine written in PowerPC code, the *Trap Manager* looks in the dispatch table for the address of the system call's entry point. This address in fact points not to the system call itself, but to a data structure called a *Routine Descriptor* for the system call. The first field of this data structure, `goMixedModeTrap`, contains an executable 68k instruction that causes the Mixed Mode Manager to be invoked when executed from emulated 68k mode. This then checks the remaining fields and determines the instruction set of the routine being called by examining the `routineRecords[]` field. The `ISA` field of each `RoutineRecord` specifies the instruction set; the `procDescriptor` field is a pointer to the routine to be called. Figure 2 illustrate how the process occurs.

A native PowerMac application executes a system call through the Routine Descriptor. Here, the Mixed Mode Manager determines whether a mode switch is required in order to emulate a 68k system call. Otherwise the native PowerPC system call is invoked without switching modes.

The use of Record Descriptors instead of pointers is the way in which Apple enables software written in one instruction set to call code written in another. The technique is required only when it is necessary to call external code that might be in a different instruction set. The most obvious example is

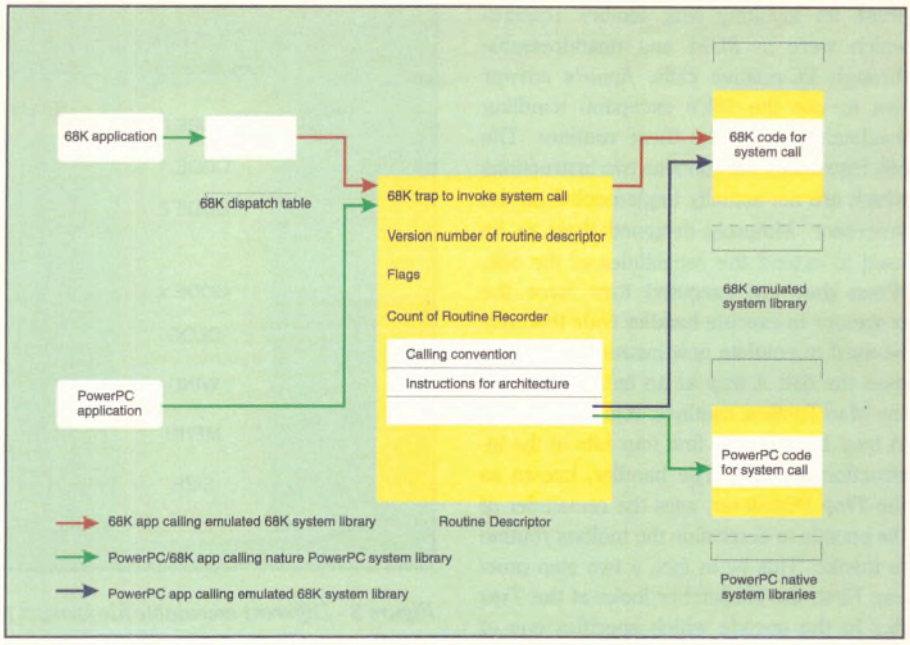


Figure 2 - The Mixed Mode Manager routes all combinations of 68/PowerPC system calls

that of a callback routine or any time when a procedure pointer must be passed to the system software. Other examples include grow-zone functions, control action procedures, event filters, VBL tasks, Time Manager tasks, trap patches and completion routines.

Procedures that are only called internally

Even in in the heyday of the Macintosh Classic, 32 KB wasn't enough to run GUI applications

by the application do not require Routine Descriptors. Furthermore, so long as the caller and the callee routines are of the same instruction set then it is not necessary to use a Routine Descriptor. In fact, Apple recommends that developers should use normal procedure pointers in that scenario.

1984 - The way it was

There were a number of inherent limitations from the original 68k runtime environment. Application files comprised data and resource forks. Code was stored in the resource fork. Since relative addressing on the 68000 processor was restricted to signed 16-bit offsets, code was further divided into 32 KB chunks known as segments. Relative addressing was chosen because of the need for position-independent code. In the early days of the Mac, 256 KB or 512 KB of RAM was considered a luxury. So, in order to run large applications, it was necessary to load and reload blocks of code into memory. What this meant to the developer was that the largest offset in a code segment was limited to 32 KB.

The problem facing developers was that, even in the heyday of the Macintosh Classic, 32 KB wasn't enough to run GUI applications. Apple came up with the idea of a jump table which would contain references to functions in other 32 KB segments. The jump table was actually implemented as an array of executable 68k instructions. If the segment containing the subroutine to be called was already loaded into memory, its entry would contain a `jmp` instruction with 32-bit relative address to move the program counter (PC) to the appropriate section of code. Otherwise the jump table contained a call to the `LoadSeg()` subroutine. When `LoadSeg()` was completed it updated the entries in the jump table for all subroutines contained in the loaded segment so that they referenced their respective subroutines in memory. Program control was then switched to the subroutine that was being called. Obviously, all of this happened transparently to the running of the actual program. The Mac's Segment Manager took care of routing via the jump table. When a program was first loaded for execution, the stack and the heap were initialised and an area of memory would be set aside to store the jump table and global variables. This area of memory became known as the *A5 World* since it was accessed through offsets to the 68k's A5 address register. Other data stored there included application parameters and QuickDraw global variables.

While the above mechanism was fine for calling application routines, it was inappro-

priate for invoking Mac toolbox routines which were in ROM and unaddressable through PC-relative calls. Apple's answer was to use the 68k's exception handling mechanism to invoke these routines. The 68k instruction set contains two instructions which are not actually implemented on the processor. Motorola designed them to be used to extend the capabilities of the 68k. When they are executed they force the processor to execute handler code that may be used to emulate new instructions. Apple uses the 68k *A trap* as an entry point into the Mac Toolbox routines. It is know as the 'A trap' because the first four bits of the instruction are 0xA. The handler, known as the *Trap Dispatcher*, uses the remainder of the opcode to determine the toolbox routine to invoke. This is, in fact, a two step process. First, the Dispatcher looks at the *Type* flag in the opcode which specifies one of two dispatch tables, one for low-level, the other for OS routines. Then it takes the remainder of the opcode as an offset into the appropriate dispatch table. This offset contains the address of the Toolbox routine. When the routine has completed execution, the Trap Dispatcher returns program control to the instruction following the A trap.

Tapping the power in '94

The format of an executable file on the PowerMac is again divided into two forks. This time, however, the data fork stores the code. Figure 3 compares the format for the 68k and PowerPC-based Mac. Unlike the restrictions of the original 68k, code isn't limited to 32 KB segments. Application code exists in the data fork as one contiguous block known as a *code fragment*. When code is loaded into memory the *Code Fragment Manager* prepares it for execution. The Code Fragment Manager is equivalent to the Segment Manager of the 68k based

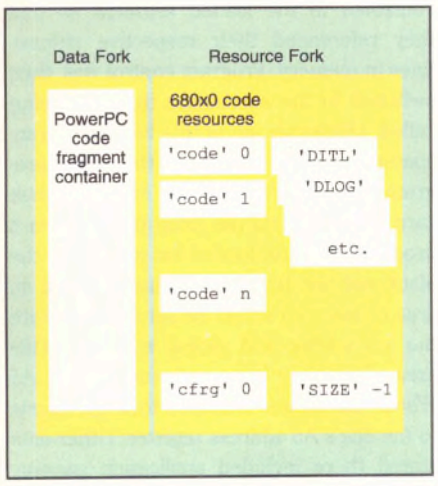


Figure 4 - The file structure for a fat application

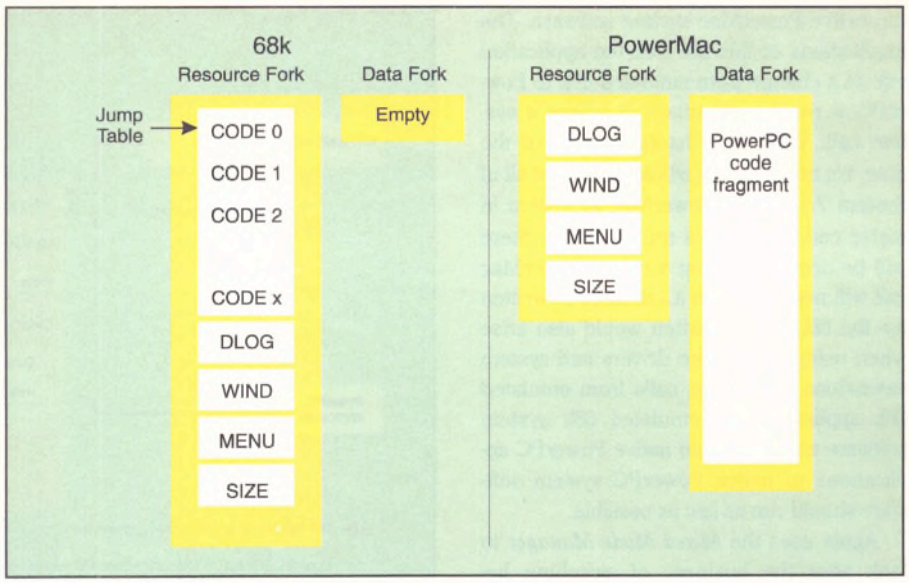


Figure 3 - Different executable file formats for 68k and PowerPC Mac apps

Mac. However, when a fragment is loaded into memory it's job is to resolve any references to external routines. For instance if a code fragment calls a routine in an import library, the Code Fragment Manager must ensure that the library is present in memory in order to determine the address of the routine being called. An import library is another type of code fragment. If it isn't present, the Code Fragment Manager must also load it into memory and resolve its external references.

Sharing of global data on the PowerPC is not as tricky as on the 68k based Macs

The actual process of resolving references involves looking up the symbol for an external reference in a special data structure called the *table of contents* (TOC) and replacing them with physical addresses known as export addresses. The TOC is actually built automatically by the compiler and linker. Only at runtime do the external references become resolved. The process is known as *binding*.

As in the 68k the stack and the heap are initialised for the application. Rather than store global data in the A5 world, it is placed on the application's heap. If the fragment is of an import library then its data may either be placed on the application's heap or on the system heap. Either way, the A5 world is unnecessary on the PowerMac. Code isn't restricted to 32 KB segments and global data is stored on the heap. Now this is all fine and well but there are some QuickDraw routines still implemented in 68k code. Remember, QuickDraw globals are stored in the A5 world of a 68k based Mac. In order to give applications access to them on the PowerMac, Apple stores pointers to the globals in the application's heap.

Since an application's global data on the 68k is tied intimately to its A5 world, it is extremely difficult for another application to gain access to this A5 world and so see someone else's global data. On the PowerMac, the TOC makes it relatively straightforward. Sharing of global data on the PowerPC is not as tricky as on the 68k based Macs.

Where code is actually stored in physical memory is dependent on whether the virtual memory manager is enabled. If it is not then, as well as everything else, the application's code is loaded onto the heap. When enabled the *Virtual Memory Manager* uses the application's data fork as a paging file. Apple calls it *file mapping*. The result is avoidance of file thrashing in the 68k environment when an application loads into memory and immediately swaps out into a backing-store file. On the PowerMac, portions of code are loaded as and when they are needed.

Fat apps

At the time an application file is loaded, and before it has begun execution, there is no way to know the instruction set of the code: 68k or PowerPC? To alleviate this problem Apple has added an extra tag in the resource fork of the executable file. This resource, called `cfrg` tells the PowerMac Process Manager that the file is, in fact, a PowerPC application. Now, given that code written for the 68k resides in the `CODE` tag of the resource fork and PowerPC code lives in the data fork, it is possible to distribute applications as a single executable that

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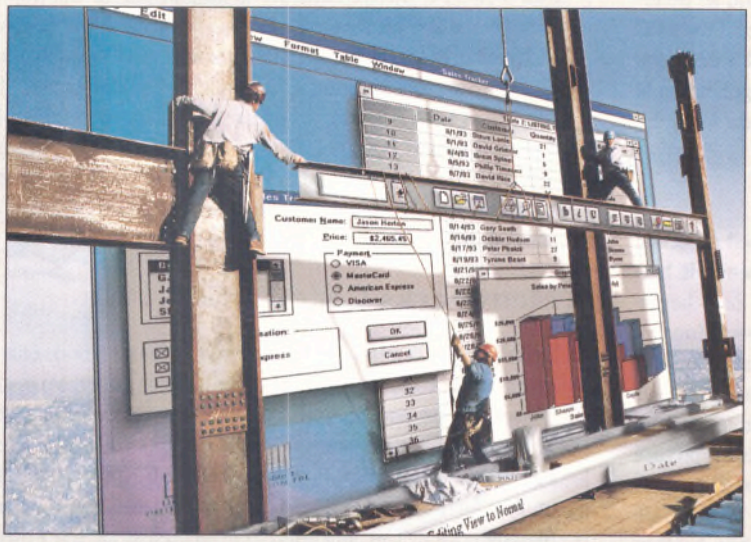

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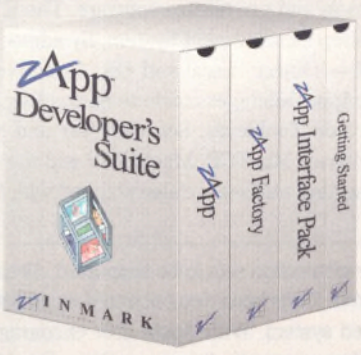

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may run natively, either on a 68k- or a PowerPC-based Macintosh as shown in Figure 4. Apple calls such a file a *fat application*. The way it works is as follows. A 68k Mac will treat the executable file as any other, loading application code from the `CODE` resource, oblivious to the fact that the data fork contains PowerPC machine code. On a PowerMac, the Process Manager will be able to see the `cfrg` resource and so determine that the data fork contains PowerPC machine code. If it does not find a `cfrg` resource then it will assume the application is for the 68k and will load the code from the `CODE` resource instead.

From Mac to PowerMac

When the Macintosh was dropped a decade ago onto an unsuspecting audience it heralded a break with the past, a new beginning... From then on user expectations of personal computing would be rated against that of the Macintosh. The euphoria was summed up in the television advert at the hands of Ridley Scott who painted a picture of personal computing as an Orwellian 1984, complete with obligatory big brother cliches. A girl runs up to the big brother screen worshipped by the drone users. She smashes it to reveal the Macintosh, and a new era in personal computing. Today, 10 years on, it is the place of the PowerMac to rekindle envy of the Macintosh among the user community. With Windows running on PCs being the norm for 40 million users, Apple needs to increase its market share of the personal computing industry. The price/performance against that of a similarly configured Pentium driven Windows system is key to Apple's marketing effort for the PowerMac.

Macintosh Anywhere

Emulation is a side effect of moving to a new architecture while attempting to maintain backwards compatibility. For Apple, this backwards compatibilty is crucial. It must first convince existing Mac users to upgrade. Then it can concentrate all its effort on making PC users defect. An awful lot of work has gone into making the 68k emulation as seamless as possible: so much so, in fact, that it would appear native PowerPC applications suffer as a consequence. But the emulation and the Mixed Mode Manager does provide a mechanism whereby parts of the OS kernel can remain in the 68k instruction set. So there is no need to rewrite, debug and test the entire kernel for the PowerPC. This has meant that Apple could bring the PowerMac to the market quicker. It now has more time to recode the remaining system routines. The design of the Mixed Mode Manager could enable further instruction sets to be supported. Already, System 7 has been demonstrated on an 88000 based system. With Apple now encouraging hardware manufacturers to clone the Mac, who knows what the future has in store. System 7 on a PC? Somehow I doubt it... ■

For a review of the latest Symantec C++ for Macintosh turn to Paul Smith's column on page 54. Further information may be obtained from APDA on 0101 716 871 6555.

Developing for the PowerMac

Macintosh with PowerPC Starter Kit

The Starter Kit is a set of technical documentation for software development on the PowerMac. It contains the *PowerPC 601 Risc Microprocessor User's Manual* from Motorola which details the instruction set and architecture of the processor. *Inside Macintosh: PowerPC System Software* is an addition to the popular *Inside Macintosh* manual included in the kit that explains the innards of the system software, emulator, Mixed Mode Manager, Exception Manager and the Code Fragment Manager. For developers planning to port existing 68k applications, the Starter Kit comes with *Migrating to Macintosh with PowerPC Checklist*, a condensed version of the Programmer's Introduction to Risc and PowerPC self-paced training course from Apple developer University. The final technical manual in the Starter Kit is *PowerPC technology: An overview for Apple third party developers*, a guide and high level overview of the hardware and software paths to the PowerPC.

Metrowerks CodeWarrior

CodeWarrior is a development environment for both 68k and PowerPC applications. It provides an IDE, an application framework called PowerPlant that supports the Apple Object Model and source level debuggers for both 68k and PowerMac processors. There are three versions. The Gold edition includes Metrowerks native C, C++ and Pascal for the 68k- and PowerPC-based Macintosh and a C/C++ cross compiler hosted on 68k for PowerPC targets. The Silver edition is for the PowerMac only: it provides Metrowerks C/C++ and Metrowerks Pascal for the PowerMac. The Bronze edition is only available for 68k Macs. It provides 68k hosted and targeting Pascal and C/C++ language compiler systems.

Macintosh on Risc SDK

This is a CD-ROM that comes complete with a set of development tools for building new PowerMac applications and porting existing 68k apps to the PowerPC. It includes an ANSI compliant C/C++ compiler, a PowerPC assembler and a remote PowerPC debugger hosted on 68k Macs that connects to the PowerMac via a serial cable. There is a new set of system header files which provide source code portability between the two platforms; MacApp has been updated to use pointer based objects that makes it compatible with the PowerMac and a new version of Apple Installer which can install either 68k or PowerPC builds of an application on a user's machine. A complete version of the Macintosh Programmer's Workshop (MPW) Development System 3.3 comes with the SDK. This provides MPW 68k assembler, SourceBug ToolServer, SourceServer, ResEdit and MacsBug. The SDK also includes a PowerPC linker, compiler build tools, sample PowerMac applications and a complete set of online documentation in DocViewer format.

Essential Tools Objects

ETO is a subscription-based CD-ROM for Apple developers that comes out three times a year. It include new IDEs, compilers, debuggers, application frameworks, testing tools and pre-release software. The ETO contains the Macintosh Programmer's Workshop Development System, Symantec C++ for both Macintosh and MPW and MPW C, C++ Object Pascal and 68k Assembler. There are 68k and PowerPC versions of MacApp. Debuggers include SourceBug, SADE and a PowerPC debugger. Other tools include ToolSever, SourceServer and a Virtual User testing tool. For communications there's MacTCP, MacSNMP and the Macintosh Communication Toolbox. In addition, several utilities are also shipped with ETO including ResEdit and MacsBug.

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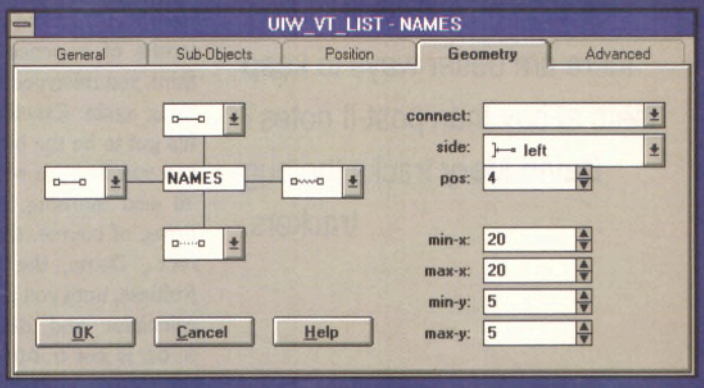

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CIRCLE NO. 665

It's a bug's life

The complete biography of bugs needs to be well kept. Surely there are better ways to keep them at bay than post-it notes? **David Mery** tracks the bug trackers.

Home at last, after a long working day. Bad news awaits patiently on the doormat. It's a bank statement. Fire up Windows, launch calculator, check statement. Tap, tap, tap... Nearly correct but not quite: there is a few tenths of a pence difference. Okay, you think you mistyped a number. Do the whole thing again. Exactly the same error. Why? It's got to be the bank statement... But how can you be sure where the error lies. Wait 'til next morning. A call to the bank confirms, of course, that the statement is correct... Damn, the whole situation seems fruitless, until you play a little with Windows calculator and discover that `3.011 - 3.01` is not `0.001`. There's still a **bug** in this simple program! Try it.

This rounding bug in a floating point numerical library is so obvious that it has probably been discovered by thousands of users since Windows 3.1 was first introduced. But it is still present in NT. Was it written on a post-it by the help line and lost since... Or was it forgotten because more serious bugs were discovered in the meantime... What is it like being a bug? Does anyone care about it?

A bug's life

A bug has a life of its own. Its life history should be kept in great detail. The birth of the bug is the unknown factor, nobody knows how, when or where. The story really begins when a bug is discovered. This either happens when the software is still in development phase, by testing or by an ultra keen user putting up the red flag. Usually, someone tries to reproduce the bug. The problem is then passed on to someone else to solve. Now it's the turn of the project manager to decide if the problem is bad enough to warrant inclusion of the correction in the current or a future release. The official death of a bug is declared when a corrective program or a new version of the software is delivered. The process is very similar for a feature request. Since every software house, from one person shops to big companies, is confronted with the same problem, some softwares exist to automate the whole process. These are dubbed bug tracking tools.

From discovery to fixed

The main role of these tools is to record all the information gathered during the evolution of a bug or an enhancement request. They follow the bug through its lifetime and record every single relevant detail. At any time during development it should be possible to generate a detailed report on the progress of a bug fix. By automating the

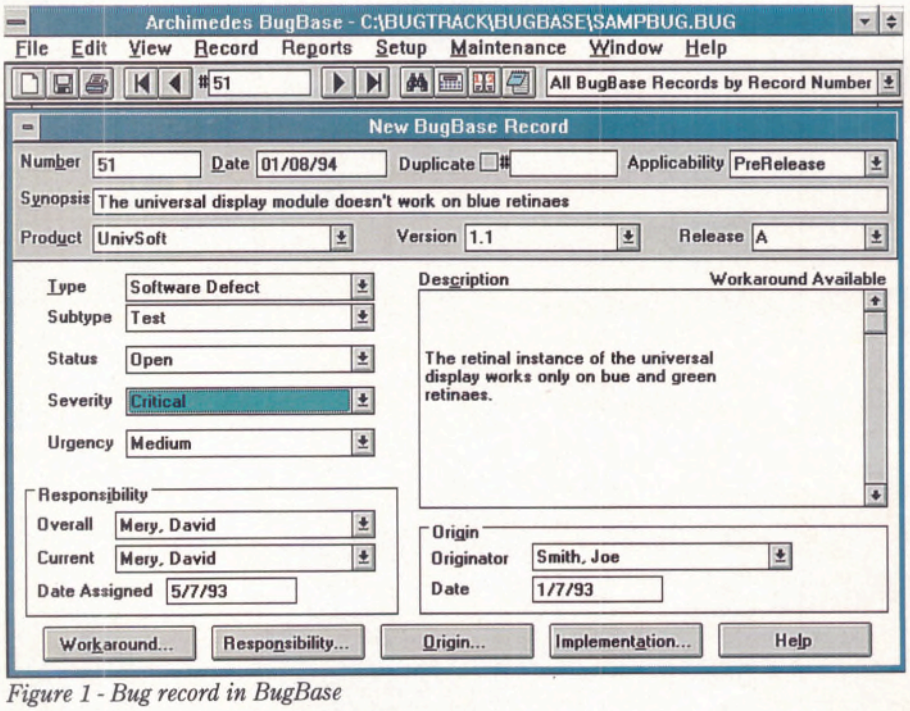

Figure 1 - Bug record in BugBase

Was it written on a post-it by the help line and lost since...

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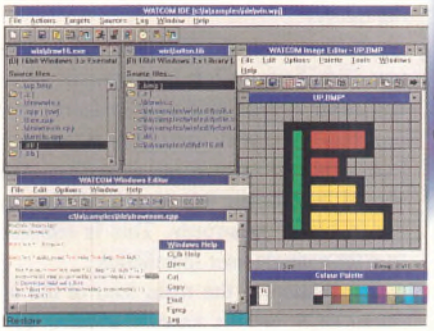
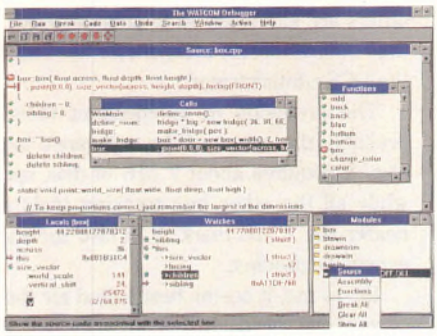


Watcom C/C++ 10.0 includes a source editor with syntax highlighting, a suite of resource editors, testing and monitoring tools for Windows 3.x and NT development.



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process, they create an infrastructure in whcih a developer can enter details that can later be recalled.

When a bug is found, a description must be filled in, as well as the name of the technician who entered it. The bug is marked as 'just discovered', in other word open and unreproduced. The project manager can assign one particular developer to fix it. If the problem can be reproduced, then its status evolves. When the bug is eventually fixed, it appears on the QA team's screens as fixed but untested. After QA considers the problem solved, the bug record is marked as fixed and tested. The job is nearly finished. The next step is for the writer to document all bugs that passed the previous stage.

Finally the project manager declares the problem closed and decides in which release it will be included. At any time, the state of all the bugs can be checked, who is working on what, were there more bugs in the current release than in the previous one? Hard Imagine doing all that work with post-its or email! Of course, in standalone versions, all the different roles occupied in a development team can be assumed by one individual.

BugBase for Windows

San Francisco based Archimedes Software released both the single user and the network versions of BugBase in 1993. BugBase V1.64 is the only one of the four tools I installed that wasn't a new version just released or a beta. Projects comprise three databases, one containing all bugs' details, one describing releases and modules of the project and one for names of the people involved in the project. All three databases are presented as child windows containing a list box of all the items. The list of fields is fixed but can be modified before a database is created. However, once it's open, it's too late. The structure cannot be changed but data ites may be added or removed.

BugBase implements probably all the fields you'll ever need to track bugs. But, if you have already organised a specific description format then you'll have to change to the one of BugBase or use the free text fields to add your specific information. Arguably the most valuable field is the workaround one with an indication of its status - empty or detailing some information - displayed in the main bug description dialog box.

There's an implementation dialog box which records an estimated cost and delay of fixing the bug at its discovery, and the actual ones at the conclusion of the project. The query model is based on filters. Creating a new filter is intuitive, selection is done by a click in a combo box. BugBase includes both text and graphic reports which can be applied to the whole database or just to a selection.

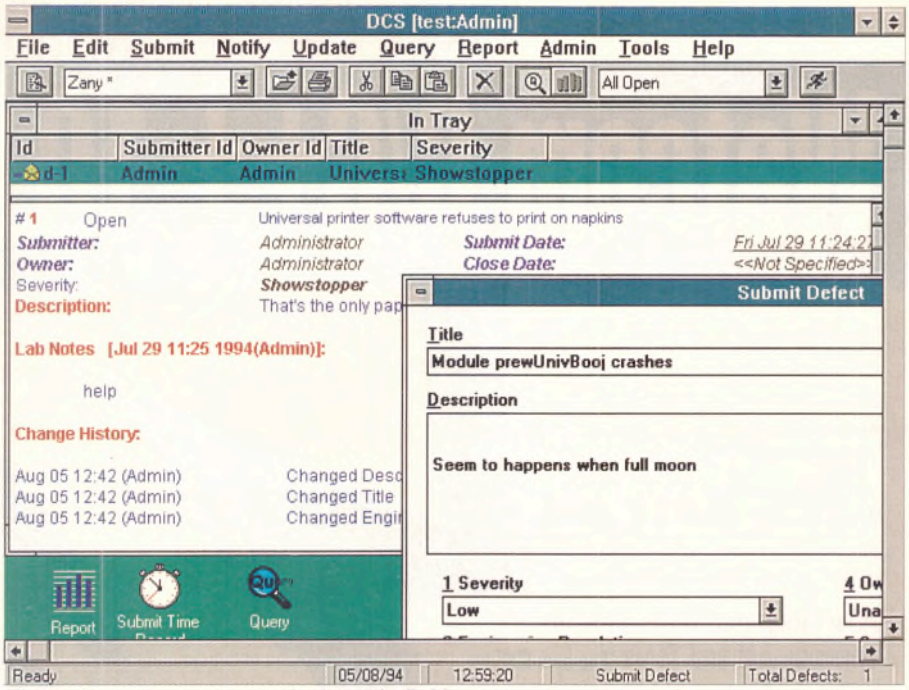

Figure 2 - In Tray and submit record in DCS

If you have never used a bug tracking tool before and want software that's simple to use without doing any customisation then I believe BugBase is fine for the job. Otherwise you might be better off looking at another product.

BugBase costs £360 for a single user and £1,230 for a 5 users network licence.

Archimedes Software
010 1 476 715 67 00
Distributed in UK by Grey Matter
0364 654100

Defect Control System

The Software Edge based in Colorado, has just finished version 2.10 of its Defect Control System (DCS). Two main features were added: integration with PVCS and support of mail notification via cc:Mail or MS Mail which builds on the automatic internal messaging system of the previous version. But, be warned: for the support of external mail to work, you need the DCS Mail Server, which cost an extra £900 per server!

A DCS user can submit bug defects and time records, perform queries and generate reports while an administrator can additionally edit forms' layouts, create and modify users, group security, and much more. The modifications of forms are limited: not all fields can be deleted. Only text and choice fields can be added. I found the ability to decide what will appear in the DCS internal mail In Tray and how it will be presented, a neat feature. Queries are entered in a dialog box, logical operators are selected on a keypad-like arrangement of push buttons. Queries are effective on defects or on time records. Five types of reports are present: a quick view, defect rate, trends, distribution and by module. The first one is textual; all the others are graphical representations. Reports apply by default to the whole database, but most of them have a 'where' field in which a query can be constructed. There's no way through to attach an existing query.

DCS' security features are omnipresent, you even have to log in a specific project and need to launch a new instance of the program if you want to work on another project. When security is not a concern, there should be a better way to relax it than typing in blank passwords. This is especially true for a single user installation.

In addition to the main icon of the software, DCS installs several utilities in its Windows group. Some perform functions not directly accessible from the main DCS tool, eg adding and deleting projects, while others are shortcuts, ie to submit defect or time records. Some tools are for use only by the DCS administrator.

The profusion of independent tools is probably the cause of the software's large size. It requires about 7 MB of disk space while all the other bug tracking tools are nearer the 2 MB mark. It is also the most expensive product.

So, to me, it seems best suited for those of you that need all that security and are ready to pay the price for it. It does its job well but there seems to be a bit of an overkill on both size and price. In such a software, you shouldn't, for example, be able to resize windows to a point were you cannot access the sliders anymore!

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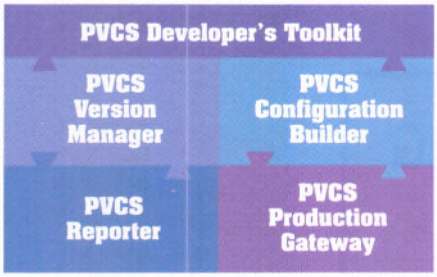

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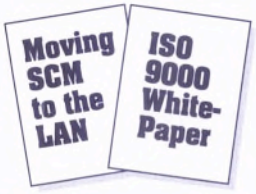

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Track for Windows

Track for Windows is the only product of California based Soffront Software. The first version was released in January 1993. I tried the more recent 2.06 version. Two design decisions make this product very adaptable. First, the internal format for the databases is the dBase IV .DBF file format. Second, with every field displayed as a child window, they can be moved or resized without restrictions. Any number of fields can also be added or removed 'on the fly'. This last decision, though, carries problems as well as advantages. It offers the best flexibility over all the other tools while still remaining very easy to customise. But since Windows 3.x limits the number of open resources, adding many fields when other applications are open means that Track for Windows will crash with a GPF. So, either you limit yourself or you'll have to wait for Chicago. It is a resource problem, not a memory one. Adding more RAM won't solve it either.

Each database is composed of at least three tables; for bugs, for 'customers' and for parameters of the systems where the bugs have been found. In the default configuration, records in the bugs table can be linked with records in any of the two other tables. Additional tables can be created, but the process is not documented and not very intuitive. With Soffront on the phone, I managed to add one table. A complete mail notification system is integrated, so when someone modifies or adds a record anyone else can be notified. MS Mail and cc:Mail are recognised, but for those without any mail system installed, Track for Windows also provides its own mail system. A list of all the modifications made to a record are automatically kept in an audit trail.

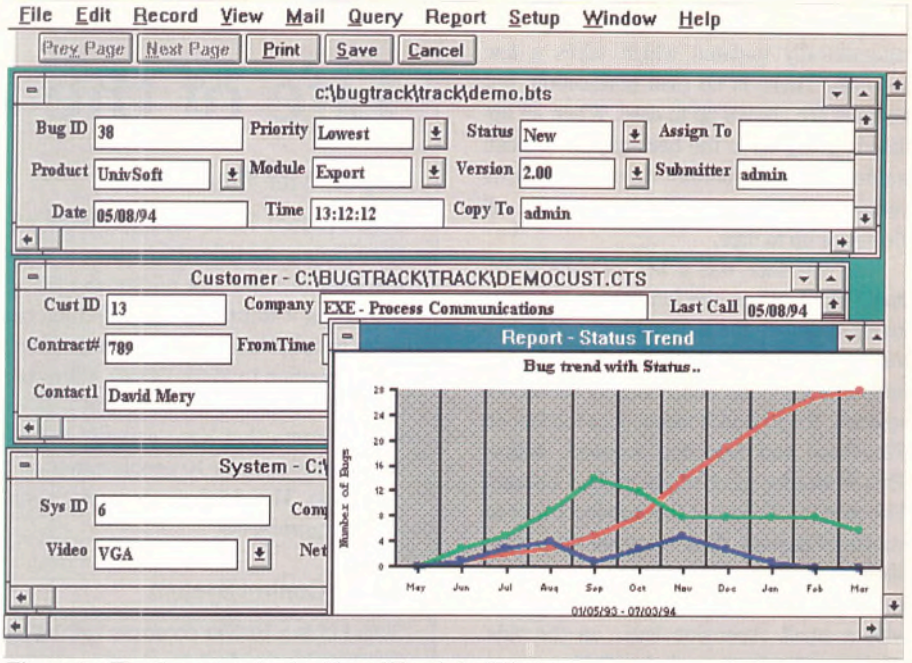

Figure 3 - The three standard tables of Track for Windows

Queries are entered according to the 'query by example' model in an empty record window. Reports can be general or limited to a query. Track for Windows generates both textual and graphical reports. In graphical mode the number of 'field values', ie bars, that can be plotted is limited to four.

