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The Software Developers' Magazine

Borland's last stand or not

Delphi guru interview

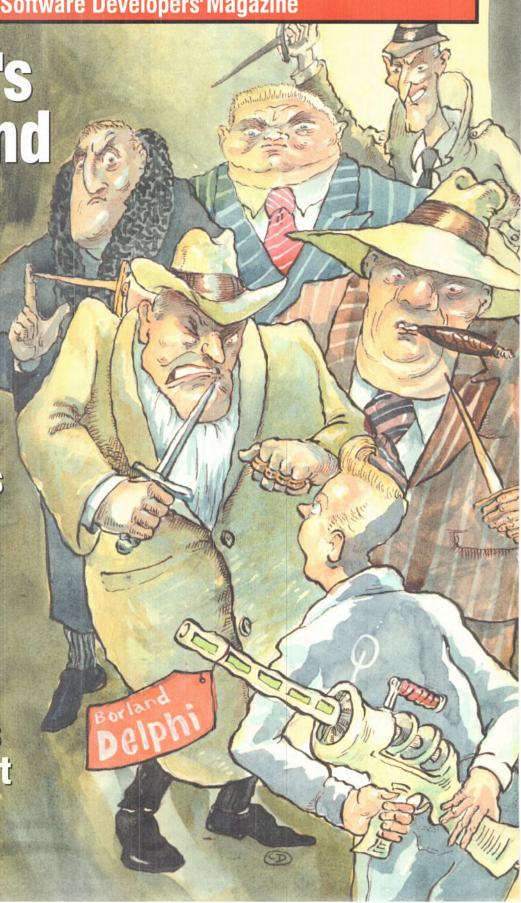
Pictures on the Web

Playing games with the RNIB

Classic programming books

**Electric moths** in Jules' wallet







#### COMMENT



Why we should be suspicious of the dual

processor Mac; computer games as therapy a technique for curing brainwashed cult members; searching for a better name for the

Information Super Highway.

Electrowonga - electronic cash - is supposedly about to oust the humble fiver. Jules May has reservations about this non-folding currency.

#### **NEWS**



The latest news on the EXE show and three other conferences announcements. Also why European developers are more productive than American ones.

#### Products News ......14

PureVision sends post-mortem debugging information directly to the developers by email. How's going Microsoft's best-seller Windows 95 beta code.

Rave about Verity Stob. Psychedelic 3D glasses wanted. And more on C++ copy constructors.

#### **REVIEWS**



DBtools.h++, best of both worlds ......65

Barry Smith looks at Rogue Wave's DBtools.h++, a complete re-write of its database class library Db.h++. Forget about C, this is a library for C++ developers.

#### Me and my bookshelf ......74

A C++ programmer's favourite reading - Francis Glassborow gives us a tour of the well-thumbed tomes that he always keeps within reach of his PC.

#### 

Bob Swart reviews C - A Reference Manual (Fourth edition) and Edward Kenworthy discovers how to solve problems with Design Patterns: Elements of Reusable Object-Oriented Software.

#### **FEATURES**

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Delphi has secured the grudging admiration of even devoted C++, Visual Basic and PowerBuilder zealots. EXE Magazine interviews the leader of the Delphi team: Anders Hejlsberg.

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Developing software for the visually impaired requires some special care but it isn't that tough. EXE teamed up with the RNIB to challenge the games developers amongst you. To get you started

David Mery gives a few hints.

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#### Seamless, but open to interpretation ......47



A one to many association between two classes may seem straightforward. But when moving from design to implementation it can be interpreted in several different ways as Mary Hope demonstrates...

#### Pictures on the Web ......57

A WWW page is not much use without pictures. Peter Collinson uses a wide range of tools to manipulate his images, and performs some alarming sounding aeronautical stunts to get them.



#### THE BACK END

Competitions, freebies and offers for EXE readers.

#### 

The crossword, the legal problems of a taxi driver, our Worst World Wide Web sites selection and Verity Stob on Doom.



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# SoapFlakes

#### Two's a Crowd

HE OLIVETTI M20 was, as expected in a machine with an Italian pedigree, a stylish looking beast. An elegant case in metallic grey sculpted plastic, topped off with a handsome matching monitor. The only incongruity was a burn mark on the keyboard, where my boss Graeme had dropped his fag on it.

It was 1985. The IBM PC had not yet quite conquered all. I was working for a software house which had fallen on thin times. The good news was that we had secured a contract with the GLC for 12 licences for our software. The bad news was that the GLC, presumably seduced by the M20's good looks, had purchased a dozen of them, and it was on these machines that our software had to run.

Playing around with our loan M20, we quickly made two important discoveries: a) the grey plastic keyboard was not very heat resistant and b) it had two CPUs. On boot up, the machine offered a menu which defaulted to an exciting-sounding powerful Z8000 (or maybe Z800000) processor and ran an OS called, as far as I remember, GucciDOS. The alternative, which the manuals implied one would be soft in the head to use, was a humble 8088 running MS-DOS 2.1. Like the fools we were, we believed the manuals, and wasted three valuable months wrestling with the worst Basic compiler in the world ever, totally failing to port our application.

The story ends happily, because we then started again from an MS-DOS angle, and with a few weeks of desperate middle-of-thenight assembler programming of the inspired type that is only possible with the wolf at the door, we shipped the software out.

I inflict this saga upon you because of the new PowerMac. As you can hardly have failed to notice after the recent barrage of TV advertising, Apple has introduced a machine which has a PowerPC as its main CPU, but also boasts a 80486 chip to do its DOS/Windows work. And I reckon that this signals the beginning of the end for the Macintosh line.

The reason Olivetti shipped the M20 with an 8086, and that Apple now throws in a 486, is that both companies have failed to make their standards bite. After all, neither

wants to go to the expense of including a spare CPU in its box. Their reasoning must be that, comforted by the knowledge that there's a 'real' chip in the machine (ie one that can run MS Flight Simulator), customers will feel safe. Once they have bought it, the punter will fall in love with the clever alternative technology, and stop worrying about the comparative expense and rarity of native software for the box.

Wrong. What actually happens is punters think: 'Why should I buy a Mac with a 486 in it, when for the same sort of money I could have a Pentium with an extra 8 MB of RAM?' Anybody who starts developing software for the PowerMac now deserves what he gets. Especially if you use the amazingly cumbersome Microsoft Visual C++ suite for the Mac - a system based on a cross-compiler, and which requires a 'proper' PC and a Mac networked together to work - what do you think Uncle Bill is trying to tell us here, children? As the VeePee of Corporate Finance observes in Apple's own commercial, this is not a machine to be taken seriously.

Unless of course they revive the GLC, in which case all bets are off.

Will Watts

#### Computer Games? What a brilliant idea...

REVERSING THE DAMAGE caused by dangerous cults is sensitive and specialised work. It is no time for playing games. Or is it?

As we approach the millennium, there are many prophesising the end of the world.

It's not just Christians and proponents of other conventional religions who are into this - the idea is popular with a number of dangerous cults now appearing. With crank scientific theories or quasi-religious beliefs the charismatic, self-appointed cult leader gets rich, gains power or satisfies other needs by preying on innocent, ordinary people through elaborate and crafty physiological and psychological techniques including mind control (brainwashing).

Prior to a member's indoctrination, the 'enrolment' techniques include hypnotism, (disguised as meditation), ego destruction, sleep and food depravations which can lead to 'false memories'. To keep a member loyal, confidence is removed and their vocabulary revised so that words detrimental to the cult are re-associated with satanic meanings.

With a decade of experience, a degree in Theology and training as an 'exit counsellor', Graham Baldwin, who runs Catalyst - a recognised counselling and therapy centre based in Nottinghamshire, has pioneered a hugely successful technique in restoring a forcefully removed confidence.

Baldwin told *EXE*, 'We have experienced remarkable success using computer games as part of the therapy. Not every game is suitable. For example chess can go on forever with no urgency to make a move, whereas in Sim City one is forced to make a decision in a given time or face the consequences....' (which are flooding or losing the city to some other disaster).

'Religious cults tend to affect a person's ability to think critically and evaluate situations. Using computer games is a way in which we can help a client re-learn critical thinking and decision making'.

Cult marketing strategies extend to any means including E-mail. The Information Highway penetrates millions of homes and universities world-wide reaching a massive audience, any member of which can become innocently drawn into a dangerous, ecclesiastic and totalitarian society - even a journalist, who set out to infiltrate a particular sect, had to be rescued.

The Information Highway has many faces - most of them friendly... 'Although many attempts are being made by cults to recruit new members, the Internet is extremely useful to us for tracking the progress of cults in both the UK and USA - we are able to share information with exit

# RAD-ROI

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"Delphi is Borland's best product for years." Tim Anderson, Personal Computer World April 1995

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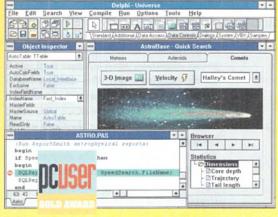
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it take before the machines, containing the necessary protocols, appeared on the black market, exactly as has happened with mobile phone programmers? Bear in mind that, once electromoney has been magiced into existence, it's completely untraceable.

'Only you can spend the money; it's unstealable'. What if my card is stolen, or I lose it, or I put it in the washing machine, or I leave it on the back shelf of the car and it melts? Nobody can get at my money, but nor can I. The money hasn't exactly disappeared, but nobody can get it. Oh, except the banks, of course.

'It does everything that cash does'. Rubbish. How can I transfer money from my card to yours, for a loan, say, or as part of a private sale? The shopkeepers, instead of having a little tray, must have a special machine. Guess who will sell them the machine. Guess who will sell them another, and another, as the security is endlessly breached.

'It's cheaper for us to handle. We don't like bits of paper.' Oh yes? Then why is a bank swimming with bits of paper? Why do I have to fill in three different ten-page forms in order to get an interview to ask for an overdraft? There's nothing banks like



why should I care what they want? It doesn't cost me anything to carry and use cash; I just do it. They might be able to handle electronic money cheaper than they can handle cash, but they can't do it cheaper than I can. Are they going to give the cards away, or the transfer machines? Like Hell!

The fact is that while electronic money in smart cards has a lot of advantages, it's not a replacement for cash. The very things which make cash effective are the problems they're trying to solve. Cash is stealable, but that's because it's easy to carry and easy to give and take. Cash in circulation is hard to measure, but that's because cash is the only money that exists while it's not moving. Cash wears out sooner than plastic does, but that's good because it means that counterfeit money can be removed from circulation quickly. Any attempt to solve the problems will necessarily remove the advantages too, and we'll be left, not with a replacement for cash, but something entirely new.

Do you remember all the talk about paperless offices? Yes, it does seem funny now, but at the time it seemed reasonable. What nobody thought about back then was this; that we've spent the best part of 3000 years learning how to run commerce, we've got legal instruments in place to support the protocols we've developed, and it's going to take a comparable length of time to dismantle that machinery so that paperless offices become practical. We need paper, and if we're going to take the paper away we need to replace it with something that does at least the same job, whatever else it may do. We've had money for just as long, and all the same arguments apply. We can't remove cash, because we don't really know how to trade any other way. Whatever we replace cash with, it must do at least all the things that cash does.

Finally, there's one more thing which concerns me. Every country has a national bank, which is responsible for creating, circulating, and destroying money - here it's the Bank of England. The high-street banks are commercial enterprises, just like a grocers. It seems to me that the national bank, among other things, controls commercial enterprises as it manages the economy. Any attempt to replace cash should come from the national bank, not from commercial outlets. To do otherwise is to allow, yet again, the tail to wag the dog.

Though Jules doesn't like the idea of electronic money, he might be persuaded. If you have a scheme for cashless money, why not send him some and see how he likes it? If you call him on 01707 662698, or email him on cix as jules, he will promise to spend anything you send him.

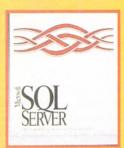
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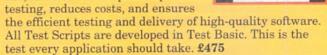
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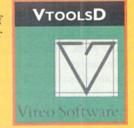
code SourceSafe was acquired in the recent merger of Microsoft with One Tree Software. Source-code control prevents users from accidental code loss, allows back-tracking to previous versions, branching, merging, and the managing of releases. SourceSafe



provides robust versioning and configuration management functionality plus security and audit-trail capabilities. SourceSafe supports an open approach, for use with development tools from Microsoft and many other vendors. £325 per user

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## Letters

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

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it will be considered for inclusion. Letters may be edited.



Sir,

Unlike your disgruntled reader (Letters, *EXE* May '95), this reader likes the magazine the way it is, especially now that Ms Stob has returned. Is there a Verity Stob Fanclub? If not, why not?

Bill Pringle Stirling FK8

Are there any more like you at home?; -)

#### Psychedelic

Sir,

On receiving the May issue of your magazine, I was delighted to see that good sense has prevailed again, and that Verity Stob has been restored to her former position on the back page.

Unfortunately, the free pair of psychedelic 3-D glasses, required for reading the article on page 78, were missing from my copy. Could you please send me a pair?

Raymond Butler Croydon Surrey

Sorry, all gone. You could try applying to Wired directly, since this page was inspired by its wacky layout...

Ms Stob blushed when shown the letters of Messrs Pringle & Butler, thanks them for their kind remarks and says they are a pair of sweeties.

#### Life without BIOS

Sir

Dave Bartrum (Letters, *EXE* May '95) should look at int 15h services 90h and 91h. When an int 13h service issues a request to the disk it also issues an int 15h with ax = 9000h. A multi tasking operating system can trap this.

When the disk is ready and interrupts, the ISR issues int 15h with ax = 9100h.

Full details are in (among other places) Ray Duncan's book Advanced MS-DOS Programming.

Roger Woollett (Internet address supplied)

#### Hello World

Sir,

What's this new Stob section with lousy jokes? Do you really think that a trivial C program could be considered a 'Programmer's suicide'. Try to write that in an automodifiable code where none of the letters in the words 'Goodbye World' appear. That would be a little better.

Sarah Leftcroft Inverness Scotland

Sorry you didn't include the code in your letter. That could be an idea for a competition. Any takers?

#### Hmmm!

Sir,

Do you think in future, you can make your program lists slightly bigger? I've just got some nice OCR software and it would save loads of time if I could scan in the programs & dump em straight into C. It recognises most characters, but a few are a bit dodgy...

This would help me and a great many others get more from your magazine.

Mark Lansley (Internet address supplied)

The layout in small characters on a yellow background (which doesn't show up when Xeroxed) was adopted some years ago, when developers used to photocopy the code to enlarge it and type it in. In recent times, with the increasing predominance of long Windows programs full of house-keeping material, we are publishing fewer complete listings, so

there is much less code which you can type in and run straight off. Ease of photocopying has thus become less of a priority.

We are unwilling to increase the font size because we would rather use our precious space for the articles. Note that the full code is usually available for free by other means. Most of it is in the exe/files topic on Cix and, from this month, also on ftp.exe.co.uk (anonymous ftp). Alternatively, the unwired may send us an SAE and disk stating which code is required, and it will be sent by snail-mail.

We believe that this policy allows us to make the most of the magazine space available, while allowing our readers to get hold of source code quickly and conveniently. However, if there are many others with Mr Lansley's problem we are happy to reconsider.

#### C++ Copy Constructors

Sir,

Just a small note to point out that in the OOP article 'C++ Copy Constructor' in your April edition, the author fails to point out a solution to the problem of the copy constructor being called when the assignment operator is used.

That solution is simply to change the declaration of the operator= operator so that it returns a reference to the object, e.g.

demo& operator=(demo& dmo);

Since the temporary instance is no longer created, the copy constructor is not called.

As far as I am aware this is the recommended method of declaring assignment functions for this very reason, since there is obviously a potentially large overhead in performing the same operation twice.

Paul Bramley Software Services Kingston Communications (Hull) plc



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Requiring users to find bugs in machine generated C++ code, and understand how that maps to the original 4GL code, just doesn't make sense.

EXE: You emphasise Delphi's versatility as an advantage, but surely it is also a drawback? If one needs to build, say, a client/server application, PowerBuilder offers better CASE/database management facilities than Delphi.

AH: There's an inherent advantage to being versatile. Look at the computer on my desktop. Do I need a dedicated word processor, a PC for my spreadsheets and a terminal with access to my customer records? No, I've got one PC that's versatile enough to do all these things.

A very large American retail chain — one of the largest - just standardised on Delphi over PowerBuilder precisely because their engineers can do 85% of all their work using Delphi versus 60% of their work using PowerBuilder. That saves them enormous amounts of money and complexity, including in ways you may not have considered.

# Man

As an example, skills and techniques learned writing a small utility are directly applicable to client/server projects. A lot of today's programmers started out by writing those little command-line utilities in the good old days. It's a great way to experiment with and master the use of data structures, object-oriented techniques or learning about the Windows API. Consider, also, how using the same tool for a broad range of applications provides a company with a neat training path: someone can start writing non-database programs and then gradually move onto projects dealing with valuable corporate data.

There's no end to the components and views you can add to Delphi. The population of programmers who can build components in Delphi is much larger than with any other tool on the market. We're back to the days when one programmer in one room can build and test something that can be used by tens of thousands of other people. Can you imagine what the availability of specialised component sets will be like in six months? In a year?

I think the entire point of combining a component-based visual development environment with an object-oriented compiler and database technology is to make sure you never run out of gas. That's not a bug — it's a feature.

EXE: But if you want a quick and dirty hack, surely it makes sense to use Visual Basic, because everybody can use it without having to master a scary, complex language like Pascal.

AH: As we like to say, "It's not your father's Turbo Pascal any more". We made sure that the Object Pascal code you have to write is as easy as Basic but without limitations.

We've taken great pains to make sure that when you're interacting with components, the code you write is as simple as possible — but no simpler. Many reviewers have remarked that they thought they were coding in Basic when they first started using Delphi. It's that easy. When they want to do something more interesting and start using

the richness of the language, they usually start remembering how much they like Pascal.

In fact, I think you are missing an essential advantage of Delphi. Anybody who has used a compiler — especially one that supports good type-checking — knows that it is really a programmer's best friend. When it tells you it's probably not a good idea to take the square root of your Window caption, it's showing you a logic error in your code and saving you time. Is it an advantage that BASIC will perform automatic type conversions in that circumstance instead of giving you an error? I wish my spell checker program could complain about the logic of a paragraph I've written in the same way as our compiler warns you about illogical programming statements.

Our 32-bit compiler goes even further and offers you all sorts of hints about problems it detects in your program. This kind of help is invaluable and one of the things that makes programming in Delphi very productive.

#### Inheriting from Turbo Pascal

EXE: Turbo Pascal, and now Delphi, are well known for fast compile/link cycles. How is this done?

AH: Borland has over ten years of experience in building the world's fastest compilers, and we've put that knowledge to good use in Delphi — it compiles at about 350,000 lines per minute on a 90 MHz Pentium. A number of factors contribute to this throughput. Delphi units (code modules) compile to .DCU files, which you can think of as a combination of a C++ precompiled header file and an .OBJ file. (It's funny how the hot topic in the C++ community is pre-compiled header files and incremental linking - Borland's Object Pascal technology has had these features for more than eight years.) Delphi units specify what other units they depend on through USES clauses - sort of like C++ #includes of header files. By analysing the USES clauses of each unit in a project, the compiler can automatically perform minimal builds with no need for a make file. The net result is that the compiler never compiles more than it has to, and it never compiles the same thing more than once. Finally, the clean syntax of Object Pascal allows for very fast parsing.

EXE: Is the compiler engine itself written in Delphi? How much does it differ from the Borland Pascal 7 compiler?

AH: The compiler is written in assembly language. It is fully backwards compatible with Borland Pascal 7, and we've added lots of object-oriented extensions such as class references, virtual constructors, and the IS and AS operators. We did a lot of work to enable declaring, registering and filing properties and we generate run-time type information that's used to communicate published property, event and method information to the development environment. You'll see some interesting applications of that capability in our 32-bit release. One very unusual enhancement was our use of bound method instance pointers to implement event delegation. They're very efficient and fit nicely into the language. And of course we did a lot of work to add structured exception handling. In addition, there are lots of little niceties that people have requested, such as support for C calling conventions.

We're quite happy with the class reference model. It's simple to understand, efficient, and allows us to add garbage collection in some future release.





Exceptions are a quiet revolution — they truly simplify the way you write code. For the most part you can write your code as if errors will never occur.

EXE: Delphi implements objects in a manner similar to Apple's Object Pascal, with all objects allocated on the heap. Previous versions of Turbo/Borland Pascal used a more C++ like approach, with the ability to allocate objects on the stack and statically. Can you explain the reasoning behind this change in approach?

AH: It really is a question of features vs. complexity. The philosophy of Delphi's Object Pascal language is to deliver the **right** set of language features, as opposed to any language feature ever known to mankind. It's the well known 80/20 rule: You can get 80% of the power for 20% of the complexity, but squeezing out that last 20% of power makes the whole thing five times as complex to program. Mixing static and dynamic allocation of objects is one of those features that fall into the latter group. By implementing a pure reference model we were able to simplify the entire Delphi component library, and do away with a lot of the pointer management that plagues other products. Even though Delphi objects are allocated on the heap, in a typical Delphi application you never have to deal with allocating and freeing them.

EXE: I find this answer quite surprising and counter-intuitive. You had already implemented mixed static/dynamic allocation, and therefore presumably cracked the problems involved, so why go to the trouble to revert to the Apple Object Pascal approach which you had initially rejected?

AH: We didn't revert to anything, because we really started with a clean slate. Our class reference model is sufficiently powerful and flexible that having only one sort of class is actually an advantage. Once you give someone two ways to do the same thing, you have made your product less usable and you have to now help them understand when to use a statically allocated class versus a dynamically allocated one. We're quite happy with the choice we've made. It's simple to understand, efficient, and allows us to add garbage collection in some future release. And, of course, if you've got old code from Borland Pascal 7 that uses old style objects, you can still compile it from within Delphi.

Figure 1 - Delphi's floating-point exception classes

```
type
  EMathError = class(Exception);
  EInvalidOp = class(EMathError);
  EZeroDivide = class(EMathError);
  EOverflow = class(EMathError);
  EUnderflow = class(EMathError);
```

Figure 2 - Handling floating point exceptions

```
try
PerformCalculations;
except
on EZeroDivide do ...;
on EMathError do ...;
end;
```

EXE: Why did you abandon OWL, instead of revising it, like the C++ development group? As I recall, shortly after it was first released, Borland proposed OWL to the Object Management Group as a Standard for application frameworks under Windows. A complete revision after so few years doesn't inspire

confidence in the company's commitment to its standards.

AH: The proposal we made to OMG was based on the C++ OWL, which is quite different from Pascal's. The Pascal OWL library really wasn't designed with exceptions, properties, events, and so on in mind, and it was based on the older more complicated object model. We felt that a fresh start was more appropriate in order to attain the ease of use that we wanted for Delphi. But we did carry over quite a lot of code from OWL, and Delphi will still compile your old OWL applications.

#### EXE: Exception-handling - what were the major influences on your design?

AH: We looked at a number of languages and implementations, and were most influenced by C++ and Modula-3. As in C++, an exception in Delphi is simply a class, which means you can take advantage of the inheritance mechanism to handle whole sets of exceptions easily.

For example, Delphi declares a number of classes which deal with floating-point exceptions (shown in Figure 1). As you can see, EMath-Error is the ancestor of the other exceptions. This turns out to be really neat when you write a TRY..EXCEPT statement to handles floating-point exceptions (Figure 2). If the PerformCalculations procedure raises an EZeroDivide exception, it is handled by the first handler. If it raises any other EMathError exception, the second handler takes care of it. Since there is no ELSE clause, no other exceptions are handled — they are instead propagated to an enclosing exception handler.

We also borrowed... that is to say we were *inspired* by Modula-3's syntax for exception handling. Especially the TRY...FINALLY block for protecting resources, which is something of a pig to do in C++.

Exceptions are a quiet revolution — they truly simplify the way you write code. For the most part you can write your code as if errors will never occur, instead of spending the bulk of your time trying to determine if an error occurred, and if so, how best to clean up and back out of what you were doing. Delphi's Visual Component Library was designed from the ground up with exception handling built in, and that is a large part of the reason why Delphi and applications written in Delphi are so fault tolerant. One of my favourite demos is a little two-liner that, on the click of a button, assigns NIL to a pointer, and then dereferences the pointer. Each time you click the button, Delphi reports that a General Protection Fault exception has occurred, but because of the built-in exception handling logic, the app keeps running instead of bringing itself down.

#### EXE: Delphi's ability to handle GP faults is indeed one of its neatest tricks. Was it difficult to implement?

AH: It wasn't too bad, but it did take some nifty use of TOOL-HELP.DLL which implements the Windows low-level system tools interface. We basically register an interrupt call-back function which maps processor faults into Delphi exceptions. The reason that it all works, though, is that VCL was engineered from the ground up to be exception aware. Because of that, when a GP fault occurs and is mapped into an exception, the operation that was in progress will automatically know how to back out and clean itself up.

EXE: Can we expect any other major syntax additions/changes, for example Eiffel style assertions?

AH: We're always evaluating new language features, and surely there will be some in the upcoming 32-bit version. I'd rather not get into specifics, but as a rule, we don't really think

about language extensions in the abstract. Instead we look at the language as part of a bigger picture (class library, component model, visual environment) that must evolve as a whole to support new technologies and improve ease of use.

#### Delphi 95

EXE: Can you give Delphi programmers any guidance on how best to write applications that will be portable to the 32-bit version of Delphi?

AH: Delphi's Visual Component Library was designed with portability in mind. As long as you stay away from in-line assembler, 16-bit pointer arithmetic, and Windows 3.1 API functions which aren't supported in the Win32 API, your apps should port with little or no modification.

The Cardinal and Smallint types were introduced to facilitate portable code. Of the built-in types, Shortint, Smallint, Longint, Byte and Word have identical representations in 16- and 32-bit code. The Integer and Cardinal types, on the other hand, represent the most efficient signed and unsigned integer types of the particular platform. In the 16-bit version they are 16-bit entities, and in the 32-bit version they are 32-bit entities. In general, you should use Integer and Cardinal whenever possible, and Shortint, Smallint, Longint, Byte, and Word only when the exact storage representation matters.

Any 64K limitations found in the 16-bit version will disappear in the 32-bit version. For example, the 32-bit version allows you to declare arrays and allocate heap blocks of any size up to 4GB!

EXE: What is the current state of the 32-bit version? Will it support 16-bit VBXs, like BC++? Delphi 16-bit code runs somewhat slower than C++ - are you doing anything about this for the 32-bit version?

AH: Delphi was written to be portable — we've been working on the 16- and 32-bit versions in parallel since day one. The 32-bit version is in field test now, and it will ship shortly after the commercial release of Windows 95. Yes, there is a foundation of 32-bit VBX support technology available in-house, but our primary focus is OCX controls. That's what the competition is working on, and that's where we see the market going.

With respect to better code generation, Delphi-32 generates the same high-quality code as Borland C++ 4.5 — in fact, they use the same optimising back-end code generator.

EXE: Delphi is a terrific tool for rapidly developing state of the art software, but a number of shareware authors have expressed a wish that executables could be made smaller. Is it technically feasible to create a DLL-based version of VCL?

AH: It's something we're looking at, and certainly some of the 16-bit complexities with respect to multiple DLL clients are gone in 32-bit land. I can't yet comment on specific solutions, other than to say that we're actively looking at ways to make our executables even smaller.

I sometimes hear the comment "The programmers that wrote this %&##\$ thing should be forced to use it themselves!". Well, we did.



Some old gripes

EXE: A long-standing and major criticism of Borland Pascal is the proprietary nature of the object file format. Why won't Borland at least document the file format? At the moment, if you don't have the source code, all your units become useless each time the compiler is updated.

AH: We're well aware of these issues, and the 32-bit version will address them in a number of ways. What I can tell you at this point is that the 32-bit compiler has an option to produce .OBJ files, which can be linked with .OBJ files produced by other compilers.

EXE: A related issue: the Delphi user has still to translate the (typically) C/C++ headers of DLLs into Delphi import units, an exercise which is at best tedious and time consuming. Given that Borland has a lot of C++ parsing expertise lying around on the ground, are there ever been any plans to create a header file translation tool?

AH: Well, I'm not sure which C/C++ headers you're talking about. We've already translated all the Windows and OLE 2 API header files, and corresponding interface units are included with Delphi. But you're right, if you have a 3rd party DLL that was previously only interfaced to C/C++, somebody will have to do the translation. Usually, it's not that bad and I think you'll see an increasing number of vendors providing Delphi interface files for their DLLs. Also, I think you'll see more and more products take advantage of the OLE 2 ITypeLib and ITypeInfo interfaces, and we'll provide a tool that takes that information and produces a Delphi interface unit.

#### Delphi's new classes

Although Borland and Turbo Pascal have had object-oriented extensions for some time, the introduction of Delphi saw a significant revision of the object model used by the language. In the older systems, the reserved word object was used to declare a type which behaved much like any other. As with C++, these objects could be allocated on the heap, or placed in static storage, or even made into automatic variables on the stack.

Delphi instead uses the reserved word class to create new types. Delphi's object variables are all references - ie they are implemented as pointers - and so their contents must be stored on the heap. In most cases the Visual Component Library hides the business of allocating and freeing these objects from the user. Interestingly enough, this reference approach to handling objects was also used in Apple's Object Pascal, which predated Borland's first introduction of objects into Turbo Pascal.

Delphi also introduces syntax to support class methods (similar to C++ static member functions) and properties, which are data fields used in creating visual components. Delphi continues to offer the original object syntax, but it is not used in the new libraries.

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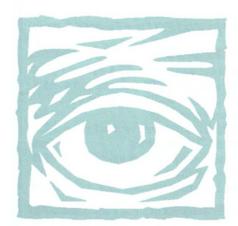
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## Adventure in a blind alley



Developing software for the visually impaired requires some special care but it isn't that tough. EXE has teamed up with the RNIB to challenge the games developers amongst you. To get you started **David Mery** gives a few hints.

When creating a program, very few developers think about the special needs of disabled people. This restricts considerably the range of software which disabled can use. To help change this situation, *EXE* is collaborating with the Royal National Institute for the Blind to launch a game contest. The goal is to develop an adventure game which can be enjoyed by most of the visually impaired population.

First let's - talk - about the implications. Contrary to common belief, not all visually impaired persons are blind. The term covers a much wider range of the population. To be successful the game must be usable and enjoyable by the largest number of potential gamers: from those with only a partial loss of sight to the completely blind. Windows or other GUIs are not a good choice of operating system. How do you navigate between windows when you don't see the windows themselves, let alone the mouse cursor? The best platform is DOS. That doesn't mean that the game has to be text only but it must have a textonly mode.

Clearly, the more interface options a program offers, the more people can use it and the better it is. Most games developed these days are graphics based. But for nearly all adventure games, the move from text to graphics had more to do with making the game attractive than introducing features impossible to render in a text environment. So why not offer both options? Graphics for those that can use it and text descriptions for the rest.

Another issue to bear in mind is timing. Computer users react with very different speed; this is even more true for the visually impaired. So, do not require the user



to respond within a fixed time or, alternatively, make the time delay a parameter.

The marketing considerations when developing applications for visually impaired are really the same as for any other section of the public. Either you limit the options and target the software to a particular group of the computer users, or you design the program to make it as open as possible.

#### Text, then voice

Why so much emphasis on a text interface? Because displayed text can easily be read out by suitable specialised devices. For instance, all the PCs at the RNIB Red Hill College are equipped with HAL, a speech synthesiser, and LUNAR, a screen enlarger. Some of the students are happy using only the LUNAR system as long as they can set the colours to what's best for their vision, while others do all their work with the speech synthesiser. Several solutions for several needs. This really cannot be over-emphasised.

#### **Turing test**

Every year Robert Epstein, Research Professor at the National University of San Diego, directs a contest in artificial intelligence based on the 'Turing Test'. This test was devised by Alan Turing to determine if a machine is *thinking* or, in other words, is *intelligent*. In the test, a panel of judges converse with the machine via a terminal. If the panel cannot distinguish if they're effectively conversing with a machine or with a human, then the machine is considered to have passed the Turing test and it must be concluded that it is indeed *intelligent*.

Epstein recently received suggestions to modify the test to allow visual and auditory input even though Alan Turing specifically ruled out such input. The Prize Committee favours Turing's view, but it's still an issue. To help them make a decision, Epstein is turning to the blind and deaf community. He's looking for a professional who is both blind and deaf to advise the Committee.

Robert Epstein can be contacted by email at repstein@nunic.nu.edu or by phone on 001 619 436 4400.





#### GUIs and the visually impaired

Satisfactory solutions have been developed for the visually impaired to give them access to DOS machines. From speech synthesiser to Braille output, there are many products on the market. But walk into any office today and you will find mainly Windows or Mac workstations. For persons with only a partial loss of sight, magnifier programs can be the solution but what about completely blind people?

GUIs are tied up with visual clues to such an extent that it looks like an impossible task to find a non-visual representation. How to indicate which window has the focus, where the mouse cursor is, what icons are present, etc? Direct manipulations such as double clicking on an icon, drag and drop or selecting options in a dialog box are among the many advantages provided by GUIs to sighted users. Even text displayed in GUIs is often in graphical form.

Another related problem is information overload. Graphical representation allows a sighted user to access a great amount of information in a very short time. To read or describe a whole screen precisely when several applications are open could take a very long time.

The first commercial GUI screen readers are now appearing on the market but the technology is still in its infancy and is probably not the best solution for GUIs. The problem is that they are *graphical screen* readers not *graphical interface* readers. They focus only on the information content present on the screen.

The Commission of the European Community funded a project to examine these issues. Textual and Graphical User Interfaces for Blind People (GUIB) as it is called, surveyed visually disabled computer users in 1993 and discovered that 46% had used a GUI and that 39% of those that hadn't might need to use one. The first figure must have increased since the survey was done. GUIB also surveyed software firms and found that only 27% planned to have text based alternatives to GUIs. Unless solutions become commercially available the future is bleak for visually impaired computer users.

#### Non-speech representation

A lot of effort has already been put into devising ways a visually impaired person can interact with a GUI. Even though some work is now quite old, little of it has reached the commercial stage. Some of the projects have come to a complete halt mainly because of developers changing job.

Some earliest work in this area was done in 1988 by Alistair Edwards at the Open University. He created an interface where entities of the visual interface were replaced by auditory elements. His system was primitive because of the way that he imposed constraints on the GUI environment. The number of windows in the GUI desktop was fixed. Windows were of a fixed size, could not be moved and did not overlap. Edwards's environ-

ment was a step in the right direction but still far away from a standard screen in a modern GUI. One important gain from this research concerned the type of sounds that should be generated. 'The tones used were simple square-waves of different pitches [...] One way that the user's memory load could be reduced would be if more information could be conveyed in the sounds used in the interface.'

One of the most impressive projects using auditory signals is the SonicFinder by Bill Gaver in 1993 at the Xerox EuroPARC in Cambridge. Gaver created a desktop for the Macintosh where all the interactions were associated with speech and non-speech sounds. He added meaningful sounds to all common desktop operations such as cut and paste. In his system every computer object was acoustically modelled on the sound produced by different natural materials.

Windows could be rendered as blocks of wood and the mouse as a bit of metal. When the mouse was moved it would sound like a soft hammering on a piece of metal, the closing of an open window could be the sound of a hammer banged on a block of wood and so on. Three parameters were used to distinguish between each objects: shape, size and material, and one for events happening to a particular object: mallet hardness.

This approach gives a lot of information in a totally non visual way, in a very short time. Though very convincing, SonicFinder has been released only as a developer's version and never went to the stage of a formal release. Gaver says 'it was used by many people very informally. It is now completely out of date, it wouldn't run on any Macintosh today'.

This research could also be used for the benefit of the sighted. Gaver devised a sound system in the lab that would alert all the researchers of different events happening.

The GUIB group has development teams all around Europe working on several projects, including one which is also based on non speech sounds, although this time it was developed for the Windows environment. Mouse tracking is represented by steps walking on different natural surfaces. The surfaces correspond to the condition of the desktop: active or passive window, Program Manager... The mouse shape is associated with two main sounds: elastic band when on a window's border and clock ticking for the hourglass. Icons are associated with a spring sound: when they're activated the pitch changes. A switch sound is used for buttons.

Handling windows is more complex. When a window pops up, you can hear a door opening with a pitch which is function of the window's size. Status bars are step sounds on a sand surface. Moving is like scratching and sizing like an elastic band. The desktop is associated with a continuous sound of cricket, jungle, sea or forest.

(Continued overleaf)

The cost of such systems, about £240 for HAL and £200 for LUNAR, means that they're not as widespread on home systems as they should be. A digitised recording of a voice played via a sound card could be an alternative solution. The problem with sound cards is that, although they're low cost, they're usually difficult to install and often have controls located in the most awkward positions. The volume knob on most cards is located on the back of the card itself. For these reasons they're not as popular with the visually impaired as you might expect. Only two PCs at Red Hill college are equipped with sound cards. If you plan to include sampled sound and voices in your game, make it an option.

Speech generated by synthesisers is notoriously unclear, although regular users of such devices become adept at understanding the synthesised voice. Most products offer a memory and a repeat option, but it's still a good idea to include a 'redisplay last message' command in the game.

#### Configuration

Special care must be given to the configuration of the game. This bit of software needs to be accessible by most right away. It should be text only, with a good colour contrast, and should be controlled by easily accessible keys on the keyboard. Experienced PC users can access function keys without much trouble, but novices may have problems moving back and forth from the standard keyboard to the function keys.

Besides the obvious option of choosing between text or graphic mode, the background and foreground colours should be customisable as well as the key assignments. The numeric keypad is often needed by magnifying programs, so if you plan to use direction keys in your game do not depend on being able to use these keys.

One problem that can easily be overlooked is that of the documentation. If it can't be read, even the best game might end up on a shelf. As you can probably guess by now, the official advice is to provide options.





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# elphi

a developer's introduction

Last month's article took a critical look at the implementation of Delphi from a programmer's point of view. This month, we're going to conclude by examining some other aspects of the system, notably the VCL library, and the writing of Components. We'll also look briefly at ways in which you can trim the fat from your Delphi programs.

An overview of the VCL library

The diagram in Figure 1 is taken from Borland's on-line documentation - it provides a thumbnail sketch of the VCL (Visual Component Library) hierarchy. Not all of the built-in VCL component classes are shown, but the diagram does illustrate the most important groupings within the family tree. In Smalltalk fashion, all classes are derived from TObject, the great-great-grand-daddy class. This class implements a certain amount of low-level functionality, such as InheritsFrom, which determines whether or not a particular object is ultimately derived from some specified class. There's a method called InstanceSize which returns the amount of storage (in bytes) required by an object of a certain class and another method, ClassName, which returns the class name of a specified object. Incidentally, if you snoop around inside a Delphi program's .EXE file,

Dave Jewell

concludes his series on
Delphi. In this month's
article he gives
some practical tips to
Windows developers on
how to get to grip with
some powerful aspects
of the language.

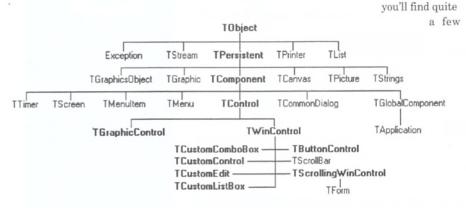


Figure 1 - An overview of the VCL object hierarchy. Although not all classes are shown in this diagram, you can see the major sub-divisions into visual and non-visual components, windowed and non-windowed components, and so forth.

occurrences of what looks like class names embedded within the code segments. Part of the reason this stuff never gets stripped out is because of the need to satisfy ClassName calls at run-time. If you've got the VCL source code, you'll find that TObject is implemented inside the System unit itself (\DELPHI\SOURCE\RTL\SYS\SYSTEM.PAS).

The next level of the hierarchy includes TException, which implements the structured exception handling capabilities of Delphi and TStream, which handles the streaming of objects (both forms and components) to and from files. As already stated, Figure 1 doesn't tell the whole story - there are other low-level classes such as TFiler, TReader and TWriter which are part of the streaming mechanism. TPersistent objects can be streamed to and from a file hence the name. Most other useful VCL classes are derived from this class.

#### **Encapsulating GDI**

The TGraphicsObject is the ancestor of the TFont, TPen and TBrush classes, all of which are object-oriented wrapper classes around the LOGFONT, LOGPEN and LOG-BRUSH data structures which should be very familiar to the seasoned Windows developer. All three of these classes appear as fields within the all-important TCanvas class. TCanvas is the object oriented equivalent of a device context. Using the TCanvas class, graphics programming under Windows can become very much simpler than it is when done traditionally. For example, Listing 1 shows a simple FormPaint routine which draws a series of rectangles on the form background - the result of running this code is shown in Figure 2.

There are several things to notice here. Canvas is a run-time property of the form itself, whereas Brush (of class TBrush) is a property of the Canvas. Color, in turn, is a property of the brush object. This demonstrates the well-structured, hierarchical nature of the VCL library. When we assign a value to the Color field of the brush, a new brush is created behind the scenes using standard GDI calls. The resulting brush

handle is automatically selected into the device context corresponding to the Canvas object. Thus the need for the programmer to concern himself with creating and deleting drawing objects and selecting them into and out of device contexts is eliminated.

You'll also notice the call to FrameRect. This is a method of the Canvas object and doesn't therefore need to be passed a device context - the HDC is implied. There is a number of other Canvas methods which do the same job as Windows API functions of the same name; Rectangle, Ellipse, RoundRect and so on. Be careful not to confuse Canvas methods with API calls!

Wherever possible, it's better to use the VCL library rather than the API. Not only will you write less code this way, but you'll also have a much better chance of moving your application painlessly to 32-bit Delphi once it becomes available. This is especially true when sending and receiving Windows messages - the layout of many messages has changed between Win16 and Win32, hence the need for the 'message cracker' macros used by C/C++ developers.

If you do find it necessary to perform a graphical drawing operation that isn't directly supported by VCL, you can simply use Canvas.Handle to give you the device context for the canvas. Similarly, the Handle property of the form will give you the corresponding window handle.

#### Two component kinds

Returning to the VCL hierarchy, the next port of call is TComponent. Any control which can be manipulated from inside Delphi's form design environment must be derived from this class - and this includes forms as well. There's an important distinction to be made

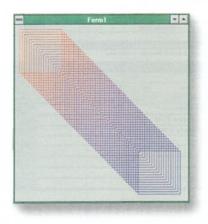


Figure 2 - Running the small FormPaint routine shown in Listing 1. With VCL's encapsulation of the Windows GDI, you're not forever worrying about selecting things in and out device contexts, destroying objects and other nonsense...