In my opinion, Track for Windows, with support for the DBF file format, is well suited to those of you that are going to move from a simple tool developed in-house or when you need to import or export data easily with a database product. If you need hundreds of new fields, it might be a good idea to wait for Chicago.

Track for Windows costs $595 for a single user and $1,995 for a 5 user network.
Soffront Software
010 1 408 263 2703

Track Record

UnderWare, from Massachusetts, is just finishing version 1.5 of Track Record. I tried the beta. Track Record approach is completely different from those above. Instead of using a traditional database model to store all bug tracking information, Track Record has an object base and dissociates completely the objects themselves from the views users have of them. It is similar to the Model-View-Controller now used in most object oriented tool. Because of this, depending of your background in computing, you may spend some time getting used to the way Track Record works.

Unlike the other bug tracking tools in this article, the first step is not the creation of a database. There isn't any database per se. The first thing to do is to create new items. These can be bug reports, features, persons, appointments... Items are typed; types are organised in an inheritance tree. For instance, a bug report item gets all the fields of the bug report type and of parents' types, in this case, of the task type. To display a list of some items, all bugs, for instance, a view must be created. Views are called outlines in Track Record. Basic ones are included on the disks. When an item is

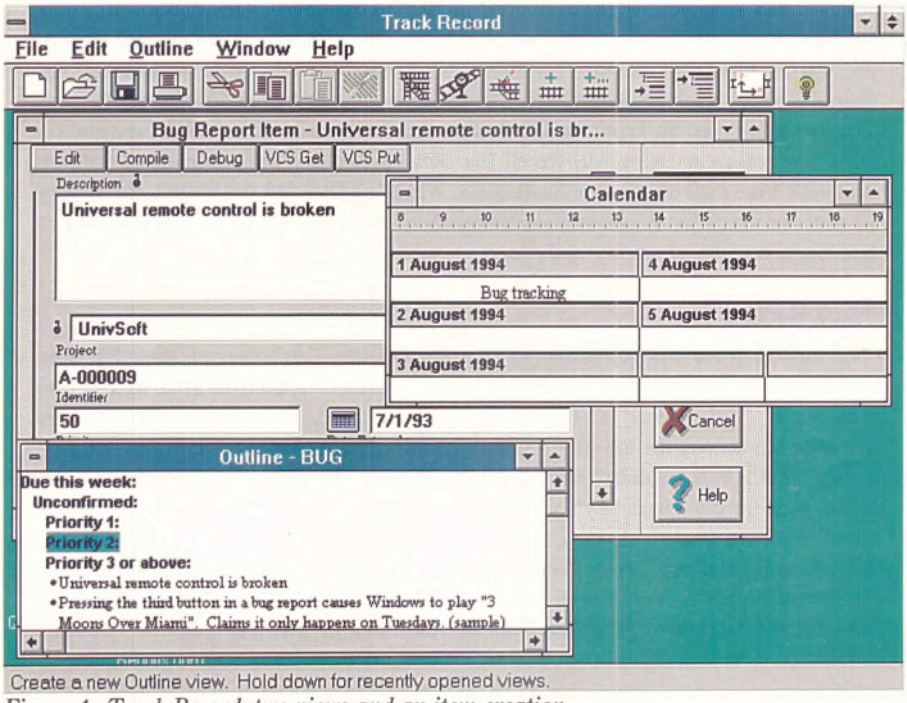

Figure 4 - Track Record: two views and an item creation

modified or added, all outline views are automatically updated which takes a few seconds. There is no mail notification, but outlines are always up to date. When an update is going on in the background, a small traffic light in the bottom right corner turns yellow or red, when it's green again all views are up to date.

The interface has a few original tricks that I liked. When the left mouse button is kept pressed on the new outline toolbar button, for instance, instead of creating a new outline, a list of the more recently used ones appears. It's so much faster than to click on File/Open and selecting a saved outline. This works for most of the toolbar buttons. The graphic design of the buttons could be improved though, their roles are not always obvious. Another GUI trick presents related items in complex windows as one line fields with a small expansion lever on the side. Click on the lever and the fields are expanded. Also, the right mouse button is heavily used on contextual menus.

The design of the dialog boxes for the predefined items can be modified and new items created. It works, but it's not an easy process. An .INI file has to be modified by hand and then the database must be rebuilt. A graphic editor is planned for a future release, but for the time being if you want to customise the items then you'll have to learn the description language used in the .INI file.

Queries are created through a query tool where items to be queried are dragged and dropped, resulting in a list of applicable relational tools appearing. Timed tasks can be viewed in calendar outlines and queried. There are keywords to create recurrent tasks, like 'every week'. Queries can be attached to outline views as can graphic reports. The beta I worked with was very stable. The only problem I encountered was that sometimes the link with GSW (graphic server for Windows) was lost and graphic reports were empty, however, UnderWare says it has already fixed the bug.

The first time Track Record is used can be really tricky. Don't try to experiment before reading the documentation. It is a rather different model and interface, but once you get the knack, it's a very powerful tool that could easily be tailored to do much more than just bug tracking.

The current version V1.08 of Track Records costs £149 for standalone configurations and £129 per seat for 5 users. The upgrade to V1.5 will be free.

UnderWare
0101 617 267 9743
Distributed in UK by SoftWerk
0440 730121

Life of the bug trackers

BugBase for Windows

Scott Pickford Plc a contractor working in the geophysical and geological fields, for 120 oil sites, started writing its own bug tracking application with MS Access. But this was a tedious and time consuming job so instead it bought BugBase. Scott Pickford is now using it to track bugs and enhancement requests for four products: a geological and a geophysical software, a large Fortran mapping database program and a PC product. According to Mark Beasly, software manager, BugBase was cheaper than the cost of a tool developed in-house and it is 'doing everything you need... it was written by programmers that have experienced what software people need.' At Scott Pickford BugBase is used by 10 people either on a PC or on Unix workstations with the SoftPC emulation. The database contains, says Mark Beasly, about '300 bugs and enhancement requirements.'

Defect Control System

Sims Ltd is a British company writing educational softwares for the PC market. It had developed a simple defect tracking software in-house, but wanted a more powerful system. Peter Castle, head of QA, comments on a pilot project to test DCS: 'the fact that the [project] team quickly came to rely on DCS and thought of new ways of using the product convinced us to adopt it.' It is now used for all of Sims' 16 software projects by some 50 users. The largest project database contains 2,300 defects!
On the separation of the tasks, Peter Castle adds 'DCS is used by the Testing Group to record all defects found in our products during testing. All development engineers have access to DCS for defects that are assigned to them via Development Team Leaders. Our Project Management Group also have access for management information - such as defect rates, types of defect and functional area against which they are being recorded.' DCS was adapted by adding custom fields and modifying submission and update forms as well as adapting the format of the In Tray. 'The ability to attach files to defects,' concludes Peter Castle, 'means that data sets, screen dumps - anything - can be attached, greatly increasing the understanding of that defect.'

Track for Windows

When Ian Dick, a British independent financial system consultant, was contracting for the San Francisco based stock broker firm Charles Schwab and Company, he had already recommended a testing software for its current project but 'tracking was a hole, [there was a need for] concentrating on pure bug tracking'. After looking at a few products Ian Dick selected Track for Windows. This software is 'simple and easy to use and can be easily tailored'. The standard database 'was tailored out substantially by changing some labels of existing fields and adding some new drop down lists.'
The data generated by Track for Windows is regularly exported in MS Access and reports are generated using MS Excel. Ian Dick appreciated the response of Soffront who added the mail interface at his request. When Ian Dick left the project, there were 13 users of Track for Windows monitoring about 230 bugs. With this tool it is easy to find 'bugs, module by module and people, area by area.'

Track Record

John Taylor, development manager at Unipalm, is using Track Record, since 'TR does the job' and because he 'couldn't find any other [products, apart from DCS which] cost a lot more!' Track Record is 'not real flash, it doesn't include a mail interface or fancy graphics but it does the job' (the currently released version doesn't have any graphic capabilities). Unipalm didn't have any similar product before. Track Record is currently used for one project by six people. About 500 bugs, 200 features and all the release notes are tracked down. Unipalm plans to use Track Record for new projects. John Taylor considers 'Track Record very customisable. You need to be interested in programming but it's very useful, a very good tool for programmers. [We also have a] sales tracking software, but it's too fixed, you can't modify anything in it.'

QA, no thanks

Amongst the four bug tracking tools I tried, Track Record is, by far, the one I preferred. I really liked the complete separation between the items' views and their storage. The first hour or so is not easy, but after that, you really feel the power of such a tool. Track Record, in my opinion, also makes very good use of the Windows' interface. Most of the information and commands are easily accessible but, at the same time, the interface is not cluttered. In addition it's the cheapest!

Errors detected after a system goes live cost a hundred times more to fix than if they were found at earlier stages of development. So there is a need to keep track of bugs as soon as they're discovered, preferably before the release of the software. Errors may be bugs in code or they may be discrepancies between a design requirements and the actual developed functionality. A history of all the feature requests will be invaluable to analyse what happened and what's the best route to modify the software, so it's more in line with the specifications. Some companies, like Mercury Interactive with its new Enterprise Quality Architecture, are already working on the integration of bug tracking with testing software, to form a more complete picture.

Articles and ads for compilers and debuggers are common but it's usually hard to find any reference to bug tracking tools, software testing programs or version controlling softwares (although this slightly less true for the last one). Obviously many developers are still not yet accustomed to the idea that code evolves and can be reused. Maintaining several versions of a program and keeping track of bugs and enhancements requests can be a nightmare without the right tools. To write the code and perform some immediate debugging, developers are well catered for. But it seems harder to justify tools that are not just for code generation but for general QA. Every time QA is mentioned, developers think that they will lose their cherished liberty and will have to spend their time filling tens of useless forms. This just isn't true anymore. Most tools can be adapted to the way developers work, so the use of these tools should be painless. Nor should small development teams feel they're immune to QA because it's only for the 'big boys' and not for lonely developers. With tight deadlines, it's so easy to forget that bug discovering three hours ago.

Obviously many developers are still not yet accustomed to the idea that code evolves and can be reused

It can really help

A common failure in the introduction of QA tools in small development team happens when tools are imposed by the hierarchy. It's even worse when everyone is under pressure, with slipping completion dates. the Directors, of course, want to know what the developers are doing since the software should already be on the shelves. A bug tracking tool, chosen early in a project by the developers themselves can, in addition to its main function, help later on to deal with this. When the tension arises, it can be quite convenient to be able to show, in a few mouse clicks, that 20 new features which were requested the day before, all with a maximum priority. Now that bug tracking tools are affordable and adaptable to most situations they should become more widespread. ■

Talking native ftp Pt II

Laine completes his exposé of ftp and creates a C++ utility for NT

Having read last month's article by now, you should all have a reasonable idea of what really goes on behind ftp. Well, I couldn't leave it at that could I? So this time I complete my tour of ftp and provide an ftp utility that has practical uses. Honest.

Passing the security gate

The first order of business after opening the control socket is to verify that the user (either human or software) has the authority to access the server. The `USER`, `PASS`, and optionally `ACCT` commands must be executed in sequence. If any of them returns an error status (4 or 5 in the first digit), you must start over from `USER`. Since most accounts don't use the `ACCT` information, and some don't need a password either, the state machine for login should watch the return code for a `2yz` class of code, and terminate the login sequence at that time.

Getting around

Although there are FTP servers running on radically different types of operating system, nearly all of them have some sort of directory structure for organising files. `CWD` and `CDUP` let the FTP client switch directories on the server. `CDUP`, by the way, was added to ease the pain of moving among directories on differing systems. Unix systems use:

```
/sub1/sub2/sub3
```

while TOPS20 systems use:

```
<sub1.sub2.sub3>
```

If this is the current directory on both machines, you could switch to /sub1/sub2 (or <sub1.sub2>) on either system with a `CDUP`.

Unfortunately, the `CWD` command can't be made as versatile. While it is possible to use the same commands to move between directories on DOS and Unix systems by switching one directory level at a time to avoid the difference between \ and /), this doesn't work with TOPS20, which insists that you specify the entire directory name every time. The RFC goes to great lengths to warn about this. Fortunately, SIMTEL (a famous ftp archive) was about the last remaining TOPS20 system on Earth, so I don't think many of us will have to worry about that eventuality.

There is also a PWD command which returns the name of the current directory in a status message. This is especially convenient for learning what directory you are in immediately after logging in.

Into the right mode

Different operating systems have different methods of representing text files. As a simple example, DOS puts a CR-LF character pair at the end of each line, while Unix has a single LF. And IBM mainframes use EBCDIC, of course. When transferring text files, one machine should not have to know what OS the other is running. In particular,

1yz	Positive Preliminary reply
	The requested action is being initiated; expect another reply before proceeding with a new command.
2yz	Positive Completion reply
	The requested action has been successfully completed. A new request may be initiated.
3yz	Positive Intermediate reply
	The command has been accepted, but the requested action is being held in abeyance, pending receipt of further information. The user should send another command specifying this information. This reply is used in command sequence groups.
4yz	Transient Negative Completion reply
	The command was not accepted and the requested action did not take place, but the error condition is temporary and the action may be requested again. The user should return to the beginning of the command sequence, if any.
5yz	Permanent Negative Completion reply
	The command was not accepted and the requested action did not take place. The User-process is discouraged from repeating the exact request (in the same sequence).

Figure 1 - Result Code Categories (from RFC 959)

When transferring text files, one machine should not have to know what OS the other is running

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

CIRCLE NO. 672

it shouldn't have to know how to translate the other machine's text file format into its own. The TYPE command takes care of that. The argument to type can be A (ASCII), E (EBCDIC), I (Image, or binary), or L <byte size> (to set the local byte size - I've never quite understood the usefulness of that one, but then I haven't worked on a machine that packed five 7 bit characters into a 36 bit word since 1983).

If you select TYPE I, the file is sent as a stream of bytes, with no interpretation. TYPE A, on the other hand, causes the sending end to translate into the Telnet character representation (ASCII code, lines terminated with CR-LF) before sending. The receiving end translates into its own local representation for text which may not be ASCII at all - it's the format on the wire that's important. In this way, anyone can send text files to anyone. Each system only needs to know two translations.

Note that TYPE E is not supported by all FTPs. It doesn't really do any good at all to set this mode if both machines aren't IBM mainframes. Basically, TYPE E just lets two IBMs transfer a text file in the most efficient way (no translation). TYPE A would also work between two IBMs, as the file would be translated EBCDIC-ASCII-EBCDIC.

Streams and structures

Along with specifying the type of the data, you can also tell how it will be transferred with MODE m. Most transfers happen in byte stream (S) mode, the default. You can choose instead to use block mode (B), which adds a header containing sequence and length information on each chunk of the file sent. This is recommended for transferring a group of files in rapid succession, to avoid the waits necessary to synchronise the data connection between files in stream mode. There is also a compressed mode (C), which does some simple run length encoding to minimise bandwidth.

As if this wasn't enough, it is also possible to specify the file's structure with the STRU command. The default structure is file (F), which means 'no structure'. Also available are record structure (R) which allows for record based systems that, for example, store each line of a text file in a separate record, and page structure (P) which enables the sending of sparse files, again by placing a header on each page of the file.

Fortunately most programs use the default transfer mode and file structure, as the combination of these with the TYPE specification could create endless amounts of interoperability problems. Not to mention hopelessly confusing us pitiful programmers.

```
(connect control socket)
 USER xyz
 PASS abc
 CWD mydir
 TYPE I
 (start listen for data connect on unused port)
 PORT 1,2,3,4,x,y (IP = 1.2.3.4)
          (listen port = x*256+y)
STOR myfile
 (accept incoming connect on data connect on port xy)
(close listen socket for port xy)
(send myfile across data connection)
(close data connection)
```

Figure 2 - Command Sequence for STOR

Making connections

Before you can start squirting data, you must setup the source and destination points for the data connection. PORT tells the FTP server which TCP port and IP address to connect to. The argument format is a bit strange - six decimal numbers separated by commas. The first four numbers are the four bytes of the IP address. The last two are the upper, then lower bytes of the port number. The default PORT is the IP of the FTP client and TCP port 20, but most clients seem to select a different port number and send a port command even when the default would do, since that makes sure that multiple ftp sessions on the same machine don't conflict with each other. Usually, the FTP client opens a socket to listen passively on its chosen port in anticipation of the server's connection. So two different processes can't listen for the same TCP port on the same IP address at the same time.

PASV (Passive) is used to tell the server that, rather than actively opening a socket, it should passively listen for a connection request from someone else. PASV takes no arguments, but replies with a status message revealing the IP address and port number it will listen on. The purpose of PASV is to allow two servers to connect directly to each other under the control of a client, thus avoiding transferring the same data twice.

Transferring Data

Several commands are available for sending data back and forth on the data connection, the most common being STOR and RETR, which perform as you would imagine. Also in this category are STOU (Store Unique which makes a new filename if the file already exists on the server), APPE (Append data to an existing or new file), LIST (send a listing of the current directory including file sizes, permissions, etc), and NLST (sends a list of filenames separated by CR-LF, useful for wildcard file transfers).

It's important to get the order and synchronisation correct when doing transfers. Figure 2 shows the general sequence of a STOR command and its trappings. The most important thing here is to start the client's data socket listening before issuing the STOR command. Otherwise the connection could be refused.

Other Commands

As you can see from the list published in last month's article-, there are several other commands, including DELE (delete file), MKD (make directory) and RMD (remove directory). Another command that can be useful, for example, when trying to parse the information from the results of a LIST command (which are *not* standardised) is the SYST command, which returns a name describing the server's environment (usually the OS). One important command is ABOR, which can be sent on the control connection to abort a transfer in progress on the data connection. Finally, there is a catchall SITE command, intended for site specific commands. Any commands implemented by the server which are not in the standard should be implemented as subcommands of SITE. For example, our ftp server has a site specific command that lets the user tell which group of customers they are in. The command is sent to the server as:

```
SITE GROUP xyz
```

Although FTP clients interpret the commands you type (for example, a PUT command gets translated into the stuff in Figure 2), most will let you send a command directly to the server with no translation in a manner similar to this:

```
QUOTE SITE GROUP xyz
```

A three way transfer

Now that we know all the FTP commands, I can explain how to transfer a file from machine B to C from FTP clients running on

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```
// rrftp - remote to remote ftp
//
//  This program copies a file from one
//  remote host directly to another
//  remote host without the data
//  passing through this host. The FTP
//  protocol is used. The program
//  assumes it is running in a console
//  in Windows NT. It will not run in
//  standard Windows because it uses
//  argv for input and stdout for
//  output.
//  Compiles with Visual C++ 32bit.
//  Create a project containing this
//  file and WSOCK32.DLL, and make the
//  project type "Console
//  Application".
//   To use it, say:
//
//  rrftp fromname@fromhost
//                [/frompass]:fromfile
//        toname@tohost[/topass]:tofile
//
//  (That should all be on one line...)
//  All ftp response messages are
//  printed to stdout, so you can see
//  what went wrong (or right).
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <winsock.h>

char *splitname(const char *arg)
  { // separate name from host info
  char *temp = strchr(arg,':');
  if (temp)
    *temp++ = 0;
  return temp;
  } // splitname()

class CFTPEndPoint
  { // a splishod ftp ctl socket class
  SOCKET sock;       // control socket
  int isopen;        // T if logged in
  int responsecode; // most recent 1-5
  char responsetext[256];
public:
  char host[256];    // hostname
  char name[256];    // login name
  char pass[256];    // account's
                     // password

  int IsOpen() {return isopen; }
  int Response() {return responsecode; }

  void Login(const char *info);
  void Close();
  void Passive(char *IPandPortStr);
  void Active(const char *IPandPortStr);
  void StartGet(const char *filename);
  void StartPut(const char *filename);
  void SendCommand(const char *cmd);
  int ReadResponse();
  CFTPEndPoint(const char *info)
    { isopen = 0; Login(info); }
  ~CFTPEndPoint() { Close(); }
  static void WaitFinish
                    (CFTPEndPoint &a,
                     CFTPEndPoint &b);
  };  // class CFTPControl

void CFTPEndPoint::Login
                    (const char *info)
  {
  char *temp;
  if (IsOpen()) Close();
  // split out host, username, and pass
  temp = strchr(info,'@');
  if (!temp)
    { // must have host and username
    printf("usage: blah blah\n");
    return;
    }
  *temp = 0;
  strcpy(name, info);
  info = temp+1;
  temp = strchr(info,'/');
  pass[0] = 0;
  if (temp)
    {
    *temp++ = 0;
    strcpy(pass, temp);
    }
  strcpy(host, info);
  //// get the service and protocol #'s
  //// and create sockaddr_in
  servent *pServ;
  protoent *pProto;
  hostent *pHost;
  sockaddr_in SockAddr;
  short pproto;

  memset((char *)&SockAddr,
         0,sizeof(SockAddr));
  SockAddr.sin_family = AF_INET;
  pServ=getservbyname("ftp","tcp");
  SockAddr.sin_port=pServ->s_port;
  pProto=getprotobyname("tcp");
  pproto = pProto->p_proto;

  if(pHost = gethostbyname(host))
    // named the host
    memcpy((char *)&SockAddr.sin_addr,
           pHost->h_addr,
         pHost->h_length);
  else
    // gave IP address
   SockAddr.sin_addr.s_addr=
                       inet_addr(host)

  ///////// Connect
  sock = socket(AF_INET,
                SOCK_STREAM, pproto);
  if (sock == INVALID_SOCKET)
    return;
  if (connect(sock,(sockaddr
*)&SockAddr,
      sizeof(SockAddr)) == SOCKET_ERROR)
    {
    printf("connect() error %d\n",
           WSAGetLastError());
    return;
    }

  /////// Now we're connected - Log in.
  if (ReadResponse() > 3)
    { Close(); return; }
  char cmd[256];
  sprintf(cmd,"USER %s",name);
  SendCommand(cmd);
  switch(ReadResponse())
    {
    case 2:
      // logged in
      break;
    case 3:
      // need password
      sprintf(cmd,"PASS %s",pass);
      SendCommand(cmd);
      if (ReadResponse() == 2)
        break;
    default:
      Close(); return;
    }
  isopen = 1;
  } // void CFTPEndPoint::Login()

  void CFTPEndPoint::Close()
  {
    if (!IsOpen()) return;
  isopen = 0;
  SendCommand("QUIT");
  ReadResponse();  // get "GoodBye"
  closesocket(sock);
  } // void CFTPEndPoint::Close()
  void CFTPEndPoint::Passive
                    (char *IPandPortStr)
  { // send PASV and get IP and Port it
    // is listening on
  SendCommand("PASV");
  if (ReadResponse() != 2) Close();
  char *start = strchr(responsetext,
                       '(');
  if (!start)
    start = responsetext;
  else
    start++;
  char *end = strchr(start,')');
  if (!end) end = start+strlen(start);
  strncpy(IPandPortStr,
          start, end-start);
  IPandPortStr[end-start] = 0;
  } // void CFTPEndPoint::Passive()

  void CFTPEndPoint::Active(const char
                      *IPandPortStr)
```

Figure 3 (Pt I) - Remote to Remote FTP

machine A. The first step is to connect one of the FTP clients to B's FTP server and the other to C's FTP server. After logging in and switching to the proper directories, issue the `PASV` command to B, then a `PORT` command to C using the IP address and port returned by the PASV command on B. Finally issue a RETR command on B and a STOR command on C. This should transfer the file from B to C, without it ever going though A. That this works is a tribute to the amount of effort and thought put into the FTP specification.

Sample source code

If you're running WinSock and interested in FTP, you're in luck. Although the source for newer versions is no longer widely distributed, I have kept the source to an earlier version of WS_FTP, a very nice WinSock ftp client that presents list boxes of the local and remote files and allows transferring with a single mouse click. If you got the WinSock disk from a few months ago, you already have it. Otherwise, you can ftp it from `ftp.morningstar.com: /pub/cpp/ws_ftp_s.zip`.

FTP in Winsock

By way of an example I have written a working NT command line utility that will copy files between two remote hosts without the data ever touching your doorstep. Pretty cool when you want to move 10 MB between two machines connected by ethernet, and you're across a telephone wire, and you only have ftp access (no telnet to a user shell).

The program is listed in Figure 3. It uses FTP to control two servers at once. RRFTP (Remote to Remote FTP) implements ex-

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```
  { // send a PORT command
  char temp[256];
  sprintf(temp,"PORT %s",IPandPortStr);
  SendCommand(temp);
  if (ReadResponse() != 2) Close();
  } // void CFTPEndPoint::Active()
void CFTPEndPoint::StartGet
                (const char *filename)
  { // issue a RETR command
  char temp[256];
  sprintf(temp,"RETR %s", filename);
  SendCommand(temp);
  } // void CFTPEndPoint::StartGet()

void CFTPEndPoint::StartPut
                (const char *filename)
  { // issue a STOR command
  char temp[256];
  sprintf(temp,"STOR %s", filename);
  SendCommand(temp);
  } // void CFTPEndPoint::StartPut()

void CFTPEndPoint::SendCommand
                (const char *cmd)
  { // send a command to the server
    // and echo it to the display
  char temp[256];
  sprintf(temp,"%s\r\n", cmd);
  printf(">%s: %s", host, temp);
  if (send(sock, temp, strlen(temp), 0)
      == SOCKET_ERROR)
    Close();
  } // void CFTPEndPoint::SendCommand()

int CFTPEndPoint::ReadResponse()
  { // read a response from the socket
    // and set responsecode
    // appropriately returns
    // responsecode / 100 (class)
  responsecode=0;
  int multi = 0;
  char *rsp = responsetext;
  do  { // read a line until not cont.
    // line peek into buf and find \n
    int len=recv(sock,rsp,254,MSG_PEEK);
    if (len <= 0 ) break;
    rsp[len] = 0;
    char *nl = strchr(rsp,'\n');
    if (!nl) nl = rsp+len-1;
    int notoread = nl+1-rsp;
    // now actually read it.
    len = recv(sock, rsp, notoread,0);
    printf("<%s: %s", host, rsp);
    rsp[len] = 0;
    int code = rsp[0];
    if (!multi)
      multi = (rsp[3] == '-');
    else
      multi = (code != responsecode)
            ||(rsp[3] != ' ');
    responsecode = code;
    } while (multi);
  responsecode -= '0';
  return responsecode;
  } // void CFTPEndPoint::ReadResponse()

void CFTPEndPoint::WaitFinish
                (CFTPEndPoint &a,
                 CFTPEndPoint &b)
  { // keep reading responses from a & b
    // until both register response
    // codes of 200, one is higher than
    // 299, or one of the sockets is
    // closed.
  fd_set readable;
  int a_done = 0, b_done = 0;

  while (!(a_done && b_done))
    {
    FD_ZERO(&readable);
    if (!a_done)
      FD_SET(a.sock,&readable);
    if (!b_done)
      FD_SET(b.sock,&readable);
    if (select(0, &readable, 0, 0, 0)
        == SOCKET_ERROR)
      {
      printf("Error in select!\n");
      a.Close(); b.Close();
      break;
      }
    if (FD_ISSET(a.sock,&readable))
      { // a got a message
      a.ReadResponse();
      a_done = (a.Response() >= 2);
      if (a.Response() > 2)
        {
        printf("Unexpected code.\n");
        a.Close();
        break;
        } // if a.Response
      } // if FD_SET
    if (FD_ISSET(b.sock,&readable))
      { // b got a message
      b.ReadResponse();
      b_done = (b.Response() >= 2);
      if (b.Response() > 2)
        {
        printf("Unexpected code.\n");
        b.Close();
        break;
        }  // if b.Response
      }  // if FD_SET
    }  // while
  } // void CFTPEndPoint::WaitFinish()

void exitfunction()
{ WSACleanup(); }

int main(int argc, char *argv[])
{
WSAData wsadata;
WSAStartup(MAKEWORD(1,1), &wsadata);
atexit(exitfunction);

if (argc != 3)
  {
  printf("usage: (blah blah)\n");
  return 1;
  }
char *fromfile = splitname(argv[1]);
char *tofile = splitname(argv[2]);
if (!fromfile || !tofile)
  {
  printf("usage: (blah blah)\n");
  return 1;
  }
CFTPEndPoint from(argv[1]);
if (!from.IsOpen())
  {
  printf("Could Not Connect to: %s\n",
         from.host);
  return 1;
  }

CFTPEndPoint to(argv[2]);
if (!to.IsOpen())
  {
  printf("Could Not Connect to: %s\n",
         to.host);
  return 1;
  }
// prepare both to send/recieve
char IPandPort[256];
from.Passive(IPandPort);
to.Active(IPandPort);
// start up the send/receive
from.StartGet(fromfile);
to.StartPut(tofile);
// gather & print messages till done
CFTPEndPoint::WaitFinish(from,to);
// shut 'em down
from.Close();
to.Close();
return 0;
} // main()
// end of rrftp.cpp
```

Figure 3 - Remote to Remote FTP (continued)

actly the process that I previously outlined, running a program on computer A that sets up computers B and C to transfer a file between themselves. I compiled and ran this program under Windows NT 3.5 (Daytona) using Microsoft Visual C++ 32 bit Edition 1.0, although it should work just fine with NT 3.1 and/or a later version of the C++ compiler (as well as with anyone else's C compiler, since I didn't use any MFC classes). It definitely *won't* work with straight Windows 3.1, unless you use one of the 'EasyWin' type libraries that give you replacements for things like `printf()`. All the WinSock oriented code should work fine under any Windows WinSock, though (and it should work without much change under Berkeley Unix, too).

Most of the program is pretty straightforward, non-object oriented C++ code (you'll have to excuse that, I've spent the last three weeks writing Unix shell scripts, and my mind won't function in an OOP manner at the moment). A few things do bear explaining, as always.

First, although I keep talking about 'TCP port 21' as being the control connection for FTP, you won't find the number 21 anywhere in the program. That's because I learn the proper port number by calling `getservbyname()`, a WinSock function that tells me the port number to use for any given standard service. I could have used 21, but doing it as I have makes my program more portable to odd installations who want to put their ftp server's control port on some other value. (In Windows, the value associated with a service is in the SERVICES file in the WinSock directory. In NT, it is stored somewhere in the Registry - I don't know where because I never had any desire to change it).

In the `Login()` function, where I do the `getservbyname` and `getprotobyname()`, I also do a `gethostbyname()` to learn the IP address of the remote host based on the name on the command line. Note that I check for this failing, in which case I assume the user entered an IP address instead. Since `gethostbyname()` can't convert an ASCII IP address into the four byte structure needed by `connect()`, I use `inet_addr()` (also a WinSock function) to convert it for me.

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After filling in the `sockaddr_in struct` with all pertinent information about the other end of the connection and what protocol/port I want to use, I create a socket, then `connect()` to the other end. At this point, I can begin sending data to the other end with `send()` and getting data with `recv()`. Any program that uses TCP sockets will contain code almost identical to everything up to this point. Only the data that is sent changes.

The next point of interest is the `ReadResponse()` function, which *should* handle multiple line responses. I haven't fully tested it though, so don't be surprised (but *do* send me mail) if it locks up someday while connecting to some strange system.

The real tricky part of reading responses is in getting full lines of text rather than just blocks of bytes. The problem is that `recv()` works kind of like `read()` does on files.

How ever many bytes are ready to read, it returns all of them up to the maximum size you've requested. There could be 10 lines in there, or there could be only half a line. Fortunately, FTP servers rarely send out half a line in a single packet, so you really only have to worry about the case of multiple lines. Drawing heavily on the source code to WS_FTP (the best FTP client I've ever seen, and free too), I do the trick of peeking at the receive buffer first, searching for the newline, then doing a destructive read only up to the newline. This seems to work fine between NT and SunOS or Solaris.

The only other interesting portion of RRFTP is the function `WaitFinish()`, notable in its use of `select()` to wait for input from two different sockets simultaneously. This is done by creating an `fd_set` struct and using the `FD_SET()` macro to put in the sockets we want to watch for. Then we call `select()`, which blocks until one of the sockets has data ready to read (it is possible to select on 'ready-to-write', and 'error' as well).

When `select()` returns, the `fd_set` you created has been modified to contain only those sockets that actually have data ready. You can then check for each socket with `FD_ISSET()` and read the data accordingly.

The logic behind `WaitFinish()`, by the way, is that if the FTP server ever returns a 2xx class code, that means it has finished the transfer and is ready for a new command. If it sends a code of 3xx or greater, that means that either it wants more input from you (which means something is wierd at the server, since we have already given it all the info it needs) or that it encountered an error. If I wanted to be extremely thorough, I would add in the logic to abort the transfer on both ends (using `ABOR`) in the event of error.