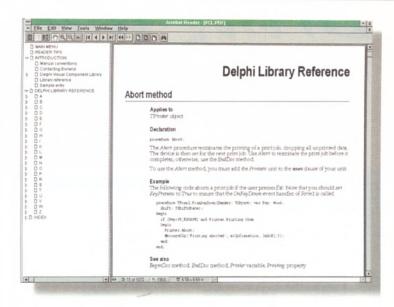


Figure 3 - The infamous Acrobat reader - at the time of writing, it's the only way of viewing the forthcoming Object Pascal and VCL Reference manuals. Windows/NT users need not apply...

here between visual and non-visual controls (or components - as I said last month, the two terms are synonymous). According to the *VCL Reference Manual*'s definition, a visual control is something that the user can see and interact with at run-time. Examples of this are push buttons, listboxes and so forth. By this definition, you might think that menus and File Open dialogs are examples of visual controls, but they aren't! A better definition might be: a visual control is something that has the same design-time representation as it has at run-time.

To make this clearer, think about menus, common dialogs and - say - TDataSource controls. None of these have a design-time representation which is remotely similar to what they look like at run-time. (In fact, DataSource components have no run-time representation as far as what appears on the screen is concerned.) They are simply 'placeholders' - convenient hooks for accessing the functionality of Windows menus, COMMDLG.DLL and the database subsystem.

When creating your own components, it's very important to derive your new component from the right place in the hierarchy. If you get it wrong, you'll end up fighting the system all the way. If you want a visual component, then derive it from TControl. If you want a non-visual placeholder, then derive it from TComponent. As an example, if you were creating a new 'super-Image control' capable of displaying GIF's, JPEG's and other esoteric file formats, then you'd derive it from TControl. However, if you want to encapsulate PKZIP-compatible compression routines into a VCL component, then it makes far more sense to use a non-visual control based around TComponent.

Having taken the visual component branch, there's now a further sub-division into windowed and non-windowed controls. As the name suggests, a windowed control corresponds directly to a HWND at the API level. Windowed controls can receive the input focus, respond to mouse clicks and so on. Virtually all the 'standard' controls such as check boxes, edit boxes and push buttons are derived from TWinControl, as is Tform, the form class itself. The TGraphic-Control, on the other hand, doesn't correspond to a window, so it consumes less system resources. It does include a canvas on which to paint and it responds to paint messages. It's therefore ideal for creating the 'super-Image control' referred to earlier.

To summarise then, when you're creating a new component, you first need to ask yourself whether or not the control will be visual. If visual, you then need to ask whether or not it needs to receive the input focus. Based on the answers to these questions, you can derive your new component from an appropriate ancestor class.

Let's now have a look at how to write components and ensure that the size of the application is reduced to a minimum.

#### Component writing

A Delphi component is written as an Object Pascal unit. Compiled units are linked together into a single large DLL called COMPLIB.DCL which is used by the Delphi development environment. Obviously, when you create an .EXE file, the code for each unit is linked into your executable. A particular unit can contain multiple components, and these components can be placed onto different pages of the Component Palette.

When creating a new component you'd normally use the Component Expert (available from Delphi's File menu) to generate the skeleton of your unit. You tell the expert what you want to call the new component, the class it's derived from and the Component Palette page where you want the component to be located. Listing 2 shows a skeletal unit generated by the Component Expert - you need to add the component-spe-

cific variables and function declarations to the TGizmoList class definition, and then add the code for any new methods.

You'll notice that the only routine (other than methods of the exported class definition) which must be exported from the unit is the Register procedure. Every component unit must have this procedure. It's called by the Delphi development environment to register components, assigning

```
procedure TForm1.FormPaint(Sender: TObject);
var
   i, j: Integer;
begin
   for j := 0 to 50 do
   begin
        i := j * 5;
        Canvas.Brush.Color := RGB (250 - i, 0, i);
        Canvas.FrameRect (Rect (i + 10, i + 10, i + 100, i + 100));
   end;
end;
```

Listing 1 - A simple FormPaint routine which draws a series of rectangles on the form.

```
unit GizmoList:
interface
  SysUtils, WinTypes, WinProcs, Messages, Classes, Graphics, Controls,
 Forms, Dialogs, StdCtrls;
type
 TGizmoList = class(TListBox)
 private
    { Private declarations }
 protected
    { Protected declarations }
 public
    { Public declarations }
 published
   { Published declarations }
 end;
procedure Register;
implementation
procedure Register;
begin
 RegisterComponents('Samples', [TGizmoList]);
end;
end.
```

Listing 2 - Skeletal unit generated by the Component Expert.

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A6EBFE			160						DEL	THE		rive			
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Figure 4 - HeapWalker can be used to pinpoint the various modules used by the Delphi development environment. Using GetModuleHandle, you can use this as the basis for implementing your own run-time-only security mechanisms into Delphi components.7

them to specific pages of the Palette. A large component unit could potentially register many different components within the Register routine.

#### Security issues

One issue which is of great concern to component writers is that of security. With a Visual Basic VBX control, the VBX always remains entirely separate from the program's EXE file, and there's always the danger that some unscrupulous individual will try and use the VBX in his or her programs. When a VBX control is initialised, it's passed a parameter which indicates whether it's being used at run-time (from a compiled .EXE program) or at design-time (from inside the VB design environment). If the latter, many third-party components check for the presence of a special 'licensing' file in the \WINDOWS\SYSTEM directory, and will refuse to run if the file isn't there or is deemed to be invalid. In this way, it's possible to prevent unlicensed VBX files, intended only to be used at run-time with some finished application, from being incorporated into new programs.

How does one add similar security features to Delphi components? Since a Delphi component is linked into the program's executable file, there's no danger that a component could be extracted and used within another application - this wouldn't be a practical thing to do. However, a number of Delphi component vendors (including TurboPower - well known to Pascal developers for many years) have recently released 'trial' versions of their components onto the Internet. These trial components will do everything that can be done in the full version with one exception - they will refuse to run unless Delphi is present, creating an exception which terminates execution of the program containing the component. It's obviously a good idea to be able to distribute components in this way since users can try before they buy, while at the same time the component writers interests are protected.

How is this achieved? You'll notice that I said 'refuse to run unless Delphi is present'. I didn't say 'refuse to run outside the development environment'. TurboPower's Orpheus components will run quite happily in a compiled, stand-alone executable provided that Delphi is itself loaded in memory. By now, experienced Windows developers will be saying 'Aha!' The secret, of course, is to just call <code>GetModuleHandle</code> inside the initialisation code for your unit, passing it the string 'DELPHI'. If a non-zero module handle is returned, then you know that Delphi is running. If you get a NULL handle, then the component can generate an excep-

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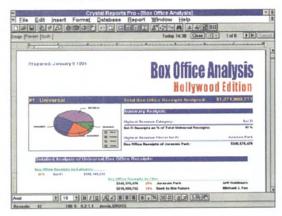
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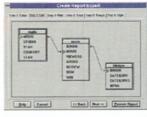
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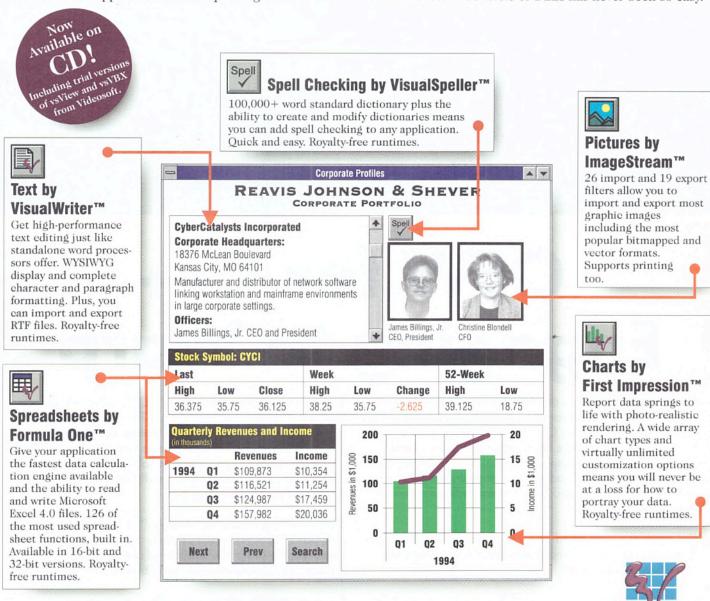
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# Seamless, but open to interpretation

A one-to-many association between two classes may seem straightforward. But when moving from design to implementation it can be interpreted in several different ways as Mary Hope demonstrates...

One of the most used expressions about object technology is that it is *seamless*. This is generally held to mean that you are dealing with the same concepts and notation, i.e. classes, throughout the lifecycle. This is undoubtedly the case. However the term *seamless* seems somehow to imply that moving from one stage to another is a natural progression, with little in the way of interpretation required. But this is not necessarily so.

Object technology may be described as the more 'holistic' approach to software development but if you look at the books on the subject there seems to be a divide between those that deal with analysis/ design and those that cover object oriented programming (usually in C++). Of course one explanation is that a text covering the whole lifecycle would be too large. But there are probably cultural reasons as well. One of the remnants of the waterfall lifecycle days is that many of us still define ourselves as 'basically programmers' or 'at heart a systems person'. The holism of object technology is often implemented by mortals who are stronger at one end of the lifecycle than another.

So although the system may not have milestones, many authors tend to fade in/out at various stages along the way. For instance the strength of Rumbaugh's Object Modeling Technique (OMT) is in analysis. Booch is probably anticipating a trend in extending his method to cover more of the lifecycle. His first book was called *Object Oriented Design* but for the second edition he beefed up the paragraph on analysis and retitled the book *Object Oriented Analysis* 

and Design. Other names firmly associated

with the front end of the lifecycle are Wirfs-Brock, Jacobsen, Schlaer & Mellor and Coad and Yourdon.

One author who tried to break through this partitioning of the lifecycle was Peter Coad. Several years ago he bought out three books (two co-authored with Yourdon and one with Nicola), one each on analysis, design and programming. However the ones on design and implementation seem not to have impinged on the market and his name is now mainly associated with the front end of the development process. At the other end of the lifecycle, if you are implementing in C++, you will get guidance from names such as Stroustrup, Scott Meyers and Koenig.

One of the consequences of this divided treatment of the lifecycle is that the handling of some of the transition points is open to interpretation. An area that has long interested me is the jump from the diagrams produced by a particular methodology to the code that actually does something. In the days of SSADM type approaches it always seemed that there was a touch of magic about the extraction of code from what went before. Coad and Yourdon in Object Oriented Analysis talked about the transition from analysis to design as being a constant source of frustration. They commented that 'The substantial shift in underlying representation has made this transition an untenable problem.'

#### A one-to-many association

All the authors associated with the front end of the lifecycle have a particular notation for classes and the links between them. I will

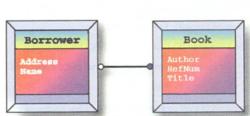
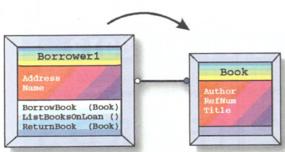


Figure 1 - Part of the Analysis Model



Easy to traverse

Figure 2 - Most accesses are from the 'one' end of the association

use Rumbaugh's as this is, at the moment, the most widely used method.

A class is defined as a group of objects with common attributes, operations, relationships to other objects and semantics. In Rumbaugh's Object Modelling Technique (OMT) a class is drawn as a three part box with the name at the top, the attributes in the middle and the operations at the bottom.

An association shows a structural relationship between classes. It means that information about the relationship needs to be preserved for some time. One frequent misunderstanding is to draw in an association when one class uses another. In Rumbaugh's notation an association is a 'remembered relationship' not a 'using relationship'.

While Rumbaugh has a number of types of information that can be attached to an association, such as multiplicity, roles, qualifiers and constraints what is not shown is the way in which the association information is accessed. Is it a bidirectional access or is the access in one direction only? It may be that this detail is too implementation specific. For instance, if the design was to be implemented in an Object Oriented Database it might not be necessary to specify whether traversal was mainly to be one way or both. In Rumbaugh's defence it ought to be noted that such information would come out in the models used to show the dynamic behaviour of the system, e.g. Object Interaction Diagrams.

Linked to the question of whether the association will be traversed equally from both sides or only from one is whether both

```
// library1.cpp
// A simple implementation
// a forward definition
class Book;
// the Borrower class
class Borrower1 {
private:
 char _name[30];
  char _address1[20];
 Book _onloan[6];
public:
Borrower(char* name, char* address);
int BorrowBook (Book book);
int ReturnBook (Book book);
 void ListBooksOnLoan();
// the Book class
class Book {
private:
  int _refnum;
 char _author(30];
 char _title[30];
public:
  Book (int refnum, char* author,
        char* title); };
```

Listing 1 - Code for the two classes in a one-to-many implementation

#### Easy to traverse

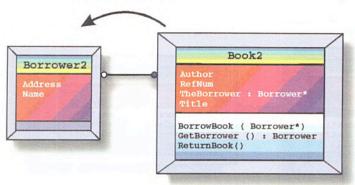


Figure 3 - Most accesses are from the 'many' end of the association.

ends of the association have to remember about each other. In general one way traversal implies one way remembrance and bidirectional traversal means that both ends need information about the other. Bidirectional traversal is possible if the remembered relationship is only stored at one end but it is an expensive operation.

In C++ these dynamics limit the options open to the programmer. To look at some of the possibilities consider a library system part of which has the classes Borrower and Book. This will generally be a one-to-many association (i.e. one book can have zero or one borrowers and a borrower can have zero or many books). This is shown in Figure 1. At the analysis stage the class diagram may not have any operations. As the design progresses these will be added. It is easy to anticipate the sort of operations that that may be required with this relationship; eg. borrowing and returning a book, checking which books have been borrowed by a library member, checking which books are out on loan, etc.

#### Five ways of killing the cat

How this simple relationship is implemented depends on the answers to several questions. Here I will describe five different ways of coding this one association in C++going from the very simple to the more sophisticated. Which is best depends on your level of programming expertise, how many classes also reference the class at the *one* end of the relationship, whether unidirectional or bidirectional access is required and the availability of a good class library.

#### Simplicity itself

The main use of the association may be to traverse from the one to the many, i.e. you know the borrower and want to find out what books s/he has. In this case only the Borrower class has to remember about the books. The simplest way to code this is simply to put an array of books in the Borrower class. This is an entry level method of implementing a unidirectional association and the

design for this is shown in Figure 2. The code for the two classes is in Listing 1.

This sets up Borrower as a simple value based (as opposed to reference based) collection class. Note that with this implementation it is still possible to traverse the association from the one to the many, eg. to ask which borrower has Wind in the Willows, but the operation is expensive as it involves searching through all the borrowers to find that particular title.

This style of implementation is fine for small, simple programs but has several limitations. It is less efficient as it uses objects rather than pointers to objects. The array has all the usual drawbacks of being a fixed size. This implementation could be upgraded by making the data structure holding the objects a linked list so that it is extensible. Or more in the object oriented

```
// library2.h
// An implementation using pointers
// forward reference
class Borrower2:
// the Book class
class Book2 {
private:
  int refnum;
 char _author[30];
 char _title[30];
  Borrower2 _borrower;
public:
Book2 (int refnum, char* author, char* title);
  void BorrowBook(Borrower2* borrower): _
  void ReturnBook();
 Borrower2* GetBorrower();
// the Borrower class
class Borrower2 {
  char _name[30];
  char _address1[20];
public:
Borrower(char* name, char* address);
```

Listing 2 - The class declarations for a many-to-one implementation

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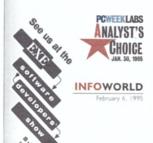
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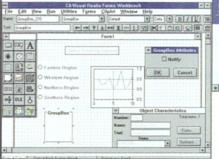


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# PICTURES WAS BONTHE WILLIAMS



A WWW page is not much use without pictures.

Peter Collinson uses a wide range of tools to manipulate his images, and performs some alarming sounding aeronautical stunts to get them.

In the last year or so I've become a happy Web publisher, Running my own World Wide Web server is fun. I use it to provide commercial information for one of my enterprises; it contains technical and ordering information for new customers, support and news for existing customers. I use it to give information to people who read my columns, and you'll find a complete list of all the articles I've written for EXE and the US magazine to which I contribute. I also use it for my own, personal 'home pages'. I publish some attempts at humour - various pieces that I have written over the years. My 11-year old son has used Quarterdeck's add-on for Word 6 for Windows to generate his home page (reviewed in EXE May '95 - Ed). He was already Word-literate and the Quarterdeck tool made HTML easy -I merely added the links.

Early on it became apparent that I needed to display more than text. HTML, the HyperText Mark-up Language, allows you do display nice looking text that adapts itself to the user's screen, but plain text gets boring to look at. It's graphical images that make the pages lively and gives you a house style. Including images on the page is easy. You just insert a piece of HTML syntax that loads the image from the server. Usually the image is stored as a GIF format colour bitmap, because this is the format that the browsers understand. Other formats are possible, but I haven't used them.

If you have images on your pages, you should consider the people who are reading them with a text based browser such a Lynx. The HTML mark-up language allows you to specify alternate text with each image that you place on the page. I try to use this wherever possible (or necessary) to give a text based reader some idea of what they are missing. For example, I have graphic that says 'Welcome' and the alternate text is set to that string. I also have some buttons that are pressed to move up to previous pages. I set the string to null for these buttons so that the Lynx user isn't teased by the default text of: [IMAGE] being displayed.

Of course, if you stuff your pages with images then your readers have to pull them over the Internet to their machine. You don't want the images to be too large, otherwise the user will get sick of waiting and will give up on your pages. I find that the Netscape browser will lose heart and gives up if pulling an image takes too long. On the other hand, Netscape caches images it has downloaded, so there is no delay next time.

If you want to display a large picture, it's often more user friendly to include a small image on the page that is a clickable icon, and give the user the option of choosing whether they have the bandwidth and the inclination to pull the whole image. This is also easy to do.

Displaying images, then, isn't too hard. What is difficult is getting hold of images to display, making sure they are in the correct format, trimming them to size and sometimes messing with their colour maps. There are many sources of images: you can raid the various sites that contain icon libraries, you can take photographs and scan them into the machine, you can pick up pictures from many Windows based tools like Word or PowerPoint, you can even create them yourself using a painting package.

#### Image conversion

I find that I now use a wide variety of tools, some on UNIX and some on Windows. I thought it would be interesting to explore some of them.

In last month's article on books for UNIX, I noted the *Encyclopaedia of Graphics File Formats* by James D Murray and William van Ryper (see also Francis Glassborrow's column this month - Ed). It's a 900

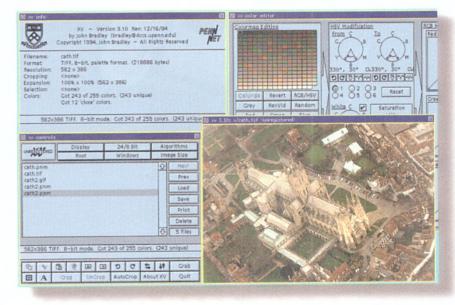


Figure 1 - Using the xv program to examine a TIF/GIF of Canterbury Cathedral



page (quite scholarly) tome that describes 43 different ways

that have been used to

store bitmap data. It seems that everyone who creates a new program will create a new graphics file format that is used to store their images. Programs often have the ability to load images from different formats, but only the best have ways of writing images out in a foreign format. Format conversion can be a serious problem.

Perhaps the oldest toolkit for UNIX that attempted to tackle the problem caused by the plethora of formats is the Portable Bitmap suite of programs (usually called the PBM package). This package was written in 1989 by Jeff Poskanzer. He released a revised version called PBMPLUS in 1991 and this is included in the standard X11 distribution.

A derivative and much improved version called Netpbm was made available in 1994. This was done by a group of people and is 'unofficial', in the sense that the original author was not involved. I recommend that you get hold of Netpbm if you don't have any of the PBM libraries. For copyright reasons, not all vendors make it available to you so you may have to pull the code from the Internet. Even if you have PBM, you might wish to look at the Netpbm suite anyway, since it supports very many more file formats than the original suite.

The PBM program was originally intended to provide conversion between the various monochrome bitmap formats that were extant at the time the package was written. It was then extended to cover grey scale images (Portable GreyMap format or PGM) and colour images (Portable PixMaps or PPM). Many of the programs deal in all the three basic types and are called Portable AnyMap utilities (PNM). These acronyms

Location: http://www.hillside.co.uk/visitor.html

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Panla who come here are a little anonymous Places take a faux coor

Figure 2 - Using Netscape to look at my WWW Visitor's book

are important because the program suite consists of a great many programs and the acronyms are used in the program names to identify the type of format that the program deals with.

To convert from one bitmap format to another with the PBM tools, you first change the source bitmap into a suitable 'Portable' format and then convert that 'Portable' file into the target format. When in the Portable format, you can manipulate the image in various ways, perhaps cropping it or converting from colour to grey scale. There are also tools that allow you to reduce the number of different colours that is used by an image. This can help to reduce the size of the target file for some formats.