Watch for errors

Speaking of errors, please realise that the error checking in this example program is terrible! Had I put in all the checks I really should have, it would have been much longer than it already is. I could have solved that with exceptions, but the version of VC++ that I'm using doesn't have real exceptions. Anyway, what would an example be without having something left up to the reader?

Laine Stump is a software engineer at Morning Star Technologies in Columbus, Ohio, he can be reached via email as laine@morningstar.com. The source code, executable, and project file for rrftp are available from ftp.morningstar.com:/pub/cpp/rrftp.zip or from the EXE office by sending a diskette and SAE. Please mark envelopes FTP. Enjoy FTP'ing!

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The art of state

Objects have state. This is a key principle of object-orientation. But what exactly does it mean? **Charles Weir** of Object Designers has the answer...

Consider the ubiquitous object. It has data; it has functionality, all combined into one neat package refered to in object technology parlance as data encapsulation. Yes, but so what? Well, in this simplified model of an object the data can influence the object's overall behaviour. In C++ terms we say that each instance of a class has data members; the behaviour of each instance depends on these data members.

The right decision

Let us begin by examining the very simple class given in Figure 1. It is a toggle: it is either 'on' or 'off' and has a function called `doSwitch` which toggles it from one state to the other. It also knows how to print itself to a stream (`operator<<`). We shall start with a simple and obvious implementation, whose data member is the character string to output (see Figure 1). As an implementation this may not win any prizes, but it satisfies the requirements and the external interface.

Consider an instance of the `Toggle` class: the behaviour of this instance in the output function. The characters printed depend on its state, determined by the string it points to. In printing this string, the behaviour of the code makes no particular *decision* based on its state. It merely outputs the string contents. However, in the `doSwitch` function, the code does make a *decision* which is represented as an 'if' statement.

In this article, we shall examine a technique to analyse and simplify such decisions; we shall look at an alternative way to implement them in C++ and we shall consider how they are affected by inheritance.

```
class Toggle {
public:
  Toggle()          : outputString( "OFF" ) {};
  void doSwitch()
  { if (strcmp( outputString, "OFF" ) == 0)
        outputString = "ON";
    else
        outputString = "OFF";
  }
friend   ostream& operator<<( ostream& out, const Toggle& t)
  { out << t.outputString;   return out; };
private:
  const char* outputString;
};
```

Figure 1 - Toggle implementation using internal data

State of mind

The Toggle implementation above represents the state of an instance using the values of its data - in this case, the characters in the string. Its member functions make decisions based only on the values of its data.

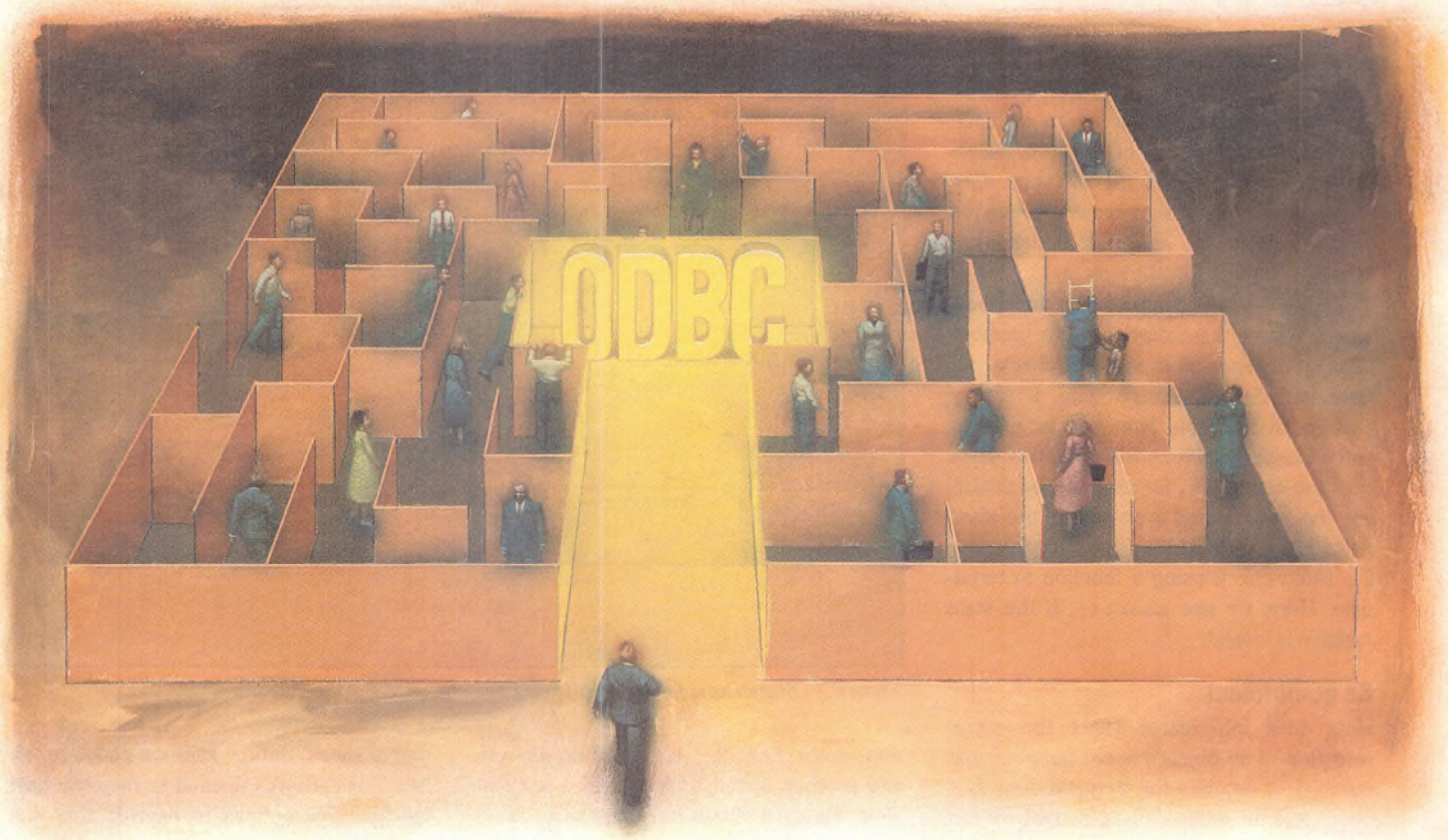
This approach is fine for simple classes. But what happens when there are more variables involved in defining the state of each instance? Consider, for example, a class representing a modem. This class, `Modem`, may have many different data members, including perhaps buffers, phone numbers, flags, and time-out counts. Between them these data members allow for an infinite number of possible states for any given instance. Yet as far as processing is concerned, only certain combinations and ranges of values are important.

An instance of this `Modem` class will make a *transition* from one state to another in response to external *events*. In C++ these events are presented to it as member function calls. We can represent the possible situations and significant events with a diagram known as a *state chart*. Figure 2 shows such a state chart for a `Modem` instance. Its notation is the one invented by David Harel, which is used in the Rumbaugh method and enhanced in Object Designers' Syntropy method. Here, the boxes represent states; the arrows, transitions. We annotate the lines with the event (the function) which causes the transition and we indicate the initial state for an instance with an arrow from a blob.

This is a major simplification. From an infinite number of possible states, we have expressed much of the interesting functionality of the class in just six. We should like to reflect this simplification somehow in the code. But how?

To tackle this question while keeping the example code simple, we'll return to the `Toggle` class; Figure 3 shows its state chart. It is pretty trivial, certainly, but it does highlight the salient behaviour of the class. In particular, it shows how the behaviour of an instance in the `doSwitch` function varies according to its state.

How are we to express this in C++?



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There is a direct, easy, and effective solution: we identify states as integer numbers then have a state variable as an instance data member. The value of this variable will represent the state of the instance. C++ makes it easy to assign names to unique numbers using the enumerated data type (enum).

Figure 6 shows the resulting implementation. Where the behaviour of a member function depends on the state, it checks the state variable; to change state, it simply changes that variable. Note how we prevent name clashes such as when another class uses the name 'ON', for example, by declaring the enumerated type within the class definition rather than outside. Observe also the sanity-check using a function to terminate. Here, we use `abort()`, if the state variable is invalid.

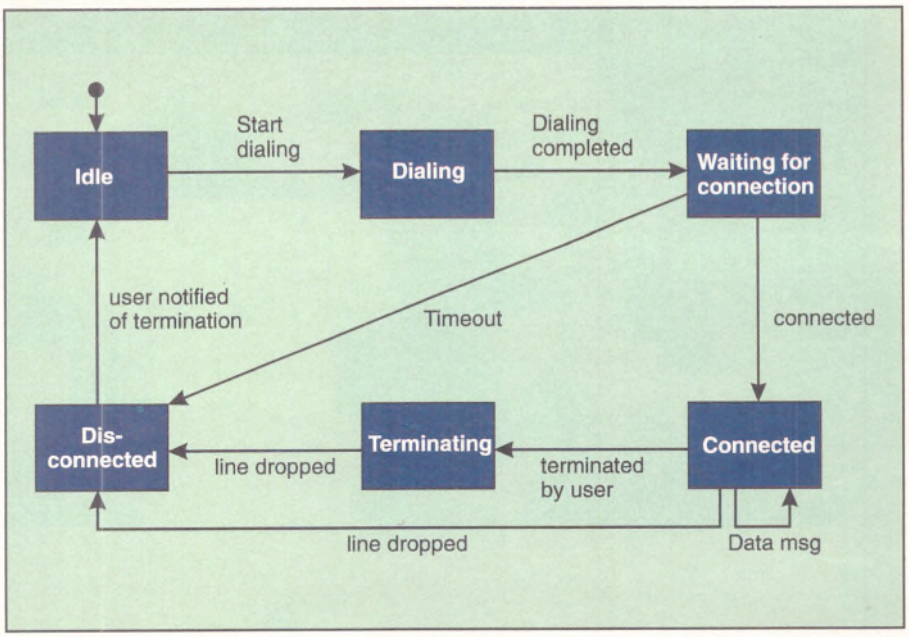

Figure 2 - State chart for a complicated object

Be conformant

How does inheritance affect the representation of an object's state? Suppose that our project requires the `Toggle` class as a base class for other classes, so that we can use a reference or pointer to `Toggle` as a pointer to instances of derived classes. What implications does this have for the implementation of `Toggle`?

In a good design, any classes which inherit from `Toggle` must be *conformant*. What this means is that, for a user calling functions using a pointer-to-Toggle, an instance of a derived class will appear to behave in the same way as would an instance of `Toggle` itself. In particular, they must appear to have the same state behaviour. For example, if we call the `doSwitch` function twice on any instance of a derived class, we expect it to appear to be in the same state (`ON`, or `OFF`) afterwards, as before. This limits severely how we can use inheritance. An example of a class which does conform to the `Toggle` interface might be a simple motor controller which has a function, `doSwitch`, that toggles it on and off, and another, speed, which toggles fast and slow. Figure 4 shows its state chart. Using David Harel's notation to nest states we can simplify this diagram and make it show clearly its conformance with the state chart for `Toggle`. Figure 5 gives the result.

State charts help us simplify the problem of representing how an object behaves

Inherited behaviour

Coding the derived class, `MotorController`, presents some problems. We can access the state values in the base class, certainly and we can extend the enumeration of states. But the state `ON` no longer exists - instead, it is divided in two. We have two possible options to express this division. Either we add more possible states for the existing state variable (`Toggle::state`); or we create a second state variable to represent the new states. In either case, the effect of setting the state to `ON` has changed. We express this by creating virtual functions to set each of the states. Thus the function `on()`, for example, can be redefined in the class `MotorController`.

The behaviour of the function `doSwitch` is the same both for `Toggle` and `MotorController`. It would be inappropriate to have to rewrite it in `MotorController` just because that class has some additional processing in different functions. However, if we add additional possible states for the variable `Toggle::state`, we find a problem. Functions defined in `Toggle` need to 'see' only

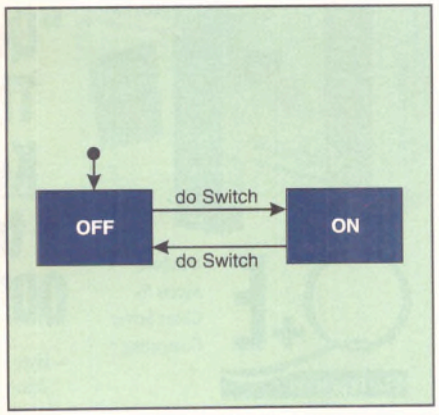

Figure 3 - State chart for Toggle

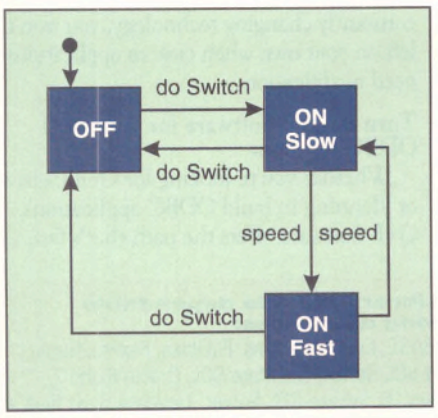

Figure 4 - Simple state chart for MotorController state chart with nested states

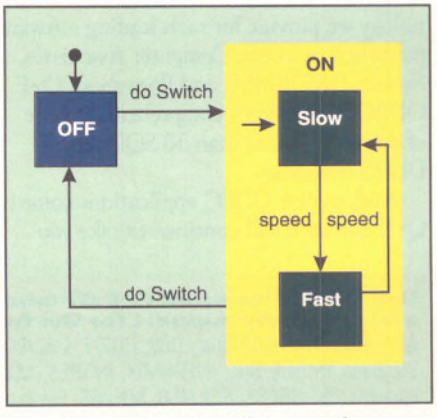

Figure 5 - MotorController state chart with nested states

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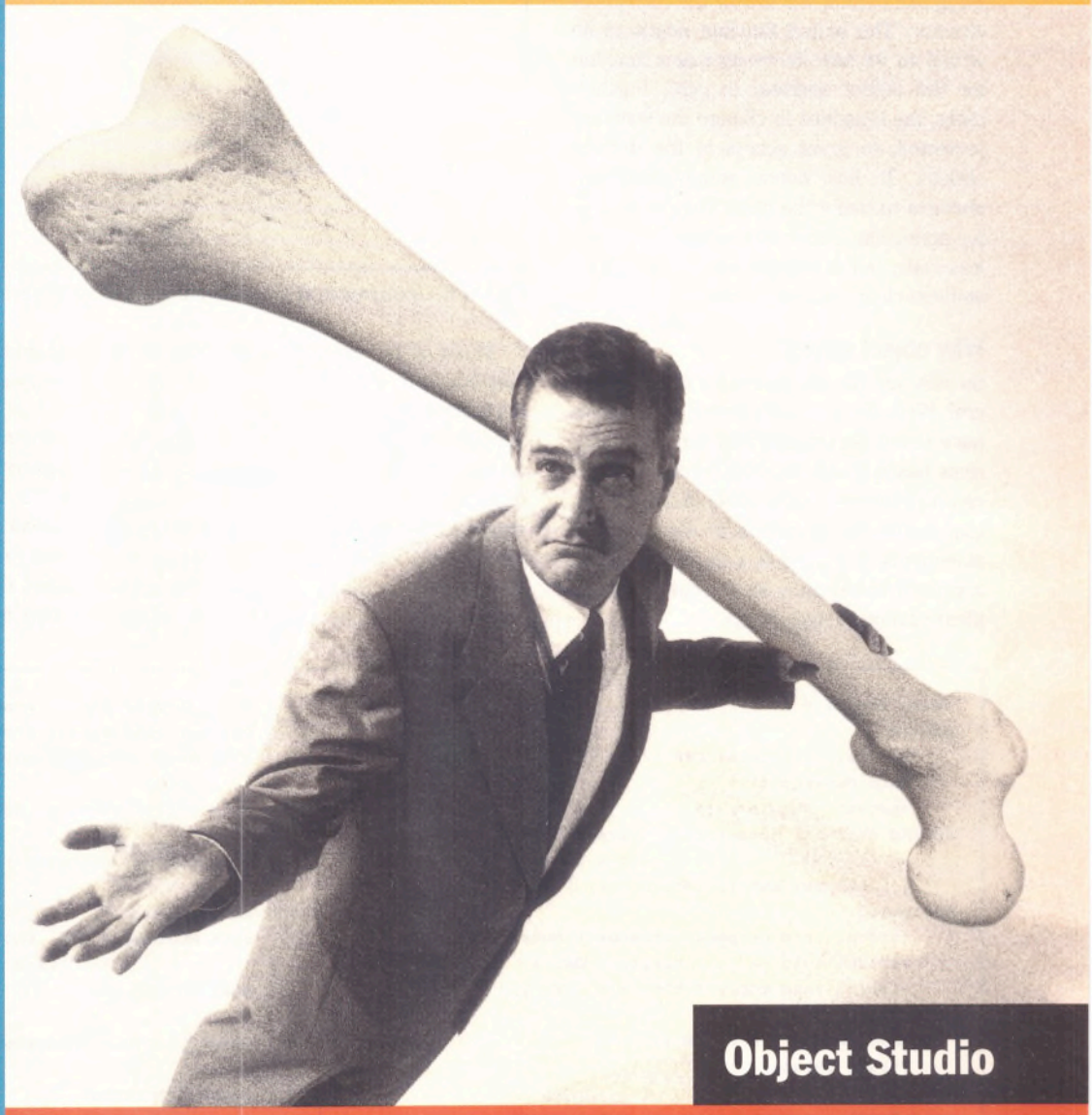

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the two values `OFF` and `ON`, while those in `MotorController` need to 'see' three (`OFF`, `SLOW`, `FAST`). There is no very elegant way to achieve this in C++.

So instead, we opt to add a second state variable in `MotorController`. Figure 7 shows the resulting code. Note the other changes in `Toggle` to allow derivation: a virtual destructor ensures that deleting a `Toggle*` pointer will invoke the correct destructor. The output function needs to be virtual so we have to create a new function for the output operator to call). Furthermore, the functions to change the state are protected, to grant access to the derived classes. It has taken some significant changes to make the class Toggle suitable for derivation. Other approaches might use less code, but at the cost of a less robust - and less clear - representation.

```
class Toggle {
public:
  Toggle()          : state( OFF ) {};
  void doSwitch();
friend   ostream& operator<<( ostream& out, const Toggle& t)
  { out << ((t.state == OFF) ? "off" : "on");  return out; };
private:
  enum State { OFF, ON };
  State state;
};
void Toggle::doSwitch()
{
  switch (state)
    {
  case ON:  state = OFF; break;
  case OFF: state = ON; break;
  default:  abort();
    }
}
```

Figure 6 - Implementation of Toggle using a state variable

Why object states?

So what are the key points for class designers? Well, first we now know that objects have states. Sometimes they can make *decisions* based on these state. Such decisions can be expressed using *state charts*.We can implement the decisions in C++ with 'if' statements, but there is a more systematic approach based on a simple but direct implementation of state charts.

Much of the art of programming is in simplifying the problem, to make it easy to implement a solution. State charts help us simplify the problem of representing how an object behaves. Yet they also have an effective implementation in C++. This can be extended to support inheritance. Which is most useful when the derived classes are *conformant*, so that they have compatible state charts. In my opinion, state charts should be part of the armoury of every C++ programmer. ■

Charles Weir is a consultant for Object Designers Limited. He can be contacted on 0279 755396, or by email as cweir@cix.compulink.co.uk. Syntropy is described in the new Prentice Hall book 'Designing Object Systems: Object-Oriented Modelling with Syntropy' by S. Cook and J. Daniels.

```
class Toggle {
public:
    Toggle() : tState( OFF ) {};
    void doSwitch();
    virtual ~Toggle() {}
friend ostream& operator<<( ostream& out,
                            const Toggle& t)
    { t.output( out ); return out; }
protected:
    virtual void output( ostream& ) const;
    virtual void on()  { tState = ON; };
    virtual void off() { tState = OFF; };
private:
    enum TState { OFF, ON };
    TState tState;
};
void Toggle::output( ostream& out ) const
{
    out << ((tState == OFF) ? "OFF" : "ON");
}
void Toggle::doSwitch()
{
    switch (tState)
    {
    case ON:  off();            break;
    case OFF: on();             break;
    default:  abort();
    }
}
class MotorControl : public Toggle {
public:
    virtual void changeSpeed();
protected:
    virtual void fast() { mcState = FAST; }
    virtual void slow() { mcState = SLOW; }
    void on()  {Toggle::on();  mcState = SLOW;}
                                // Redefinition
    void off()  {Toggle::off(); mcState = OFF;}
                                // Redefinition
    void output( ostream& ) const;
                                // Redefinition
private:
    enum MCState { OFF, SLOW, FAST };
                // State OFF is a redefinition.
    MCState mcState;
};
void MotorControl::changeSpeed()
{
    switch (mcState)
    {
    case SLOW:  fast();          break;
    case FAST:  slow();          break;
    case OFF:   /* No action */  break;
    default:    abort();
    }
}
void MotorControl::output( ostream& out ) const
{
    switch (mcState)
    {
    case SLOW:  out << "SLOW";          break;
    case FAST:  out << "FAST";          break;
    default:    Toggle::output( out ); break;
    }
}
```

Figure 8 - Implementation of Toggle and MotorController

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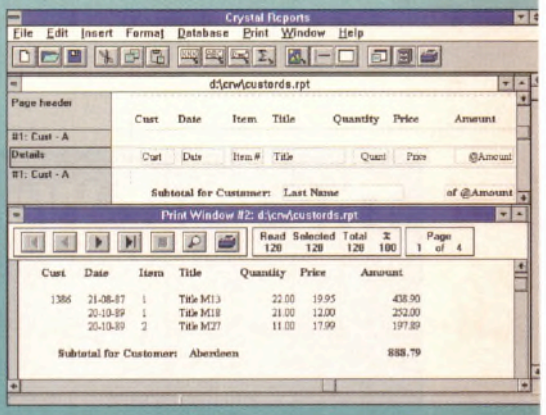

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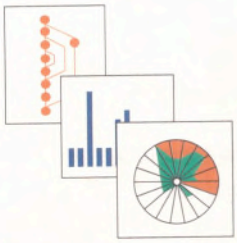

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CIRCLE NO. 682

Symbolic execution

If you thought the way to validate a program was to run it and see if it crashed then you should listen to **David Ross**. He has rediscovered an interesting way to examine the flow of execution.

In this article I will look at a simple program analysis technique, called symbolic execution. I found this technique very interesting when I first encountered it several years ago, however there are some serious limits to its application in practical situations. I still think these ideas are worth discussing as these limits introduce interesting issues in themselves. For instance, take a look at the code fragment in Figure 1 (I'll try to stick with Pascal syntax, the line numbers are to help when discussing the programs in the text). What *exactly* does this code do? While you think about that, I'll briefly describe symbolic execution.

When examining or debugging a program it is often useful to try to construct a model of the program's behaviour as an aid to comprehension. While it is possible with traditional tools to analyse the execution using specific test values, a large number of such tests would be needed in order to reveal the full picture. The power of symbolic execution is that it involves running the program using variables with symbolic values which represent a whole range of values, rather than a single specific value. Since the inputs and outputs of the program are then represented by symbolic values, a single execution may determine the program's behaviour for a wide range of inputs.

```
1 a [i] := 3;
2  a[j] := 2;
3  c := a[i];
  ...
4  a[i] := 2;
5  a[j] := c;
6  e := a[i];
```

Figure 1 - What is the value of e?

```
1  VAR  x, y : INTEGER;
2
3  BEGIN
4    x := 15;
5    readln(y);
6    y := y * x;
7    writeln(y);
8  END.
```

Figure 2 - A simple straight-line program

In sequence

The principle idea behind symbolic execution is easier to demonstrate using simple statement sequences, eg the program shown in Figure 2. Using symbolic execution it is possible to describe the effects of statements by first describing the inputs to the program as symbolic values and then recording the values of the program variables as the program is executed. The symbolic values represent arbitrary inputs, but are constant for a given execution instance, ie the value read in at some point in the program cannot be changed by subsequent statements.

Consider the program fragment in Figure 2. Initially, all variables will have undefined values, but when the program executes line 4 the value of x is set to 15. Instead of requiring the user to supply a literal value, executing line 5 sets the value of y to some arbitrary symbolic value, say `sv(1)`. At line 7 the output of the program is given by the value of y at that point, ie the symbolic expression `sv(1) * 15`.

Assignment of a literal constant or expression is simple. Program inputs are defined by a *unique* symbolic value, while assignments of expressions involve replacing any identifiers referenced in the expression by their current value. These semantics are little different from normal program execution: the introduction of symbolic inputs to represent arbitrary input values. The use of such symbolic values means that some variables may not be simple literal values, but instead have to be represented by a symbolic expression involving the symbolic input values. Program outputs may also involve symbolic expressions. The behaviour of the program in Figure 2 can then be described by taking the symbolic value as a parameter of the behaviour as:

`fig2(sv(1))→sv(1) * 15`

Conditional statements

Clearly, most programs will not be straight-line and will require more than a simple mathematical function to describe their behaviour. Things become much more interesting when we consider the introduction of conditional constructs. These increase the number of paths through the program, each of which may be represented by a *path condition* and a behavioural description similar to that derived for the program in Figure 2. The path condition encodes the state required to ensure that the particular path is followed. This is usually a set of conditions placed upon the symbolic input values.

As each conditional statement is executed two new paths are created, one consistent with the condition, the other inconsistent. Symbolic execution follows both paths to determine their behaviours. This does not mean that a program with n conditionals has 2^n paths, since there are

```
1  IF y < 10 THEN
2     x := y;
3  IF y >= 10 THEN
4     x := 0;
```

Figure 3 - An example of redundant paths

```
1     IF x < 0 THEN
2       x := x - 1;
3     IF x >= 0 THEN
4       x := 0;
5     result : = x;
```

Figure 4 - Why reason with values?

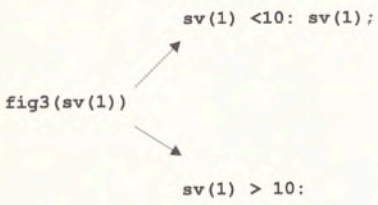
```
1  readln(x);
2  for y = 0 to x
3     write(y);
```

Figure 5 - A trivial loop, or is it?

often cases where the path conditions leading to the conditional statement rule out one or other of the new paths, as that path would be inconsistent with the prevailing conditions. If this is the case, the conditional is redundant along that particular path. This does not necessarily mean that the code is itself redundant, though that would be the case if one of the new paths was redundant along all paths through the program.

Consider the program fragment shown in Figure 3. If, at line 1, the symbolic execution follows the path where the value of `y` is less than `10`, ie it executes line 2, the condition at line 3 can never be met. The `TRUE` path through that condition is not executed. The code is not redundant since it may be executed if `y` is not less than `10`. Hence, the behaviour of the program may be summarised by only two cases, rather than four:

An important point is that the path conditions are made with respect to the values of the variables, rather than their identifiers.



The value of any variable at a point in the program's execution may be resolved in terms of constants or symbolic input values (themselves constant for a particular execution instance). Identifiers are not permanently tied to a particular value. It is therefore difficult to reason with path conditions expressed in terms of identifiers.

Consider the program fragment in Figure 4. When executing line 1, if the conditional is `TRUE`, ie the value of `x` is less than zero, `sv(1) < 0`. Line 2 is now executed, so `x` is set to `sv(1)-1`. Examining line 3 we again test the value of `x`, but it has changed. We know that `sv(1)` is less than zero and that `x = sv(1) - 1`. Given these facts we can determine that this conditional is inconsistent with the current path conditions. We must reason with the values of the variables and hence the symbolic values, since the value at a given point will not change. If we instead said at line 1 that `x` was less that zero, such a fact would be invalidated if `x` was assigned a positive value later on . The fact about `sv(1)` is it cannot be affected by subsequent statements.

Jumps and loops

Jumps are easily handled. Execution simply continues from the relevant statement. One problem is that such jumps may introduce loops into the program. There is no real problem with the symbolic execution of loops, since they can be seen as a combination of a jump and an optional condition (most loops are designed to terminate, so there should be some termination test). However, when dealing with arbitrary input values the possible paths through the program may become infinite (bounded by problems of overflow and processing time). This problem is best shown using the example given in Figure 5.

Consider the loop which prints out the numbers 0...x. The problem is that when the program is analysed through symbolic execution, `x` does not have a real value, but is instead represented by `sv(1)` say. The first time line 2 is executed, `y` is assigned the value `0` and line 3 is executed. Execution then returns to line 2 when `y` is tested to check whether it exceeds the upper bound of the supplied range (ie is `0 > sv(1)`?). To process this condition, `sv(1)` may be constrained to satisfy the condition so that execution continues with the body of the loop. It may also be constrained to fail the test. The problem is that if `sv(1)` is constrained to satisfy the condition and the loop is executed, the test is again analysed. In effect the system creates a path through the program for every possible value of `sv(1)`, ie for all integers!

This is clearly a problem for automatic analysis systems, though it is possible to derive a general description of the loop's behaviour with a single execution using other techniques. But, if the symbolic execution is semi-automatic, allowing the user to decide which path to follow, the user would clearly need to execute the loop only a few times before realising its general behaviour.

The meaning of structure

The real problem with symbolic execution is in the understanding of structured variables such as arrays and linked lists. It is not always clear which item is being referred to by an expression. Take the example given in Figure 1. Is it clear that the value of `e` will always be `2`? What if `i = j`?

First examine lines 1 to 3. The value of `c` is `3` if `i = j` and `2` otherwise (since the assignment on line 2 would overwrite the assignment on line 1. Looking at line 6, `e` is assigned `2` if `i = j`, otherwise it is assigned the value of `c`. But, if `i = j`, `c` is also `2`, hence `e` is assigned `2` regardless of the relationship between `i` and `j`.

Interactive execution

The problems with array variables and loops highlight a key issue for symbolic execution, since we are trying to reason about arbitrary values the system has to cope with large numbers of possible execution paths. For an automatic system these quickly complicate the analysis. However, at least one system has been built which makes use of user interaction to help decide which branches of the program to follow (see below). I can imagine extending such an interactive system, having it keep track of the prevailing path conditions and ruling out some choices as necessary, only asking the user for their preference in cases such as that shown in Figure 1 (eg should `i = j`?).

Further reading

Symbolic execution (sometimes called symbolic evaluation) was originally developed by J C King, though a recent review is provided by L A Clarke and DJ Richardson (1981): *Symbolic Evaluation Methods For Program Analysis* and Munchnick & ND Jones (eds) *Program Flow Analysis*, Prentice-Hall, 264-300. An interactive symbolic execution system for an assembler language is discussed by C Abbott (1983): *A Symbolic Simulator of Microprogram Development. IEEE Trans Computers*, Vol. 32, No. 8, 770774. The example shown in Figure 1 is adapted from P J Downey and R. Sethi (1978): *Assignment Commands with Array References.*, Journal of the ACM, Vol. 25, No. 4, 652666.

■

David is independent computer programmer and consultant specialising in Windows. In an earlier life he programmed in Prolog but now uses Visual Basic and C++. He can be reached on 100112.652@compuserve.com.

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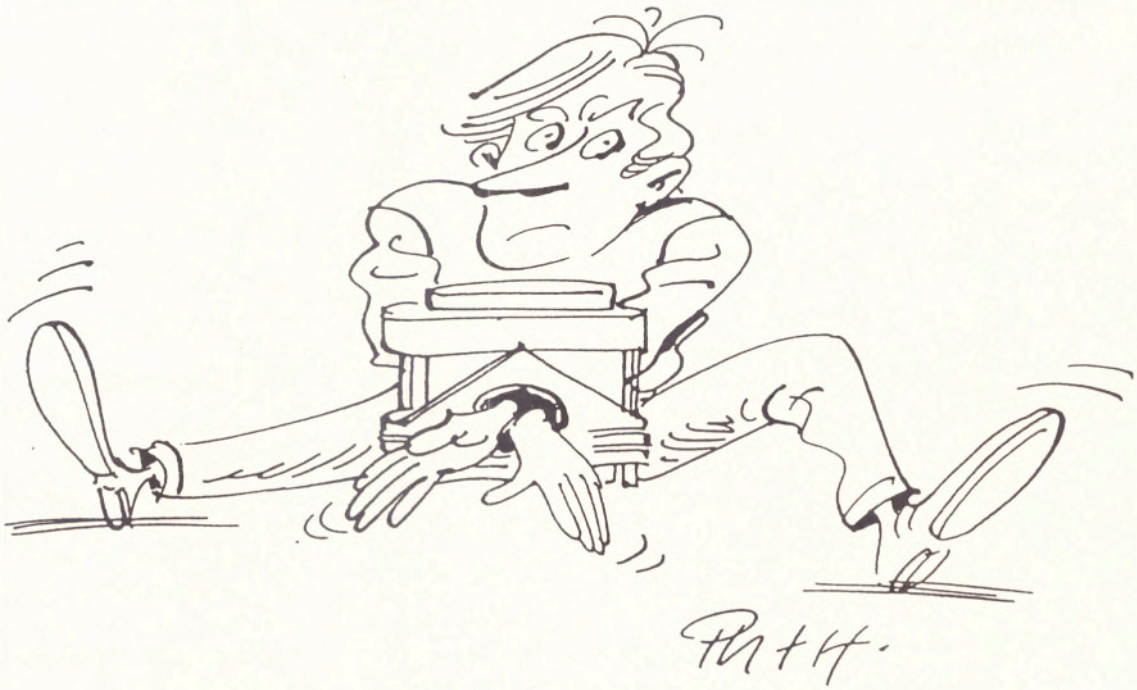

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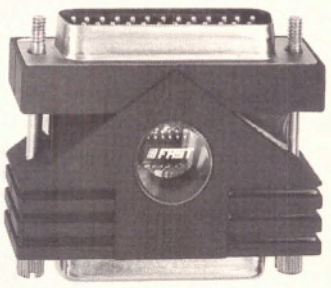

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CIRCLE NO. 684

Mayhem!