For example, to convert from a TIFF format file to a GIF that is half the size of the original, you will do these operations:

% tifftopnm cath.tif > cath.pnm
tifftopnm: writing PPM file
% pnmscale 0.5 cath.pnm >
cath2.pnm

The first command takes a TIF format and creates the PPM file. Then we run the scaling program to halve the size of the image. Now let's make a GIF file. There isn't a pnmtogif command, so we try the nearest likely command:

Here's a snag. The TIF format supports 24 bit colours, but GIFs only have 8 bits. A scanned-in photograph typically contains a great many colours - but it turns out we can get away with a great deal fewer. The ppmquant command takes as a parameter the total number of colours that it may use to display an image. It picks the nearest colours

and outputs a PPM file. If we choose 256 colours then the image will be close to the original, but it may consume all the colour map registers on the target machine. Anyway, we also want to reduce the size of the file. As a first hack try 64 colours: I've found that this number usually presents an image that is not too different from the original when displayed on a screen (48 is OK too).

#### TECHNIQUES

% ppmquant 64 cath2.pnm >

cath2.ppm

ppmquant: making histogram...
ppmquant: too many colors!
ppmquant: scaling colors from

maxval=255

to maxval=127 to improve clustering...

ppmquant: making histogram...

ppmquant: 30245 colors found

ppmquant: choosing 64 colors...

ppmquant: mapping image to new

colors...

At this stage I like to check the image using an image display program that can read PBM files. If it looks fine, I may cut down the colours and try again - anything to save a few valuable seconds of my Web page reader's time and phone bill. Finally I can translate the file into a GIF.

% ppmtogif cath2.ppm > cath2.gif

I hope that this is enough to give you a flavour of how the package is used. The software has a great many other uses than manipulating images for the Web. I used it some time ago to digitise my signature, creating an Encapsulated PostScript file which is automatically sucked into my Word fax template. I have no scanner, but I do have a fax machine and a fax modem. I signed my name on a page and faxed it into the computer. I used the PBM suite to process the G3 fax raster image. The image needed cropping and resizing before being written out as an EPS file. I found that writing my signature about twice the size of the final image, and then halving the size (and thus doubling the resolution) of the bitmap by two meant that the pixelisation of the final image was reduced. You don't see any 'jaggies'.

#### Looking at images

Processing files with UNIX commands is useless unless you can see the intermediate images. In recent times, I have become a devotee of the xv program for this. The xv program was written by John Bradley and is made available as shareware on the Net. He makes the program free for personal use but requires any business who makes serious use of the program to pay a registration fee of \$25. I have decided that I now fall into that category and have sent off my money.

The xv program is a client of the X window system, but does not make any use of any standard widget set. Instead Bradley has preferred to use the raw X protocol. As a result, xv has its own house style (right down to the little horizontally rotating cursor in the shape of a little 3D fish that's used when xv is busy doing something).

# Воосн RUMBAUGH



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# DBtools.h++, best of both worlds

Barry Smith looks at Rogue Wave's DBtools.h++, a complete re-write of its database class library Db.h++. Forget about C, this is a library for C++ developers.

Two unpleasant surprises await programmers new to the world of client-server development. After mastering Codd's relational algebra and grasping the simple beauty of ANSI standard SQL, the first shock is the sheer ugliness of the C programming interface you have to learn to embed SQL statements in your programs. The second shock is that you have to learn a completely new interface every time you start to work with a database from a different vendor.

From the point of view of developers using C++, things are even worse. The SDKs supplied by database vendors are all designed with C in mind; they leave you to write the C++ encapsulations yourself. Enter Rogue Wave's new class library: DBtools.h++.

Many readers will be familiar with Rogue's other libraries, which include among others the widely-used general purpose toolkit, Tools.h++ and the mathematics library, Maths.h++. In fact, Rogue has had a database class library on the market for some years now under the title Db.h++. This was originally developed by Glockenspiel and sold to Rogue by the asset-strippers at

Computer Associates. The new product is a complete re-write based on the experience of selling and supporting the old database library.

DBtools provides a very generic and elegantly designed C++ interface that gives you the best of both worlds by wrapping up ODBC data sources (see box on ODBC pitfalls) and proprietary database APIs. You get the generality of ODBC, and also the performance and functionality of the vendor's native interface. DBtools supports common extensions to the SQL paradigm — like BLOBs (binary large objects), stored procedures and extended SQL function syntax — but it does so in a platform-independent way. And if you really need to get at the vendor's interface directly, the DBtools classes will lend you the relevant handle.

#### **Access Libraries**

DBtools is multithread safe and portable between DOS, Windows 3.1 and Unix. Other ports - to NT and Macintosh for example - were not yet shipping at the time of this review but the NT version should be available when you read this article. Unlike some



```
DBtools interface classes
                                         Producer method
RWDBManager
RWDBDatabase
                                         RWDBManager::database()
                                         RWDBManager::connection()
   RWDBConnection
     RWDBSystemHandle
                                         RWDBDatabase::table()
    RWDBTable
     RWDBReader
                                         RWDBTable::reader()
                                         RWDBTable::cursor()
     RWDBCursor
     RWDBDeleter
                                         RWDBTable::deleter()
     RWDBInserter
                                         RWDBTable::inserter()
     RWDBUpdater
                                         RWDBTable::updater()
   RWDBResult
                                               various, e.g.
                                                RWDBDatabase::executeSql()
    RWDBSelector
                                         RWDBDatabase::selector()
     RWDBCursor
                                         RWDBSelector::cursor()
                                         RWDBSelector::reader()
     RWDBReader
```

Table 1 - Main database interface classes in Dbtools

C++ database class libraries, it provides support for multiple platforms. Each target database interface is supported by means of a separate 'access library'. At the moment there are three such libraries: generic ODBC, Oracle7, and a single access library that supports both Sybase and Microsoft SQL Server via 'DB-Library'. Native support for other leading engines like Informix (in alpha) and Ingres (in beta) will follow in due course, but at the moment you must use ODBC to talk to these products. The newer Sybase client API provided with Sybase System 10 is also not yet supported: with SQL Server 10, you would have to use the DB-Library package. Both source and object versions of DBtools ship with your choice of one access library. The others are priced as

For this evaluation, I ran Microsoft SQL Server 4.2 under Windows NT 3.1. I used both the DB-Library and ODBC access libraries to talk to SQL Server, and I also ran programs against a Microsoft Access 2.0 database using ODBC. I built test executables running under NT and Windows 3.1, using the Microsoft and

```
Borland 16-bit compilers and the Microsoft Win32 SDK compiler.
```

DBtools supports both static and dynamic linking, and the design allows you to link more than one of the access libraries to your application. You make database connections using a given linked access library by using library-specific identification strings: in other words, the access libraries do not have overlapping symbol sets. This gives the developer great flexibility. You can defer until runtime deciding which access libraries will actually be used to make connections, and you can have active connections simultaneously via different libraries. This is an improvement on the old Db.h++product, which limited you to a single target platform at a time.

It is worth pointing out that to use DBtools properly you really need to have the relevant database SDKs as well. I used the ODBC SDK and also Microsoft's SQL Server Programmers Toolkit. For example, to use the ODBC access library, you must link to Microsoft's ODBC DLLs (these in turn invoke the third-party ODBC drivers

dynamically). To use the DB-Library package from a 16-bit Windows application, you need to link with the w3dblib import library. The object libraries that are shipped with DBtools do not cover every possible permutation of static and dynamic linking, debugging and builds. release 16/32 bit libraries. and so forth. To build different versions of the Rogue libraries you would normally need to have the relevant SDK headers as well.

For this reason, and in general for debugging, it is very fortunate that Rogue Wave ship both object and source licences. The source comes with well-structured and commented make files, so when you need

to start tinkering it is not hard to see what to do. Full source is available for the access libraries, not just the core interface classes.

If you are committing

seriously to DBtools you would be well advised to buy a source licence for your chief developer along with cheaper object-only licences for the rest of the team. The makefiles supplied with the package were for the Borland and Microsoft compilers.

Whether or not you buy source licences, you get a tutorial manual and a set of example source files. Some of the DBtools classes build on the excellent foundation provided by the general-purpose *Tools.h++* libraries (reviewed in *EXE April '94*). As a bonus, DBtools includes a full *Tools.h++* licence; if you buy DBtools source, you get Tools source too.

The DBtools library I used was a very late beta, which I gather changed very little when it went into production, unless you count the glossier manuals. I had comparatively few problems getting it to work: most of the difficulties I had resulted from the fact that the Borland versions of the access library DLLs were built with the Borland C++ 4.0 compiler, and were looking for the old Borland C runtime library DLL, whereas I had the 4.02 DLL. A quick rebuild soon put this right and then the customary 'hello world' program (see Figure 1) built and ran correctly first time.

#### Database interface classes

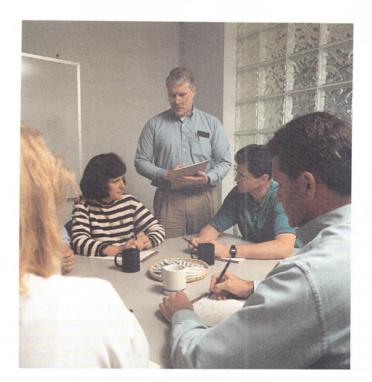
When you look at the 'hello world' program, you can see straight away how well it is suited to this sort of thing. The objects encapsulate the lifetime of the database connection, of the result set and of the iteration over the result set. You can stop worrying altogether about allocating memory, storing handles, disconnecting and deallocating. Sit back and let the constructors and destructors orchestrate all that for you.

The classes used in the 'hello world' program are part of a set of platform-independent interface classes, which together form the library's public programming interface. These classes contain private pointers to objects from a set of corresponding platform-specific implementation classes arranged in inheritance hierarchies. The use of reference semantics within the interface classes makes them lightweight and can provide considerable performance benefits.

For example, a single database to which you connect is represented by the RWDB-Database class. This hides a private pointer to an RWDatabaseImp implementation object; but the actual object will be an

```
#include <rw/db/dbmgr.h>
#include <rw/db/dbase.h>
#include <rw/db/result.h>
#include <rw/db/table.h>
#include <rw/db/reader.h>
#include <rw/cstring.h>
#include <iostream.h>
/* DBtools hello world example */
int main()
  // connect to database
 RWDBDatabase db = RWDBManager::database
    ("SYBASE", "mysvr", "myid", "mypasswd", "mydb");
  // execute SQL statement
 RWCString sql = "select \"Hello world!\" ";
 // SQL returns one row, "Hello World!"
 RWDBResult rslt = db.executeSql(sql);
 RWDBTable tbl;
 RWCString msg;
 // get first (and in this case only) result set
 while ( (tbl = rslt.table()).isValid() )
   // initialise a reader
   RWDBReader rdr = tbl.reader();
   // use reader to iterate through result set
   while ( rdr() )
     rdr >> msg;
     cout << msg << endl;
    // prints "Hello World!"
 return 0;
```

Figure 1 – DBtools SQL 'hello world' program. In the interests of clarity, status checking and error handling code is omitted





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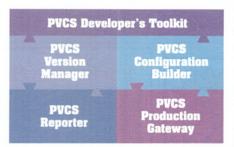
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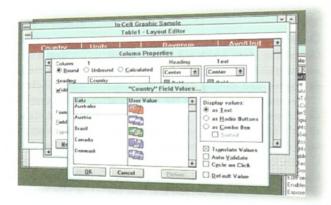
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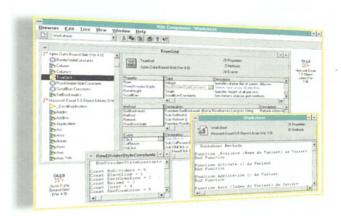


# VBA Companion

With the increasing popularity of applications that support OLE Automation, the advent of OLE controls (OCX) as the replacement for the VBX Standard, and the anticipated release of environments with full OLE container support, you'll need a tool that enables you to browse, search and print OLE object descriptions whenever you need them.

#### VBA Companion is the OLE object browser for Microsoft Windows and Windows NT

Whether you write Excel macros or program in C++, VBA Companion's flexible interface and intuitive displays make it an indispensable part of your desktop.



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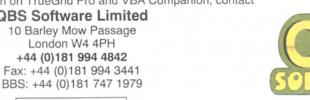
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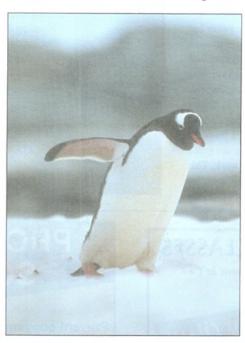
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Excellent opportunities exist for bright graduates with one year + experience. Personal background requires a solid understanding of the project life cycle and a commitment to high quality coding. You will be trained in all aspects of Investment Banking,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

£17-£25K + Banking benefits

REF: SC/03/EXE

#### CAMBRIDGE - MANY, MANY EXCITING OPPORTUNITIES

A wide variety of specialist, leading edge IT companies in areas as diverse as: ROBOTICS, TELECOMMUNICATIONS, MULTI-MEDIA, GIS, BUSINESS MODELLING,

FINANCIAL/TREASURY, EMBEDDED SYSTEMS and SOFTWARE/GUI RESEARCH/ MANUFACTURING require high calibre software development staff at junior and senior levels. Technical skills required include: C, C++, VISUAL C++, VISUAL BASIC, X-WINDOWS/MOTIF, GUI's, NT, TCP/IP/X25/X4000, PROGRESS, SAP, Relational Databases, INTERNET CONNECTIONS and ATM (Communications not ATM machines). REF:/04/EXI

#### INGRES/ORACLE/SYBASE/GUPTA/OOD AND OOP

ALL LEVELS

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 ALL LEVELS

UNIX/VMS/MS WINDOWS/NT MFC/C/C++

A degree in computer or natural science, two years solid C/C++ programming experience and a sound understanding of UNIX, VMS or MS-DOS are required to work on large scale programs with user interaction. You will need an intelligent problem solving approach to work and be a quick learmer 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 To £30K + benefits Analyst Programmers 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 XVT libraries or networking skills.

REF: SC/08/EXE

#### SOFTWARE ENGINEERS-SENIOR SOFTWARE ENGINEERS

Various Client/End Users, Software Vendors and Software Houses dedicated to strategic 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 technology based careers and management responsibility.

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

£12-£25K + benefits VISUAL BASIC SKILLS MUCH IN DEMAND - PLEASE CALL TO DISCUSS LEEDS - LOW LEVEL C++ WINDOWS COMMS DEV ALL LEVELS

LONDON COMMS SPEC X25, X400 £40-60K C. C++/MFC - Countrywide REF: SC/09/EXE REF: SC/10/EXE REF: SC/11/EXE

REF: SC/12/EXE REF: SC/13/EXE

the soft corporation
Third Floor, 7-15 Rosebery Ave, London EC1R 4RP



Third Floor, 7-15 Rosebery Ave, London EC1R 4RP Tel: 0171 833 2772 Fax: 0171 833 2774 email: jmcb@softcorp.demon.co.uk

#### SHARELINK

#### PRIVATE INVESTOR INFORMATION SYSTEMS

#### BIRMINGHAM

Already a market leader in telephone based financial and information services, ShareLink is now further developing its range of company and market information services for private investors. The following staff are required to resource these developments.

Senior Analyst Programmer

To £25k

You will have been instrumental in achieving business objectives by delivering practical, commercially led solutions, preferably in the financial sevices sector. You will have a background in PC software development and support with significant experience of linking to internal and external networks and business systems (eg AS400). Supervisory experience would be an added advantage.

Analyst Programmer

To £20k

A minimum of two years C programming experience in a PC development environment is essential, ideally in the financial services sector. You must be a team player with good communications skills.

Both positions require you to have strong technical skills and to enjoy the challenge of a leading edge environment (C, C++, Visual Basic, ODBC, Windows NT).

In return ShareLink offers not only a comprehensive benefits package

but also a uniquely creative environment in which to excercise your talents. If you wish to be considred please send your CV to Phil Larvor at Bretton Informatic, Spencer Court, 141-143 Albany Road, Coventry, CV5 6ND. Tel: 01203 691909 Fax: 01203 0670267 Email Bretton @Cix.Compulink.Co. UK



# LUSAS

Finite Element System

# Software Engineer C++ / MFC / OOD

A vacancy exists for a software engineer to join a small, dynamic team developing an innovative 3D interactive CAE graphics system which will capitalise on many aspects of the Windows environment ('95 and NT).

Initially you will be responsible for developing a new user interface. You will report to the Product Manager and enjoy a high level of autonomy. You should be imaginative with an intelligent problem-solving approach and a desire to learn new skills. You should also have a sound knowledge of C++ and OO concepts (OMT preferably) and some experience of working with MFC. Experience of working in a multi-platform environment (Windows and Unix) would be helpful.

If you are interested please send your CV to The Personnel Manager.



Forge House, 66 High Street, Kingston upon Thames, Surrey, KT1 1HN, UK. Tel: +44 (0)181-541 1999 Fax: +44 (0)181-549 9399

# TOMES FOR TECHIES

This month we feature four top sellers from publishers McGraw Hill plus our first book on Delphi by regular EXE contributor Dave Jewell.

#### **OLE Wizardry: Programming OLE Applications** and Custom Controls Using Wizards

by William H Murray III and Chris H Pappas

448 pages

Normal Price: £28.95

#### ☆ Price to You: £23.30 ☆

LE Wizardry, written for all Windows developers who want to program in OLE but don't want to learn the hard way. Comp. Sci. professors Murray and Pappas teach you how to build OLE applications using Microsoft's new development tools: Microsoft Wizards and Microsoft Foundation Classes. An ideal reference for anyone wanting quickly to get up to speed on OLE. Includes CD-ROM.



#### C: The Complete Reference, Third Edition

by Herbert Schildt

Heavy Metal OLE2 Programming

Free \$tuff from the Internet

Oracle Performance Tuning

TCP/IP Network Administration

Unauthorised Windows 95 Developers Resource Kit

912 pages

Normal Price: £25.95 ☆ Price to You: £20.80 ☆

Internationally recognised program-ming expert Herb Schildt includes everything you need to know on C programming in this one comprehensive volume. Over 300,000 worldwide sales is testimony to this popular work, now in the third edition to include the latest developments in C programming. Sectioned in five easy-to-navigate parts, C: The Complete Reference is liberally peppered with many examples which clarify th



#### The Visual C++ Handbook, Second Edition

by William H Murray III and Chris H Pappas

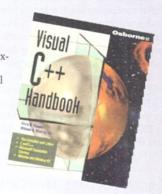
1136 pages

Normal Price: £25.95

#### ☆ Price to You: £20.80 ☆

nother authoritative guide from Another authorition to game.

Athe professors, who thoroughly explain Visual C++ concepts and the traps to avoid. Take advantage of all the new programming options that Visual C++ has to offer with this newly revised and updated edition. Fundamentals to advanced topics include the Visual C++ compiler, resource editors, debuggers, profilers, and special tools for creating Windows apps. Write elegant Visual C++ programs of your own in



#### Open Computing Guide to the **Best UNIX Tips Ever**

by Kenneth H Rosen, Richard P Rosin-

and Douglas A Host

752 pages

Normal Price: £23.95

#### ☆ Price to You: £19.20 ☆

from shell short cuts and mail tricks to password ageing strategies and crisis control, here's a reference bible for everything you ever wanted to do with UNIX. You'll discover how to avoid common pitfalls and streamline shell programming. Tips on UNIX tools, ef-

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#### Without Exception

Anders Hejlsberg may boast about the richness of Delpi's exception handling, but it has been pointed out to us that all this is inheritance gimmickry and what not. The following piece of code - written in Object Pascal just to show - is more than adequate for all known programs:

try {insert your program here} except

on E: Exception do {handles all exceptions} MessageDlg('Well it worked on my machine mtInformation, [mbOK], 0);

end:

Ctrl Break says: Put that in your pipe and smoke it, Anders!

#### Strange Ambition

'The Big Byte' is apparently the UK's only weekly computer show on the radio and it's been going since April last year. 'Like the New Seekers, who wanted to teach the whole world to sing, The Big Byte wants to make the whole world compute in harmony' enthuses producer Neil George. Mmm.

#### Raspberry fool

A friend tells of us of how he recently got himself into trouble while coding up a Quality Assurance system for an ice lolly factory. The bulk of the program comprised endless dialogs full of possible lolly faults, for example 'Stick not set straight', 'Chocolate coating too thick' and the classic 'Too few red ones in the hundreds and thousands'. After a day or two of this, he had had his fill of ice cream imperfections, and added one of his own. His po-faced employers were completely unimpressed when they discovered his addition at the bottom of one of the dialogs: 'Joke on stick not funny'.

#### Singalonga Programmer

We have discovered a treasure house of parodies of pop hits on the newsgroups, which we felt compelled to share. Tim Pickett and Scott Thomson created an Honours Rhapsody (to the tune of Bohemian Rhapsody)

"Is this a real world? Is this just fantasy? Caught in a LAN-slide No ESC to reality."

"Mama Just killed a RAM Put DECstatic on its pins, Now I don't see /usr/bin,

Mama

vi had just been run, But now I've got to throw it all away" etc etc Meanwhile Jessica Raine has been toiling over The Keeper of the FAQ (to the tune of The Leader of the Pack):

My friends were always giving me hell (hell, hell, hell)

They told me he posted from AOL (whattaya mean they say he posts from AOL?)

They said he had no clue But I knew it wasn't true

That's why I fell for the Keeper of the FAQ"

(Sound of modem dialup between verses...)

Unfortunately we have lost the references of where these came from (really), so we can't tell you where to find the missing 12 verses...

Please send your rants,

raves and competition

entries to:

Ctrl/Break

EXE Magazine

50 Poland Street

London WIV 4AX

#### Spot Quiz:

DIY smiley kit.