Jules casts his eye over the business side of the computer industry and is worried by what he sees. If you want to keep your job, read on.

We've had a good time, these last 10 years. We were inventing for all we were worth, creating new kinds of machines, and new kinds of programming. We rode on the wave of cheap hardware, which was so cheap that everyone could buy something, and was cheap because everybody did. We were all overpaid (well, some of us were), because everything we made would sell millions of copies. Yes, we had a real party. Now the party is over.

Many people working today won't remember the sixties. It was a time of great hope and great promise. People were building electronic brains. To be introduced at a party as a programmer was like being introduced as a fighter pilot. Then, suddenly, over a year or so, everything went horribly wrong. Computers couldn't be kept working. Programs never worked. The more ambitious the project, the less chance it had of succeeding. Programs which used to work OK started breaking as soon as they were tampered with.

It was called the software crisis. It came about because the industry started to believe its own publicity, to believe that anything which could be thought could be programmed, even though hard-pressed programmers still couldn't get their heads around the mechanics of making a program. Partly it came about because everyone was thinking about technology, and nobody was thinking about people.

The software crisis was fixed. And it was people that fixed it. There was an orgy of invention. Practically everything we know about programming was invented in two years - indeed, we've now forgotten more than we've remembered. But, the most important thing to come out of the crisis was this; that everyone was thinking wrongly about machines. The fix for the crisis didn't put the computer industry back on course, it changed its course forever. It created the program as the commodity product.

What we're facing now is a carbon-copy of the software crisis. Programs are getting

more complicated, and nobody can keep them under control. The reason is that there's no real ideas around. Almost every desk big enough to accommodate a computer is doing so. Almost every computer has a word processor in it. You and I can't possibly write another word processor, because it would have to be incredibly sophisticated to compete with the existing big players. Even niche applications, like multilingual word processors, require enormous investment. No, these base technologies rely on upgrades.

Take, as an example, Microsoft's Word 6. Word 2 was a complex product, but was no longer earning money, because everybody had it. It needed an upgrade. I don't know how many hundred programmers worked on the upgrade, but it's well-known that there's not much point in building a team of more than 10. All those people seemed necessary because of the complexity of the task.

But did it work? Well, no, not really. Apart from minor cosmetics, nothing much was achieved. The day it was released, I'm told, it had 3000 known bugs, including practically all the bugs it inherited from Word 2. The subsequent patch fixed some, and created others. Most people who upgraded were disappointed. Next time, they are not going to pay a hundred dollars for an upgrade, unless they get something in return.

I'm not having a go at Microsoft; everyone is facing the same problems. All the money is being made in upgrades, but upgrades cost more and earn less than original development. What is worse, there's a huge market of people who have been deliberately habituated to expect novelty, and it is that very novelty which can't be delivered any longer. This is serious; if people stop buying new software, they will stop buying new hardware which the new software needs. If that happens, it will be even harder for developers to exploit niches, because the niche markets won't be able to buy the more expensive products.

This is happening now. Traditionally, technology was developed in small companies, which were then bought by big companies. This isn't happening any more. Emergent technology is being allowed to wither literally on the vine, as more and more big companies perform strategic mergers. Nobody actually explains who this strategy is directed against, since each merger creates less and less competition.

The entire desktop market is caught on the horns of a dilemma. On the one hand, it can't stop developing, because then the money will stop. On the other hand, continuing development is so fearfully expensive now (and getting more so by the week), and the rewards so slight in comparison, that to continue developing will eventually bleed the company to death as profit margins slide inexorably into the red. Some large companies are right now operating on a 0.2% return on investment.

JAKE ABRAMS

It will take only one large company to file for Chapter 11, and the entire edifice will come down

It now seems inevitable to me. The desktop market is going to collapse. I can't think of anything that will save it. Software and hardware sales will vanish overnight, prices will skyrocket as dealers and distributors try to save their skins, and companies that were secured on share issues will evaporate. It will take only one large company to file for Chapter 11, and the entire edifice will come down as the investors scramble to take their money somewhere safer. It's probably going to happen sometime in the next two years.

This is a cyclical phenomenon. The computer industry will recover. But, in order to do so it must fundamentally change direction, just as it did 30 years ago. I don't know what direction it's going to take, though I do have some ideas. The point is, it will be as different from today's market as today's market differs from 15 years ago. The best way to survive this is to take big risks; lots of them.

If an emerging technology catches your imagination, get involved. If a technology no longer inspires you, move on. If you have money in the establishment, sell now, because cash is more useful. If you're a specialist in anything, get some training, because specialists won't be very useful for a while. Only this is sure; it's going to be exciting. We will, again, be the fastest moving industry, and the devil will take the hindmost.

Oh, and one more thing. If you haven't got a hobby, get one ■

Jules is a computer professional, who is developing a martial arts company as well. If you want to learn how to defend yourself, you can call him on 0707 644185, or email jules@cix.compulink.co.uk.

Son of Think C

Paul Smith tries his hand at some C++ programming on the Mac with the help of the new Symantec C++ 7.0 compiler.

Apple has just announced excellent quarterly results: sharply up from the same quarter last year, surprising many analysts. In spite of Compaq's early product sales lead this year in which it crept ahead of Apple, with IBM remaining in third place, it looks likely that Apple might regain its lead by year end. Altogether the commercial outlook for the Apple developer is much improved from this time last year. The latest word is that Apple has begun re-evaluating its developer programmes with a view to increasing value for money and effectiveness for developers, not just Apple. What's more, it has just announced System 7.5 of the Macintosh operating system (see box below). The omens are encouraging; I hope to be able to report on more progress in future columns. But for this month I have been running Symantec's new C++ 7.0 for the Macintosh.

In the beginning...

Once upon a time, there was Macintosh Pascal, developed by a third party developer but sold by Apple. It was a product ahead of its time (the mid 1980s) in that it offered source level debugging, but it was designed as an educational programming environment and was not capable of building standalone programs. Macintosh Pascal, care of its original developers, beget Lightspeed Pascal and Lightspeed C, integrated programming environments which offered full debugging facilities, rapid development turnaround even on low-end Macintoshes: this was never the case with Apple's flagship development environment, MPW. Furthermore, they had the ability to deliver stand-alone programs. Lightspeed C and Pascal became Think C and Pascal. They were purchased by Symantec, which later purchased Zortech and combined Think C with Zortech C++ to produce Symantec C++ for Macintosh version 6.0, released in May of 1993. A year later, Symantec has released C++ version 7.0. In the remainder of this month's Apple column I will give you an overview of what the new version offers.

There are two variants of Symantec C++ for Macintosh: a standalone version ($375 in the US) and an MPW-compatible C++ compiler (also $375), that runs within Apple's MPW. The standalone version includes the Symantec integrated development environment, C++ and C compilers, and a bunch of other tools;.

Think of a project

The Symantec development environment is impressive and larger than its predecessors with the small RAM footprint of the old Think C having grown to a recommended 8 MB. The central component is the Think Project Manager (TPM) illustrated in Figure 2, which displays an overview window

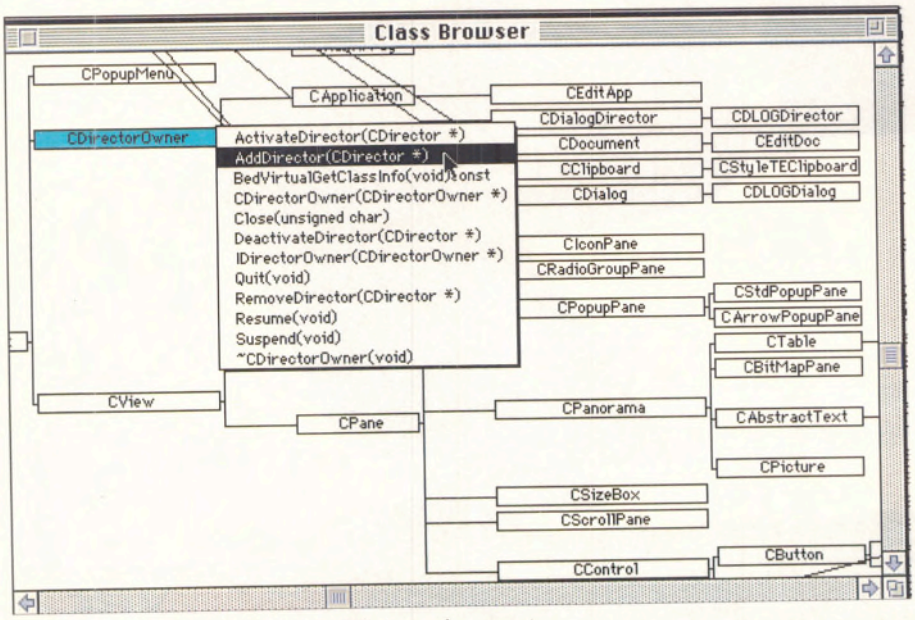

Figure 1 - Class browser integrates into environment

It bugs me that, two years on, the compilers still cannot compile the standard MacApps source code

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listing all the files and program segments in the project. The project manager serves as the point of integration of the other components of the environment and handles the 'make' process automatically, so you don't have to worry about source file dependencies. It is integrated with a graphical browser (see Figure 1) that you can use to navigate the class structure of a project and to locate functions directly in the editor.

The interactive debugger shown in Figure 3 offers full source code level debugging, single stepping and breakpoints. Pasting variable names and expressions into the data window allows them to be examined when they are in scope. The data windows are structure-aware, so if you double click on a structure value a new window will be opened. The fields of the structure can then be examined.

I was irritated by a handful of details. The debugger opens its windows on the second monitor, if there is one: in some ways this is a good feature because it conserves main screen space, but it confused me a lot because my second monitor was unplugged and I couldn't find the windows anywhere. There needs to be a 'windows' menu option to tile or stagger windows and force them to the main screen. The data windows should explicitly mark variables that are out of scope and it should be possible to drag and drop variable names straight into a data window.

New tools

Complementing the debugger is an object-oriented Inspector facility, which is new in version 7.0 of the product. This allows the objects instantiated at runtime to be browsed and the values of their fields inspected.

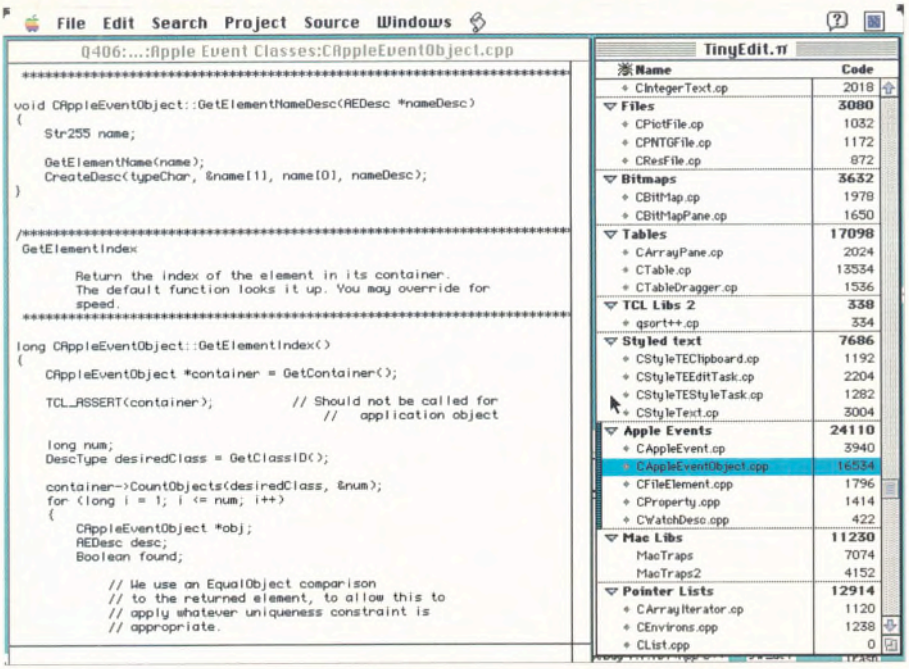

Figure 2 - Symantec C++ 7.0 Think Project Manager

Also new in version 7.0 is the Visual Architect interface builder tool, which works hand-in-hand with the Think Class Library (TCL) object oriented framework that accompanies Symantec C++ for Macintosh, to construct window layouts. The Visual Architect tool was recently purchased by Symantec from a third party developer. It is rather more than a view editor such as those used with MacApp: it integrates with the TPM and actually generates source code templates for the program that uses the interface elements you design with it.

The TPM is built around an 'open' architecture that allows editors (for source code and resources) and translators (for source code compilation) to be plugged in. The translators currently available are those supplied with the product (C, C++, Rez, a resource copier, and a .o file converter to translate MPW libraries). Third party text editors like BBEdit and resource editors like ResEdit and Resourcerer, hook into the TPM through this architecture.

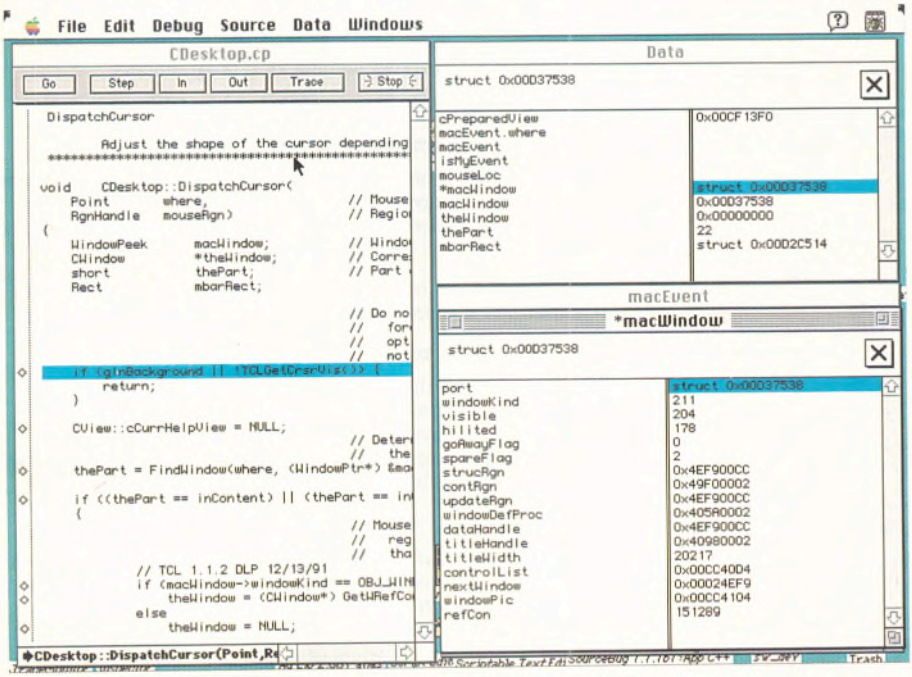

Figure 3 - The debugger

Think smart

One strong selling point of this product and its predecessors has always been the smart incremental linker. Version 7.0 of the TPM also includes links to ToolServer and SourceServer, components of MPW that Symantec has licensed from Apple. ToolServer is an Apple event driven program that executes MPW tools and scripts, so MPW tools can be integrated into the TPM. SourceServer is the MPW source code control system and provides sophisticated version control for teams of programmers; the inclusion of SourceServer answers one important criticism of earlier Think products, that they were unsuitable for multi-programmer projects. The 7.0 TPM is Apple event and AppleScript aware, so it can run scripts that automate tasks and be controllable from external scripts and programs.

The MPW version of the Symantec C++ product is a little simpler, in that it does not include the TPM and other tools that comprise the full Symantec C++ for Macintosh product (oddly, this does not affect the price of the package). The compiler is instead packaged as an MPW tool, to integrate with the standard MPW program build process. The Symantec C++ compilers (for the TPM

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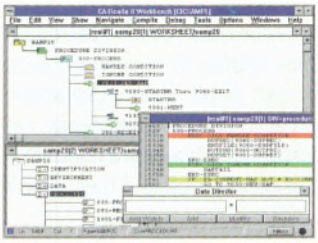

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and for MPW) are (packaging and back-end linkable output apart) fundamentally the same code, based on the Zortech C++ compilers that should be familiar to most readers of EXE. The current incarnation supports templates (although the implementation is not 100% standard) and exceptions. The compilers are optimising compilers, in tune with their Zortech heritage, and produce small and efficient code. The product quality has improved over previous versions, but there are still occasional problems noted with the code generation. It bugs me that, two years on, the compilers still cannot compile the standard MacApp source code.

Symantec's currently shipping products generate code only for the 680x0 processor, not the PowerPC processor used in the latest Power Macintosh computers. An extra-cost (but pre-release) add-on for the Symantec C++ environment allows you to build PowerPC native code.

Tickled by TCL

Symantec C++ for Macintosh includes the Think Class Library (TCL), which has evolved to become a fairly mature class framework for program development. TCL has in the past been looked on as a fairly lightweight alternative to MacApp, but the current version is a viable platform for serious program development. It uses pointer-based objects, includes the Bedrock exceptions sub-system and integrates well with the Visual Architect interface builder. A problem for users of prior versions of the TCL may be that the new version is significantly different from its predecessors, being built on pointer-based not handle-based objects and having been subjected to major design and implementation changes.

OpenDoc, not quite

The MPW version of the Symantec C++ compiler is required for the development of OpenDoc parts using the OpenDoc Parts Framework (OPF). OPF was built on the ashes of the Bedrock project, a cooperative development between Apple and Symantec that was at one stage intended to become a replacement for MacApp. Some parts of Bedrock ended up in the TCL; the Apple engineers from the Bedrock project moved back to Apple to construct the OPF, a class framework for constructing OpenDoc part editors.

Unfortunately, the current (7.0.2) version of the C++ compiler has a code generation problem that stops it being used to build OPF parts. I understand Apple and Symantec are working frantically to fix the bug. By the time you read this article all should be well.

System 7.5 to ship soon

The latest incarnation of the Macintosh operating system will ship soon. Significant enhancements present in System 7.5 include a new object oriented graphics toolbox, built-in drag and drop support, TCP/IP networking support, an 'active assistance' facility that takes the state of the art for online help several steps forward, preemptive multi-tasking within programs and a large number of bug fixes and system enhancements recently released to System 7 users as System Update 3.0. The PowerTalk collaboration software and the AppleScript system-level scripting software, previously available in System 7 Pro, have now been rolled into the system software. Detailed information on System 7.5 is available elsewhere, but I will write a few words now on some issues developers need to pay attention to.

Quickdraw GX is a new object-oriented graphics toolbox that can be used as a replacement for the Mac's original Quickdraw graphics engine. It supports object-oriented, scaleable and transformable, graphics and text: a bit like a Postscript on steroids. GX also includes a new print architecture that improves dramatically on the Macintosh's original and clunky print driver mechanism. It implements a portable electronic document format that allows documents to be printed to disk and then viewed or printed on any GX-equipped Mac.

The good news is that your programs are not forced to use GX, so if they are not aware of GX they will still work. If you want to revise your programs to take advantage of all the new features of GX, you can. The bad news is that your Mac needs at least 8 MB of RAM (16 MB if it is a Power Mac) if you want to use GX. The most significant issue for developers: your programs will need some (fairly small) changes to take fullest advantage of the new print architecture.

The *drag and drop manager* is not completely new, though it's only been around for a year or so, but it has never before been an integral part of the system software. The drag manager allows drag and drop between windows within a program, between windows of different programs and between windows of programs and the Finder. A new type of 'clippings' file has been defined, to store dragged data on disk and to act as a data source for drags into program windows. If you want to implement drag and drop in your programs then the drag manager makes it much easier than before.

MacTCP, Apple's implementation of the TCP/IP protocol stack, is bundled in System 7.5, which means your programs can take advantage of these network protocols. What's more, you don't need to license MacTCP from Apple to do it. In one sour note amongst the good news about 7.5, Apple's much hyped 'Open Transport' software is not ready in time to be included in System 7.5. This is a problem in that the Open Transport architecture, which is based on the XTI Streams model, has a different API to MacTCP. Apple has stated that new development should be based on the Open Transport APIs not MacTCP, but developers have to continue to support MacTCP since they can't be sure when Open Transport will be available.

Apple Guide is Apple's first step towards integrating 'active assistance'. This not only provides an online help system, it also uses Apple events and scripting to integrate the help system with programs so that the user can ask the help system to demonstrate how to use the software.

The help system runs the software and teaches the user how to use it. There are two stages towards supporting Apple Guide: in the first instance, you can provide online documentation with it, but to be truly Apple Guide savvy your programs need a few extra hooks to allow the help database to drive the program and draw appropriate 'coach marks' on the screen to hint at how the program should be used.

The *thread manager*, which like the drag manager was previously licensable by developers but is newly integrated into the standard system software with System 7.5, allows programs to implement co-operative and preemptive multi-tasking. This does not mean preemptive multi-tasking is used within the system software itself, as System 7.5 still cooperatively multi-tasks between active programs, but it does make the facility available for the first time to all programs that need it.

It's interesting reading the hype about Windows 4.0 in PC-bent magazines; Chicago implements a bunch of things like long file and folder names, an integrated desktop, and 'shortcuts', aka 'aliases', that Macintosh users have enjoyed for many years. System 7.5 raises the ante yet again, and demonstrates that the Macintosh continues to have the edge on the desktop.

Docs

The Think Reference online documentation tool has long been a part of the Think C and Symantec C++ product line. The latest version is included in version 7.0. Think Reference is a hypertextual electronic documentation browser that lets you search using indexes, bookmarks and hot text links. I like the button that lets you 'iconise' the window to conserve screen space. Clicking it again reveals the whole window.

With each new release of a software product, the documentation expands. Symantec C++ is no exception to this rule, and comes with three manuals, all in the jolly yellow colour that Symantec has adopted as its house favourite. These include an 800-page user's guide to the Think Project Manager and the Think C compiler, a 1000-page guide to the Visual Architect and the Think Class Library and a 190-page guide to the Symantec C++ compiler.

Hang about...

Code generation apart, I experienced a couple of other problems with the TPM. It seemed to 'hang' from time to time, especially during long project builds. One time, after it hung, I had to restart the machine and discovered that the TPM had left the project file in an unclean state and had destroyed the data in it. Symantec need to make sure that, however bad the crash, the data already saved in files is safe.

Getting a copy

To get the new versions, you have two (or three, if you are an existing user) choices. You can purchase the products from

> **It seemed to hang from time to time...**

MacWarehouse or one of the other mail order vendors in the UK, or you can purchase them direct from APDA in the USA.

If you subscribe to ETO, the APDA subscription developer tools CD, then you'll get both the TPM and the MPW versions of Symantec C++ automatically (at no extra charge). If you are an existing user and you're not in a hurry, you might consider upgrading through Symantec's UK office.

Symantec's support and upgrade policies in UK are questionable. The upgrade order form says (to paraphrase it) that the goods are shipped from Ireland and Symantec have no control over (read: interest in) goods lost in transit, and if they are lost then tough luck, you'll have to order another copy. That is an unacceptable attitude. I wish Symantec would be a bit more responsive.

Some concern

By way of a conclusion: I think that reliability issues remain a concern and that the product is still not completely stable. But the new version is a significant step forward and offers good value for money. If you already use Think/Symantec C or C++, you should consider upgrading to the new version, although if you currently depend on the Think Class Library you need to be aware that making the transition to TCL version 2 might be challenging. If you need to build PowerPC 'native' applications, or if you are simply undecided, you should take a look at Metrowerks CodeWarrior as well (which we'll be looking at in a forthcoming column). The Think/Symantec compilers are no longer the only game in town.

Paul G Smith is a software developer, consultant, and writer. He can be reached in the UK on (0727) 844232, or preferably by electronic mail at "paul@ctalk.exnet.com". Comments or questions on Apple-related development, for possible publication in EXE, should be directed to "askexe@ctalk.exnet.com".

Towards ISO C++

What changes to C++ am I going to have to handle? Ask ACCU's **Francis Glassborow**.

It seems that many people are concerned about the delay in producing a C++ standard. They imagine that those responsible must be wasting time with frivolities and wildly introducing ever more extensions. Nothing could be further from the truth. Many excellent extensions have been rejected because they fail to meet the very stringent criteria laid down for consideration of any extension. The only major extension that was not specified in the original mandate is 'namespace'. That extension arose out of an almost universal awareness of a problem that was growing at an exponential rate, that of name clashes between third party libraries. The programmers of the coming decade would not have thanked the C++ language designers if they had ignored that issue. Two major extensions, exception handling and templates were both part of the original mandate and both are far more difficult to get right than the casual observer might expect. It is not enough when producing a standard to sketch an outline of a topic and then declare that we all know what it means. We all do, but the problem is that we soon discover that we all mean different things. Those differences of opinion must be resolved before a standard is produced else we will all suffer in the long run.

What you should know

Actually the vast majority of the refinements that have to be worked on to change the initial C++ design to a full and correct standard will have little impact on most programming in C++. But there are some changes that you will need to take into account.

The biggest of these is exception handling which effectively invalidates all code written prior to its introduction. That is not a reason to rush out and bin your C++ development tools, but library developers and those intending to reuse code will need to do some pretty heavy maintenance work when they next upgrade their compiler.

Two other items that are being worked on should need very little change in style by programmers. The standards committees are actively looking at ways to solve the dynamic initialisation problem. This is a known problem with a rather awful hack currently being used to manage the problem. Actually one of the most effective solutions, that of providing C++ with true modules, is likely to continue to be rejected because of uncertainty about the time needed to implement it.

The committees are also looking at mechanisms to manage the problem of constructors with single parameters being implicit type converters. Another example of flaws in the language design that currently have to be tackled with awkward work rounds. Despite the growing demand for direct support for garbage collection this will have to wait for the next time round though I would hope that the more adventurous compiler implementors will look to providing an extension to support this in the near future.

Type affair

After many years of pressure `bool` has been added as a built in type. In future, logical operators will return a `bool`. Unfortunately, to preserve current code, a range of implicit conversions have been provided for `bool` that detract from its value for detecting silly logical expressions such as `one<two>three`.

There are several other extra built in types to support internationalisation. C creates weak types via `typedef` for a wide variety of uses such as `size_t` for an atomic integer type. It also recently used this device to support the extensions to manage wide and multi-byte characters. The `typedef` option is not appropriate to C++'s needs as a `typedef` type has been replaced by its underlying type before the compiler tries to resolve overloading. It is a pity that C++ did not strengthen `typedef` so that it could be used for this purpose, but despite the fact that several C++ compilers have switches to permit a strong version of `typedef` it seems to be too late to bring it into standard C++. I doubt that these extra types will cause any problems except in answers to quizzes.

As well as the built in types, there will be a number of user defined types such as various string and complex types introduced by the standard library. Note that the fundamental difference between a built in type and a library type will be that of a keyword versus a reserved word in a specific C++ `namespace`.

Declaration on scope

The new scope rules for the declaration of a variable in the initialisation clause of a for

```
int i=1;
int main(){
  for (int i=0; i<10; i++)
  {
     cout<<i;
  }

  cout<<i;
}
```

The final `cout` prints the value of `i` as `1`, not `10`

Figure 1 - Changes to scope

statement are rather more contentious and potentially damaging to existing code. The scope now extends from the point of declaration to the end of the following statement (simple or compound) as shown in Figure 1.

It is also possible to declare a variable in the conditional clauses of `if`, `while` and `for` (the second clause) statements. As this merely adds a facility it will have no effect on existing code. The new rules mean the code in Figure 2 is valid.

Work from a template

One of the most dramatic developments over the last year has been the appearance and rapid development of a standard template library (STL). This is based on work done by Alex Stepanov and colleagues at Hewlett Packard over a number of years. The contents cover a broad spectrum of encapsulated algorithms and containers as well as a number of other useful template based tools. Much of the work was done in other languages so despite being an apparent newcomer to the standards arena it is more firmly based on prior art than some other elements.

I am sure that the STL will have a major impact on future C++ programming. If anyone still has any doubts about the time being taken to get such extensions as templates right they should look at the interfaces in the STL, which are all that competent C++ programmers need to write their own implementations. Doing so would be an excellent way both to develop your skills and to get a better understanding of C++ and its future.

If you want a copy of the STL interfaces or other standards related material contact me for the conditions and details of access.

A helping hand

There are enumberable problem with financing the UK contribution to C and C++ standards work. The Association of C & C++ Users has come to the decision that action needed to be taken. So ACCU has set up a fund for voluntary donations to provide some financial assistance to UK C & C++ technical experts attending standards meetings. All moneys donated will be directly used for that purpose and no administration charge will be made. Decisions on assistance will be made by the ACCU committee after considering the advice provided by the UK C and C++ panels. ACCU hope that this will enable the many individuals and companies that wish to support this work, do so in the knowledge that money will be entirely spent on the work for which it is donated.

First I have some good news for the 'language lawyers' among you; ACCU has negotiated its way through the maze of copyright issues to be in a position to provide access to up-to-date versions of the C++ standards documents to those with a genuine interest. If you think you might be interested please contact me (details below) for more information.

```
if (ifstream infile,
    infile.open("myfile"))
  {
          ...
    }
    else
       //assuming we have
       //a suitable
       //exception
       //class defined
       //throw nofile;
```

Figure 2 - You can now write code like this...

Subscriptions: individual 14, student 7, corporate 75, Overload & C++ SIG 15 (+ACCU membership). For further information about ACCU write to Francis Glassborow, 64 Southfield Road, Oxford, OX4 1PA, ring 0865 246490 or email francis@robinton.demon.co.uk.

Not so open systems

When you are connected to the outside world how can you be sure that you won't attract the attention of uninvited guests? Intruders be warned: **Peter Collinson** is armed and dangerous...

I became fully internetted a few months ago and have been a little concerned about the need to thwart the hacker by making my systems a little less open. Luckily, the excellent book *Firewalls and Internet Security, Repelling the Wily Hacker* has just appeared and has given me some things to think about. You can never say that you are safe against intrusion. This is not, repeat not, an invitation to break in. I am too busy to spend my life in some dumb battle with an intruder. I am happy here doing my own thing: leave me in peace to get on with it.

Spying the logins

Very early on, the *Firewalls* book points out that most systems are woefully lacking in logging of internet activity. Things out there on the Net send and receive packets from a server on your LAN. On the whole, you don't know this has been going on, unless you happen to be looking when the connection occurs. Even then you have to be lucky. Because you cannot see this happening, you cannot detect probes from outside. You have no early warning that someone is lining you up in their sights and probing to see what you have and what servers are externally accessible.

So, my first priority was to install some logging. I found a program called `tcpd` on the Net. It was written by Wietse Venema from the Eindhoven University of Technology. Its basic idea is simple. But to understand it you need to know a little about how Unix systems deal with incoming calls from the network.

When a packet comes into your machine from the Net, it is addressed to a particular port number. The packet will contain the port number of the originating process on the source machine so a reply can find its way back to the sender. For an initial connection, the inbound port number is usually the number of a 'well known' service. These are mostly defined by `/etc/services`. For anything useful to happen, some process needs to be listening for the connection on the port number. These days, that process is usually `inetd`.

The job of `inetd` is simple. It listens for connections and starts up servers to handle them. It's controlled by a file, usually `/etc/inetd.conf`. This specifies the services that the machine supports and the program to use when a packet addressed to a port appears on the machine. When `inetd` starts, it scans this file and starts listening for all the port numbers that are enabled. When a call comes into the machine, `inetd` gets it, examines its internal copy of the file and starts a process to handle the connection. It passes the initial connection details into the process and sits back waiting for another connect. The process has a new port number that is used for any further communication. When it replies to the client, it will send this new port number. Communication can now proceed between the two processes.

The control file for `inetd` contains the pathname of the command to be called to service the incoming request and any arguments to that command. It includes a string that becomes `argv[0]`, the name of the command.

False server

OK, so how does `tcpd` fit into this scheme? Well, the answer is: fairly easily. The idea is that the `tcpd` program is called instead of the target server. The `tcpd` program does some logging of who is calling and also makes some other security checks. It then calls the process that is the 'real' server for the requested service.

You can install `tcpd` in two ways. First, you can move the existing server programs to a new location and install `tcpd` in their place. When you compile `tcpd`, you tell it to go and look in a nominated directory for the binary files that are the real servers. Second, you can just alter the `inetd.conf` file to call `tcpd` directly rather than the target server program. I have done this. For the `telnet` server, the `inetd` file on my Sun used to read (I've folded the line):

```
telnet stream tcp nowait root
/usr/etc/in.telnetd in.telnetd
```

```
telnet localhost 25
Trying 127.0.0.1 ...
Connected to localhost.
Escape character is '^]'.
220-craggy.hillside.co.uk
  Sendmail 8.6.9/8.6.6 ready  at Sun, 24 Jul 1994
  01:36:41 +0100
debug
500 Command unrecognized
quit
221 craggy.hillside.co. uk closing connection
Connection closed by foreign host.
```

Figure 1 - Making sure you have the right version of SendMail

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This tells `inetd` that the `telnet` service (port 23) is a stream connection using TCP. When the process is started, `inetd` should not wait for it to terminate but should immediately start another listener for the port (`nowait`). The owner of the running process should be root. The binary of the telnet server will be in `/usr/etc/in.telnetd` and its name is `in.telnetd`. To install `tcpd`, the line becomes:

```
telnet stream tcp nowait root
/usr/local/etc/tcpd in.telnetd
```

I tend to put non-standard things in `/usr/local` to ease the burden when I upgrade my system. So, instead of calling the `in.telnetd` process, the `tcpd` program is called instead. Notice that the *name* of the command is used to tell `tcpd` which program to run, you compile it with the knowledge that the program is to be found on `/usr/etc`.

The `tcpd` program logs connections and errors using the `syslog` daemon. This program sits in the background taking logging messages from various processes. You can control where the data is delivered by editing a control file. Messages can be dumped into a file or displayed on the screen of nominated logged-in users. If you really are worried about an intruder trashing the data from the `tcpd` daemon, then you can make the daemon write to some other machine, perhaps one that offers limited facilities to the outside world.

I send `tcpd` output to a separate file and post-process it nightly to remove common known actions. I send the remaining data in email to myself, so I am told when 'funny' things have happened. I do this in the hope that an intruder will probe at my defences with a number of common attacks before perhaps trying 'for real'. Another alternative is to use the `swatch` program by Stephen Hansen and Todd Atkins from Stanford. This is a perl program that can be used to watch log files, ignoring normal messages and picking up 'odd ones'.

I guess that I should also say that I can 'see' connections. I use ISDN to talk to the outside world and can see that little green LED on the modem light up when a connection is initiated. Being a curious person, I do tend to investigate unusal connections.

Security with tcpd

The `tcpd` program certainly tackles the problem of logging TCP and UDP accesses to my machines. It does a number of other things that can help with security. First, it validates the address and the name of the calling machine.

There are several services that use the name of the remote machine to provide authentication data. For example, `rlogin` and `rsh` use the remote hostname as a lookup key in your `.rhosts` file to see whether they will permit a password-less login. This is fine if the mapping between the IP address of the caller and the hostname is done by a local `/etc/hosts` file on the server machine.

It's less fine when the mapping is derived from the Domain Name Service (DNS). The security of your system now depends on some remote DNS server that is out of your control. The `tcpd` program helps a little with this by checking the reverse translation (IP address to hostname) with the forward lookup (hostname to IP address). If any name or address inconsistencies are found, or perhaps the forward translation cannot be done, then the program assumes that someone somewhere is being liberal with the truth. It drops the connection in disgust.

The `tcpd` program provides a number of other checks on the supplied IP address to validate that the host is what it is supposed to be. Most important, it refuses to deal with IP source routing. This is a way for a client to send a packet via a nominated route and have the replies returned using the same route: this is an excellent way for someone to pretend to be one of your set of trusted machines.

I'll guess that in most cases, these checks will be sufficient. A would-be intruder will need to become a host that you know about to get access and in general, it's hard for them to get access to the DNS service that supports those hosts.

Second, you can control access to servers based on the hostname of the calling machine. You can set up a pair of files: `hosts.allow` and `hosts.deny`.

When a connection is made, the control software looks for the (service, caller) pair in the `hosts.allow` file. If the pair is found, then the connection is allowed to proceed. The service is actually the name of daemon that is invoked for the service rather than the service name or number itself. The caller is the name of the calling machine, not the IP address.

If the pair is not found in the `hosts.allow` file, then it is looked up in the `hosts.deny` file. If the pair is found, then access will be denied. If neither of these are actioned, then the connection is allowed to proceed. So all connections are permitted if there are no control files or they contain no data.

It's possible to implement various different styles of access policy with these two files. I want my systems to be 'mostly' open so I have not done much with the files. I am concerned about the `rlogin`, `rsh` and `rcp` family of programs. I want to support these but only from a small number of hosts that I specify. So my `hosts.deny` file on my Sun contains (I've split the line):

```
in.rshd, in.rlogind,
                in.rexecd: ALL
```

meaning that all hosts will be prohibited from using these services except for those in the `hosts.allow` file. My copy of this file just contains:

```
in.rshd, in.rlogind, in.rexecd:
    LOCAL, .hillside.co.uk,
  other named hosts
```

allowing access to hosts on my network and a small number of nominated hosts.

I am fairly happy with `tcpd`. There are some limitations and you can never be complacent about these things, but at least I now know when people are calling into my machines accessing the regular services. It does only check services that are accessed from `inetd`, so SMTP access for `sendmail` or access to my WWW server are not checked. However, these do their own logging.

```
$ telnet localhost 25
Trying 127.0.0.1 ...
Connected to localhost.
Escape character is '^]'.
220-craggy.hillside.co.uk
  Sendmail 8.6.9/8.6.6 ready at Sun, 24 Jul 1994
  02:06:54 +0100
vrfy pc
250 Peter Collinson <pc@craggy.hillside.co.uk>
expn Peter.Collinson
250 Peter Collinson <pc@craggy.hillside.co.uk>
quit
221 craggy.hillside.co.uk closing connection
Connection closed by foreign host.
```

Figure 2 - Verifying senders of email

Mail systems

I am running the latest version of `sendmail`, Version 8. This is now much more secure than any previous version. Since it is newish, Eric Allman is also working to fix security bugs. Versions that defeat new security holes are generated quickly. If you are still worried, get the TIS firewalls package which has a daemon to 'front-end' `sendmail`.

The new version of `sendmail` will log attempts to probe for old `sendmail` bugs. For example, the 'Internet worm' exploited a back-door in `sendmail` that was intended for debugging use only. Sadly, many vendors did not fully understand the ramifications of this option and distributed

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`sendmail` with the DEBUG option enabled.

This has now been fixed and most, if not all, vendors can now supply you with a version of `sendmail` that has been compiled without this option. To see if you are still affected, you should enter the commands in Figure 1.

The lines in blue are typed by you. This is 'safe': the `debug` command is rejected. Actually, with this version of `sendmail`, a warning message about the probe is written into `syslog` so you can see that someone has tried your defences. If you get the response:

```
200 Debug set
```

then get another version of `sendmail`. You are exposed to unwanted access.

If you are on a SCO system and running MMDF, you are perhaps safer because MMDF does not run as root, it mostly runs using a 'dummy' user called `mmdf`. This should make it safer because it doesn't offer a route to becoming the super-user.

Some people are very worried about exporting their login names and make their mailers hide them behind 'real' names like *Fred.Smith*. If you do this because you think that it's 'better', then fine. Well, it's fine until another *Fred.Smith* joins your site and you have to resolve the problem of who the real Fred Smith is. If you are doing this in the belief that it's safer, then think again.

Who's the sender

The SMTP protocol has two commands that are used by mail systems to verify senders: `vrfy` checks whether a mail address is valid and `expn` expands any aliases that the machine knows about. Figure 2 is an example session where I am talking to my machine.

Again, the blue lines are typed by you. You get similar results when talking to an MMDF system. The `pp` mailer will not return this information if you have established a 'standard name of the user' that is not their login name.

Basically, if you run `sendmail`, the mail system will give your login name out to an enquirer, so it's just not worth being bothered about concealing login names. Your defence is to ensure that your users have good passwords.

I am not bothered about letting my login name out of the system; it's too late. I also enable the `finger` daemon on my machine, although I use a 'safe' version that is supplied with the `tcpd` package. Some people maintain that all UCP services should be disabled. So, I am taking a risk here. The use of `finger` is also logged using `tcpd`.

Barracading ports

Because I connect to the Internet using a Telebit Netblazer, I have the opportunity of adding some packet filtering to prohibit access to certain services to the outside world. You can do this with a program called `screend`, if you have a suitable firewall system. Some versions of the PPP protocol also allow this.

The *Firewalls* book has a very useful list of service port numbers and considerable discussion on what services you should and should not export off your site.

On the Netblazer, you can deny access based on the incoming port number for both TCP and UDP protocols. This is done by supplying a list of tests, unfortunately this is limited to 10.

> **A would-be intruder will need to become a host that you know about to get access**

Let's look at TCP services first. First, I deny access to any port number used by X11, ports in the range 6000 to 6999. I rarely run X services over the Internet. I always use a local client to access a remote data stream so I don't need to support access to these ports through my gateway. If I do want to do this though, I can temporarily enable the ports.

As I run Sun's OpenWindows, I also disable external access to port 2000. It turned out that you can use `telnet` to talk to the NeWS part of OpenWindows. I was not too happy about this idea so I have stopped it. I also deny access to port 144, the official NeWS port.

I permit access by external `rlogin`, `rsh` and `rexec` clients. As I have explained, I am relying on `tcpd` to cope with these on a selective basis. However, I do turn off access to the line printer spooler (port 515). I cannot see a good reason why some external site should be able to access my printers.

Since I have a Sun, I also have Sun RPC (Remote Procedure Call). This works by using a program called the `portmapper`, that translates a (program number, procedure number) pair into a TCP or UDP port number. This is done 'on the fly'. Services register themselves with the `portmapper` and are assigned a port number. This makes it hard to establish fixed external filters for the various services.

Generally, a system is also willing to release this mapping to anyone who asks. They just run

```
rpcinfo -p hostname
```

and are told the mappings. It's possible to stop external sites from contacting your portmapper by blocking access to TCP and UDP ports 111. At least, this makes it less easy to run `rpcinfo` externally and a would-be intruder must do some linear scanning of your port number address space to find the available services.

I also block a few other TCP services, largely because the `Firewall` book says that they are frequent targets. The NetBlazer will log probes on blocked ports so you are told that this is happening.

I block several UDP ports too. First, I stop access to UDP port 2049, this supports NFS and I am just not interested in anyone being able to access that. I block access to my Biff server, port 512; to `snmp`, ports 161 and 162; Sun RPC, port 111. I also deny access to any attempt to use `bootp` (port 67) and `tftp` (port 69). The last two are extremely good candidates for blocking since they provide a service that should be kept local.

Reading and software

If you are concerned with these issues then I recommend *Firewalls and Internet Security: Repelling the Wily Hacker* by William R Cheswick and Steven M Bellovin. It's published by Addison-Wesley (ISBN 0-201-633357-4).

The security of `sendmail` and its installation, care and feeding is best found in *Sendmail* by Bryan Costales with Eric Allman and Neil Rickert. Its published by O'Reilly & Associates, Inc and is ISBN 1-56592-056-2.

You can get `tcpd` from a number of places on the Internet, the best way to find a site for you is to use `archie`. Look for `tcp_wrapper` as well as `tcpd`. The `swatch` program is to be found in several places too, `archie` will help. I got mine from `ftp.funet.fi`. You'll find `screend` on `gatekeeper.dec.com`, in `pub/misc/vixie`. The latest version of `sendmail` is available from `ftp.cs.berkeley.edu`, in `ucb/sendmail`.

Peter Collinson is a freelance consultant specialising in UNIX. He can be reached electronically as `pc@hillside.co.uk` *(although your mailer might be happier to put the address the other way round) or by phone on 0227 761824. You can see his WWW home page by accessing* `http://www.hillside.co.uk/`.

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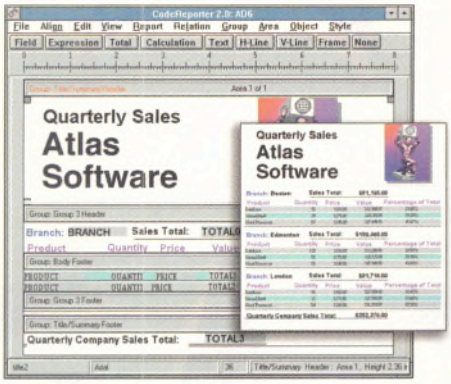

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A recipe for good X Part III

In the third and final part of **Niall Mansfield's** symposium of Motif programming he illustrates the art of hierarchical menus, ending with an acutal Motif utility.

In the last article you built a very simple menu program, with a few buttons to enable you to initiate other programs. Now we are going to extend this, so you can have a hierarchy of menus, using Motif's facilities for pull down menus. You will see how to use normal text labels on buttons, or use icons so that your menus are more interesting and perhaps more obvious for the users too. We're also going to use the **editres** tool to view the internal structure of our program, to see the structure of the widgets within it, and to change various parameters interactively.

First there was one

First, let's look at a very small program, containing a menu bar with a single pull down **File** menu, which contains just two buttons, **Open** and **Quit**. For simplicity, these buttons don't do anything. We just want to look at the structure of the program and the resulting widget tree. Figure 1 lists the program.

The program breaks down into a number of stages. First, as usual, we initialise the Toolkit. Then, we create the menu bar as a child of the main window, using the Motif convenience function **XmCreateMenuBar**. This is just a container. Now we have to build the pull down menu to be attached to it.

The next step is to create the pull down menu pane itself using **XmCreatePulldownMenu**. However we *do not* manage this widget, that would cause it to become visible as soon as the application starts. Instead we leave it unmanaged. When the user runs the program and clicks on the **File** button, the pull down will be managed by the menu system, so it will become visible, ie it will be pulled down. Then we create the two buttons, **Open** and **Quit** as children of this menu pane, as you would expect.

However, the next step is not so obvious. We now create the **File** button which will be visible on the menu bar. There is a special type of button called a **CascadeButton**, used for this specific purpose in menus. It links a pull down menu to the menu bar and causes the menu to pull down when the cascade button is pressed. For it to work correctly, the cascade button must contain information about which of the (possibly many) pull downs it is to operate; this is achieved by setting the cascade button's **XmNsubMenuId** resource to the address of the pull down menu widget it is to control. The **XtSetArg** line stores this parameter

```
#include <Xm/PushB.h>
#include <Xm/CascadeB.h>
#include <Xm/RowColumn.h>
#include <stdio.h>
main(argc, argv)
  int argc;
  char **argv;
{
  Widget mytop, this_pulldown, this_cascade,
              this_button, mbar, XtAppInitialize();
  XtAppContext myappc;
  Arg myargs[1];

  mytop = XtAppInitialize
              (
                 &myappc, "Menuprog", NULL, 0,
                 &argc, argv, NULL, NULL, 0
              );
  mbar = XmCreateMenuBar(mytop, "menu-bar", NULL, 0);
  XtManageChild(mbar);
   this_pulldown = XmCreatePulldownMenu(mbar,"MP",NULL,

/* don't manage! */
  this_button = XmCreatePushButton
                    (
                      this_pulldown, "Open", NULL, 0
                    );
  XtManageChild(this_button);
  this_button = XmCreatePushButton
                     (
                       this_pulldown, "Quit", NULL, 0
                     );
  XtManageChild(this_button);
    XtSetArg(myargs[0], XmNsubMenuId, this_pulldown);
  this_cascade = XmCreateCascadeButton
                      (
                        mbar, "File", myargs, 1
                      );
  XtManageChild(this_cascade);
  XtRealizeWidget(mytop);
  XtAppMainLoop(myappc);
}
```

Figure 1 - A simple program with menu and two buttons

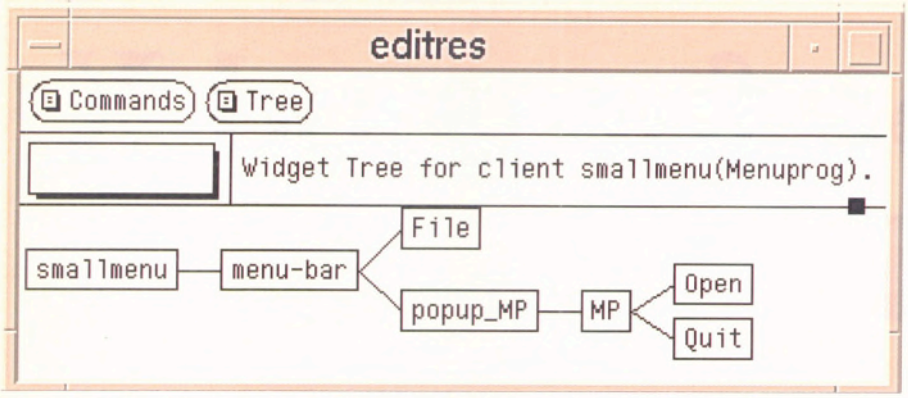


Figure 2 - The widget structure of program in editres

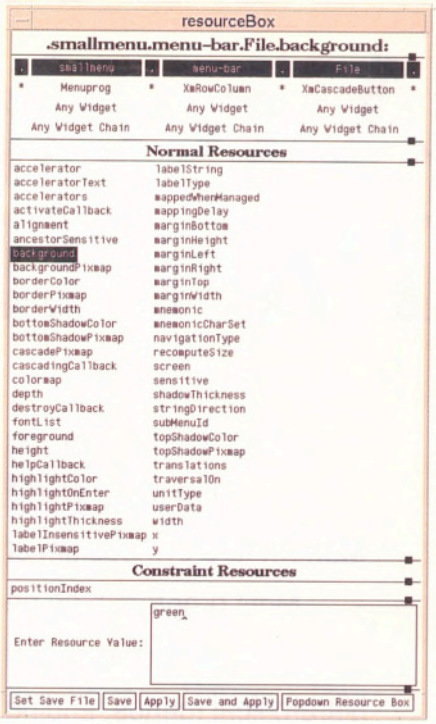


Figure 3 - Resources that apply to menu

in an argument array, **myargs** which is then used in the call where the cascade button is created.

So now, we have created the menu bar, the pull down menu with its buttons and the cascade button linking the pull down with the menu bar. All that remains is to do the usual **XtRealizeWidget** and enter the Toolkit's main loop. When you compile, run then click on the **File** menu, you get the pull down menu.

Editing resources

Now let's look into this program's structure using the **editres** tool. As its name might indicate, this is for editing resources. You use it by starting up your Toolkit program first, then running **editres**. From the **editres** menu bar, select the **Get Widget Tree** option in the **Commands** pull down. Your cursor changes to a cross-hair and the **editres** message area tells you to click on the program you want to look at.

Figure 2 shows you the widget structure of your application. At this stage you can click on a widget, such as the **File** widget which then becomes highlighted. By selecting the option **Show Resource Box** from the **editres Commands** pull down, you get a dialog listing the resources which apply to this widget as shown in Figure 3.

With this you can interactively change resources, and so the appearance and behaviour, of your program. For example, by choosing the **background** selection and entering a new colour then clicking on the **apply** button your application changes immediately.

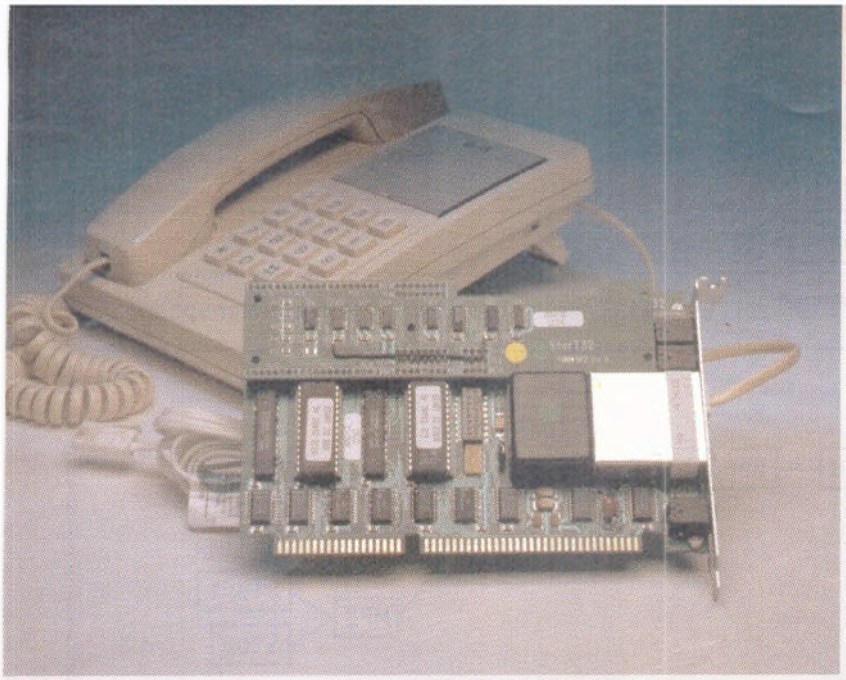
An X hierarchy

Although it isn't possible to cover **editres** in any great detail due to space, we do need to look more closely at the widget structure which **editres** has made clear, because it probably isn't what you expected. First of all, there is a new widget in there called **popup_MP** which you didn't explicitly create. In fact, **XmCreatePulldownMenu** did this all on its own. It is the parent of the widget you *did* ask for, ie the menu-pane **MP**. The reason for this is complicated, so prepare to get confused. In the X window sys-

```
#include <Xm/PushB.h>
#include <Xm/CascadeB.h>
#include <Xm/RowColumn.h>
#include <stdio.h>
main(argc, argv)
  int argc;
  char **argv;
{
  Widget mytop, pulldown_1, pulldown_2,
            cascade_1,cascade_2, this_button,
            mbar, XtAppInitialize();
  XtAppContext myappc;
  Arg myargs[1];

  mytop = XtAppInitialize
              (
                &myappc, "Menuprog", NULL, 0,
                &argc, argv, NULL, NULL, 0
              );
  mbar = XmCreateMenuBar(mytop, "menu-bar", NULL, 0);
  XtManageChild(mbar);
  pulldown_1 = XmCreatePulldownMenu
                     (
                       mbar, "MP1", NULL, 0
                     );
  /* don't manage! */
  this_button = XmCreatePushButton
                     (
                       pulldown_1, "Open", NULL, 0
                     );
  XtManageChild(this_button);
  this_button = XmCreatePushButton
                     (
                       pulldown_1, "Quit", NULL, 0
                     );
  XtManageChild(this_button);
  XtSetArg(myargs[0], XmNsubMenuId, pulldown_1);
  cascade_1 = XmCreateCascadeButton
                    (
                      mbar, "File", myargs, 1
                    );
  XtManageChild(cascade_1);
  pulldown_2 = XmCreatePulldownMenu(mbar, "MP2", NULL, 0);
  /* don't manage! */
  this_button = XmCreatePushButton
                     (
                       pulldown_2, "Start", NULL, 0
                     );
  XtManageChild(this_button);
  this_button = XmCreatePushButton
                     (
                       pulldown_2, "Stop", NULL, 0
                     );
  XtManageChild(this_button);
  XtSetArg(myargs[0], XmNsubMenuId, pulldown_2);
  cascade_2 = XmCreateCascadeButton
                     (
                       mbar, "Clock", myargs, 1
                     );
  XtManageChild(cascade_2);
  XtRealizeWidget(mytop);
  XtAppMainLoop(myappc);
}
```

Figure 4 - Code for menu bar with two menus



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tem, windows are arranged hierarchically. This hierarchy doesn't only order the windows, it also governs how visible they are, with the rule 'a child window is clipped by its parent'. This means that any part of a window which falls outside its parent's boundary is invisible. The most obvious example of this is the root window. This is the parent of all application main windows on the screen. Only the parts of those windows within the root's boundaries are visible. So in summary, a child window can be bigger or smaller than its parent, but only those within the parent are visible.

Now consider a pull down or pop up menu. The pull down menu actually extends outside the application's main window. Therefore, this pull down window cannot be a child of the application main window. Indeed it isn't; it is a child of the root window, because that's the only way it will work properly. And that is why the structure displayed by `editres` is as it is: the X window relating to the `popup_MP` widget is a child of the root, and not of the `menu-bar`. Notice also that because of these considerations, the hierarchy of the X windows relating to the application does *not* mirror the widget hierarchy exactly.

You can see more clearly how this works with a bigger example program. This second toy program is similar to the first, but its menu bar has two pull down menus, one for `File` and one for `Clock`. The code for this is very similar to the previous example, with just a few extra lines to create the extra pull down (see Figure 4).

```
><STARTMENU> File
  Quit  Quit
  <ENDMENU>
<STARTMENU> Root-background
  gray  xsetroot -solid gray
  white  xsetroot -solid white
  <STARTMENU>   colours
    green  xsetroot -solid green
    <STARTMENU> reds
      red  xsetroot -solid red
      pink  xsetroot -solid pink
      <ENDMENU>
    <STARTMENU> blues
      light  xsetroot -solid lightblue
      navy  xsetroot -solid navyblue
      <ENDMENU>
    yellow  xsetroot -solid yellow
    <ENDMENU>
  <STARTMENU> patterns
      %plaid        xsetroot  -bitmap
/usr/X11R5/include/X11/bitmaps/plaid
      %mensetmanus  xsetroot  -bitmap
/usr/X11R5/include/X11/bitmaps
/mensetmanus
    <ENDMENU>
  <ENDMENU>
<STARTMENU> Tools
  %calculator  xcalc &
  %terminal  xterm &
  <ENDMENU>
```

Figure 6 - Script to build three pull down menus

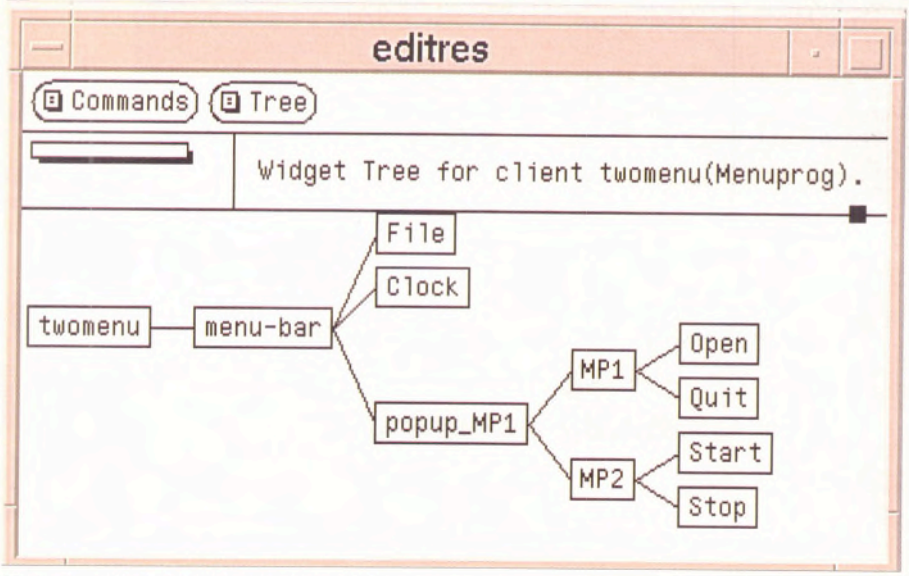

Figure 5 - Resource for program with two menus

As before, the program does nothing useful, but when you look at its structure with `editres`, you start to understand what is happening in the Motif menu internals. The hierarchy for resources in `editres` is given in Figure 5.

The `File` and `Clock` cascade buttons are children of the menu-bar, as you would expect. However, *both* the pull down menu-panes are explicitly created. `MP1` and `MP2`, are children of `popup_MP1`. Why is this? It starts to seem reasonable once you realise that only one of these pull down menus can ever be shown at the same time; so the menu bar can use this single `popup_MP1` for *all* of its pull downs, merely by making the appropriate one `MP1` or `MP2`. Only one is visible at any one time. When we look at the real menu program, below, you'll see the same effect but much more so, because of all the levels of menu.

```
{ initialize the toolkit;
 menu_bar = create the menu bar;
  create_menus_on(menu_bar);
  enter toolkit main loop;
}
create_menus_on(parent)
{
  automatic this_pulldown;
  while (read input line)
  if (this is start of new menu)
    {
 this_pulldown = create new menu
              pane as child of
                    'parent';
    /* recursive call */
create_menus_on(this_pulldown
    }
  else if (this is end of menu)
    return;
  else
```

Figure 7 - Pseudo code that creates menus recursively

Something useful (at last)

Now that we've covered the background, let's move on and do something useful at last. We want to have a menu bar with multiple pull down menus. Each of these may contain sub-menus and so on. Like all good programmers, we don't want to have to rewrite this program each time we need a new set of menus. So, just like last time, we will read in a text file which describes what the menu structure is and what each button is to do (which Unix shell command it is to execute). We need a bit of syntactic fluff to make it easy to interpret the input and make it obvious how the menus are nested; for this, we will use marker strings `STARTMENU` and `ENDMENU` as the first words on a line. (And for a start menu line, the rest of the line is taken as the label on the menu's cascade button.) Figure 6 is a script we prepared earlier which has three pull downs (`File`, `Root-background` and `Tools`). One of these has several levels of sub-menu.

The best way to handle a hierarchical structure like this is with a recursive program, so that we create the widget tree we want with as little code as possible. Figure 7 shows in pseudo-code what we want to do. The `create_menus_on` function builds all the menu at one level. If halfway through its execution a sub-menu has to be built, `create_menus_on` calls itself recursively to handle the sub-menu(s). When they are done it continues on with the rest of this level. Figure 8 lists the code proper for the program.

The main routine mirrors the earlier examples. It passes all the work to the recursive `create_menus_on` function. The callback functions `do_shell_command` and `quit_cb` are exactly the same as last

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```
#include <Xm/Label.h>
#include <Xm/Separator.h>
#include <Xm/PushB.h>
#include <Xm/CascadeB.h>
#include <Xm/RowColumn.h>
#include <.stdio.h>
#define MAX_LINE_LENGTH 1000
#define MAX_N_BUTTONS 50
#define QUIT_CMD "Quit"
#define STARTMENU "<STARTMENU>"
#define ENDMENU "<ENDMENU>"
do_shell_command(w, s)
   Widget w;
   String s;
{
  system(s);
}
quit_cb(w)
   Widget w;
{
  exit(0);
}
main(argc, argv)
  int argc;
  char **argv;
{
  Widget mytop, qbut, mbar,
              XtAppInitialize();
  XtAppContext myappc;

  mytop = XtAppInitialize
              (
                &myappc, "Menuprog",
                NULL, 0, &argc, argv,
                NULL, NULL, 0
              );
  mbar = XmCreateMenuBar
            (
              mytop, "menu-bar",
              NULL, 0
            );
  create_menus_on(mbar);
  XtManageChild(mbar);
  XtRealizeWidget(mytop);
  XtAppMainLoop(myappc);
}
create_menus_on(parent)
   Widget parent;
{
  char buf[MAX_LINE_LENGTH];
  char *s;
/* used in recursion */
  Widget this_pulldown;
  while ( (s = gets(buf)) != NULL)
  {
  char *this_cmd, *this_label;
  Arg myargs[1];
  /* skip leading whitespace */
  while (isspace(*s)) s++;
  split_line(&this_label, &this_cmd, s);
  /* new pulldown menu */
  if (strcmp(this_label, STARTMENU) == 0)
    {
    Widget this_cascade;
    this_pulldown = XmCreatePulldownMenu
                                (
                                  parent,
                                  "MP",
                                  NULL,
                                  0
                                );
    XtSetArg
    (
      myargs[0], XmNsubMenuId,
      this_pulldown
    );
    /* don't manage! */
    this_cascade = XmCreateCascadeButton
                   (
                     parent, this_cmd,
                     myargs, 1
                   );
    XtManageChild(this_cascade);
    create_menus_on(this_pulldown);
    }
  else
  if (strcmp(this_label, ENDMENU) == 0)
    return;
  /* another button on this menu */
  else
    {
    Widget this_button;

     if (*this_label == '%')
     {
     /* discard the % */
     this_label++;
     this_button = XtVaCreateWidget
                   (
                     this_label,
                     xmPushButton
                     Widget Class,
                     parent,XmNlabelType,
                     XmPIXMAP,
                     XtVaTypedArg,
                     XmNlabelPixmap,
                   XtRString,
                   this_label,
                   strlen(this_label)+1,
                   NULL
                   );
      }
      else
      this_button = XmCreatePushButton
                    (
                      parent, this_label,
                      NULL, 0
                    );
     if (strcmp(this_label, QUIT_CMD) == 0)
      XtAddCallback
      (
        this_button,
        XmNactivateCallback,
        quit_cb,
        this_cmd
      );
     else
      XtAddCallback
      (
        this_button,
        XmNactivateCallback,
        do_shell_command, this_cmd
      );
     XtManageChild(this_button);
     }