What is this? ----))))))))))))))))) :::::::--

#### Digital beer 'ere

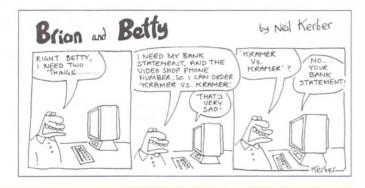
Beamish Genuine Irish Stout has recently been announced as 'present on the Internet'. This has prompted a spate of not unreasonable queries into suitable

methods of compression. The Joint Beer Experts Group (JBEG) and Brew Interface Format (BIF) have been eschewed in favour of the Fourier Transform of Beer (FTB) which reportedly maintains the hop character of the nose.

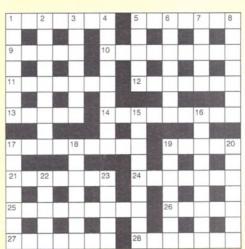
Following recent experiments by over zealous undergraduates it has also been recommended that the right size funnel and a large enough container be used when UUdecoding. Beer will short out your hard drive if you don't download it immediately... and it will also go flat.

#### Taking a break from reality

Thrust SSC, the world's first supersonic car, has been launched on the Internet as 'A milestone in the commercial development of the Net'. Visitors to the site will be able to buy official merchandise such as posters and models. 'Not only will thrustssc.digital.co.uk become the best-known Internet address in the world' claims David Probert of Digital, 'but we will use the Webserver to pioneer commercial use of the Internet'. Right.



#### PRIZE CROSSWORD



#### ACROSS

- 1. & Not a real computer at all! (7.7)
- 5. See 1 across
- Variable name used for 1 down (5)
- 10. It counts in fractions (9)
- 11. Cats using pointers? (7)
- 12. Chewing round for a good interaction (7) 13. Unhappy about follower of Pharoahs (5)
- 14. ASCII 38 (9)
- 17. Avoids sub-routine statements? (9)
- 19. Observe the microelectronic clock maybe (5)
- 21. Somehow I sail south-east with links (7) 24. Passing the time with a loop (7)
- 25. Capture or produce part of a transistor (9)
- 26. Harden in your hearing (5)
- 27. Dusts in confusion with natural folk (7)
- 28. Chunk of orange store (7)

- Discs in the library? (7)
- Jumped back and changed range (9)
- Tie slug round it's least pretty (7
- Rural outlook of standard screen (9)
- Copy 1999 onto chip (5)
- Robert Cook bears the signal... (7
- with, behind, one upset town (2,3)
- Very angry, anger at last (7)
- 15. Circumvent strings of security measures (9) 16. Strange bit at true characteristic (9)
- 17. It seems foolish trick holds 25 (7)

- 18. How folk work with hardware and software for instance (7)
- 19. Having a break with 24 maybe (7)
- 20. Most eminent at the top of the range (7)
- 22. Got sick of beer d'you say? (5)
- 23. Visions of where 18 are? (5)

#### SOLUTIONS TO MAY'S CROSSWORD

ACROSS: 1. PROGRAM 5. SCIENCE 9. CORAL

10. XENOPHOBE 11. AMENDED 12. ICTUSES

14. ENVELOP 16. GLISTEN 18. RESISTS 20. TOGGLER

23. NOSTRUM 25. LOUNGED 27. IMAGINARY

28. SONIC 29. EFFECTS 30. OPTICAL DOWN: 1. PACKAGE 2, OURSELVES 3, RULED

4. MIXEDUP 5. SENSING 6. INPUTTING 7. NEONS

8. EMERSON 15. LASERDISC 17. TELEGENIC

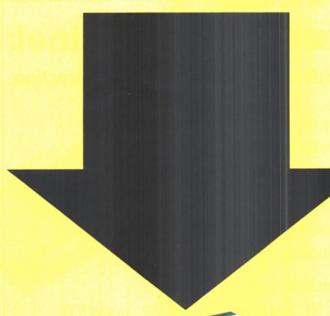
18. RUNTIME 19. SAMPANS 20. TALLYHO

21. RADICAL 24. STAFF 26. UNSET

The prize for this month's crossword is Linux FT and DR Linux, worth £100

Please send your entries to the address on top this page.

# This Way







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CHINA (Northern): C585 86 1 8316524 COLOMBIA: Construdata 57 1 610 8549 CZECH REPUBLIC: A5KON int'l 42 2 3103 652 GREECE: Byte Computer 5-A. 301 924 17 28 HONG KONE: Computer 8 Penderal 852 755 708 HUNGARY: Polyware Kft 36 76 481 236 IRAN: Gam Electronics 982 122 22374 ITALY: BFI IBEXSA SPA 39 23 31 00535

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## WORST WORLD WIDE WEB

The Motorway cafes to avoid stopping at for a cuppa while cruising that wondrous thing, the Information Super Highway etc etc.

#### United Breeders Inc.

http://www.ubi.com/

"We are dedicated to helping members achieve maximum productivity through superior genetics..."

#### Unicomp Inc

http://www.fortran.com/fortran/unicomp.html/ "Fortran for the 90s"

#### The Fortran Market

http://www.fortran.com/fortran/market.html "The place to shop for things Fortran related"

(Why all the beef about Fortran? Because an anonymous member of the editorial staff [initials DM, all complaints directly to him please] has a blinding contempt for the language. We thought letting him exercise it a little might help. MW)

#### A cab driver in trouble

Each week we show a London cab driver involving himself in an IT-related lawsuit.



Bert Muggles (Cab number 17352) accidentally violates Microsoft's exciting new trademark.

## The All-New Adventures of Verity

The problem with Doom, according to Ms Stob, is not the appalling violence, the effect on the younger generation, or even being no good at it. It's being stuck in a room with four people playing the network version...

(Scene: the offices of a small software house. The time: 5.43 pm.)

Who wants to die?

#### I want to die!

#### I want to die!

I want to die! Wait for me!

Hey Mr Red - can I use your machine? My machine is always green. It's not fair being green - everyone can see me more easily. Can we swap please? Pretty please?

#### Nope.

Sing if you're glad to be grey!

Shut up, Mr Grey.

What shall we play? Hey not too rough or hurt me plenty?

#### Hurt me plenty!

#### Hurt me plenty!

Ok, let's go... oh no, not here. I hate this level!

Are we playing teams?

I don't want to play with Mr Red. He always shoots you in the back! No I don't, you always stand in the way.

 $(Booomph\text{-}whoooosh....\,Aaaargh!)$ 

#### Sorry.

Hey, Mr Red, where did you get that rocket launcher?

#### That would be telling.

(The telephone rings.)

Quick - put the game on hold. Hello... Hello darling. No, not for an hour at least. No, I'm not playing Doom... we've got an important meeting to discuss version 2.0...

(A strawberry: ROOOAAAAR!)

... yes, some of the others are playing... Well, no, not the ones in the meeting, obviously... Come on, there's no need to be like that... What do you mean you don't like my tone? Of course I do but... Huh! Bloody woman's hung up. Which idiot took the game off pause?

#### Sorry.

(Blattta blatta blatta blatta Aaaaargh!)

Thank you very much, my partner Mr Grey. It wasn't my fault Mrs Grey rumbled you!

I feel much better now, thanks.

(Yaketty yaketty yaketty)

Uh oh. Here comes the spider.

(YAKETTY YAKETTY YAKETTY YAKETTY Aaaaargh)

#### He got me! He got me!

(YAKETTY YAKETTY YAKETTY YAKETTY Blammerammerammeram Booomph)

Ha ha! Got him! Ha ha! Got him with the BFG! The supreme talent of Mr Brown triumphs again! I am indeed the king of Doom, the most devious lurker, the chief fragger of them all. All bow down before my stupendous powers. You are not worthy to play in the same game with me. Come on you losers, do your worst, I could beat all of you blindfolded.

 $(Pant\ Pant\ Pant\ Pant\ Aaaaaargh)$ 

I fell in the soup. I fell in the soup and now I've got -1 frags.

Serves you right.

(The telephone rings.)

Hello? Oh, hello sweetie pie. No, Daddy can't come home now. No, Daddy's got to stay at work to earn some money. No darling, you go to bed like Mummy says, and I'll come and see you when you are asleep. Nightnight darling. Bye. Hahahahahaha - got you with the pistol and I only had 13% health!

Don't let good fortune go to your head. I'm taking us through.

Not now, I've only got 13% health!

You should have thought of that before you shot me.

(Bam! Blattablattablattablat!)

Eeeeeyes! And Mr Grey wins the frag race again. On we go.

Ok, let's go... oh no, not here. I hate this level!

(The telephone rings... etc etc. Continues thus until 11.00 pm, or until the network crashes, or until a spouse turns up with a real machine gun, whichever is the earlier.)



# SUBSCRIBERS CLUB

#### Discounted C (advanced programming) videos from BVG

Following the interest shown for the video featured last month (OS/2), BVG have very kindly extended their 20% discount to their advanced C programming videos. C, Volumes 1 and 2, contain a practical guide to C; including conditional branching, looping, using arrays, common C data types, explaining stack pointers, compiling to run under windows, encrypting files, defining the variable buff and much, much more. . . The videos are supplied with two tutorial disks so you can put your new knowledge into practice straight away. The videos would normally cost £53.50 (including VAT and shipping) but are available to EXE subscribers at the reduced rate of £43.40 (including VAT and shipping) Send your cheques to EXE magazine at the usual address. Or contact BVG directly with your credit card details on 01874 611633. Please allow 28 days for delivery.

#### 5 copies of Dave Jewell's 'Instant Delphi Programming'

Our very own Dave Jewell has just had published his definitive guide to Delphi Programming. He



promises to take programmers swiftly and painlessly through both the concepts and implementations of this exciting new product. He utilises clear applications and plenty of short cuts towards useful Delphi development. It has all you need to enable you to

start developing your own client/server applications. Wrox Press, the publishers, have kindly donated 5 copies to give away. Send your postcards to the usual address marked "Wrox Press" to be entered into the draw.

#### Freebies from Lasermoon

Lasermoon are the UK's specialists in UNIX Freeware and Free Operating systems such as Linux, and the BSD's. They are distributers for an extensive range of products and support services in addition to the lasermoon.co.uk internet site which is "home" to SWiM (Motif) and LINUX-FT (THE Commercial

Linux) amongst



others. They author and co-produce a number of Linux products and applications such as the standard setting Linux-FT release. They have put together a fantastc package for one lucky EXE subscriber worth \$\$\$. Send in a post card marked "Lasermoon" to win. For more information about Lasermoon call them on 01329 834944

#### Free Books from Prentice Hall

We have two excellent books to give away this month, kindly donated by Prentice Hall. Network Security - Private Communication in a Public

World is a comprehensive, comprehensible and witty guide to the latest advances in computer network security protocols. In this book the authors go beyond documenting standards and technology; they contrast competing schemes, explain weaknesses and strengths, and describe



when intending to design secure systems. Send in your postcards to the usual address and mark them "Network Security".

The second book we have is Borland C++ 4.5



Object-Oriented Programming. Now in its fourth edition this book will help you Synthesise Borland's efficient code and data to build objects, Manage large projects with uniform notation and code, Simplify your programming with C++ polymorphism, Support common

NETWORK SECURITY

Windows application requirements with new OWL classes and Adapt to OLE, the wave of the future. The book comes complete with a disk containing full source code. Send your postcards to the usual address and mark them Borland C++'.

Entries must reach us by 30/06/95.

#### **EXE Show**

There are only a few days left before the first ever EXE show. Admission is free if you have a ticket. If you don't have one there is still time to call the EXE Show hotline number on 0181 710 2190 or you can pay £10 on the door. The Royal Horticultural Halls, Westminster, June 8th & 9th 1995



#### **EXE Binders**

Binders are on sale to EXE Subscribers for just £10.50. Call customer services on 0171 439 4222 to place your order, or fax 0171 439 0110.

#### **Competition Winners**

Rise of The Robots was won by Linda Phillips from Croydon.

The Access bundle was won by Keith Burton from Barnsley.

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## **Book review**

#### C - A Reference Manual (Fourth edition) reviewed by Bob Swart



This book contains a complete description of the most important C languages. Classic C (also known as Traditional C or K&R C), Standard or ISO C (also

compatible with ANSI C) with or without the ISO C Amendment 1, and Clear C.

The new fourth edition offers two extras over earlier versions: the ISO C Amendment 1 (1994), which adds new facilities for writing portable international programs, and Clear C (also called Clean C), a subset of C that ensures C programs will have maximum portability between both Standard C and C++ environments. The authors have also replaced all references to 'ANSI C' with 'ISO C', since 'ISO C' is also the last standard to have an Amendment 1.

The book starts with an introduction to the three different C languages that are treated in the book, and a short description of the differences between these three. It is here that you might pick your favourite variety of C and focus on this specific implementation through-

out the rest of the book. The authors explain early in the book that it is unfortunately not really possible to write C code that is compatible with all three of these C dialects (at least not without using conditional compilation).

The first half of the book covers lexical elements, the C pre-processor, declarations, types, conversions and representation, expressions, statements and functions. Each of these topics is discussed in a separate chapter and the specific implementation of the three C dialects is covered in much detail. Guidelines are also provided on using, for example, comments, enum types and header files. For beginners as well as advanced C users these chapters contain a lot of inside information (of course, advanced C users might already know most of it).

The second half of the book begins with the introduction of the so-called C 'standard libraries' for both standard C and traditional C (libraries like stdio.h, math.h, float.h, limits.h, but also iso646.h, wchar.h and wctype.h) and special C language additions like NULL, \_\_DATE\_\_, \_\_FILE\_\_, \_\_STDC\_\_, etc.

The book ends with a chart of the ASCII

character set (why?) an appendix on the syntax of C, the answers to the exercises (present at the end of each chapter) and a short but useful index.

In my opinion, the book is a standard work, much like Bjarne S's C++ARM (Annotated Reference Manual). But C++ is precisely what I'm missing: the book shows a lot of examples and details on Clear C but too few C++ specifics. The book is a great source of information for anyone using C and planning to use C++ in the future or to enforce C++ compatibility by using Clear C, but it is not the book from which C programmers can learn C++. This was not the intention of the book, of course, but each discussion of Clear C leaves me yearning for more on C++.

#### Verdict: Highly recommended

Title: C - A Reference Manual (fourth edition)
Authors: Samual P. Harbison & Guy L. Steele jr.
Publisher: Prentice Hall (Tartan, Inc.)

ISBN: 0-13-326232-4 Price: £28.25 Pages: 460

#### Design Patterns: Elements of Reusable Object-Oriented Software reviewed by Edward Kenworthy



'A design pattern is a particular OO model to solve a particular, defined, problem.' If you've developed any substantial OO project then it's likely that you will have come across a

number of problems. When this happened you either bodged a solution or - wittingly or not - came up with a 'a design pattern'. Design Patterns: Elements of Reusable Object-Oriented Software begins in a similar way to the way I started this review, by describing what a design pattern is and by pointing you at some of the more familiar patterns so you can have a look for yourself. It then enumerates a large number of commonly encountered prob-

lems and describes a pattern for each that offers a 'standard' solution to the problem, from Abstract Factory to Interpreter to Strategy. Each of these patterns is then described in a standard format which covers the intent, motivation, applicability, participants, collaborations, consequences, implementation. Some sample code, known uses and a crossreference to related patterns (which might offer alternative solutions to the same or a similar problem). Phew! There's a lot of information given with each pattern in a concise form - this is primarily a reference book, not a text book. It's difficult not to recommend this book if only on the grounds that there is no other one that covers such an important area. For that reason alone I'd recommend it to anyone involved in the design of object-oriented systems. That it's also well structured and covers at least as much ground as I am able to judge (and probably more) means you really can't go wrong getting this book. The only caveat is that it is primarily a reference book and not an introductory text; some OO experience is definitely a pre-requisite.

#### Verdict: Highly Recommended

Title:	Design Patterns: Elements of
	Reusable Object-Oriented Software
Author:	Erich Gamma, Richard Helm,
	Ralph Johnson, John Vlissides
Publisher:	Addison-Wesley
ISBN:	0-201-63361-2
Price:	£20.95
Pages:	395

Title	Authors	ISBN	Publisher	Price
Visual C++ 2 for dummies	Michael Hyman & Bob Amson	1-56884-328-3	IDG Books	£18.99
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C++ for Programmers, 2nd ed.	Leendert Ammeraal	0-471-95486-1	John Wiley & Sons	£19.95
201 Principles of Software Development	Alan M. Davis	0-07-015840-1	McGraw Hill, Inc.	£20.95

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#### REVIEW

take your C++ programming seriously you will need to study Scientific and Engineering C++ (John Barton & Lee Nackman). The authors are amongst the most skilled and knowledgeable C++ practitioners. Do not let the title mislead you, this is a book that all large-scale users of C++ should read and work at understanding. The gurus of C++ often quote from this book and assume that it will be well-known and readily to hand.

The search for a design methodology for object-oriented programming has been going on for some time. The Booch Method has considerable merit, particularly for C++ development. Robert Martin's Designing Object-Oriented C++ Applications Using the Booch Method is a valuable addition to the body of work on this subject. One thing in particular attracts me to this author's books, he does not accept the current fashion that maintains that OOD is inherently superior to other design methods in all circumstances.

#### The leading edge

Now to three books looking to the future.

Parallel processing has been around for some years but almost all the material in print has been of an academic nature and not of much use to the working programmer. At last we have a book that tackles parallel programming at a practical level. *Designing and Building Parallel Programs* (Ian Foster) is the first book in this area that I would feel comfortable in giving to a software engineer as opposed to an academic computer scientist. I have no doubt that various aspects of parallel processing are going to loom ever larger in the software engineer's work. This book will give you a good start, particularly as it includes information about sources (ftp sites) where appropriate









tools and compilers are available so you can do some practical work to hone your understanding.

Have you noticed the growing use of the latest buzzword, patterns? Like object-orientation before it, it means different things to different writers. Also like OO you can view it at different levels and from different perspectives. I mentioned Jiri Soukup's  $Taming\ C++$  in my last books column. His perspective on 'patterns' is very much that of the code designer and writer. Two more recently published books tackle 'patterns' from two other perspectives.

Design Patterns (Erich Gamma et al) is still relatively close to the programmer. The authors tackle some of the better known patterns from the perspective of reusable software and reusable software design. A programmer who wants to try to understand what this new view is about would find this a good starting-point.

Design Patterns for Object-Oriented Software Development (Wolfgang Pree) is a more generalised overview of the subject area. If you are more theoretically minded this is a place to start. The author focuses heavily on application frameworks in general and ET++ (a UNIX based AFX) and MacApp in particular. You will realise from this that he is not coming at this topic from a direction that will be best suit desktop developers.

That lot should be more than sufficient to fill the most capacious holiday-reading rucksack. See you all next month.

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# Me and my bookshelf

Francis Glassborow gives us a tour of the well-thumbed tomes that he always keeps within reach of his PC.

Twice a year I have a look at my bookshelf to see what is on it that's worth pointing out to you. The decision by Addison-Wesley to issue an anniversary edition of *The Mythical Man-Month* reminded me that there are a few books about programming that have stood the test of time. Some of you may be too young to have read them when they were first published. The new edition will have some extra material in it, so it's probably worth hanging on until that comes out before buying it.

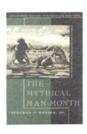
There are a few other golden oldies that you should know about. Donald Knuth's *The Art of Computer Programming* is a multi-volume work that must be getting close to an entry in the Guinness Book of Records. Not for size, nor for durability, but for the time that the world has waited for the author to complete the projected seven volumes. The history of this work would fill an entire column in itself. Addison-Wesley assures me that Knuth is writing volume four - but I wouldn't delay any work to await it's exposition of Combinatorial Algorithms.

Apart from the first three volumes of *The Art of Computer Programming*, every serious programmer should read the three books by Jon Bentley. *Programming Pearls* and *More Programming Pearls* are collections of essays which originally appeared in *Communications of the Association for Computing Machinery (CACM)*. The third book is *Writing Efficient Programs*. All three cover topics that are the bread-and-butter of good, thoughtful programming. You may not use all the ideas directly in your thoroughly modern object-oriented development but unless you are familiar with works such as these you will be doomed to find all the tar-pits by personal experience.

The Art of Software Testing (by Glenford Myers) comes from the same era as the Bentley books, but has dated rather more than they have. The book focuses on source code testing, while current thinking advocates a rather broader approach. However, as a book written by an author who understands that code should be tested, and that the purpose of testing is to break the code, it is one that you should try to read. I say 'try to read' because it has been out of print for some time and getting hold of a second-hand copy is a matter of waiting for current owners to die. Perhaps we could persuade the publishers to re-issue it.

#### Ed Yourdon says...

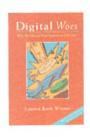
In Decline and Fall of the American Programmer, Edward Yourdon has this to say of The Psychology of Computer Programming (Gerald Weinberg) 'a golden oldie, an absolute must for your personal library, a gem, a classic...' He is right. Despite the somewhat forbidding title this is an excellent book about programming as a human activity. Again you will have a serious problem getting a copy because it has been long out of print and even library copies are beginning to fall apart. Once again this is a case where we need to apply some pressure to the publishers to get it re-issued even if they cannot get it revised.













To varying degrees, all the above books are ones that you can read away from your software development environment. Digital Woes (Lauren Ruth Wiener) is another excellent book that fits this classification. Unlike the others, it is a recent publication. The author focuses on the inherent unreliability of software. Not only is it a book that software developers should read; managers and software users will find it useful too. The author's style is highly readable and she supplements each chapter with copious references.