  }
}
split_line(plab, pcmd, s)
   char **plab, **pcmd, *s;
{
  char lab[MAX_LINE_LENGTH],
       cmd[MAX_LINE_LENGTH];
  char *l = lab, *c = cmd;
  /* copy label */
  while (!isspace(*s)) *l++ = *s++;
  *l = '\0';
  /* skip blanks */
  while (*s != '\0' && isspace(*s))
    s++;
/* copy command */
  while (*s != '\0') *c++ = *s++;
  *c = '\0';
  *plab = strdup(lab),
   *pcmd = strdup(cmd);
}
```

Figure 8 - Code to build menus recursively

month. However, we have included a new support function, **split_line**, to break a string into two parts, the first word, and the rest of the line, to make the code more modular.

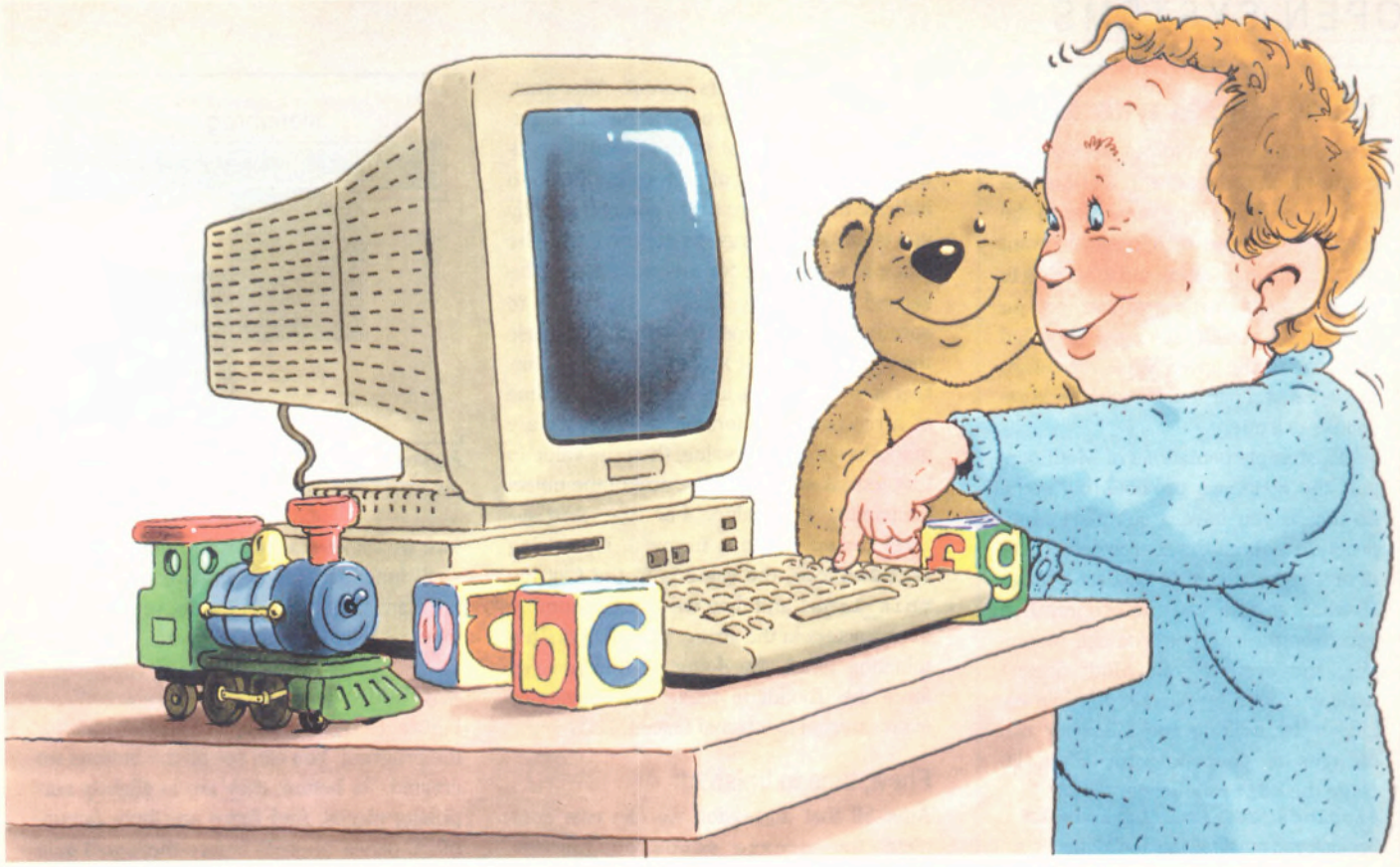
The **create_menus_on** function is the heart of the program. As shown in the pseudo-code, this function divides into three parts, one each for the start of a new menu, the end of this menu, and one for adding buttons onto this menu. Building a new menu follows the same three steps as in the first simple example: create the pull down pane, create the cascade button linked to it and add the buttons onto the pane. To make the overall menus more useful, we've added some extra code into the button-creating third of the function. If the name (**label**) of the button begins with a percent sign, we take the rest of the name to be the name of a bitmap (in the standard X location) which is to be displayed on the button instead of the text.

A tricky problem

Let's look more closely at how we created a push button with a graphic on it instead of text. The Motif push button has a resource **XmNlabelType** which indicates how the button is to display. By default the value of this resource is **XmSTRING**, giving the text behaviour you are familiar with. However, if this resource is set to **XmPIXMAP**, then the value of a second resource **XmNlabelPixmap** is taken as a picture to be displayed instead. You can try this out for yourself very easily, using the **-xrm** resource setting flags on the command-line, with any Motif program containing a push button:

```
hellow -xrm
'*labelType: PIXMAP' -xrm
'*labelPixmap: cross_weave'
```

Unfortunately, to do the same thing inside a program is not so simple. The name **cross_weave** is the name of a file containing an ASCII description of a bitmap. The push button resource actually wants an X data format called a *pixmap*, which is an internal format with colour details included. Somehow, we must read the file we have named and create this internal data type. With the command-line flags, we let the toolkit handle all that for us automatically, but within a program we have to do a lot more work. Motif is messy in some places, and this is one of them. We get around this to some extent by using a special variant of the widget creation Toolkit function. The **XtVaCreateWidget** creates a widget; where the first argument is the name of the widget, the second its type (PushButton



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CIRCLE NO. 695

Using editres with Motif

The **editres** resource editing program was introduced with X11 Release 5. It works by sending messages to the application whose resources you want to edit. The application must be able to receive these messages and act on them, for example setting a specified resource to the given value, or return the value of a particular resource in response to a query.

Most implementations of Motif support the **editres** protocol, but some do not. If you have a compiled Motif program without the source code there is nothing you can do (except whinge at whoever sold you the program). If you have the sources, you can recompile, and even if your Motif doesn't honour editres by default, you can enable it by making the following two changes to your program. First, include the **editres** header file:

```
#include <X11/Xmu/Editres.h>
```

Second, you must tell the Toolkit that it is to take notice of editres messages sent to it. You do this by adding an event handler to the top-level widget in your application:

```
XtAddEventHandler(mytop, (Event-
Mask) 0, TRUE, _XEditResCheckMes-
sages, NULL);
```

With these changes, your program will now work with **editres**.

here) and the third its parent. After that, you can enter a variable number of arguments (VA - var args) as described here, finally ending the list of args with a **NULL** to indicate that no more are to come. Normally you enter pairs of args, where the first is the name of a resource for this widget, and the second is its value. This is what we do to specify the label type. However, if you use the special keyword **XtVaTypedArg**, a further four arguments are expected: the name of a resource, the format in which we are going to specify the value, then the value in that format and finally the size of the object containing the value. For the **XmNlabelPixmap**, the format is string (**XtRString**), the value is in the C-string **this_label** and then we give the number of characters in the string, including the terminating **NULL**. By doing all this you can force the Toolkit to make the conversion from external to internal format.

Phew, time to finish off

After all that digression we can now complete the **create_menus_on** function. Having finally created a button in the format required, we check to see if its name is the special word '**Quit**'. It's only special because we decided it should be. It lets the person writing the script put a **Quit** function anywhere. This means there's very little special-case programming required to handle it. If it is a **quit** button, we register the **quit** callback on it; otherwise, as before we register a callback which will call a shell function. Now at last we can run the program. The script show above will give a menu as illustrated in Figure 9.

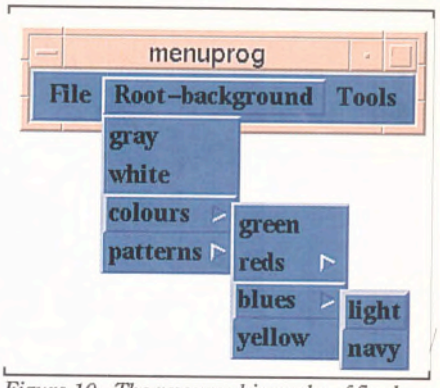

Figure 10 - The resource hierarchy of final program

A genuine hierarchy

Figure 10 is a screenshot of **editres** for the program. You can see all the buttons we created. As before, they are in slightly surprising places. And there are three popup-menu panes whereas before there was only one. On inspection, you can see that all buttons at a particular level of menu are grandchildren of the same pane, even though they don't necessarily appear together. For example, **Quit** and **gray** are at the same level. In fact there are three popups because we have three levels of pull down menu, so three menus *can* now be on screen simultaneously. The child widgets are grouped accordingly. And of course, the names would be clearer if we had separate names for each pane we created, instead of using **MP** for each one; however, we did that to reduce the amount of non-Motif and therefore non-interesting code.

This is X

So there it is, a useful tool written in less than 100 lines of Motif code. The examples in these last three articles have covered most of the important techniques of Motif programming. You have seen the basic structure of a Toolkit program, how widgets are created in a hierarchical structure and how you can use callbacks to link your own functionality onto the user interface components such as buttons and menus.

Items we have omitted are widgets, such as the Form, which provide a much more sophisticated layout than the RowColumn we have used, popup dialogs, creating your own resources, editing text and drawing graphics. These are just some of the pleasures which lie ahead of you. Bon voyage!

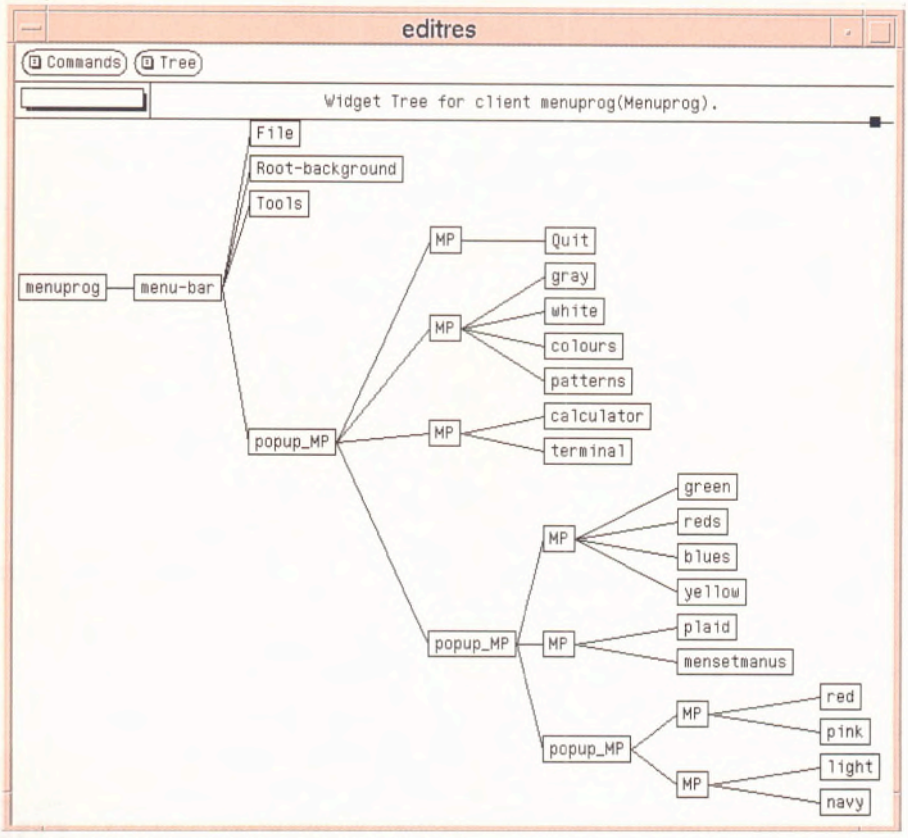

Figure 2 - Possible states for a Modem object

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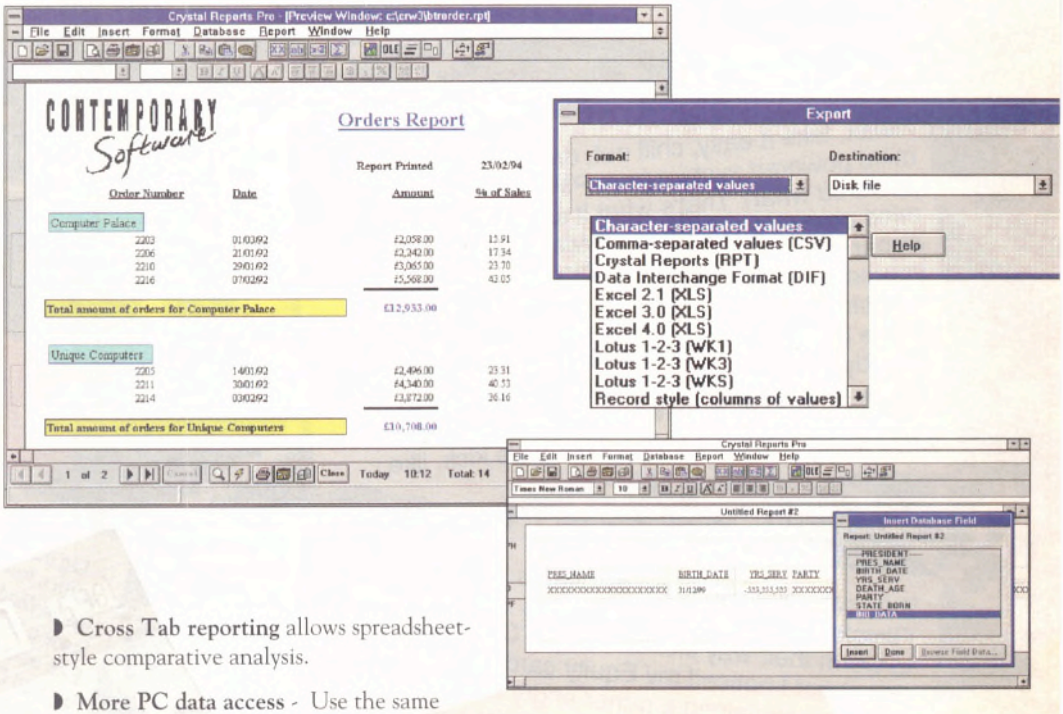

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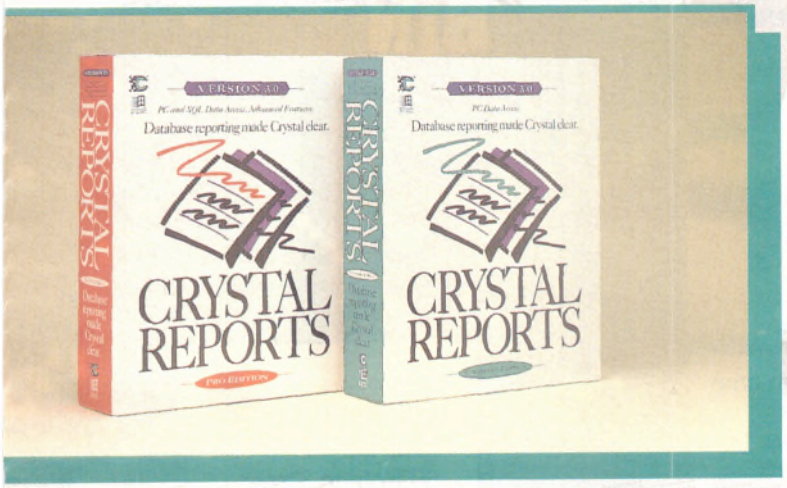

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CIRCLE NO. 696

Ctrl

Iowa University moves into the driving seat with the Iowa Driving Simulator built around a Harris Night Hawk computer. Cocooned in a contraption that resembles a flight simulator, budding Damon Hills can cruise the virtual highway, complete with traffic, contra flows and hedgehogs. EXE can report that at least one Tory MP was stopped yesterday for virtual kerb crawling.

Relax, take it easy, chill out, drop out..Woodstock.. mind powered system from PMS. Eh? Mind powered what? That's what it says here mate: 'a mind powered system to alleviate stress.' Apparently it's all to do with biofeed. You wire yourself up to the computer; it then figures out how stressed you are. Then you can go for a coffee break. EXE technical lab has been working secretly on a quicker, more permanent way to relieve tension at work which, when wired to a suitable guinea pig, gives a little more kick, like 240V more...

EXE can reveal that the dinosaurs in the *Flintstones* were fakes, impostors who managed to worm their way into the script. 'Day before the first shoot I noticed my Equity card had gone missing,' explained a rather angry looking T Rex. 'Next thing I knew, the makeup artist had smudged the eyeliner and lipstick. It was no good. They filmed without me. It was only when I saw the movie that I noticed they had used someone else instead.' Yes it's true. And the offenders are British, a Cambridge outfit called MicroRobotics which supplied the electronics for the computerised puppets.

GARBAGE COLLECTOR

Dig out those old listings. they could be worth a few bob (an EXE T-Shirt, Pen and Magic Windows Mug, actually). As the leading Software Developers' magazine, EXE asks You, the reader to send in your Big Bad Code (BBC) listing. All entries must be under 10 lines of source code and include a sentence or two on why they're baaad.

Here's one our Editor admits he wrote some time ago (last Thursday actually, but don't tell him I told you).