Programmers often ask me about graphics files. The most common question concerns the format of something such as .PCX files. We all know that most of the information is out there somewhere, but where? A recent O'Reilly publication Encyclopaedia of Graphics File Formats is just what you need. The authors have done their best to make it comprehensive and accurate, and it is not their fault that the owners of a couple of proprietary formats have refused to provide any information about them. If you are browsing through this book you should be aware that some ignoramus confused a Roman nine with a Roman eleven so two of the pages in the table of contents are collated wrongly. The first copy I had also lacked 48 pages (and copies of another 48 pages replacing them), but investigation suggests that this was a rogue copy. I only mention it because this is largely a reference work so you might not notice missing pages until long after you had bought the book. By the way, it comes with a CD and it is not restricted to MS-DOS/Windows items but includes OS/2, Unix and Apple Mac material. (See also Peter Collinson's columns this month and last month for discussions of this book. Has O'Reilly got all our columnists on a retainer, or what? - Ed.)

Fault tolerance is a topic that we are hearing more of these days. John Wiley recently started a new series of books 'Trends in Software' to act as a companion to its long-standing refereed journal *Software Practice and Experience* (now in its 25th year of publication). *Software Fault Tolerance* is the third book in this series. It is a collection of thirteen papers on the subject and should be on the reading list of anyone concerned with development of software that needs to be fault-tolerant.

#### C++ at last

This column is supposed to focus on C and C++ programming so I guess it is about time that I turned to the latest additions to my C++ bookshelf. C++FAQs (Marshall Cline & Greg Lomow) is just the book you need beside your workspace to save having to stop and explain some aspect of C++ to the newcomer in your team. (If you are the newcomer, it will also make you more acceptable to the experts in your team — as long as you don't quote it at them). There are 470 questions and answers blocked into 43 chapters. It is well worth reading on the basis of a chapter a day.

C++FAQs covers questions and answers that are appropriate to ordinary development with C++. The next book aims at providing some weighty methods and idioms in C++. If you



You can iterate through the set of result sets using the result object. To iterate through the rows of a given result set, you use an RWD-BReader (for hardened

database programmers: this encapsulates the fetch and read loop).

#### Database data types

One of the more awkward issues when accessing and comparing data from different databases, and moving data to and from C/C++ program variables is the problem of data types. Each major database has a slightly different set of native data types, and a different preferred mapping of these to C data types. Some databases support binary large objects, or BLOBs. Some SQL data types, such as DateTime and also the NULL value do not have obvious mappings within a C program. And finally, in a fully dynamic SQL environment, you may not know the data types of the various items in a result set row at compile time: this will obviously be the case in data-driven applications or applications where the user may type in SQL statements.

To deal with these issues, Rogue provides several special classes. RWCString, drawn from the Tools.h++ library, is used to handle

char and varchar columns. An extended precision floating point type from Rogue's Money.h++, RWDecimalPortable, is also supplied. DateTime types are handled by RWDBDateTime, which internally makes use of date and time classes from the Tools library. Classes to model duration, NULL values and BLOBs have been added; the BLOB class employs copy-on-write techniques to minimise memory allocations and copying of large data items.

Rogue's approach to the dynamic SQL environment is to encapsulate all these data, including BLOBs, and all C/C++ native types (except pointers) in a type-safe variant class called RWDBValue. You can test the actual type of a Value object, check whether it is NULL or not NULL and ask whether it can be converted to a given type. The logic to perform valid type conversions is also supplied. An RWDBRow object from a result set is in fact an ordered collection of Value objects, so you can process result set rows even if you don't know beforehand what the number and data types of the returned items will be.

DBtools has a powerful error model based around RWDBStatus. Status objects are embedded in all the key DBtools objects, and retain the current state of the object. Error handling can be written the old, hard way by in-line testing of status, by the use of

error-handler callbacks, or (if your compiler supports them) via C++ exceptions. Error handling can be customised both globally and on a local basis per database, per connection and so on.

#### C++ or RDBMS?

Now we know what DB tools does, it is important to be aware of what DBtools doesn't do. It is resolutely tied to the world of the RDBMS. There are very real tensions between the object-oriented programming model of C++ and the relational model used by the current generation of databases, DBtools is not intended to turn your trusted corporate database into a object persistence medium. For most companies using database technology, though, the real requirement for the foreseeable future is to build reliable applications that write transactions into relational database tables. Where C++ is the language of choice, probably the most productive, portable and pleasant way to do this right now is to use the DBtools library.

Barry Smith can be reached as bksmith@cix.compulink.co.uk

DBtools.h++ is sold in the UK by Hypersoft Europe (01159 376550 or 01273 834596). DBtools.h++ for Windows or NT costs £340, Oracle or Sybase support each costs £495.

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use of the query-building classes to create queries and bind program variables to them. A more realistic example - a select query with two inner joins - is given in Figure 2.

Because of triggers, it's possible for a single execution of a query to produce more

than one result set. The same applies to stored procedures. RWDBResult represents the set of result sets (often just one result set) resulting from a database operation.

#### **ODBC** pitfalls

I can hear some muttering in the back row about ODBC, so let's talk about that for a minute. ODBC is Microsoft's attempt to bring some order to the database world by designing an abstraction, a generalised database engine, which can be queried and manipulated via the standard ODBC API. Between the abstraction and the real engine there is a driver supplied either by your database vendor or by a third-party ODBC specialist. Microsoft itself provides ODBC drivers that can talk to Microsoft SQL Server, and also to PC databases such as dBase, Paradox and Access as if they were real database engines. Users of Microsoft's MFC class library will know that there is even a set of C++ class wrappers for ODBC.

So where does all this leave Rogue Wave's product? The answer is: with a very considerable niche to fill. Firstly, ODBC is not a pretty API. Just because it's an abstraction of a generalised database, it has a very fine-grained programming interface. And that means you, the programmer, will end up writing lots and lots of code, managing handles to more kinds of API entities than you want to contemplate, and generally not getting on with the business that your employer has hired you for. Secondly, ODBC is not at the moment suitable for every type of application because, inevitably, there is a performance overhead. There are restrictions on what you can do via ODBC: you can't exploit all the functionality of the underlying database engine. And, sadly, Microsoft's ODBC wrapper classes are very limited. They are oriented towards binding SQL result sets, via hard-coded classes that model the structure of the result sets, to input forms within an MFC-based application.

Most serious client-server applications cannot be forced completely into a simple form-filling data capture mould. They may involve complex transactions, often executed via stored procedures - transactions coded in SQL and held within the database itself. These transactions may span a distributed database. The structure of the queries may not even be known fully in advance: it's not at all unknown for SQL to be created dynamically within the logic of a program. You might even (heaven forbid!) let the user type in some SQL herself.

It is certainly true though that ODBC has an important place. It's now pretty safe to say that ODBC has seen off its rival, Borland's IDAPI, and that it's here to stay. By providing a catch-all means of accessing virtually any database, it can provide a useful lingua franca where performance is not the main issue, and where concurrent access to different types of database is a great advantage. Given ODBC's support for PC database files alongside true RDBMS products, this can be useful even in organisations (are there any?) that have managed to keep to a single-vendor RDBMS policy. ODBC can shine in management information systems by bringing many disparate types of data source together. It can also be useful in applications that manage batch transfers and reconciliations, and in standardising database access from desktop productivity tools like Excel. Finally, as Rogue Wave has realised, ODBC provides a great springboard for an industrial-strength class library like DBtools.

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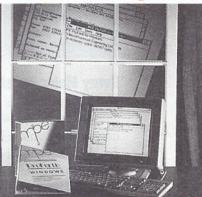
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instance of a derived
platform-specific class
such as RWDBOraDatabaseImp. Obviously the interface
classes reside in the core

library, and the platform-specific implementation classes reside in the access libraries.

Because the implementation objects are hidden, the DBtools developer is concerned almost entirely with the interface objects. These are arranged in a 'producer/product hierarchy' (see Table 1) which is quite different from an inheritance hierarchy. It means

that the main method of creating objects is not by invoking constructors directly, but by calling producer methods in classes higher up the producer hierarchy. There is a very good reason for this architecture: the lifetimes of objects lower down the hierarchy are always nested within the lifetimes of the objects higher up.

At the top of the tree is RWDBManager, a one-of-a-kind object that contains only static methods allowing you to establish connections with databases and manage error handling. To connect, you call the database class producer method of the Manager object with

strings representing the access library, server name, user ID, password and database name:

```
RWDBDatabase db =
RWDBManager::database
("SYBASE", "mysvr",
"myid", "mypasswd", "mydb");
```

Each RWDBDatabase can manage multiple connections to the same database, including one default connection. Within the Database class, you can create objects to encapsulate select, update, insert or delete operations. You can create and destroy tables, views and stored procedures, and you can manage transactions. Although you can avoid it if you want to, you can manage connections to a given database explicitly using RWDBConnection objects.

Database tables can be manipulated via RWDBTable objects and RWDBSchema objects. The latter represent the structure of a table, and can be manipulated to build up a structure at runtime, which can then be used to create a table in the database. A table object can be used to manipulate the structure of the underlying table on the model of the ALTER TABLE statement in SQL, but is also the producer class for deleter, updater, inserter and reader classes: in other words, it allows data update and retrieval. There is also a functionality to support GRANT, REVOKE, CREATE, DROP INDEX and DROP TABLE.

Column references are represented by RWDBColumn objects; schemas are essentially column collections. RWDBRow objects are collections of objects representing the value at a particular column offset in a single result set or table row.

Stored procedures are represented by RWDBStoredProc. This class supports creating, dropping and executing stored procedures. You can retrieve formal parameter lists as well as supply parameters, and you can retrieve the text of the procedure.

The various query classes — RWDBSelector, RWDBInserter, RWDBDeleter and RWDBUpdater — are a rich set of abstractions that support the full power of SQL, and make dynamic query-building a joy. There is support for positioned updates and deletes, scrollable and sequential cursors, and multiple cursors per connection. Lower-level classes like the RWDBExpr and RWDBCriterion provide a user-extensible mechanism of query expression building.

Unlike the hello world example above, which uses a quick-and-dirty call to RWDB-Database::executeSql() method, most real-world DBtools applications will make

```
#include <rw/db/dbmgr.h>
#include <rw/db/dbase.h>
#include <rw/db/result.h>
#include <rw/db/table.h>
#include <rw/db/reader.h>
#include <rw/db/datetime.h>
#include <rw/db/connect.h>
#include <rw/cstring.h>
#include <rw/rwdate.h>
#include <iostream.h>
/* DBtools example showing select query */
  // connect to database
  RWDBDatabase dbPubs :
   RWDBManager::database("SYBASE", "kamco", "sa", "", "pubs");
    get an explicit connection
  RWDBConnection session = dbPubs.connection();
     initialise tables from query
  RWDBTable stores = dbPubs.table("stores");
RWDBTable sales = dbPubs.table("sales");
  RWDBTable titles = dbPubs.table("titles");
  // create query object
RWDBSelector sel = dbPubs.selector();
     add select column list: stor_name, date, qty, title
  << sales["qty"]
<< titles["title"];</pre>
  // where stores.stor_id = sales.stor_id
// and sales.title_id = titles.title_id
  sel.where( (stores["stor_id"] == sales["stor_id"]) && (sales["title_id"] == titles["title_id"]) );
  // sort the result by store name
sel.orderBy( stores["stor_name"] );
  // initialise a reader for the result
  RWDBReader rdr = sel.reader(session);
  // declare read variables
  RWCString sStore, sTitle;
RWDBDateTime dtDate;
  int noty;
  // iterate result set using RWDBReader::operator()
while ( rdr() )
    rdr["stor_name"] >> sStore;
     rdr["title"]
                          >> sTitle;
     rdr["date"]
                          >> dtDate;
     rdr["qty"]
                          >> nOtv:
    cout << sStore << '\t
<< sTitle << '\t
           << dtDate.rwdate() << '\t'
           << nOtv
                       << '\t
           << end1;
  return 0;
```

Figure. 2 - DBtools Select query example based on the query:
"select stor\_name, date, qty, title from stores, sales, titles where
stores.stor\_id = sales.stor\_id and sales.title\_id = titles.title\_id
order by stor\_name, title"



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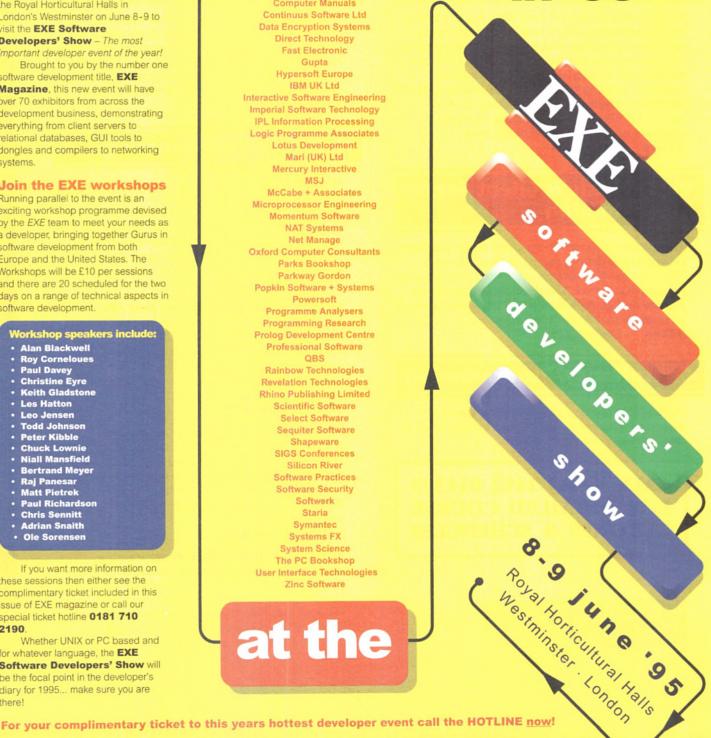
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#### TECHNIQUES

number that you have obtained can now be used as the argument to giftrans.

giftrans -t 6 file.gif87a > new.gif89a

The other way of making a transparent image is to use the PBM toolkit, assuming that you have NetPBM. This includes a version of ppmtogif that supports a -trans option to create a transparent colour. You can give this an RGB hex value or it can read the name of a colour from the standard name-to-mapping database that is used by X.

#### 3D images

Recently I have been playing with 3D images using a Windows program that was given away on the front of PC-Direct magazine. The package is called Simply 3D from Visual Software and comes on a CD. The version supplied with the magazine was time limited and I have subsequently bought a copy.

The program allows you build a 3D model of some world and then place the 'camera' and set up lights. The program computes the final image using 3D rendering techniques. You can also use the program to create ani-

mations, flying the camera through your world. The program is quite simple to use: my 11 year old son, Glyn, can use it to create images that please him.

Figure 3 shows one of his images under construction in the program. He created the space station himself using cones and cylinders. The only piece of clever stuff that I helped with was the World. This is a sphere (that comes with the package) with a 2D projection of the world taken from Corel Draw's library wrapped around it. The ability to map 2D bitmaps onto 3D objects is a great feature of the program. Also notice that objects are composed of materials and these can be defined to be shiny.

The program can save GIF bitmaps directly (along with a number of other formats). You can also specify the size of the final image. It turns out to be a good idea to render pictures to their final display size, this way you don't lose all the subtle colour mapping used to make the image look truly 3D. I tend then to reduce the number of colours used by the image to 48 or 64 using the PBM toolkit so that they don't take quite so long to load.

Unfortunately, the program does not come with any easy way to construct 3D

models.
You can use the standard objects that come with the pack-

age, and these can be arbitrarily resized. The package comes with a tool called 'Visual Font', it is used to create 3D objects composed of TrueType font letters. It takes the text that you type in and 'extrudes' the letters making a solid 3D object that is the logo or word. You can also optionally add bevels on the corners of the letters.

You can also import objects that you have drawn as a 2D vector image in Corel Draw or Adobe Illustrator. These can be extruded to form 3D objects in the program. Actually, this is a little flaky, and I found that I needed to be very careful with the images that I was importing otherwise the program fell over, usually taking Windows with it. I think that I was very probably running out of memory.

Peter Collinson is a freelance consultant specialising in UNIX. He can be reached electronically as pc@hillside.co.ukor by phone on 01227 761824.



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#### TECHNIQUES

Figure 1 shows a typical xv screen layout (grabbed by xv itself incidentally). The picture of Canterbury Cathedral was taken by me while flying a Cessna 152 over the city. If the CAA is reading and wondering whether I was flying below the legal height I can assure them that I was at 1500 feet - there was a 'times 2' extension on the camera lens. The picture was scanned in by Mark Wheadon at the Computing Lab of the University of Kent.

The original image has some camera shake induced both by the engine and the need to hold the camera in one hand while flying with the other. This was magically removed by using the image sharpen tool in Corel PhotoPaint (a recent acquisition).

When you start xv program, you are presented with a single image window. Pressing the right button in this window gives you the control box, shown in the bottom left hand corner of Figure 1. There are a great number of buttons here, and I don't intend to go through them all in detail. The top left-hand window is the image information window. It's obtained by selecting the 'Windows' button and choosing from a drop down menu. A similar procedure is used to pop up the colour editor, shown hiding behind the image window.

The xv program will do a great many things. I mostly use it for looking at images, for cropping images to remove edges that I don't want, and for scaling images. It's OK to make images smaller but making bitmaps larger usually doesn't work too well. The program is also an invaluable tool for format conversion, it will write bitmaps in GIF, JPEG, TIFF, PBM, X11 bitmap, XPM, BMP, Sun rasterfile, IRIS RGB, 24-bit Targa format, PostScript, FITS and PM formats. It will read images in most of those formats



Figure 3 - Using Simply 3D to create an image

#### Where to get things

My server is to be found on http://www.hillside.co.uk/.

I got my copy of NETPBM from unix.hensa.ac.uk, it's /uunet/systems/ window-sys/X/contrib/utilities/netpbm-1mar1994.tar.gz, mirroring a file on UUnet.

You can find information on making transparent images on WWW, its URL is http://melmac.harris-atd.com/transparent\_images.html. This page will point you at source and documentation for giftrans.

The latest version of xv is available using anonymous FTP, its URL is ftp://ftp.cis.upenn.edu/pub/xv.

The Netscape browser is available using anonymous FTP from ftp://ftp.netscape.com/netscape/, see also their home Web page http://home.netscape.com.

Simply 3D is available from Visual Software (UK Sales) Ltd, 0151 933 8772. It costs £69.

Spinning the Web, How to provide information on the Internet by Andrew Ford is published by International Thomson Publishing, ISBN 1-850-32141-8. Managing Internet Information Services by Cricket Liu, Jerry Peek, Russ Jones and Adrian Nye is published by O'Reilly and distributed in the UK by International Thomson Publishing, it's ISBN 1-56592-051-1. Both these books will provide you with the information that you need to prepare HTML with inline images.

The Encyclopaedia of Graphics File Formats by James D Murray and William VanRyper is published by O'Reilly and Associates ISBN 1-56592-058-9.

too. If you have access to PCs, then BMP and Targa formats will provide a bridge from many Windows applications into the UNIX system and back again.

When I started putting images onto my Web server, I created an image for my welcome page by starting with the PostScript program that is my normal letterhead logo. The PBM package was used to change the PostScript into a GIF and xv moved that into BMP format. I moved the BMP file to my Windows machine and used Microsoft Paint to create a rectangular image. This was shipped back to the UNIX machine and xv was used to crop the image and change some of the colours slightly before writing things out as a GIF.

#### **Transparent images**

The problem with bitmaps is that they are always rectangular, a severe limitation

when you are trying to design a good-looking Web page. Fortunately both the Netscape and Mosaic browsers support transparent images. This allows you to have a rectangular picture with 'holes' that means the image floats on the page. Transparency important because the user can change the background colour in their viewer. Figure 2 shows a transparent image it's looking at my Visitor's book page with Netscape.

The 'Welcome' image here started life as some PostScript, and was transferred to Microsoft Paint where I coloured the letters and created the shadow by using cut and paste. A certain amount of pixel editing was then done to clean things up. The background was coloured grey. I moved the image back into xy to create a GIF.

When we talk about the GIF format, we normally mean that we are working to the 1987 standard (known as GIF87a). In fact, there was a revision on 1989 (GIF89a) that supports the ability to nominate that a colour in the image should be rendered as transparent (among other things).

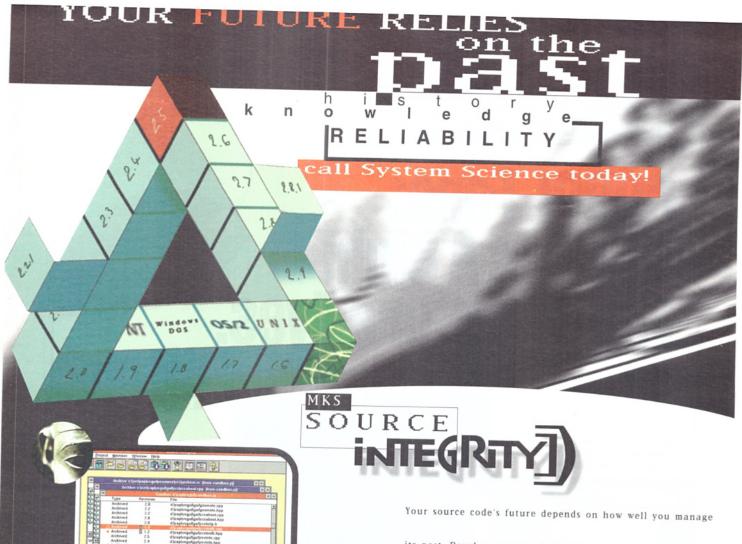
I planned to make the grey background into a transparent colour. I used a program called giftrans written by Andreas Ley from the University of Karlsruhe in Germany. The giftrans program can take a numeric value for the colour to be made transparent:

giftrans -t #ffffff f.gif87a > n.gif89a

The hexadecimal number after the '#' sign is created by taking the three values for red/green/blue for the colour. The values are converted into hexadecimal and concatenated.