```
...
void main (void)
{
char* pCh;
strcpy (pCh, "Big Bad Code");
printf("%s", pCh);
}
```

Guess he hasn't heard about **malloc()**.

CODE BIN

Poor Melanie, our hard working Sub Editor, had a tough time finding a suitable caption for this photo which appeared mysteriously on the Production Desk last week. Can you help? Send in your funniest caption. Best one wins a £10 Music Voucher.

Listings to the Garbage Collector, completed Crosswords and inspired thoughts for the Photo Caption should be addressed to:

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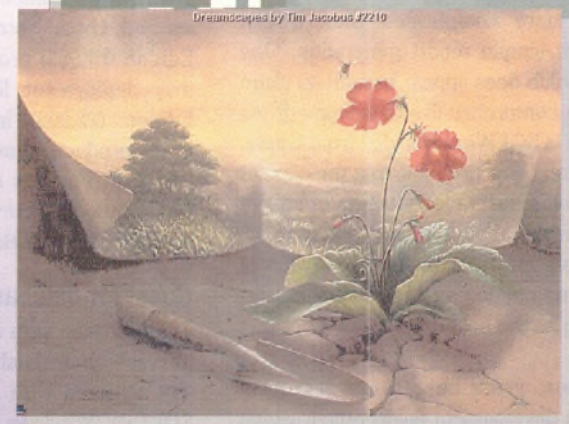
Break

Sifting through the mountain of software this month, David came across this, one of several, pretty screen savers from Second Nature Software. Unfortunately for him, his poor little 386 SX just couldn't take it. So here's a screenshot from my disgustingly fast 486 DXF. In case you're wondering, Intel has gone hexadecimal...



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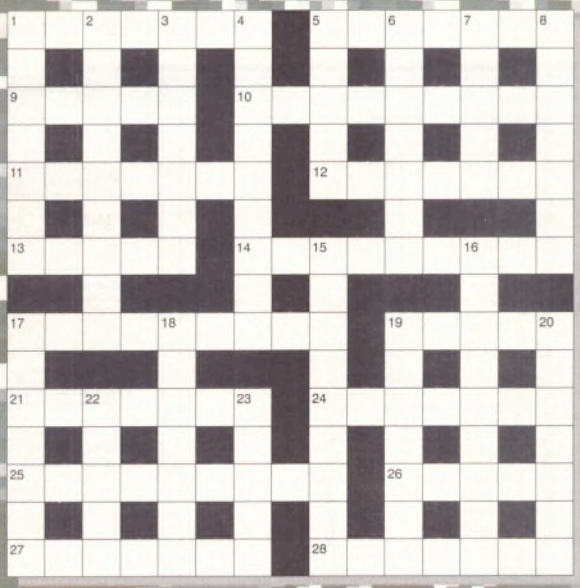
PRIZE CROSSWORD



ACROSS

1. Collect data to translate (7)
5. A sugary clone (7)
9. Earful on the line (5)
10. Surgical system? (9)
11. Fighting medievally, headlessly pushing out. (7)
12. Three-toothed missile. (7)
13. Wear away as Elizabeth went by horse. (5)
14. Best left to experts with technique? (9)
17. Before screen flasher that gives warning. (9)
19. Pentavalent impurity with blood to spare? (5)
21. Summary to be coded later. (7)
24. Amends with current data. (7)
25. Get rid of broken line I tame. (9)
26. Lager ones best avoided. (5)
27. Wandered off with broken paces & yearning start. (7)
28. Spanish festivals for screen animations. (7)

DOWN

1. Cheer up the operator's. (7)
2. It gives immediate access to data. (4,5)
3. Tick off and list chunks of data. (7)
4. Increase size of almost lone logic elements. (9)
5. Creative person's job finder. (5)
6. Where you embark on a network. (7)
7. Aries may somehow lift up. (5)
8. Two-fingered in our cases. (7)
15. Cyclic displays of videotex pages. (9)
16. Build an algorithmic base. (9)
17. Business between input and output. (7)
18. Useful little routine. (7)
19. Cheat on the roof with a fresh start. (7)
20. How chips' coating opposes current. (7)
22. Three way start then hesitation for game one. (5)
23. Antelope from oriental country. (5)

This month's crossword is sponsored by Lotus who is giving away a copy of ScreenCam, a Windows screen and sound capture utility. July's Crossword winner was Christine Grover.

SOLUTION TO AUGUST'S CROSSWORD. ACROSS: 1. COLLATE 5. TRAFFIC 9. LOGIC 10. TERMINALS 11. MACHINATE 12. ARSON 13. SELECTS 15. TOILERS 17. STYLISH 19. TANGENT 21. GRATE 23. CARRIAGES 25. ATTRIBUTE 26. ITEMS 27. STRINGS 28. SATANIC **DOWN:** COLUMNS 2. LOGICALLY 3. ASCII 4. ENTRAPS 5. TORMENT 6. ANIMATION 7. FLAGS 8. CASINOS 14. CRITERION 16. EVERGREEN 17. SIGNALS 18. HICCUPS 19. TARGETS 20. TESTS IC 22. ALTER 24. IDIOT.

Taking the fifth

SQLWindows 5.0 marks a new direction in Gupta's offensive to break the dominance of traditional tools from database suppliers. **Ian Murphy** examines the approach it has taken.

As people look for better and easier development tools, we are due for a rush of GUI builders on the market: some new, others substantially improved from previous versions and some which are of little use for anything more complicated than screen building or simple report generation. One product which does appear to fulfil its claim of being a comprehensive development environment is SQLWindows v5.0 from Gupta. Unfortunately, it is probable that the current hype surrounding the acquisition of shares and statements about Oracle wanting to acquire Gupta may just overshadow what is likely, in my opinion as a journalist and developer, to be the best development product of 1994.

For some years now, Gupta has been shipping a development environment which whilst winning awards and capturing a large share of its target market, has failed to break the domination of the traditional database vendors and their often, overly complicated, extremely expensive and under powered tools. Gupta's own figures of 36,000 SQLWindows licences as of December 1993 demonstrates this. However, the launch of v5.0 and the 50,000 copies of SQLWindows Solo which Gupta is about to give away free should change this and ensure that there is a future for the company, without it becoming a subsidiary of Oracle.

Client/server in a box

SQLWindows is a collection of tools. Solo, which is currently being shipped free, is a single user limited size Gupta SQLBase engine. Starter Edition (£995) adds new libraries and Lotus Notes integration; Network Edition (£1,995) provides unlimited connectiviy deployment licences and Corporate Edition (£2,995) includes the TeamWindows product, some CASE tools and the compiler. For this review of the product I was using the Corporate Edition and the Windows NT SQLBase v5.2 engine.

Quest for database design

The first step with any database product is to create your database. This was traditionally achieved with the SQLTalk/DOS and SQLTalk/Windows products. It would appear that there has been no work done on these products in this release. I believe that the future may well see both of these products fall by the wayside in preference to Quest which supplies a full graphical front end for database administration. Viewing the system catalogue, adding/modifying/deleting tables, creating new forms, building reports and queries which can later be distributed in runtime form for users can all be done from here. Quest can also be given out as an end-user product which saves a lot of problems for people wishing

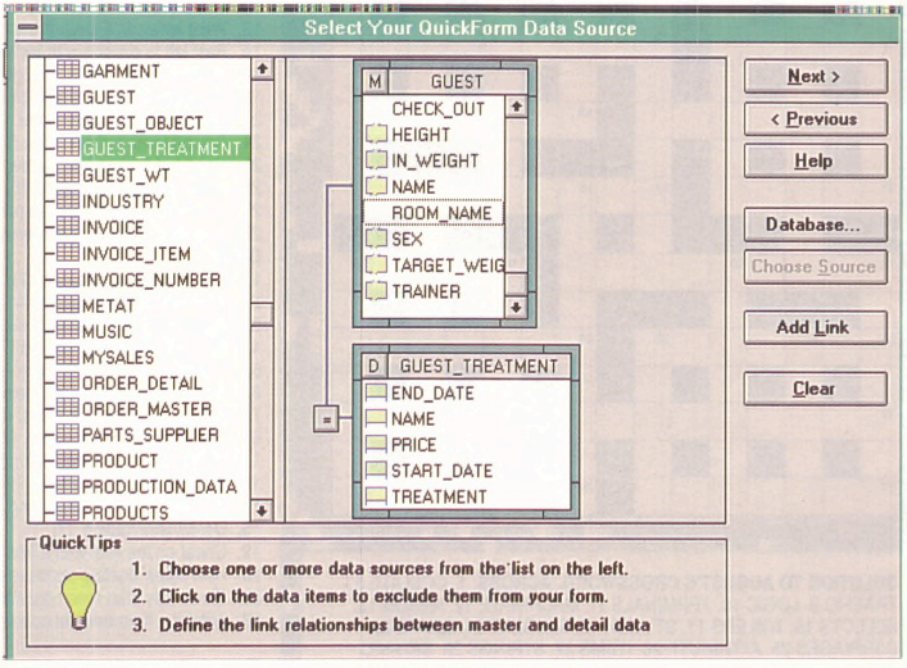
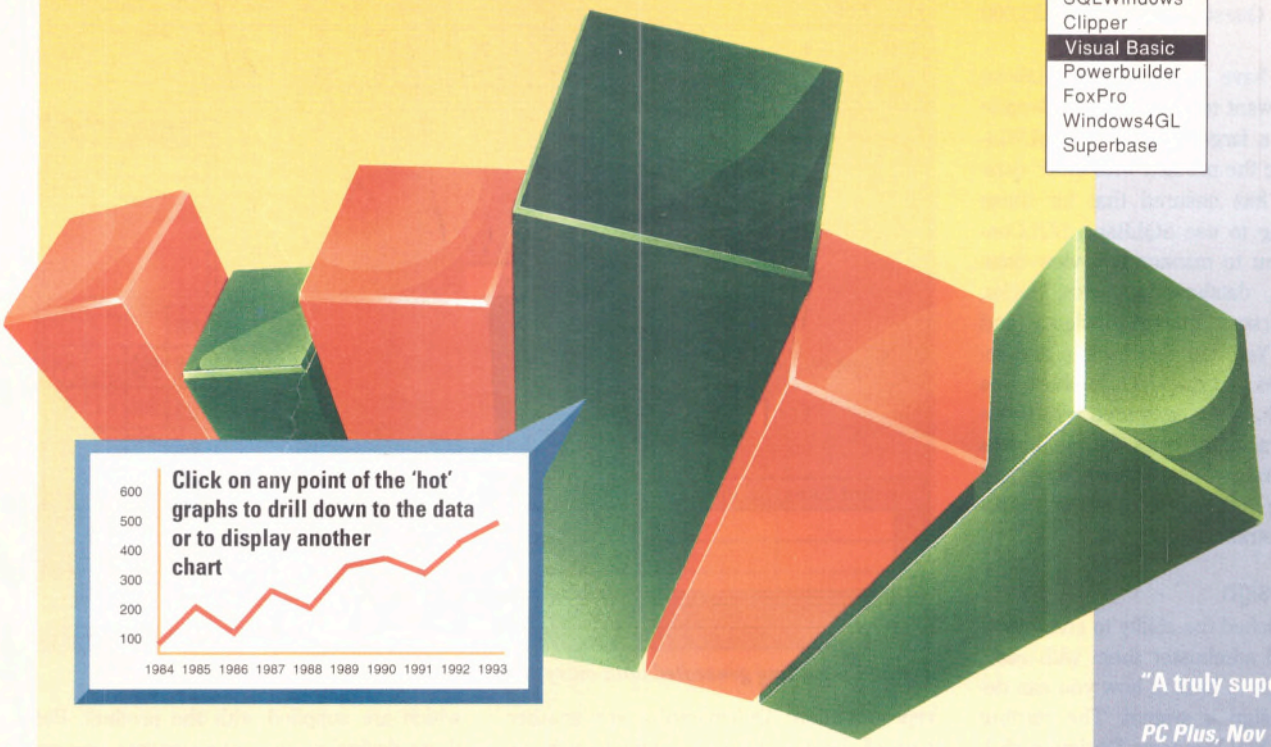


Figure 1 - QuickForms, a starting point for building apps

TeamWindows is potentially the make or break part of this release

Language

Visual C++
C/C++
SQLWindows
Clipper
Visual Basic
Powerbuilder
FoxPro
Windows4GL
Superbase



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dGE has been voted Best Graphics Tool for six years in a row, and in 1992 Graphics server was voted Best Add-on DLL. Microsoft licensed our technology for the graphs in Visual Basic Pro (we've added 'hot' graphs to our VBX since then).

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The future of applications development lies in 'components' which programmers can use time and again. Graphs and charts are part of so many of today's applications that it makes sense to use the same graphing component, especially one which 'gets full marks for coming with so many interfaces' *(Windows Tech Journal, April '93).*

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If your long-term plans include Windows NT, you can be confident that Graphics Server will still deliver the charts you want. In the latest release we have added a 32-bit version for Windows NT. And we have developed an OLE 2.0 automation server - the beginning of the end for function calls!

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Graeme Kitt John Marsh

"A truly superb tool"

PC Plus, Nov '93

"You won't find an easier way to add charting to your Windows applications"

PC Magazine, Sept '93

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to build their own reports. As a product in its own right, Quest has sold some 33,000 copies.

Once you have created your database you will then want to administer it. Despite the fact that a large number of SQLWindows sites use the product with other databases Gupta has ensured that for those people wishing to use SQLBase, SQLConsole allows you to manage and view database activity, database statistics, locks, processes, cursors; cursor efficiency and cache usage. You can also backup and restore databases and map I/O. In short, this is a tool which, when compared with those shipped by Oracle, Informix, Sybase, Ingres *et al*, demonstrates Gupta's capability in and understanding of the needs of DBAs and database administration in general.

SQL thru design

Having established the ability to create new databases and administer them with ease, the next step is to look at how you can develop and design a system. The starting point here is SQLWindows Designer v5.0. When you first start SQLWindows Designer, in line with other Windows based products, you are given the opportunity to use a quick design tool, in this case, QuickForms shown in Figure 1. You are then asked to select the type of Window you want to create. Once you have decided on whether to use a Form window or an MDI window, you are asked to choose the data source. A full list of tables in our database is then displayed from which we can now select those tables we need. From these we choose a small number of fields. Once we have decided on the tables and ensured that the links between our tables are established, SQLWindows builds a sample form as shown in Figure 2.

At the top of the form is a standard set of buttons which can be edited by clicking on the right mouse button. These are part of the General Windows Class `cQuickCommander`. Creating default forms is nothing new but when you want to work with them, to add features or objects, then that is where speed of development is important. In the early days of Windows development, hours could be spent designing a button for the screen, let alone testing and debugging the code which lay behind it. The toolbox provided with SQLWindows ensures that there is little you need to do to add an object to the screen bar. Simply select the type of object from the toolbox.

Adding menu bars to the screen is also designed to be a simple task with no code writing required. A facility called QuickGraphs is also available. This allows you to link the data on the screen with a graphical

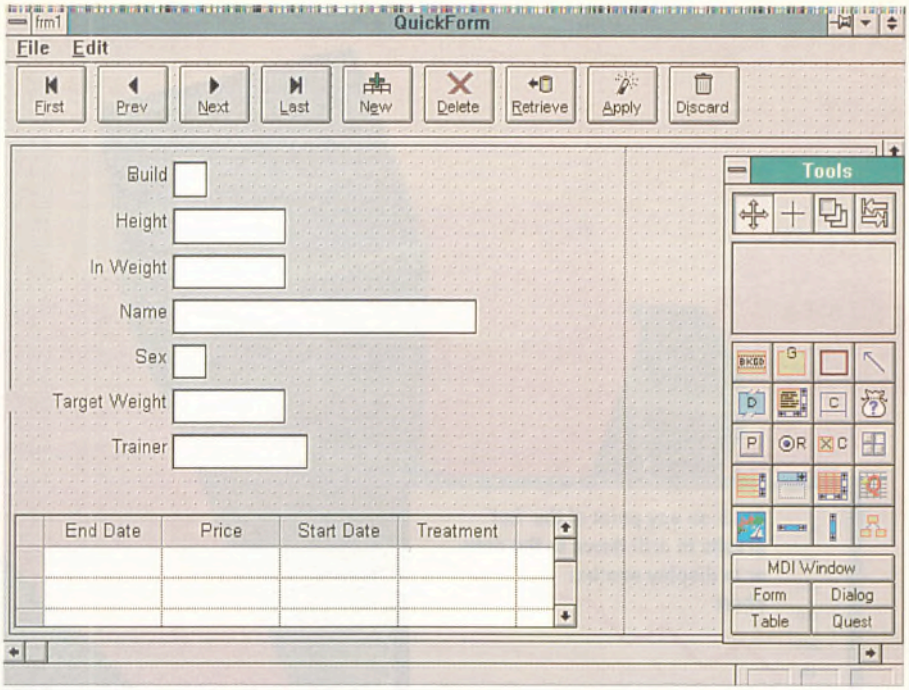


Figure 2 - Editing generated data-entry form

representation. QuickGraphs are another part of the QuickObject technology introduced into this release by Gupta. Many systems designers today are working with their users to create macros or Visual Basic routines which can be run from MS Excel to grab data from a database and display it both in textual form as well as graphically.

> **SQLWindows v5.0 should pick up some substantial market share from corporates with large Notes installations**

Whilst I would not like to suggest that SQLWindows is a replacement for these systems, where there is limited graphing of data taking place, then it may provide a more robust solution particularly where data will be updated and has to be written back to the database.

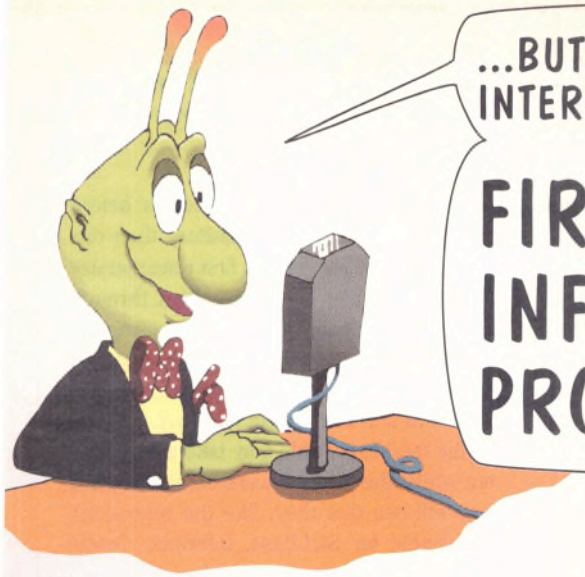
It's all in the object

For those of you used to Visual Basic, PowerBuilder and several other tools, it may appear that there is nothing new here. On the surface, there probably isn't. But it is beneath the surface that SQLWindows v5.0 stands out from the crowd. Gupta has invested a lot of money in its QuickObjects technology and is serious about ensuring that it doesn't just make claims over being object orientated, but can prove it too. This shows itself in the vast array of libraries which are supplied with the product. For those designing corporate systems, one example is the QCKMAIL.APL (quick mail library) which provides integration into any MAPI, VIM or MHS compliant email system. To add the QCKMAIL.APL line to the library section; to add an address field, address book button and send button takes less than 2 minutes. The inclusion of a mail library is also a feature which Gupta's competitors have yet to realise. When designing distributed, corporate wide applications you should no longer need to spend time fighting APIs and several hundred lines of C code.

In addition to this there is the NOTESLIB.APL which provides integration into Lotus Notes and contains library classes which allow you to logon onto a Notes database, pass and receive data and use Notes mail. As a consequence your address book becomes available to you without you having to re-enter all of your names and address into a Gupta table; you can run Notes macros, search databases and check error messages. Given the criticisms recently levelled at, and acknowledged by, Lotus over developer support, ease of use and need for a more comprehensive development environment, SQLWindows v5.0 should pick up some substantial market share from corporates with large Notes installations. Indeed, for the small developer, given that there are over 750,000 Lotus Notes licences currently installed, QuickObjects for Lotus Notes represents an opportunity for immediate return on investment.

Getting native

The term compiling is used in two instances



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within SQLWindows. SQLWindows is an interpreted language. A compile from the compile menu option syntactically checks the source, the variable references, and the integrity of the class hierarchy, but does not compile the application into a binary executable. Because it's an interpreted language certain operations are a lot slower than when compared to a traditional 3GL language. The SQLWindows compiler was introduced to provide the ability to compile sections of SQLWindows procedural code into C DLLs to enhance performance. To use the SQLWindows compiler you will need Visual C++ 1.5 installed on the machine.

Compiling your application from within SQLWindows Designer will generate code whether or not there is a C/C++ compiler on the machine. However, using the Compiler icon from the program group means that you must have Visual C++ installed on your computer to create the executable.

Other tools

ReportWindows allows you to design reports quickly and easily and then distribute them throughout the corporation to end users. Although I was impressed with the ease of use, it is very much in line with other report generators on the market. From my work with it there are no outstanding features, as such, to make it appear otherwise.

EditWindows is included for backwards compatibility. Previous versions of SQLWindows produced runtime files with the extension .RUN: in order to edit these files you used EditWindows. As you can now produce executable files directly from SQLWindows, there is no use for this product unless you have several old applications in which case I would suggest loading and recompiling these applications to give better performance and an opportunity to enhance them at the same time. The other use for EditWindows was for simple internationalisation of programs without having to go through extensive recompilation. However I

> **I have never been a fan of just changing things by patching directly in runtime or executables**

have never been a fan of just changing things by patching directly in runtime or executables I'd rather see a complete and comprehensive recompilation.

TeamWindows (see Figure 3) is potentially the make or break part of this release. Whilst TeamWindows has been supported in other releases, it has undergone a number of changes which should remove any doubt about the ability of Gupta to deliver a product which can be used in a formal environment as well as for single programmer productivity. When you first start TeamWindows it will immediately upgrade your existing repository so you **must** ensure that you have a valid backup. This is not a reversible process which I can't say makes me particularly happy. In any upgrade, things can go wrong and expecting people to make their own copies of vital files rather than allowing the software to make its own temporary backups seems a design flaw to me.

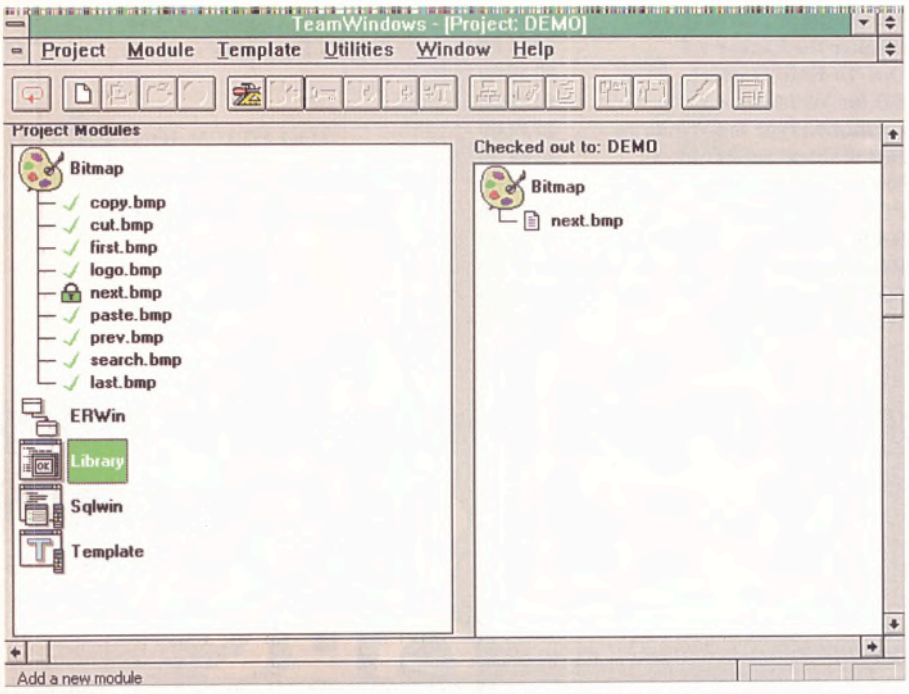

Figure 3 - Working from the repositary with TeamWindows

Being a team player

If you haven't used TeamWindows before and therefore have no repository then one will be created for you the first time you use the product. You are then guided through the creation of your first project or given the opportunity to add the demo project so that you can see how projects work. The first step is to add the project and then compile all the templates. This may take a little time but whilst the templates are being compiled you will see that they, like the repository, are usable for SQLBase, Informix, Oracle and Sybase projects.

Once you have created your templates you can then make any changes or edits to them that you wish using the browse templates option shown in Figure 4. For those who haven't worked in a team orientated environment before, the advantage of this is that all code can be controlled, all input forms, buttons etc can be made to conform to a corporate standard. If, during development, it is felt that changing a layout which has been used numerous times before is necessary, then this can be effected in one quick and easy move.

In order to change a module, you need to check it out, which places a padlock on the module in the project modules window. In the checked out window you can then see the modules checked out and to whom they are checked out. You can then make any changes you want to the module concerned. When you come to check in the module you are asked to enter a note about the change made, whether it was a major or minor alteration and whether the module is complete and ready for promotion to production status. Versioning control is also taken care of by a DLL callable interface to PVCS. TeamWindows makes calls to this interface to enable version control via PVCS to be used on the repository.

Underlying all of this is the Repository Manager which holds all the information about the project and particularly about the database. The depth of this repository manager is shown by the number of databases supported - AS400, DB2, Informix, Ingres, Oracle, Oracle 7, SQLBase, Sybase - and the different CASE tools - LBMS and Popkin. This will enable Gupta to compete effectively on the desktop, on departmental servers where small teams of programmers may be working and more importantly, in the lucrative corporate database design market threatening other players such as Informix, Oracle, Microsoft and Sybase. In recognition of this, Oracle have already made one raid on Gupta's shares and formally an-

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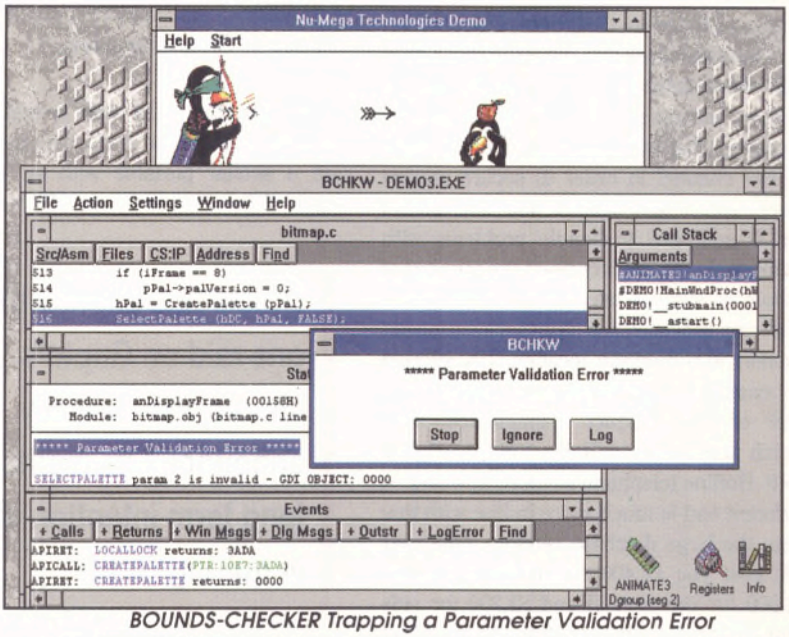

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nounced its medium-long term intention of acquiring Gupta.

Finally there is good network support and full ODBC support within SQLWindows. ODBC is achieved through the ODBC Connectivity kit.

Information search

The manuals are well written and clearly laid out with the *Quick Start* manuals allowing you to create applications quickly and get to grips with the product in a very short space of time. For the more serious programmer the detailed manuals are well written in as much as they list the features available, go through the menu options and give the correct syntax for the different functions. The sample files are compatible and you can load them as programs to modify and learn techniques from, but I felt, at the end of the day, that perhaps a little more could have been done to make the product more usable from a designers point of view.

Technical support is big issue these days with most suppliers wanting to charge for support and many of the database vendors accepting that the low margins often taken by the channel in order to secure market share, mean that dealers and distributors are ill equipped to handle problems with support. Gupta has increased the number of people in support over the last few years. With the movement of Northern European support to a different location, UK support is benefiting. Registered users will get one year of free product maintenance, after which time costs will be 15% of original RRP. Hotline telephone support, however, is different and is much more in line with that from the large database vendors. One year will cost you £2,400 for the first contact, £1,800 for the second and £1,200 for subsequent people although this can be offset by a 60 day trial at £480. For corporate support there is a Star Service including on-site consultancy which has been in place for three years. According to Gupta, once taken, companies continue to renew but at a price of £24,000 per year this may be out of reach of some companies. This price, however, does include product maintenance and I would hope so.

Simply load and go...

Installation is still from floppy diskettes. There are some 20 diskettes in the Corporate Edition package with no immediate plans to move to a CD-ROM based distribution. As befits a Windows product, the installation was simple and easy to accomplish with good installation notes in the manuals. The entire corporate edition took up approx 55 MB of disk space. The product ran reliably, if a tad slowly on an

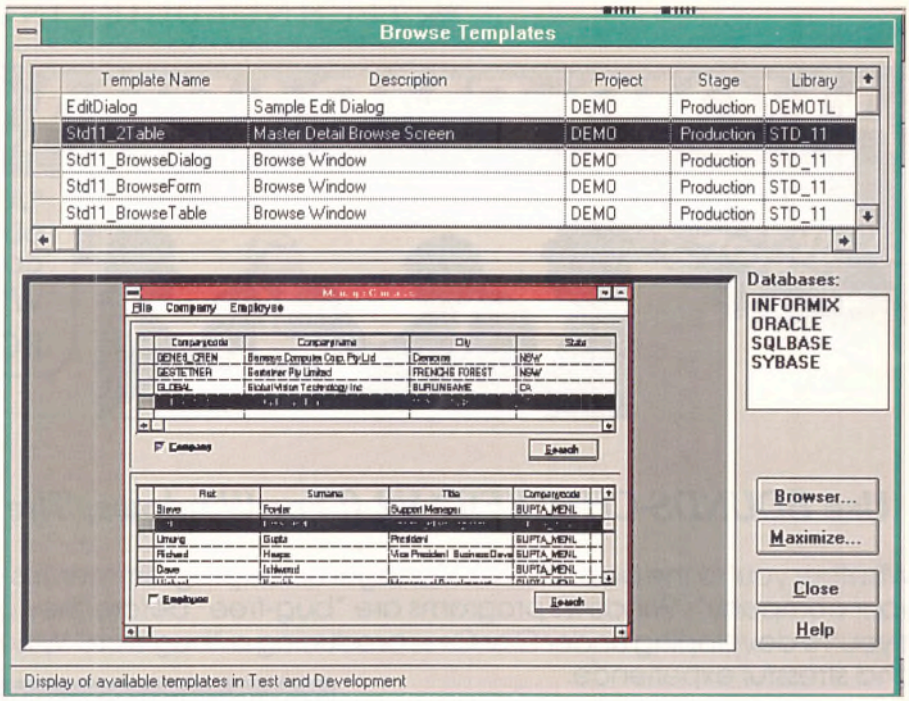

Figure 4 - Browse template

80486 25 Mh z DX with 8 MB RAM although I have seen it running much faster on a similar portable with an equivalent spec. When moved to my HP Netserver it ran, well, like 'greased lightening'. One thing which did annoy me, and which needs addressing, is the adding of icons into the program group. The Corporate edition comes complete with Quest, the Compiler, EditWindows, ReportWindows, TeamWindows, SQLTalk/ Windows and the SQL Console. Whilst all barring the Console can be fired off from the Tools menu within SQLWindows Designer, Quest and SQLTalk Windows are used for DBA tasks on the databases.

Oracle has already made one raid on Gupta's shares and formally announced its medium-long term intention of acquiring Gupta

To sum up

SQLWindows v5.0 finally delivers that which Gupta have suggested was possible in previously releases. The ease of development was truly startling; the simplicity of installation not just on a single machine but running with a SQLBase server under NTAS using Windows for Workgroups on the clients was so easy that it was accomplished by a non-technical person in only a few minutes; the ability to incorporate objects using a mail library and therefore mail enabling my application was achieved in less than two miuntes; I could go on but this is a developers publication not a general market magazine and I suspect that you are more interested in *how* rather than *what*.

All database products, as far as I am concerned, have one single common failing, that of giving some form of introduction to database design and, in particular, an introduction to the needs of RDBMSs and normalisation. Lacking from Gupta's doumentation were a of a couple of chapters covering just the main points and explaining third normal form which could be sectioned in a part of the manual covering performance issues.

Whilst SQLWindows is not aimed at the new programmer there are an awful lot of people who use databases in a standalone environment or share them between a very few users. Often these databases have grown piecemeal. As they are opened up to more and more people then performance becomes an overriding issue. Many employers won't send people on courses to learn proper techniques and therefore products get a reputation for being bad performers when a small manual could be produced to ensure that such claims don't arise from programming ignorance.

Ian Murphy is a Client/Server expert and accomplished Chef (apparently). He can reached by email as imurphy@cix.compulink.co.uk.

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Spreading the News

One of the earliest and most widespread uses of the Internet is that of the Usenet news system explains **Paul Richardson.**

When asked 'what is the Internet?', part of my stock answer is that it is a community. This facet of the Internet predominantly manifests itself in the Usenet news system. Usenet is a large collection of discussion groups in which people 'listen' and 'talk' (electronically speaking, that is). They are similar to CompuServe's forums but generally speaking are more anarchic in nature. Usenet has a widespread appeal by being a worldwide system with a vast number of contributors and having a huge diversity of topics.

Hundred megabytes a day

The relationship between Usenet and the Internet is a trifle tricky to get one's mind around (though not for an *EXE* magazine reader, of course) in that neither is bounded by the other. Usenet is a service that utilises the Internet as a transport mechanism, but news does reach all of the Internet. It is dependant on local policy. Conversely, Usenet extends beyond the Internet to many other computers by using transport mechanisms such as UUCP.

As more and more people join the Internet the number of topics increases and the amount of news traffic goes up. The number of topics rises for two reasons; first because new users introduce new topics, and because the amount of traffic in a topic may become unwieldy and so the group is split. As of the 22nd July, there are over 10,205 topics that comprise Usenet, accounting for about 118 Mb of news being created every day.

Speaking Topically

At this point I need to introduce a little jargon. The *topics* that I have mentioned are referred to as *newsgroups*. An individual contribution is known as an *article* or *posting*. The utility that is used to read and post news articles is termed a *news reader*

To choose a given newsgroup from the 10,000 or so that are available, you *subscribe* to it. When you've had enough, you *unsubscribe*. If you wish to pass comment on someone else's posting and you wish all the newsgroup readers to see it, then you *follow-up*. However, if you wish only the author to receive your message, you *reply*. If you simultaneously post a message to several newsgroups then you are *cross-posting*. Another important concept is that of a *thread*, which is the collection of an original posting and all its follow-ups.

Follow the dot

Newsgroups are denoted using a dot separated hierarchical label rather akin to domain names but with a crucial difference: the most significant component is the leftmost one. As an example, consider one of the most popular newsgroups: `news.announce.newusers`.

The (incomplete) list of top level hierarchies in Figure 1 will give an idea of the diversity of topics available on Usenet. The hierarchies can be categorised 'geographically' or 'topically'. A geographically orientated newsgroup could relate to a country, an organisation or even a town (eg `cam.misc` - miscellaneous threads relating to Cambridge). While I have only mentioned the UK hierarchy, there are hierarchies associated with many countries. The ISO two-letter country code is used.

As an anecdotal aside, I was told recently that since the release of the film *Four Weddings and a Funeral* there have been several postings by Americans to `uk.misc` asking for good best man jokes!

The number of components in a newsgroup name is not fixed. For instance there

alt	The 'alternative' hierarchy (often very)
bionet	Biiological matters
bit	From Bitnet mailing lists
biz	Commercial topics
comp	Everything computer related
gnu	The GNU project
ieee	Institute of Electrical and Electronic Engineers
info	Garnered from more mailing lists
k12	Run by American children
misc	Anything else
news	Relates to Usenet itself
rec	Recreational discussions
sci	Scientific matters
soc	All about society
talk	Often lengthy exchanges on hot subjects
uk	Our very own, national newsgroups

Figure 1 -Top-level Usenet hierarchies

AFAIK	As far as I know
BTW	By the way
FAQ	Frequently Asked Question
FYI	For your information
IMHO	In my humble opinion
RTFM	(I think most of you already know this one - mail me if not)
MOTOS	Members of the opposite sex
MOTSS	Members of the same sex
WRT	With respect to

Figure 2 - Internet slang

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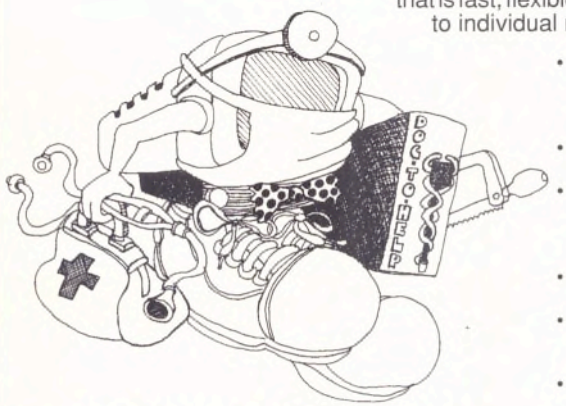

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is a `rec.humor` (sic) and a `comp.sys.ibm.pc.digest`. The number of components in a name usually increments by one when a newsgroup is split into two topics.

It's all in the name

There aren't many conventions regarding newsgroup names, but I will outline those that do exist to assist you in subscribing to a useful selection. You will notice that a significant number of newsgroup names end with '*.d*.' This indicates a discussion group in which people pass comment on the articles in the related newsgroup. As an example, contributors to the newsgroup `comp.binaries.ibm.pc.d` are discussing executables posted in `comp.binaries.ibm.pc`. Discussion groups are great places to ask questions. Where can I find fabprog.exe? Why wouldn't megautil.exe work on my Tandy GTi? You will notice another set of newsgroups that are suffixed with `.announce`. These are good groups to keep one eye on because they contain postings of significance, eg announcing the release of a new version of software.

When using your news reader to view the list of available newsgroups, you will see that some newsgroups are marked `moderated`. This signifies that all postings to that newsgroup are automatically routed to a person who has volunteered to filter, edit and organise the articles. Moderated groups are necessary because of the wide variance of expertise among Usenet users and lack of self-control by some users whose postings can quickly degenerate into fruitless arguments. Hence, when you subscribe to a moderated newsgroup you can be confident that it will have a good signal-to-noise ratio.

server:	<waiting for TCP/IP connection on port 119>
client:	<open a connection to server>
server:	200 zippy news server ready - posting OK
(select the newsgroup to operate on)	
client:	GROUP uk.net-nerds
server:	211 92 21496 21588 uk.net-nerds group selected
(initialise the server's article pointer to the first article)	
client:	STAT 21496
server:	223 21496 <496243@company.co.uk>article retrieved - statistics only
(retrieve the headers)	
client:	HEAD
server:	221 21496 <496243@company.co.uk> article retrieved - head follows
server:	(header lines
server:	appear here)
server:	.
(move on to next article)	
client:	NEXT
server:	223 21499 <514281@organization.org> article retrieved - statistics only
(repeat HEAD and NEXT until no more articles in group)	
(the user now requests a complete article from the list of headers)	
client:	BODY <496243@company.co.uk>article retrieved - body follows
server:	(message body
server:	appears here)
server	.
client:	QUIT
server:	205 bye!

Figure 4 - An example news reader NNTP session

Usenet culture

As I mentioned earlier there is a strong sense of community evident in the Usenet world. In common with any distinct social group it has developed its own culture. By this I mean, ways of doing things, a style of expression and its own jargon dictionary. There are characters who become famous (or indeed, infamous) and are spoken of in reverential tones (or reviled unreservedly). Usenet has its own historic moments, the ripples of some still resound through the electronic galaxy.

There are certain topics that have given rise to the most bitter and protracted arguments ('flame wars' in Usenet parlance). If a new user broaches such a topic, there is an almost tangible collective groan from the old-timers who contemplate the bandwidth that may be sucked-up by a renewed conflagration and make a note to add the topic to their 'kill file' (a means of automatically binning articles).

Two topics that could be considered Usenet 'old chestnuts' are the issues of, porn on the Internet and using Usenet for commercial purposes. These topics are important though. I hope that some form of consensus can be reached by the Internet

Path: company.co.uk!organization.org!S.A.Dribble
From: S.A.Dribble@organization.org
Newsgroups: rec.net.antics alt.great.ideas
Subject: Great new hobby!
Message-ID: <<496243@organization.org>>
Date: 25 June 94 14:37 GMT
Followup-To: alt.great.ideas

Yo, fellow net surfer dudes, I've got an idea for a great new hobby. It's so cool that I can't understand why it's not mega already!

So what does a guy do when he has to give up train spotting because his anorak has rotted away, hey? - COLLECT IP NUMBERS!!!!

Nerdly yours,

Samuel A. Dribble

Figure 3 - An example Usenet article

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community rather than the problems festering until legislation is passed to control Internet use.

As an introduction to one facet of Usenet culture, familiarise yourself with the, incomplete, list of Frequently Used Abbreviations (FUAs - I just made that one up!) in Figure 2. You will find these abbreviations used elsewhere in the Internet world, eg in mail messages.

Practical Uses

As Usenet was developed by computer scientists and it is a computer to computer communication technique, it is not surprising that a disproportionate number of newsgroups are devoted to discussing, developing and sharing software and computer related chit-chat. From a software developer's viewpoint the potential uses of Usenet news are manifold. I will outline some of them below.

I have frequently had cause to draw on the collective expertise of the regular contributors to technical newsgroups in the `comp.*` hierarchy. It is truly difficult to come up with a question that stumps these guys. Many of the more popular newsgroups have a **Frequently Asked Questions** (FAQ) file that is maintained by a respected contributor. New readers are asked to read the FAQ list before asking questions in the newsgroup.

The FAQs are regularly posted to the newsgroup. They are also available by ftp from `rtfm.mit.edu` under `/pub/usenet/news.answers/`.

Newsgroups can also be formed to assist the process of developing a sizeable project. This is particularly useful if the developers are located in different time zones. An example of this practice is seen in the development of the Intel Unix clone, Linux.

The latest versions of source code and executables can also be distributed via Usenet, and, as can be imagined, binary and source code traffic accounts for a sizeable proportion of bandwidth used. The newsgroup `comp.binaries.ibm.pc` is very popular and is used to share public domain and shareware software for IBM compatible PCs.

Usenet utilises the same 7-bit protocol as Internet mail and hence to transmit binaries, techniques such as UUENCODE/UUDECODE must be employed. In addition, binaries are often split over several articles which can make reassembling the original file a nightmare unless you use a news reader that is capable of combining and uudecoding multipart binary postings in a single step.

Behind the scenes

One of the most difficult concepts to get a handle on is that there is no hub or centre of any sort to the Usenet system. Instead there are many computers that exchange new articles in a peer-to-peer relationship. The result is that news spreads through the Internet (and beyond) in a manner akin to a flooding algorithm. News articles do not necessarily reach a user's computer by this flooding technique. It is more usual for the user, through his news reader, to interrogate a local news server for the purposes of scanning, reading and uploading articles.

The protocol that is used to transfer news on the Internet is called **Network News Transfer Protocol** (NNTP) and is defined in the document known as RFC 977 (available from **ftp.demon.co.uk** under **/pub/rfc/**).

server:	<waiting for TCP/IP connection on port 119>
client:	<open a connection to server>
server:	200 zippy news server ready - posting OK
(client requests any newsgroups that have been created since 07:13 on July 26 1994)	
client:	NEWSGROUPS 950726 071300
server:	235 New newsgroups since 950726 071300 follow
server:	flip.bat.zip
server:	bing.bang.bong
server:	.
(client now requests any new articles in any group that have been posted since 07:13 on July 26 1994)	
client:	NEWNEWS * 950726 071300
server:	230 New news since 950726 071 300 follows
server:	<496243@company.co.uk>
server:	<514281@organization.org>
server:	.
(the client now loops requesting each article in the list just received)	
client:	ARTICLE <496243@company.co.uk>
server:	**220 <496243@company.co.uk> article follows**
server:	(headers and body
server:	appear here)
server:	.
client:	**ARTICLE <514281@organization.org>**
server:	**220 <514281@organization.org>article follows**
server:	**(headers and body**
server:	**appear here)**
server:	.
(in a reversal of roles, the client now offers recent articles to the server)	
client:	IHAVE <514281@organization.org>
server:	435 I just gave you that!
client:	IHAVE <473940@institution.edu>
server:	335 I need that one
client:	(headers and body
client:	appear here)
clients	.
server	235 Article transferred successfully
client:	QUIT
server:	205 bye!

Figure 5 - An example peer-topeer NNTP session

The protocol that is used to transfer news on the Internet is called **Network News Transfer Protocol** (NNTP) and is defined in the document known as RFC 977

Innards of a Usenet article

It will help to refer to the example news article in Figure 3 during the following explanation. In many ways a news article can be viewed as a mail message, but rather than being sent to a specified set of recipients, it is sent to the readers of a newsgroup. As a result of this similarity the Usenet community has adopted a standard set of message header lines that is a superset of those commonly used in mail messages. The obligatory header lines are:

```
From:
Subject:
Message-ID:
Date:
Newsgroups:
Path:
Followup-To:
```

Path: contains a list of all the hosts that the message has passed through. Each host that receives the message will prepend its name to this header. It is used to ensure that articles don't loop back to a host which has already received it.

Newsgroups: is a fairly obvious header. It is only necessary to mention that more than one newsgroup can be specified on this line, indicating that the article should be posted to all of these newsgroups.

Followup-To: indicates to which newsgroup an article posted in response to this one should be sent. This is particularly important if you cross-posted to several newsgroups and want to identify which one follow-ups should be directed to, or, in the case of the original article being posted to a newsgroup in which no discussion is allowed, eg a binary newsgroup.

If the value against this keyword is `poster`, then follow-ups are not permitted at all, any response should be sent directly to the author.

Serving up the news

Now that we understand the article format, we can look at how news servers exchange articles. The protocol is similar to the Post Office Protocol described last month, in that human-readable commands and responses are exchanged between hosts over a TCP/IP stream in a client-server fashion. Rather than simply list all of the commands and responses that make up NNTP, I will refer to the two example sessions in Figures 4 and 5 and describe what is going on. For a detailed description of the protocol I refer you to RFC 977.

The two sample sessions are representative of two very distinct but very common applications of NNTP. The first, in Figure 4, is that of a news reader interrogating the local news server. The second, in Figure 5, demonstrates how peering news hosts exchange new articles.

In the news reader session of Figure 4 the aim is to retrieve all the article headers for a specified group. These can then be compared with articles that the user has already read and the remainder displayed on the screen. The user then chooses to read one from the list before finally quitting. You will notice that the articles are not identified by the message ID but by another value (eg 21496), an index that the news server has assigned to the article which has no significance outside of this context.

In the peer-to-peer session of Figure 5 the two hosts exchange articles that their peer has not already seen. The `NEWGROUPS` and `NEWNEWS` commands make use of a stored date and time that indicates the time and date that the last successful peer-to-peer session took place between these two hosts.

In closing

I hope that the above is a reasonably coherent introduction to the use and workings of Usenet news. One word of warning though; unless you plan on assuming the lifestyle of a high-tech hermit, keep the number of newsgroups that you subscribe to low. Have fun! ■

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.

Book Review

It's alive! The new breed of living computer programs - Reviewed by David Mery

When I saw this book my first impression was: eye catching title; nice cover. I must admit, I was eager to read it. But disappointment came quickly as I turned the pages... I yearned for the wonders of genetic algorithms, of worms and viruses. Instead I discovered the author had decided to take the opportunity to expose *all* his concerns about life in general and several related and not so related matters.

Do we really need philosophical, metaphysical and just plain futuristic discussions about life, the universe and everything? Frederik Cohen finds correlations between life evolution (replication) and Shannon's communication theory. He speaks of nanotechnology, Asimov's laws of robotics and *StarTrek - The Next Generation* (in that order!) Cohen preaches a future of Orwellian proportions. In his words: 'we are dependant on computers and they are dependent on us. The sooner we acknowledge this, the better it will be for all of us.'

We are not talking *Origin Of The Species* here. Thirty pages or so dedicated to defining what life is, in both natural and artificial worlds seems a bit of an overkill. 'A creature is alive in a given environment if and only if it is composed of living creatures, or it can produce an 'offspring' that is alive in that environment.'

There are numerous examples of living and non living things. Ask yourself, 'is fire alive?' 'Is a mule alive?' Border on the philosophical by questioning whether a person on life support is still alive? It get's there eventually. Finally we come to computer viruses. Whoops, that's a non word in this context. The lengths to which the author goes to prevent mentioning this word is quite laughable. Yet he offers nothing that so aptly describes its vulgarity.

Interestingly, however, Cohen believes: 'we would be far better served learning how to live with these new life forms [life in our computer systems] than to try to fight against them. Perhaps we can even farm them.' *Farming* viruses?

If you like it terse you'll love the chapter on 'Formalities'. Einstein would be impressed. There are pages of mathematical formulae defining these vir... ooops sorry... living creatures. For those who can't recite the Greek alphabet backwards there's also some pseudo English.. The definition is based on Universal Turing Machines. Now that everything is defined, Frederik Cohen decides that he will call these creatures, '*LP*s'. The problem is that since he doesn't use any mathematical formalism in the rest of his book, this supposedly formal chapter doesn't seem to prove anything. A rose by any other name Mr Cohen: calling these living entities *LP*s, living programs, viruses, whatever, won't make them any more or less serious.

While I do feel critical of the way much of the subject has been handled I was impressed, nay fascinated by its insight into previous software experiments such as Corewar or Tierra. Code examples are included, mostly written as Unix shell scripts. The two exceptions are some fixed Life games (no input) written in C and a sample assembly code showing how a program can be designed to be executed on both 6800 and 8086 targets. All the others are shell scripts such as replication scripts that append themselves to other scripts and companion ones that copy the original ones and replace them. Some examples also show how to automate network administrative maintenance by creating scripts that distribute themselves on all the machines on a network and evolve to keep only the most effective, or best fitted, versions of themselves.

As a footnote, a Macintosh disk is included with the book. But there's no description of its content. I didn't have any access to a Mac so couldn't play with it. No offence to Apple, but I'm sure I'm not the only one... It does surprise me, though, that the publisher chose this format: PCs would have been the obvious choice. Another oversight is the list of example programs in the book itself. Macintosh programs? No way: these are for Unix systems.

Verdict: Avoid

Title:	*It's alive!: the new breed of living computer programs*
Pages:	*153*
Price:	*£32.95*
Author:	*Frederik B. Cohen*
Publisher:	*John Wiley & Sons*
ISBN:	*0-471-00860-5*

Polishing Windows - Reviewed by Edward Kenworthy

Modern Windows programs need to look good and be innovative in order to succeed. Dave Jewell's book claims to show Windows developers how to include such features as 'toolboxes, status bars, Excel-style dialogs and other professional user interface elements' into your applications. The book assumes that you're using the Windows SDK (not anything as modern as OWL or the MFC!) and begins by covering, belabouring one might say, how to handle loading string resources. Fortunately this only takes one chapter. The rest of the book then goes on to describe how the various user interface elements are built using the SDK. In covering these Jewell also explains some, relevant, general purpose techniques. He sometimes emphasises a point quite heavily but on balance I feel this is preferable to skimming over useful or important techniques.

If this book had been written two years ago, despite a sometimes laboured style, it would have been an impressively innovative work. If it had been published even a year ago it would have been worth getting hold of a copy. However Borland C++ v4 and Microsft Visual C++ had made it redundant before it had even been published. Both of these provide a very simple way of implementing the majority of the user interface elements presented by Jewell - and without all the sweat. If you're still using just the prehistoric SDK then you might be interested in this book. (But then if you're that far behind the times are you really bothered about a 'modern' user interface?) If you're using any sort of modern tool then forget it.

Verdict: Not recommended.

Title:	*Polishing Windows*
Pages:	*491*
Price:	*£24.95 (plus disk)*
Author:	*Dave Jewell*
Publisher:	*Addison Wesley*
ISBN:	*0-201-62437-0*

The C Video Course - Reviewed by Sarah Allen

How do you learn a new language? Usually when people learn a foreign language, they either go to a training course or buy a set of books, audio tapes or videos. For a computer language, it's either a course or one of the many 'Teach yourself C' books on the market. But companies have been investigating other options. Mind you, I can't really imagine listening to *PrograPhone* on my Walkman. Worse still, watching a Yank demonstate the worst cliches of his nation while, simultaneously writing C code.

So I was a little sceptical when the Editor asked me to try Silicon River's C video course. Still, hopefully hard cash would follow. At least that was the impression he left when we finished the conversation. Next day a box arrived on my doorstep. Not that the postman had much to worry about: since the mysterious disappearance of the dog last summer, it's been the megaton compiler boxes to which he's taken a particular disliking...

It's a pretty light box. However, the same can't be said of its contents. From the top, there's six videos, a tutorial guide and a diskette.

The course is very structured, divided into nine sections, each comprising several individual units. The recommended way to fluent C is as follows. First, sit comfortably in armchair; cocoa and video 'remote' to hand. Next watch video presentation, turn to corresponding course unit in workbook, then work through the exercises. And if there are any video workshops: return to armchair with cocoa and 'remote' and sit through another video. Phew! And remember, always check your answers to the tutorial with those on the disk. Yes Gran.

The course is based on the 1990 ISO standard of the C language. Its goal is to 'take you from beginner to proficient C programmer in the shortest time possible'. Since Silicon River is currently working on a C++ video course, this training emphasises the common points and differences between C and C++. So, according to Silicon River, it is also a good start for developers that do not yet know C but want to learn C++. I'm not convinced. I think that while it may well be possible to teach yourself C with this video, writing C structured programming code in C++ defeats the whole purpose of object orientation. I hope that the C++ course won't be based too much on this one.

As expected, life for the new born C programmer begins with the infamous 'Hello world' program. By the end there's some pretty advanced explanations of compiler workings such as the different phases. The main nine sections teach in order: program flow control; everything about simple data types and parameters; the more complex arrays and pointers types; how to deal with dynamic memory allocation and pointers, structures and unions; file manipulations; how to handle and prevent errors and at last a general 'advanced topics' section. A C glossary has been included at the end of the book, but I don't particularly like it. I feel that it should include function prototypes instead of function names. How do you remember the arguments to `strcpy`, for example? An index is definitely missing.

> **C expertise is by no means instantaneous. But 60 hours condensed training seems a little excessive**

With regards to the video itself, special effects have been used to give the impression that Nigel Evans, the teacher, is pointing directly at C code. Suprisingly, the source code is readable but, of course, I would have benefitted from a larger TV screen. A colour TV is a must, not that I particularly appreciated Nigel's white jumper.

A C compiler is a must for doing the exercises. Any make will do, so long as it supports the ISO C standard. On the accompanying disk, one directory contains files used repeatedly through the course. Make files for Borland, Microsoft and Symantec compilers are provided here to compile the examples into a library. In a few instances, programs are run through a debugger step by step to check the value of variables after every line of C. So it's better, if you have one available. Anyway, at one point or another you'll probably need a debugger. It's the only true test of a real C programmer.

Most exercises are designed to test your understanding in a particular topic. Some get you to rewrite the examples with other assumptions or different instructions. Others are simply questions regarding particular code samples. For dummies, hints are always available. Not that I ever needed them of course! All in all, you'll have to go through 329 exercises.

The course takes more time than I first expected, but I found it was comprehensive. Now I'm not saying I actually enjoyed watching the videos themselves (since I consider myself quite accomplished at C), but overall, the complete package appeared to offer much of what it promised.

My only warning to those of you contemplating video based training is that while there are only 13 hours of tape to watch, the time to go through the complete course, doing all the exercises, is more like 60 hours. C expertise is by no means instantaneous. But 60 hours condensed training seems a little excessive.

Verdict: Recommended

Title:	*The C Video Course*
Package:	*6 videotapes, 1 book, 1 disc*
Pages:	*463*
Price:	*£199.95, £10 delivery (for EXE subscribers, it costs £49.95, £8 delivery)*
Author:	*Nigel Evans*

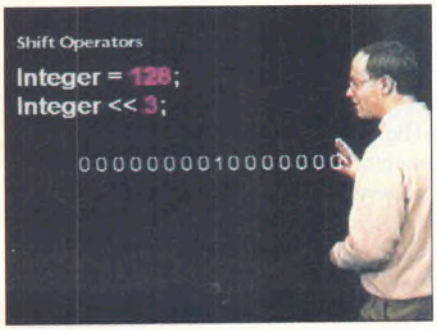


Figure 1 - Cheer up Nige: it's only C Standards

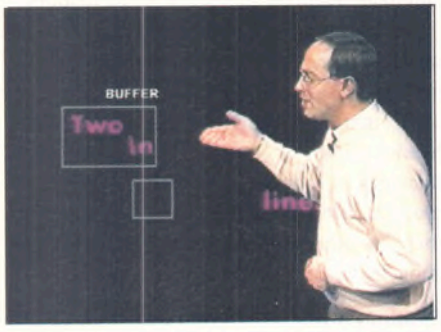


Figure 2 - Notice position of right hand pushing those bits

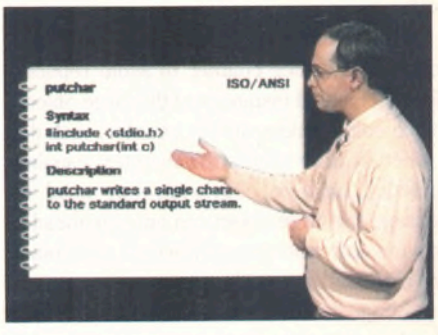


Figure 3 - Two in the hand is worth...

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.** Unless your letter is marked 'Not for publication', it will be considered for inclusion in this section.

Overworked Overload

Dear EXE
I thought you would have had an avalanche of letters criticising the article, 'Operator Overload' in Vol 8-Issue 10 April 1994, page 52. Since I have waited in vain for someone to defend the textbooks Francis Glassborow implicitly denounces, I suppose I'll have to offer a belated defence myself. Of course, in doing this I put my head on the block too.

Anyway, Francis was trying to present a solution to implementing arithmetic operator overloading for classes containing large data structures.

I don't claim any greatness in the solution I present, because it is, according to my vague recollections, the classic textbook version. Let's just hear it for the textbooks, eh?

Rather than have an instance embedded in an object, you embed a pointer to an instance. This makes the enclosing object very lightweight and perfect for passing by value.

For the more advanced, you can introduce an instance counter to avoid replicating unchanged instances of the large object. Each copy increments the counter, each destruction decrements the counter, causing deletion on zero. Obviously any need to change the large object can only go ahead if it's the only instance, otherwise a copy must be made.

I hope this helps to increase sales of textbooks, and at least has reassured some of those who were daunted by the prospect of Francis' tortuous means to achieve operator overloading.

Crosbie Fitch
East Sussex

Safety with parameters

Dear EXE
Francis Glassborow ('Anarchy in Parameter Land', August) rightly points out that function parameters are often used to change external variables to which they refer and that this can often be a source of confusion. Several years ago I thought of a way to solve this problem, though I am not sure how the solution could be implemented. The idea is to allow the use of multi valued functions, eg:

x,y = fnPolarToCartesian(*r, theta*);

where *x* and *y* in this case are of the same type, though in general any (specified) number of different types may be returned. Thus all input to such a function would be via the parameters, and all output via the return values. This seems to me to be a much clearer and safer way to have variables adjusted as a consequence of function calls. Normal type checking would apply, though in the example shown it is still possible to return the x-result as y and vice-versa. Of course, this kind of fault can occur with the traditional return via parameters, and perhaps more readily.

Obviously this facility would require the compilers to be re-written: I do not think that even C++ can be forced to behave in this manner.

I am not a compiler expert myself, so there may be a good reason why multi-valued functions have never been compiled.

On a more general note, perhaps you could have a new section in the magazine which would be devoted to new or unusual language features, as suggested by readers.

I appreciate that language design is often difficult, but it seems that the specialists do not always get it right. C++ private class members have to be declared in header files, for example, whereas Eiffel manages to hide them most effectively, and more in line with OO philosophy. So there may be others like myself who have the audacity to think that they could do better!

Richard Prosser
Kenilworth

Commute, don't compute

Dear EXE
I felt compelled to write a few words on Cliff Saran's editorial ('Commuter Heaven', August). There are indeed many ways in which the use of computers, the internet and all the other features of the emerging 'global village' could be used to better peoples lives. However, segmenting them into isolated groups is not one of them. I could not agree more that the way disabled people in this country, and many others, are treated is appalling: Our public transport sytems can only be a daily nightmare for them. But the solution to this is better transportation, not better computers, not a wider internet nor any other technology related gimmick. We need to *integrate* our society, not seperate it into 'sections who can cope with the outside world' and 'sections who can't.'

Going to work every day, whatever the accompanying stresses and strains is an important part of our social development: just look at the severe depression that many redundant workers suffer. Opting out is, of course, still a viable option for many who feel happier out of the 'rat-race'. But *everyone* should be given this initial option: if they choose not to take it, all well and good, that is their decision to make, not ours.

I realise that the editorial was written as a well intentioned solution to an ever-present problem within our society. It was this in particular that spurred me to write in: good intentions after all, pave the road to many places. Most human beings need contact with each other. We must ensure that computers are used to bring people together not further apart.

M Dibble
Portsmouth

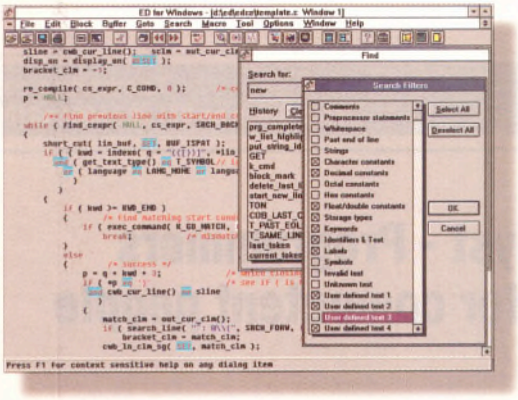
Letter of the Month

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.

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, errm, 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 supports multiple windows, multiple files per window, and multiple languages too



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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), rom 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/ibmpc/windows3).

Train without strain

Les Peck argues the case for better training from employers

In theory, training is the heartbeat of a successful company. Skills, abilities and the product range should expand in harmony. But it doesn't always happen. Some companies have an inbuilt resistance to training. To management, it's a zero fill: 'If I train 'em, I'll lose 'em'.

In many cases, staff are only hired to fill spaces in the team sheet. I well remember graduates who were there to keep records or make out purchase orders. They were not encouraged to develop their skills. The company called it 'work experience'. It didn't matter if they left. Next year's milk-round would provide another harvest.

When the project reached the point of critical inertia, the company saved the game by hiring contractors. From the company's viewpoint, contractors were cost-effective. They came with all the skills and were ready to start on the day of arrival. The headcount wasn't overloaded and the in-house software engineers were still on hand to update the records and order the parts. There was a negative side, of course. At the end of the project, the contractors packed their bags and took their knowledge with them. Only those who'd worked with the hired-help had actually gained anything.

But why is training seen as such a 'no-go' area? In the deadline situations that haunt our business like the Ghost of Banquo, time costs more than money - and cashflow equals company survival. In the days of make or break, there never seems to be enough of either to spend on training.

When I handled banking systems in the 70s, 'training' meant six-months away in a three-star hotel. The thought of such high expenses linger on in the minds of management - and fear of the 'off-site-training-budget' syndrome tend to block all but the absolute essentials. But that was yesterday. Modern training methods have cut training time from weeks to days - and many schools will (if asked) supply an on-site instructor.

If that still seems too much of an investment, many of the better software houses now supply quality training information on video. For example, for the cost of half a set of golf clubs, Softvision provides a first class training tape on Visual Basic. If you check the software catalogues, you'll find many others on offer. One tape can train as many people as required.

Training doesn't have to cost the earth and the long-term benefits to the company can more than balance the expense of hiring a never-ending stream of contractors.

Although career development is critical to every graduate software engineer, no-one wants to move for fun. It's not career-effective; too many CV entries shows a restless spirit - and no employer wants to hire a nomad. For the company, a settled team means continuity for the next phase of the development. And far less time is lost 'breaking in' the new recruits. Training makes a team effective. Involvement gives each member of that team a level of responsibility to make the project work. Whatever the situation, training is a modest price to pay for overall success. ■

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Excellent opportunities exist for bright graduates with one year + experience. Personal background requires a solid understanding of the project life cycle and a commitment to high quality coding. You will be trained in all aspects of Investment Banking, relational databases, 4GLs and Object Orientated Design. A good opportunity for a second career move.

£17-£25K + Banking benefits **REF: SC/03/EXE**

SYBASE/INGRES/VMS/C **1-3 YEARS £25-£30K + BONUS**

Excellent opportunities for Graduates with 1-3 years experience to join a Banking Organisation. Training will be given in the Derivatives/Financial Instruments market. Motivated self-starters who want to take on responsibility in a progressive organisation where skills are rewarded on merit.

OTHER PLATFORMS/DATABASE CONSIDERED. **REF: C/04/EXE**

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Additional experience of: SQL, Forms, C and C++ required. We currently have client companies including Management Consultancies, Systems Houses, Systems Vendors, Bank and Finance clients looking for candidates with: Relational Database design, Database tuning, Systems Administration, DBAs, Pre/Post Sales and solid programming knowledge and expertise. Please call to discuss your particular requirements.

£18-£40K + benefits **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 incompetitive time scales. Opportunities vary from small to large software companies involved in expert systems, GUIs, Image Processing, GIS, EIS, Communications, Networking and Object Orientated Databases. Graduates through to senior software engineers/team leaders are required. Please call to discuss.

£14-£35K + Benefits **REF: SC/06/EXE**

UNIX/VMS/MS WINDOWS/NT MFC **ALL LEVELS**

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

£16-£28K **REF: SC/07/EXE**

LONDON/HOME COUNTIES WINDOWS SDK/NT DEVELOPMENTS

Senior Development Engineers **Analyst Programmers**
To £30K + benefits **To £27K + benefits**

Strong programming skills in C or C++ and Windows NT are pre-requisites for these positions. Experience in some of the following areas is also required: MS-DOS 5.0, MS Windows 3.1, Windows NT, Windows SDK, MS C 7.0, MFC, Visual Basic, Visual C++ and Microsoft NT. Also desirable are Windows XUT libraries or networking skills. **REF: SC/08/EXE**

SOFTWARE ENGINEERS-SENIOR SOFTWARE ENGINEERS

Various Client/End Users, Software Vendors and Software Houses dedicated to strategic 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:

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

COMMERCIAL DEVELOPMENT: Using technical based skills already developed, but offering opportunites to apply analysis and design skills rather than remain 'a technical guru' in various environments including finance. Please call to discuss your particular career, growth and potential.

£12-£25K + benefits **REF: SC/09/EXE**
VISUAL BASIC SKILLS MUCH IN DEMAND - PLEASE CALL TO DISCUSS **REF: SC/10/EXE**
LEEDS - LOW LEVEL C++ WINDOWS COMMS DEV ALL LEVELS **REF: SC/11/EXE**
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VB, C++, FOX Support

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Due to continuing success in this area we are increasing the number of individuals substantially over the next twelve months. We will be looking for a range of skillsets throughout the year as shown.

Profile - Developer Support

- Minimum two years in-depth experience in one or more of the following areas is essential: Microsoft C++®, Visual Basic®, Foxpro® or in software development in an equivalent product
- Excellent interpersonal skills
- Highly motivated
- Focused on teamwork
- Experience in a problem solving environment would be an advantage
- Ideally qualified as a Microsoft Certified Professional
- Strong customer service focus

If you meet the above requirements and are interested, please send your CV quoting reference MS013/EXE to: Recruitment Services, Microsoft Ltd., Microsoft Place, Winnersh Triangle, Wokingham, Berkshire RG11 5TP, or for more information call us on 0734 270416.

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All levels
To £45,000 plus banking bens.
Our client is commited to the replacement of existing technology with Windows NT, and will soon represent one of the most technologically advanced environments in the City, with a vast array of projects under way. You should have experience of either VBasic or VC++ and some database exposure. Knowledge of Excel, Word and OLE would be beneficial, as would the apitude to adapt to a highly creative trading environment. Contact Paul Lyons.

Oracle/Ingres/Informix - Crosstrain to Sybase
London
c£30,000 plus banking bens.
Our client, one of the world's largest and most respected banking organisations, has recently undertaken a strategic front office development. They are looking for talented analyst/programmers with experience of a major RDBMS, Unix, some knowledge of C, and ideally exposure to a Windows front end. They offer immediate Sybase/Powerbuilder work, with external training and full project lifecycle involvement. Contact Paul Lyons.

C++/OOD/Unix Developers
London
All levels
To £50,000 plus bens.
We have numerous opportunities within the investment banking/securities industry to work on a range of business oriented development projects. You will need at least a years commercial experience for entry level roles, but candidates with X Windows/Motif, RDBMS, Realtime systems, mathematical aptitude or of course relevant business skills will be offered roles with significantly greater challenges and rewards. Contact Paul Lyons.

Sybase/Powerbuilder A/P
City
To £35,000
If working at the cutting edge of systems development excites you, your Sybase, Powerbuilder skills could be the stepping stone to a bright new future. This leading systems house working in the financial markets can offer an environment in which you can shine. This is a brand new development where your 3 plus years experience will be put to the test. Any knowledge of international banking systems would be an advantage but not essential. Contact Colin James.

Oracle v6/v7 A/P's
West London/City
To £32,000 plus bens.
With renewed confidence in the market we have seen a large leap in demand for Oracle based developers with a strong technical background. If you can offer 2 plus years Oracle v6/v7, Forms 3.0/4.0 coupled with Pro C in a development based role, I can offer you two clients where job satisfaction and long term career prospects are guaranteed. These are customer facing roles so good interpersonal skills are essential. In addition any knowledge of Case Tools and 3GL's would be an advantage. Contact Colin James.

C++ Developers
City
£30,000 plus bens.
You will be working on a Global Risk Management project where your C++ skills will be fully utilised. In addition knowledge of GUI's, (Motif, Windows, Windows NT, OS/2 etc.), RDBMS, OOD and OOA across a mix of operating systems would be an advantage. This system will be portable and database independent and offers a leading edge environment providing excellent opportunities for career development. There will also be a chance for specialisation in the future. Contact Colin James.

Excel Specialists
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JOB
C/.Windows/SDK

LOCATION S. London
SALARY To £25K

This market leading financial software house is seeking two additional Programmers to work on the development of new products. Suitable candidates will have solid C programming skills in addition to good experience with the Windows SDK. Our client is increasingly using C++ and therefore experience of Visual C++ and the MFC will be an advantage. The successful candidates will work in a stimulating environment with the opportunity for excellent training and career development.

REF:EXE/40

JOB
C/Visual C++

LOCATION Berks
SALARY To £25K

A fast growing, energetic Software Publishing House, is looking for a C/C++ Developer to join its professional and committed team. Candidates should have a minimum of two years solid C development experience, backed up by a sound knowledge of C++. Any exposure to the Windows API or OLE 2.0 would be advantageous, but is not essential. The successful candidate will be working in a state of the art technical environment for an organisation that recognises hard work and results.

REF:EXE/41

JOB
C/C++

LOCATION S. London
SALARY £18K-£27K

Our client is a fast growing developer of Client/Server application development software for mainstream business applications. Currently, they are looking for three Developers with strong C and/or C++ skills. Any exposure to Windows would be advantageous. Candidates must be bright, capable of learning the latest technologies and possess excellent communication skills. Successful applicants will be involved in whole project cycles and can expect to be using the latest development tools.

REF:EXE/42

JOB
C++ Programmer

LOCATION Herts
SALARY To £28K

Opportunities to work in such a stimulating technical development environment rarely come along. We are seeking a bright, highly competent C++ Programmer to work alongside like-minded individuals, developing a new generation of communications products. Ideally, you have at least six months Visual C++/MFC experience, but Visual C++ training will be given to exceptional candidates with experience of other C++ compilers. Working in a young friendly environment, the successful candidate will enjoy the social as well as the technical aspects of this position.

REF:EXE/43

JOB
Unix Support Consultant

LOCATION Middx
SALARY £20K-£24K

This is a wonderful opportunity for a Unix technical support specialist to expand his/her skills. The job role is that of European Customer Support, embracing responsiblity for testing/porting new software releases to European Unix platforms and the provision of training/technical consultancy. Candidates will have a minimum of two years Unix (preferably with some systems administration), as well as knowledge of networking and PC's. Any experience of C or SQL programming, VMS or Novell would be advantageous. Opportunity for European travel, so any knowledge of a European language would be useful.

REF:EXE/44

JOB
Visual C++

LOCATION Yorkshire
SALARY To £25K

A leading developer of communications and networking solutions is currently looking for two Developers with Visual C++/MFC skills. Applicants should be educated to degree level and must have at least one years postgraduate experience in C and C++. Any knowledge of communications would be useful. Candidates must be able to demonstrate an ability to keep learning the latest technologies. Excellent career prospects and challenging development projects are on offer.

REF:EXE/45

CONTRACT VACANCIES - UK WIDE

Sybase SQL Server		
City	Consultant	6 months
Visual Basic/C++		
Manchester	Soft Engineer	6 months
Oracle 6/Forms*3		
Surrey	Programmer	6 months
Unix/C		
W. Mids	Programmer	3 months
Apple Macintosh		
City	Developer	6 months
Ingres/Unix/C		
Yorks	Developer	3 months
Embedded/Real Time Systems		
Herts	Soft. Engs x2	3 months
C/DOS		
W. London	Programmer	3 months
C++/Visual Basic		
Surrey	Developers	3 months

REF: EXE/46

Windows NT		
City	Developer	6 months
Windows NT/C		
Middx	Programmer	6 months
MS-Windows/SDK/C		
W. London	Progs x3	3 months
Visual C++/MFC		
Kent	Software Engineer	6 months
MS-Windows/Banking		
City	Consultant	6 months
C++/VB/Finance		
City	Developers	6 months
Visual C++		
London	Analyst Programmer	4 months
X-Windows/C		
Surrey	Soft.Eng x2	6 months
Windows/C++		
London	Project Leader	6 months

REF: EXE/47

Visual C++		
W. London	Programmer	3 months
VB/C/SQL		
S. London	Anal. Progs	6 months
Borland C++/Multi-Media		
S. London	Soft. Eng	3 months
C++/Multi-Media		
London	Developer	3 months
Visual Basic v3		
City	Programmer	6 months
VB/MS Access/WAN		
City	Software Engineer	3 months
Visual Basic/MS Access		
City	Programmer	6 months
Visual Basic/C++		
London	Developers	6 months
Windows/Visual Basic		
West Mids	Programmer	3 months

REF:EXE/48

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Software Artists

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This young dynamic developer of graphics software is seeking enthusiastic engineers who want more than 'just another' programming role. You need at least twelve months indepth MS Windows and C++ experience and have the wish and ability to develop 'state of the art' software either in a team environment or one man projects. Preferably you will have experience of some of the following Windows SDK, OLE, Database design, and Win32. Future projects will lead you into Windows NT and Chicago.Ref: AW3500

DOS-BIOS

South West **to £24,000**

An exciting opportunity exists for Software Engineers with at least 3 years PC software development experience. You will be developing leading edge real-time data management software working within a small dedicated team. You will have graduated with a good degree and have indepth understanding of MS-DOS at device driver and interrupt level. You need also to be fluent in C ad 80*86 assembler and have the ability to deliver quality software on time. Good opportunities exist to progress to other environments such as Windows NT and Novell Netware. Ref: AW3506

MS Windows SDK/C++

Surrey **to £23,000**

Expansion within this specialist multimedia developer necessitates the recruitment of high calibre Software Engineers. You need to have twelve months post graduate experience including MS Windows SDK and C++. You will be developing state of the art graphics applications and future development will lead you into Windows NT. Ref: AW3502

Visual C++, GDI Shrink-Wrap Products

City **£Open**

Developing high class multi-media products for a fiercely competitive industry demands exceptional software designers. Add to that the latest software techniques and tools on a variety of the most current platforms and you have a very exciting demanding and challenging role. You must have experience of developing Visual C++, GDI software for shrink-wrapped products in a demanding commercial environment. Ref: MJ3501

C, DOS, Real Time

London **to £23,000**

This developer of real time communications software for the sports industry is seeking well qualified Development Engineers. You need to have achieved a 2nd class degree minimum and have indepth MS DOS and C experience coupled with exposure to Yourdon methodology. You will be developing software which will produce up to the minute information and images worldwide. Ref: AW3503

Digital Audio/Video Effects

London **to £30,000**

Real time video in WINDOWS, 30G byte real-time systems, object oriented design and development, sophisticated GUI front ends. Sounds amazing doesn't it? Well it is! If you are a young, bright software or hardware engineer, have C or C++ experience from an audio or video background and equally importantly, have a real enthusiasm for video/audio systems or techniques this is the company for you. A highly creative atmosphere within a thriving ground-breaking company for right minded people. Ref: MJ3505

AI, Windows3, C++ Imaging Start Up

Cambs **£open**

My client requires 2 exceptionally talented software designers to join a team developing novel PC based image processing/inspection systems. The right candidates will have excellent academic qualifications, a minimum of 2 years C++ and Windows 3.1 experience and be capable of holding their own in a very small and high calibre free thinking company environment. One of the most challenging opportunities currently available. Ref: MJ3507

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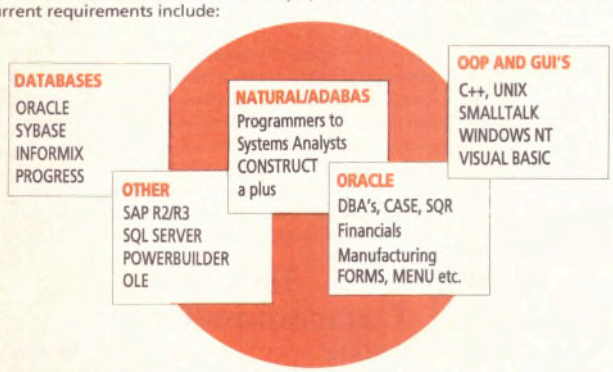

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EXEnders

Things have been swimming along tickety-boo up here in the high-powered, shoulder-pad wearing, gigabyte-toting dare-devil world of software development soap opera. Particularly well since a mysterious phone call shattered the fragile peace that is a pre-coffee morning in the office.

We're talking real coffee here of course: the treacle like substance that accrues in percolator pots after two to three hours of quiet but persistent bubbling. It's rumoured that the cleaners sometimes add a little special something to the concoction, kind of like dead rats in scrumpy. No one believes this of course because you'd be able to tell: it'd smell better for a start. Dealers on the streets of LA would blanch if they were asked to carry *real coffee* amongst their assortments of life-endangering substances: there are some acts that are just too low to stoop to. But like the weak fools that we are, our spirit gives in to the flesh. Oh, some may come out with excusing stories ('...well, yeah of course there was a lot of it around when I was a kid. But I just kind of sniffed it, y'know, for the aroma. I never really inhaled though'.) There's more caffeine in one cup than you'd find in a halls of residence within which the enterprising Dean had franchised a 24 hour Pro-Plus Stop shop during the last week of finals.

Try to think of that last paragraph as less of a digression: more of a sub-plot. A telephone call it was: not to the newsdesk hotline as one might imagine, but to the private line (truly this informant was in the know) of our erstwhile newshound Vicky 'hold the front page' Cooper. Vicky would like to be working for a tabloid newspaper expounding on subjects more relevant and useful to the world we're living in today, such as what kind of tights Princess Di considers *de rigeur* at present and Ten Things You Didn't Know About John Major's Optician. Previous attempts to get the editor to include a regular feature 'Operating Sytems of the Rich and Famous' have proved unsuccessful so far, but you never know.

Anyway, Vicky, always looking for that elusive 'scoop' leading to better and brighter things, was understandably elated when the curiously husky-voiced caller on the other end of the phone announced his intention of imparting some seriously gob-smacking info. Obviously a story of such a volatile nature could not be imparted over the phone, the mysterious caller continued, but suffice to say that certain evidence had come to light which linked the directors of one of the larger software companies to a priveliged organisation in an incident involving two bald-headed eagles under dubious circumstances.

The only catch, Mr Mystery added, was that unfortunately, due to the volatile nature of such an exclusive it was vital to maintain the highest level of security. Under no circumstances should she attempt to rendezvous at 'the drop' alone. Neither could such a situation occur in the city: riddled as it was with counter intelligence groups (for example, *The Sun*, which counters intelligence on a daily basis).

Ideally, the caller suggested (here his voice cracked a little: obviously the strain of such high-level politics) an office outing of some sorts. Was such an excursion possible to arrange? 'You betcha shorts it is' Vicky cried (rather excitedly) and hastened to the bank to front an all-expenses paid bonanza to Brighton, with as much frivolity as possible in order to confuse and delude any would-be assailants. It's planned for this Friday and everyone's looking forward to it very much. The editor, however, is looking forward even more to the journey back when he can show Vicky his press clipping of Louis V Gerstner Jr presenting the Royal Ornithologist's Society with a cheque for £20,000 towards the conservation of America's Rocky Mountains birdlife... **M**

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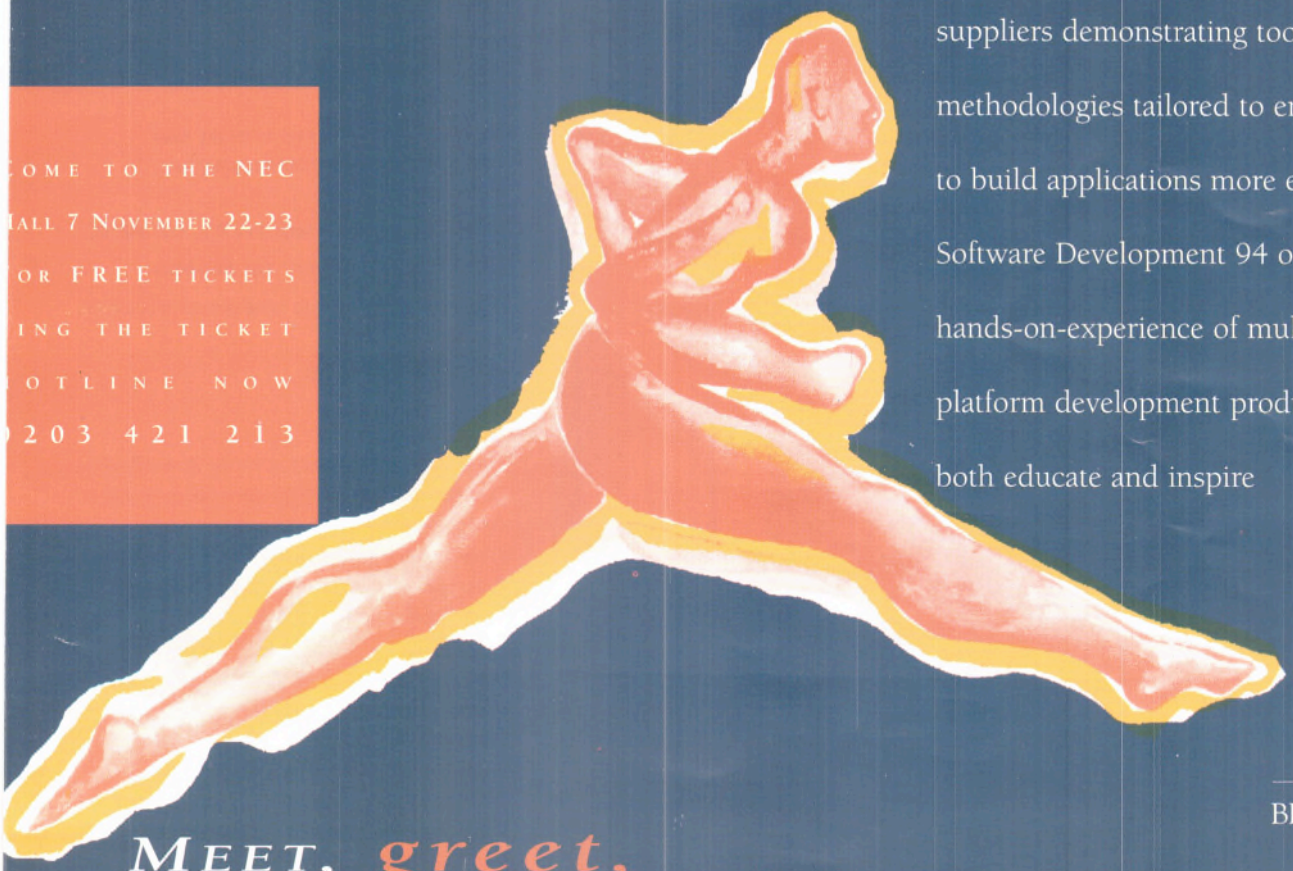

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