Numeric encoding causes loads of grief. You can use xv to help. Load the image into xv and open the colour editor window. You will see the grid of colours that is displayed for each colour in the image. This grid can be seen in Figure 1. Look in the grid for the background colour. Now you need to work out its index in the colour map. Start counting from zero at the top left hand corner of the grid, proceeding left to right across the grid and wrapping back to the left hand side when you reach the end of each line. The





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Prigg Meadow, Ashburton, Devon TQ13 7DF Tel: 01364 654100 This approach may duplicate data but integrity is preserved and access in both directions should be speedy. If traversal is required from the Borrower to the Book class (which books has Fred got out?) then the

BOTTOWETABKEY dictionary is used. To move in the other direction (who has Wind in the Willows?) the BOOKABKEY dictionary is used.

Returning a book is a two stage process. First the function will find out who the Borrower is from the Bookaskey dictionary (and change this) then use this information to update the Borroweraskey dictionary.

#### A prediction

The current state of seamlessness is that it means the concepts and notation of classes

are used throughout the development cycle. We have classes in our analysis model and chapters about implementing classes in our programming books. The next stage may be to go beyond the commonality of classes at all stages of the lifecycle. The implementation stage will pick up and develop the concepts used in the analysis and design stages. We will know we have got there when textbooks and manuals have chapter headings that focus on implementing these analysis and design constructs. So out will go headings like 'function/operator overloading', 'polymorphism' and 'friends' and in will come headings that talk about implementing inheritance, aggregation and associations. The terms will acknowledge that coding in C++ (or whatever language) is a stage that follows on from a design. As a quick test of whether it had already happened I did a quick survey of the C++ books on my bookshelves. How many of them included 'aggregation' in the index? None. How many of the analysis and design books included it? All of them. Seamlessness still has some way to go.

Mary Hope teaches software development at Thames Valley University. She can be emailed at hope\_m@slough.thamesvalley.ac.uk

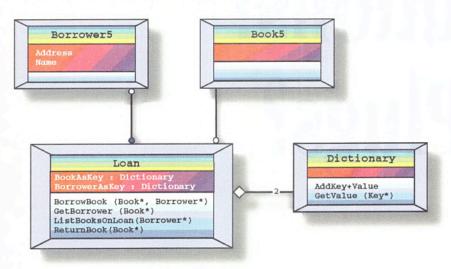


Figure 6 - The class design for the association as a separate class





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#### TECHNIQUES

```
// library4.h
// Bidirectional rememberance without friends
// forward reference
class Borrower4;
// the Book class
class Book4 (
private:
  int _refnum;
  char _author[30];
  char _title[30];
  Borrower4* _borrower;
public:
Book4 (int refnum, char* author, char*
       void BorrowBook(Borrower4* borrower);
   void ReturnBook();
  Borrower4* GetBorrower();
// and a function to enable access
    void ChangeBorrower
                 (Borrower4* newborrower); );
// the Borrower class
class Borrower4 {
private:
  char _name[30];
  char _address1[20];
   Book4 _onloan[6];
public:
  Borrower4(char* name, char* address);
  int BorrowBook (Book4* book):
  int ReturnBook (Book4* book);
   void ListBooksOnLoan();
// and the functions to enable access int
AddBook (Book4* newbook);
           int RemoveBook (Book4* returned
book); );
```

Listing 4 - The class declarations for a bidirectional implementation without friends.

through functions it provides for this purpose. So in this case if the BorrowBook function is accessed through a Borrower object the information about who has borrowed the book in the Book class is updated by a function provided by the Book class, i.e. ChangeBorrower. This takes a Borrower as a parameter and assigns it to the Borrower attribute in Book. Conversely if the Borrower details are amended through an AddBook function in the Borrower class. This is shown in Figure 5. The class declarations for this implementations are shown in Listing 4.

This implementation maintains the class encapsulation, but there is a price to pay. These functions to change the book and borrower details are public and the class designer has no control over how they are used. The classes have to be properly used to maintain data integrity. The BorrowBook and ReturnBook functions can be defined to maintain data integrity, but there are open doors to the attributes. Less than ideal!

#### A separate Association

There will be times when it is appropriate to make the association into a separate class. This may be because extra information makes it substantial enough to stand alone

or that other classes need to interact with (in this case) the loan information. Or it may be to obtain more cohesive classes and thus try and future proof the system. But, whereas the implementations described previously could be carried out using a 'home grown' container class or a simple array, this implementation is more demanding and assumes the availability of a class library. One way of implementing the association as a class (suggested in Rumbaugh 1991) is to use two instances of a Dictionary class in the association class. Almost all class libraries will have an instance of this type of container class. In essence a Dictionary class maps a value to a key. Generally speaking both the key and the value have to be derived from a base class. The pictionary class comes with functions to add a key and value, find a value when given a key etc. The class design for this implementation is shown in Fig 6.

If efficient bidirectional traversal is required then one instance of the Dictionary class has the 'one' class as the key (i.e. Borrower is the key and the set of Books borrowed is the value). The other has the 'many' object as the key (i.e. the Book is the key and the Borrower is the value). Thus when a book is borrowed, changes are made in both dictionaries. In the Bookaskey dictionary the Borrower is changed if the book is already in

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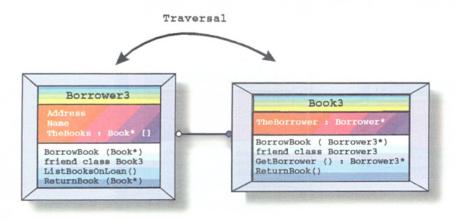


Figure 4 - Class diagram for a bidirectional traversal with friends.

spirit of things it could be a container class with member functions to add/delete and iterate through the items within it.

#### Moving to pointers

This implementation is appropriate when the main use is still a one directional traversal but it is from the 'many' to the 'one', e.g. who has borrowed a particular book. In this case you have to use a slightly different approach. You cannot put the Borrower object in the Book object because potentially

```
// library3.h
// Bidirectional rememberance
// using friends
// forward reference
class Borrower3:
// the Book class
class Book3 {
private:
 int refnum;
 char _author[30];
 char title[30];
  Borrower3* _borrower;
public:
Book3 (int refnum, char* author, char* title);
 void BorrowBook (Borrower3* borrower);
  void ReturnBook():
  Borrower3* GetBorrower();
 friend class Borrower3;
// the Borrower class
class Borrower3 {
private:
 char _name[30];
 char address1[20];
  Book3* _onloan[6];
public:
  Borrower3(char* name, char* address);
  int BorrowBook(Book3* book);
  int ReturnBook(Book3* book);
  void ListBooksOnLoan();
  friend class Book3;
```

Listing 3 - The class declarations for a bidirectional implementation using friends

the Borrower object will be contained in several books. One object can only reside in one place, however its address can be in several. There is now no avoiding using pointers!

The design for this implementation is shown in Figure 3. Strictly speaking the design should not show the attribute holding the Borrower pointer, but this is included for clarity. The class declarations are shown in listing 2.

As with the previous implementation it is possible to traverse the association in the non preferred way but it is an expensive operation. To ask 'which books has Fred got?' involves examining all the books to see if Fred is the borrower.

#### Bidirectional with friends

Sounds iffy! The situation here is that you wish to implement the association so that you can efficiently move in both directions. For example, you are as likely to ask 'which books has Fred got?' as 'who has Wind in the Willows?' In this case using friends gives tight control over data integrity.

A simple way to store this data is to put an array (or link list, container class etc.) in the class at the 'one' end of the relationship and a pointer to this class in the 'many' end. As before this should not really be shown in the class diagram but is included in Figure 4 for clarity.

The complication with bidirectional traversals is that you must ensure that when new data is added both sides of the association know about it. To put it more simply, you must maintain data integrity. It is not good enough to hope that the user of the classes will organise this. The class design must make it impossible not to update both sides simultaneously. One way to do this in C++ is to use the friend construct. In a nutshell, friends of a class get access to its private parts. Thus any function or class that is declared as a friend of another class can access and modify that class's attributes.

In the design shown in Figure 4 both classes can update the data through Borrow-Book and ReturnBook functions. Note that these two classes have been declared as friends of each other. Thus the BorrowBook and Return Book functions can update not only the attributes in their own class but those in the associated class as well.

Using friends can be upsetting for purists who don't like to see encapsulation tampered with, but in its defence it has to be said that the access is controlled. 'Friendship' in this context is a one way street. A class cannot get access to another class's attributes by declaring it as a friend: you have to be given friendship, you cannot claim it. The syntax for this is very straightforward and the code for the two classes using this implementation is shown in Listing 3. As before the simple array could be replaced by a container class.

#### Bidirectional without friends

In this implementation we again want to be able to efficiently traverse the association from both ends. And as before we want to ensure that there is data integrity by simultaneously updating both ends of the association.

The conventional way of doing this is to update the attributes in the 'other' class

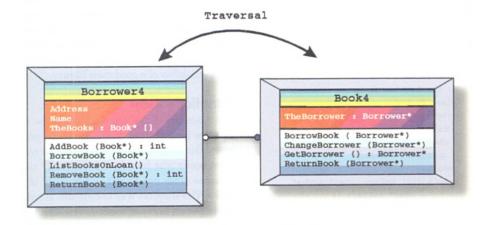


Figure 5 - A conventional bidirectional traversal without friends

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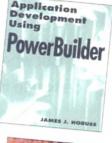
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#### TECHNIQUES

Project Options Dialog. This will cause Delphi to reorder the segments so as to minimise the size of the executable.

- (3) Turn off the 'Pentium-Save FDIV' option on the Compiler | Project Options page. Pentium-Save FDIV's may be safe, but it also increases the code size of your program.
- (4) Add {\$\$ 65535 } to the beginning of your program's project file (use 'View Project Source' from the View menu). This will cause Delphi to coalesce code segments together, minimising the number of code segments which go into the executable. As the number of segments is reduced, the amount of 'fixup' infor-

- mation is also reduced, further shrinking the size of your .EXE file.
- (5) If you run something like Resource Workshop on your finished .EXE file, you'll find that it will often contain a lot of string resources, bitmaps and assorted cursors that are never actually referenced by your code. You need to tread carefully here: be really sure that something isn't referenced before stripping it out. As an example, look at Figure 5. This shows Resource Workshop examining one of my programs, WIZ-ARD.EXE. There are no less than ten bitmaps in this .EXE file, none of which are used unless you happen to have used Speed buttons in your application. I
- stripped them out, with no ill effects as far as my application was concerned.
- (6) Finally, there's a small shareware application available called EXEChain. This program works by chaining together .EXE segment relocations in a manner which reduces the total number of relocations, and thus, the size of the file. In practice, I've found that with 'Optimise for Size and Load Time' enabled, EXEChain has little or no effect, but your mileage may vary. I'll upload the EXEChain file to the 'exe/files' area on CIX from where you can download it.

I couldn't hope to cover the entire VCL library here in the space available. There are numerous other classes, including string lists, a class to access the printer, classes to handle exceptions, and even a class to simplify the business of reading and writing data from .INI files. Nevertheless, I hope that you will at least have gained something of a feel of the library architecture from this brief overview. Also the list of tips is by no means definitive, and if you've got any tips of your own, I'd love to hear from you.

Dave Jewell is a freelance consultant, Windows developer and author of Instant Delphi' from Wrox Press. You can contact him via email as djewell@cix.compulink.co.uk.

#### About the reference manuals

Note: It's been said by some that the VCL framework is a work of art and I'm inclined to agree. However, even the best works of art can prove impenetrable for the novice. This is where Borland rather fell down by not shipping the VCL Reference Manual along with the product. This manual, along with the Object Pascal Reference Manual is now being printed and both should be available soon. If you want to get hold of them in a hurry, you can download them in Acrobat format from the Borland/Delphi conference on CIX. Acrobat won't, unfortunately, work under Windows/NT but you can always print out the information yourself.

The files names are OBJLANG.ZIP for the *Object Pascal Reference Manual* and VCLREF.ZIP for the *VCL Reference Manual*. Be warned though; these files are very large - VCLREF.ZIP is nearly 4 MBytes in size and expands out to an Acrobat file that's over 1000 pages long.

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#### TECHNIQUES

tion, disable certain features of the component or whatever - it's up to you.

If you explore the loaded module table using HeapWalker, you'll notice that Delphi loads a couple of other modules into memory while it's executing. These are DELPHIED (the Borland core editor DLL which is also used by Borland C++) and DELPHIKB. If

you check for these modules too, and above all encrypt, obfuscate and hide the code which does the checking, then you should end up with a secure system. Figure 4 shows part of the Delphi module database courtesy of HeapWalker. The GetModuleHandle technique works just as well whether you're running Windows 3.1, Windows 95 or NT.

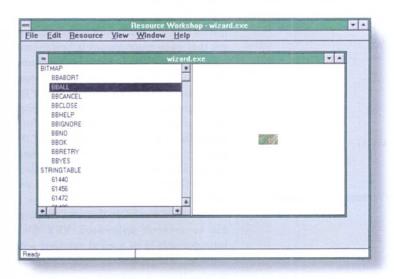


Figure 5 - Not one, but TEN unused and unloved bitmaps lurking inside every Delphi EXE file. If you don't use SpeedButtons inside your Delphi program, then you can whip them out with impunity!

#### Shrinking your application

Having written a couple of moderately successful shareware programs myself, I know that one of the most important considerations for a shareware program is size. The smaller your program is, the more likely it is that it can be squeezed onto some magazine's cover disk, thus getting the software out to a large number of people. Unfortunately, Delphi doesn't score too well in this department - as I said last month, the minimum size of an executable is around 150 KBytes. When all cover disks are CD's, the issue will become rather irrelevant, but until then it's worth giving some thought to how you'd go about reducing the size of your Delphi program. Here are a few tips:

- (1) Firstly, and most obviously, turn off the debugging options on the Compiler page of the Project Options dialog. Also make sure that 'Include TDW Debug Info' is unchecked on the Linker page of the same dialog. This will ensure that Delphi doesn't include any debug information into your executable.
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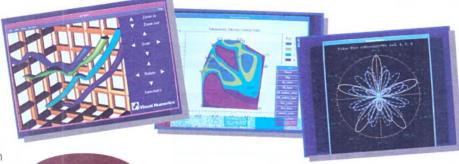
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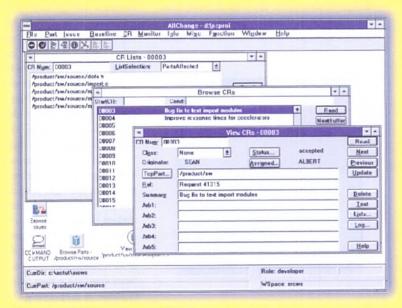
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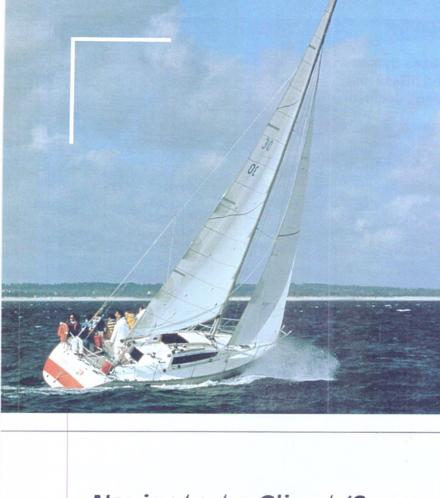
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#### GUIs and the visually impaired (continued)

#### Blind and remote access

Along the same lines, the Mercator project developed by Elizabeth Mynatt, Keith Edwards and Kathryn Stockton at the Georgia Institute of Technology in Atlanta associates both speech and non speech elements to an X Window system. Speech is useful to say the title of a window or an icon, menu options or a list of active windows. In an article published in the January issue of the interactions magazine, the researchers explain the importance of giving some information on the state of the objects: 'Nonspeech audio, in the form of auditory icons and filters, convey the type of an object and its attribute. For example, a textentry field is represented by the sound of an old-fashioned typewriter, while a text field which is not editable is represented by the sound of a printer'.

Mercator is in its third revision. The original version could be installed on any X Window system but experience showed that this was not good enough. The researchers subsequently introduced some modifications to the Xt Intrisics toolkit and to the low-level Xlib library. They soon realised that these modifications could be of value to developers of a completely unrelated type of applications. 'A somewhat modified version of our "hooks" into Xt and Xlib has become part of the standard X11R6 release of the X Window System. A protocol, called RAP (Remote Access Protocol) uses these hooks to communicate changes in application state to the external agents.'

RAP is not yet a standard in the X community, but it shows that work that began with the sole intention of making GUIs more accessible to the visually impaired can end up benefiting everybody.

#### One for all

In order to avoid developing many GUI specific systems, GUIB is creating a formal language to describe man-machine interfaces. A screen reader with output in both Braille and speech has been developed using this framework. One goal is to keep as much information about the spatial layout as possible so that a blind can collaborate with a sighted person. Menu items, for instance, are presented in Braille but windows names are spoken. Of course this necessitates a special hardware with a Braille 'display'. Part of GUIB's work involves designing a prototype equipped with non conventional input-output devices such as a multi-lingual speech syn-

thesiser, a Braille display, a sound generator, a cordless headphone and a pressure sensitive touchpad.

Finding the right input device is also not an obvious task. GUIB evaluated the use of a mouse, a joystick, a trackball, cursor keys, a touchpad and Braille routing keys. Cursor movements were indicated by sounds. The results showed that with most systems the blind group was slower than the sighted one, but just as accurate. There doesn't seem to be a clear best choice, although this research shows that the sound-based approach is important.

To go further in the sound representation of a 2D graphical screen, GUIB built a sound screen which gives a spatial sound representation. It's made of a 2D multi-channel loudspeaker array system. The array is composed of 5 speakers arranged as the points on the number 5 on a die. X and Y coordinates are converted into a set of discrete output voltages which are then converted into weighted output signals for each loudspeaker channel'. Each event or user action generates a specific sound played at the right location in space. The next step is to build a 2D headphone system.

The GUIB consortium is also doing some research on more theoretical aspects which could be beneficial for both sighted and visually impaired computer users. How do we perceive computer generated graphical representations? Which elements are important and which ones are redundant information? The goal is to produce a scene description from any graphics screen. If this goal can be reached, then a 'hyper-renderer' could produce a description of a screen from the input of the scene description. Since the description is independent of any media it could be output to the most suited technology available and evolve easily when new technologies appear or become affordable. Coupled with some input on the part of the screen the user is interested in, the hyper-renderer could describe only a specific area of the screen.

A lot of work has been carried on in research labs all over the world. They all seem to indicate that a mixture of speech and non speech auditory representation works relatively well. As soon as commercial applications start appearing, a standardisation of which sounds to use will be required. In the hardware field, the development of new equipment to visualise these sounds may benefit from the recent attention given to virtual reality.

#### References

HAL and LUNAR are produced by the UK company Dolphin Systems which can be reached on 01905 754577.

The Guardian published an article on "Windows for the blind" which mentioned two mailing lists BLIND-L at LISTSERV @ UAFSYS.UARK.EDU (Computer Use by and for the Blind) and DEAFBLND at LISTSERV @ UKCC.UKY.EDU (Deaf-Blind).

EXE published an article on software development issues for the disabled.

'Software Interrupts Disabled' was in the November '90 issue.

The leader of the European project 'Textual and Graphical User Interfaces for Blind People (GUIB)'

can be contacted by fax at 00 39 55 410 893.
The RNIB Web site is at http://www.rnib.org.uk/
The NCSA Mosaic Access Page at

http://bucky.aa.uic.edu/ contains many interesting links.

interactions is a quarterly publication focusing on human-computer interaction.

It is published by the ACM (001 212 8697440).

Supply your documentation on disk as a text file and use large fonts in the printed version (a Courier fixed font of 10 pts or a proportional font of 20 pts are good choices).

#### And the winner is...

The jury will be composed of students of the RNIB Red Hill College. They will evaluate all the entries after their holidays in September. Student John Hill is just finishing his studies at the College. He suffers only a partial loss of sight and is quite happy playing graphic games like *Doom*. He emphasises the need for a game to be attractive: 'it must be gripping enough'. He explains that it's too often believed that because someone is visually impaired he/she is not as bright as someone with full vision. This is of course untrue and very offensive. The game must have a DOS text interface, but that should have no influence on the game's logic.

Several years ago, Infocom produced some great games such as *The Hitchhiker's Guide to the Galaxy*, but all these titles are now old. There's a need for some more contemporary text based adventures games. One feature that has appeared recently is a

multi-player option that is available when the computer is connected to a network or a modem. Once again this is not a 'must have' feature but it could add to the game.

There's a big gap between Infocom's games and *Doom*. So there's plenty of room for a modern text based adventure game. Here's your chance...

Entries should be sent on a disk to EXE -RNIB game contest c/o EXE Magazine by August 31st.



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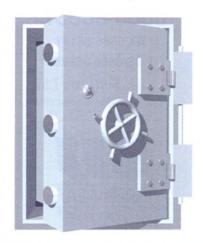


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#### A Short History of Anders H and Turbo P

1960: Anders Heilsberg born in Copenhagen, Denmark.

1979: Enrols at the Danish Engineering Academy. Co-founds PolyData, one of the first Danish microcomputer companies.

1980: Releases his first Pascal compiler — a 12K Pascal subset in ROM for the British NASCOM Z-80 based kit computer. Eventually sells the rights to this product to Lucas Logic.

1982: PolyPascal for CP/M-80 released. Product is now a complete implementation of the Pascal language.

1983: Sells the Borland founders (Niels Alex Jensen, Ole Henriksen, Mogens Glad, and Philippe Kahn) on the idea of a Pascal compiler with an integrated editor. In November releases Turbo Pascal 1.0 for CP/M-80, CP/M-86, and MS-DOS. The newly formed Borland company, essentially penniless, places an advert for Turbo Pascal in *Byte Magazine*, bluffing the *Byte Ad* executives into giving them credit. The compiler is priced at \$49.95 and is an instant hit.

1986: Turbo Pascal 4.0 released, featuring an Integrated Development Environment — the first of its kind for the PC environment — and introducing modular compilation (previously Turbo Pascal programs had to be compiled all in one go and could be no larger than 64K unless overlays were used). CP/M support is dropped.

1988: Turbo Pascal 5.0 released, featuring integrated debugging and VROOMM (Virtual Runtime Object Oriented Memory Manager) overlay management technology.

1989: In response to Microsoft's object oriented QuickPascal, Borland releases Turbo Pascal 5.5, which has its own OOP extensions. Microsoft later drops QuickPascal from its product line.

1990: Turbo Pascal 6.0 features a new, much improved Integrated Development Environment, and includes the Turbo Vision object oriented application framework.

1991: First release of Turbo Pascal for Windows. Features a Windows hosted IDE and the ObjectWindows Library (also known as OWL).

1992: Borland Pascal 7.0 includes both a DOS and a Windows hosted IDE, and allows developers to target DOS, DOS Protected Mode, and Windows.

1995: Delphi and Delphi Client/Server released on schedule on St Valentine's day.

#### EXE: Is Delphi Pascal 8? Is there going to be a Pascal 8, and if so - when?

AH: No, Delphi is not Borland Pascal 8.0 — it is a new product, specifically targeted for Windows developers. Our current priority is Windows 95 and NT. We've kept Turbo Pascal 7.0 on the market for DOS and Extended DOS development.

(AH declined to be pressed further this matter - Ed)

#### Delphi and databases

EXE: Delphi requires that one includes the Borland Database Engine with database applications, even if one only wants to access the odd DBF. Any plans to clean this up? AH: We're working with several third parties, including SAX Software, Eschelon Development, Sterling Software, Great Lakes Software, and Shoreline Software. They have, or will soon have, products to help you deploy your Delphi database applications. In addition, we're making a deployment kit available, via CompuServe and Internet.

EXE: Also on data access: is it possible to modify/inherit from the data access controls to provide, for example, 'native' access to FoxPro/Clipper databases? If so, are any such products being developed by Borland or Third Parties?

AH: Yes, it is. I know of several Third Parties working on native access to FoxPro/Clipper as well as BTrieve. Some of them are in beta at this point. Interested parties can contact them on CompuServe in the DELPHI forum.

EXE: How have Borland's recent troubles affected Delphi's development and its take-up? Was the absence of a Language Reference Manual in the initial product a consequence of these troubles?

AH: In the two years we were developing Delphi, the company did go through some difficult times. That was all resolved before we shipped. Now the entire company is focused on development tools, we've won the Lotus lawsuit, we've launched Delphi and Delphi Client/Server world-wide, and both products continue to sell well above expectations. In fact, I understand that Grey Matter reports that Delphi is the #1 selling development tool in the UK. The Delphi development team is 100% intact, and focused on Delphi for Windows 95.

We really underestimated the demand for the Language Reference Manual. It will be included in Delphi for Windows 95. Meanwhile, we've made good by uploading an Adobe Acrobat version to CompuServe and our WWW page, and a printed version is now also available from Borland.

### $\label{eq:exercise} \textit{EXE: Which part of Delphi are you least proud of?} \dots \textit{and which part most?}$

AH: The thing I'm the least proud of is probably the initial lack of a Language Reference Manual. But that's taken care of now.

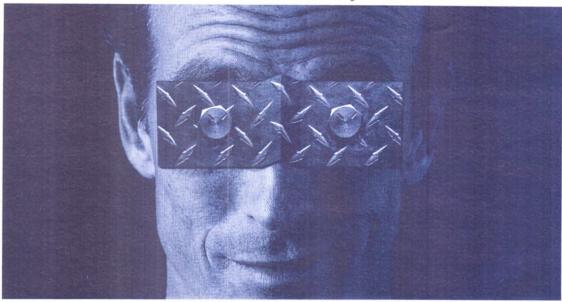
What I'm most proud of is the fact that the energy we invested in foundation technologies like extensibility and exception handling enabled us to build Delphi in itself. Can you imagine VB or Power-Builder written in themselves? By building Delphi in Delphi, we really got to feel on our own bodies what was right about the product, and what needed fixing. I sometimes hear frustrated users comment "The programmers that wrote this %&##\$ thing should be forced to use it themselves!". Well, we did, and we're really proud of the result.

Many thanks to Anders Hejlsberg for sparing more time than he anticipated on this interview. Thanks also to Dave Jewell and the boys at Mobius for suggesting all the clever questions. The interview was conducted by Will Watts.

Now you mention it, we actually did try to call Delphi "Power Visual Turbo Pascal Objects for Windows", but as luck would have it that name was already trademarked.



## C/C++ without Object Master

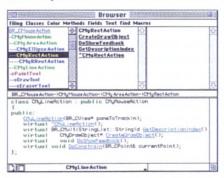


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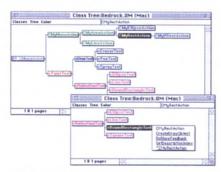
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Published by ACI UK Ltd, Barons Court, Manchester Road, Wilmslow, Cheshire SK9 1BQ. Tel (01625) 536178. Fax (01625) 536497. AppleLink: ACI.UK "I use the browsing and navigational capabilities of Object Master and I couldn't live without them."

-Chris Knepper, Software Engineer at Taligent



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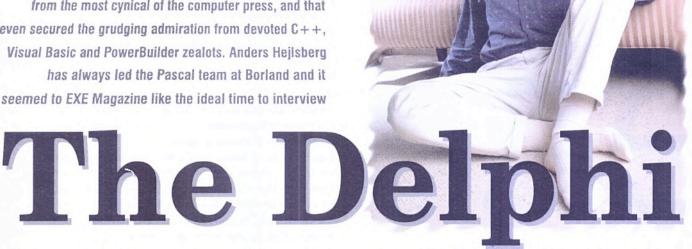
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CIRCLE NO. 144

In the early Spring of '95, things looked extremely grim for Borland. In the previous profitless year, the company had been obliged to sell off Quattro Pro, but was still fighting a look-and-feel lawsuit with Lotus over it. It had undergone one huge wave of redundancies and was about to begin another, Legendary Borland boss Phillipe Kahn had been unseated. People had stopped taking Borland seriously.

Then, out of the Turbo Pascal shed at Scotts Valley emerged a development system that had the Borland CompuServe forum and the Usenet comp.lang.pascal group buzzing, that drew rave reviews from the most cynical of the computer press, and that even secured the grudging admiration from devoted C++, Visual Basic and PowerBuilder zealots. Anders Heilsberg has always led the Pascal team at Borland and it



EXE: We are all pleased you resisted the opportunity to christen a product Power Visual Turbo Pascal Objects for Windows · but how did it come to be called 'Delphi'?

AH: We actually tried to call it "Power Visual Turbo Pascal Objects for Windows", but that name was already trademarked. (Grins.) One of the senior guys in QA dreamed up 'Delphi' as a code name quite early on, and every time we did a market survey of product name candidates, everyone said "well, those are OK, but we really like 'Delphi". So in the end we kept it.

EXE: How did the idea for Delphi evolve from Turbo/Borland Pascal? At what stage did you decide to add the environment, database support and so on?

AH: The key idea was to design a tool that combines visual development environment, Client/Server database support, and a native code compiler. Before Delphi, you always had to make a choice. Do I go for the performance of a native code compiler, or the ease of use of a visual development environment? Do I go for a powerful object-oriented language, or a proprietary 4GL Client/Server tool? What programmers really want is all of the above, in one package. That's what we set out to do.

What it really boils down to is productivity — we wanted to design a tool that would make developers more productive, all the way from prototype to production code. Other products lure you with visual tools, but once you get halfway through your project, they let you down because of sluggish performance, lack of extensibility, or gen-

We like to say, "It's not your father's Turbo Pascal any more". We made sure that the Object Pascal code you have to write is as easy as Basic.

eral stability problems. The competition talks about adding extensibility and improving performance. That's a fundamental difference between their products and ours. Extensibility and performance was on the white-board the first day we started designing Delphi, and it permeates the entire product.

For example, if you want to design a new component in Visual Basic, you have to write it in another language, such as C or C++ (or Delphi, for that matter). None of your VB skills can be reused, you have to learn a different language, and you can't easily inherit from any of the built-in components. Delphi, on the other hand, allows you to write new components in Delphi, and you can inherit from any of the built-in ones. That's true extensibility, and it translates into a substantial productivity boost.

Another key aspect of Delphi is its versatility. Other tools tend to focus either on Windows application development or on Client/Server development, and one always trades off the other. Delphi is equally adept at both, as is evident from the kinds of applications our customers are building. They range from shrink-wrap Windows utilities and multi-media games, through desktop database applications, and all the way up to multi-user enterprise-wide Client/Server solutions. The point is that almost any Windows application needs some form of database access, and any database application needs some form of Windows specific programming — to be productive, you need a tool that does both.

I hear our competitors say that you can use their tool for rapid prototyping, and then port your app to C++ for production. But you know, rapid application development isn't really rapid unless you can go from prototype to production, all using the same tool! I also hear how competing products will address performance issues by generat-

ing C or C++ source code. (AH may be thinking of Crescent, which is developing a product called Stingray to translate Visual Basic code into Visual C++ - Ed.) This idea of building the application with one tool, and then having it generate C++ source files that have to be run through another tool, is ludicrous. How are you expected to debug the final code?

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6



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#### Artoo, meet 3DR

At the Computer Games Developer Conference in Santa Clara, Intel announced 3DR version 2, an improved version of the company's 3D graphics library for Windows which has been optimised for the Pentium. New to this release is support for general lighting model and materials palette, matrix operations and camera model and rational quadratic patches. The library also includes a texture processing toolkit, a user interface toolkit, a maths library optimised for the Pentium and support for Visual Basic. The 3DR SDK is available with run-time system, documentation and example programs free from Intel Architecture Labs. A shrink wrapped redistribution licence is also available. Intel is on 01793 696000.

#### A home page of one's own

Perhaps the review of Web authoring tools in the May issue of EXE Magazine has inspired you to have a go at setting up your own Web site. One public access Web server that appears particularly good value is the service from Webzone1. For a paltry £12 per year - the price of Webzone1's cheapest service - you get a Home page that can be accessed through a unique User ID number. If you splurge £18, you can have a Home page with a name you provide. The webzone1 server can be reached at http://www.demon.co.uk/proacrt/webzone1.

#### Thread into Orbix

Iona has released Orbix-MT, a multithreaded version of Orbix that uses Solaris Threads. The company states that the new product is aimed at developers who need to create non-blocking client/server applications. Orbix-MT supports either a thread per object requested from the server, a pool of threads created at startup or a thread per object. Orbix-MT is sold as an add-on to Orbix at \$1500. The complete Orbix package, including Orbix-MT, costs \$6,500.

#### Aid to OLE

To help developers create VBA applications, Apex Software has created VBA Companion, an OLE 2.0 object browser for viewing the relationship between objects in the Windows registry. It includes a search facility, a built-in report generator for producing summaries of available programmable objects, and the ability to add comments to individual objects and access developer-supplied help files for the selected object, property, method, event or constant. VBA Companion is priced at £65 from QBS Software (0181 9943441).

## Somebody's watching you...

Beta testing will never be the same again. The problem with end user feedback is that that a call logged at the help desk will typically take a day, maybe more, before it is actioned by a developer. Often the information provided by the user will be, at best, vague. In some cases it will be downright incorrect. More often than not, problems will be difficult to reproduce since the developer will have little or no knowledge of the user's hardware and software configuration.

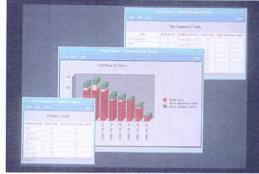
Pure Software, the company that created the popular Purify memory leak monitor for Unix, has produced what it claims to be the first software tool to automate remote software testing. The tool is called PureVision. Pure Software's Object Code Insertion (OCI) technology allows PureVision to bind to an application. When the application is run, PureVision invisibly captures data on usage patterns and the reasons behind fatal errors. It also saves information on the user's configuration such as hardware and version of operating system, together with details of the build number of the program.

Information for post-mortem debugging is available to developers. PureVision saves a full stack trace, heap size and other related information when the program crashes. Once captured all this information can be emailed to the development site automatically, though Pure Software has added the ability for end users to preview the material being sent.

Back at the development site, Pure Software provides a suite of predefined reports and charts for analysing the information captured. For instance, it is possible to determine the effectiveness of testing at a particular user site by checking usage patterns to see which of the product's features are being used the most. More importantly, it can point out features in the product which have not been tested thoroughly by the end-user. As well as the report on features used, Pure-Vision also shows runs/hours over time, runs/hours per site, number of unique crashes and percentage of successful runs to unsuccessful runs. According to Pure Software, the performance overhead is minimal. For developers, PureVision will work with both C and C++ code and can check all object code, including libraries from third party companies. Since the application need-

n't be compiled to use it, Pure Software claims that the OCI technology used in PureVision is faster than an equivalent source code implementation.

PureVision is expected to ship in the third quarter of 1995 for Solaris 2.0 on SPARC. SunOS and HP-UX versions will be available at a later date. The price for 10 test suites incorporating PureVision is expected to be in the region of \$35,000. Pure Software can be contacted in the Netherlands on 0031 2503 85402.



With PureVision developers can monitor their software running at a remote site

#### **OLE2** and SOM with Neuron Data

Ten years ago Neuron Data had only one product: an expert system called Nexpert Object. The developers had some problems moving it across platforms, so they developed Open Interface, a cross-platform tools for GUI development. Since then, Neuron Data has moved into the Client/Server arena with Neuron Data Elements Environment. This a portable and modular (component based) development environment, hardware and operating system independent.

It comprises four main modules: GUI , data-access, objects and rules. Other third party modules can be plugged into the architecture. The rules module is based on the inference engine of Nexpert Object and the GUI module is Open Interface. The objects module provides a consistent interface to access objects. Neuron Data just added support for OLE2 and SOM. Since Neuron Data has published an API to allow other interfaces to be plugged in, it shouldn't take long for a CORBA interface to appear.

Applications developed with Elements Environment can be written in C, C++ or at a higher level in a proprietary scripting language, very similar to Object Query Language (OQL). Pure script applications can be moved between platforms without the need for recompilation.

Neuron Data claims that Elements Environment runs on more than 35 hardware platforms and GUIs including DOS, Windows, NT, Macintosh, OS/2, OSF Motif, Open-Look. Neuron Data is on 0171 2241184.

#### Campus Microsoft

I'm sure you will have come across the Microsoft Network. MS has now gone one step further with the announcement of the Microsoft Online Institute, an online education programme with an interactive 'campus' bookstore and classrooms. There's even a so-called guidance centre and a student union. No doubt we'll all get virtually legless in the virtual bar... Unsurprisingly, as well as online courses, the Institute will provide information on MS products and services. Microsoft can be contacted on 01734 270000.

#### One less to remember

So phONEday's gone by. Without a hitch? We think not. For anyone still hacking the '1' into their databases, Quest Computer Systems may have the answer. It's a Windows utility called CodeQuest which allows users to correct area codes. CodeQuest costs £10 from Quest Computer Systems (0116 2773029).

#### Simulated Power

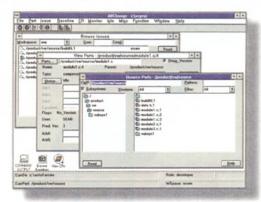
Software Development Systems (SDS) has a new version of its SingleStep for the PowerPC simulator which it claims can execute 7,500 instructions per second on the host computer. SingleStep supports the EABI ELF/DWARF object file standard for embedded PowerPC applications which allows it to work with many PowerPC embedded compilers. The simulator also includes a trace buffer which has a similar function to the trace buffers of in-circuit emulators. It can hold a million instructions and is configurable. The starting price for a single user licence is \$1,500. SDS can be reached on 01442 876065.

#### Far and Aware

Database developers using Visual Basic or Visual C++ can now obtain the latest version of FarPoint Technologies' data input validation VBX controls. In Aware 1.5, FarPoint has apparently rewritten its combo and list box controls so that they can handle data of more than 64 KB and display multiple columns. Bitmaps can now be placed in rows and columns; columns can also be resized and there is a new search facility. As well as these controls. Aware offers boolean, binary, calendar, clock and formatted edit controls (for currency, date/time, mask, double/single, long integer, memo and text), all of which can be bound to MS Access database fields. The UK distributor of Aware is Contemporary Software (01727 811999). The package costs £110.

#### Changes to AllChange

AllChange moves up a gear to version 3 this month. The change configuration management and version control software from Intasoft now provides a GUI interface both for Windows and Motif. Under Windows AllChange 3 runs as an MDI application where each part of the underlying database for change configuration may be independently viewed and operated upon. The Unix version offers a client/server architecture. The database itself represents a hierarchical design tree for modelling



Browsing a project in AllChange 3

product structure. Facilities are provided for independent user workspaces where development and builds can be performed in one place together with pools for sharing objects within a project.

New to version 3 of AllChange is the addition of full audit trails with life cycle status logging, site specifiable Change Request numbering schemes and support for Quality Metrics. Action triggering is available which enables procedures to be automated and provides reporting via email. Baselining and configuration builds using build threads are also available. AllChange integrates with PVCS and Intasoft's own SMS version control system. A five user licence for DOS/Windows costs £1990.

Intasoft has also released version 5 of SMS. As with AllChange, GUI front ends are available for both Windows and Motif. As well as a project history, SMS enables revisions to be identified by name, date, author, revision number and reason for the change. File locking is available on checkout and the files themselves can be restricted to read-only, write and administrative users. The version control system also provides a build facility with dependency generator and analyser tools. A single user licence for the DOS/Windows version of SMS is priced at £490. Intasoft is on 01392 217670.

#### **Final Countdown**

Are we counting the days yet? Well Microsoft says it's all set for August. It seems as if Windows 95 may really be happening in two month's time. There are already 400,000 copies of the preview release shipped, making it probably the broadest scale beta programme in the industry to date (besides Windows 3.x) - and Microsoft is charging for it! According to the company, more than 2,000 copies are being sold per day.

What can we expect when it finally arrives? As Microsoft pointed out, 'it won't cure cancer'. But it sees Windows 95 as a platform capable of reducing the so-called hidden costs associated with PC ownership. For instance, Microsoft claims that Windows 95 will significantly reduce the support burden for PCs. A recent Gartner report estimated the cost of this support as \$1,100 per PC per annum.

The people who will really make a difference are developers. Without any applications for the new platform, Windows 95 would be as useful as a Ferrari with four flat tyres. Not surprisingly, developers seem to have taken to Windows 95 in masses. There are more than 350 independent software vendors working on Windows 95 applications. Over 130,000 SDKs have been shipped according to Microsoft. And there are more than 500 Windows 95 applications being developed.

Hardware companies too have gone overboard making their kit 'Windows 95 ready'. It used to be plug and pray when it came to installing sound cards or network cards or, in fact, anything that wasn't in the box when the PC was purchased. Companies like Creative Labs have now built plug and play into their adapter cards. There are over 180 plug and play devices today and 80% of all new network cards can plug and play. This should mean no more sleepless nights juggling the Sound Blaster with the network card and SCSI controller.

As the shipping date draws closer and closer, EXE will keep our readers informed of the latest developments. Stay tuned...

#### Have a nice SPA

What could you do in Nice from the 11th to the 14th of June beside dipping a toe in the water? Why not attend the sixth annual conference of the Software Publishers Association (SPA)? The conference special keynote will be devoted to 'application development platforms' with speakers such as David Nagel (AppleSoft's Senior VP & General Manager), Ian Fraser (Novell's VP Europe Middle East & Africa) and Bernard Vergnes (Microsoft Europe's President). To attend the event call the SPA on 0033 145630202.

#### **Hummingbird expands**

Hummingbird Communications, best known for X Window products acquired Beam & Whiteside Software, developers of TCP/IP and NFS products. Beam & Whiteside's BW-Connect NFS suite of products enables DOS, Windows and NT machines to become NFS servers. If your primary development platform is Unix, these products could prove handy when you have to work with Windows or NT systems. Hummingbird is on 0113 2467253.

#### Client/Server benchmark

Client/Server Labs is opening an independent testing lab for Client/Server environment this month. The Client/Server Labs bought exclusive rights on the RPMark benchmark developed by IBM to test performance in a real-word environment. It is made up of a transaction based component (a subset of TPC-C), a decision support component (PC clients performing ODBC requests) and a file serving component (a subset of BAPCo). An on-site test at the Client/Servers Labs costs \$12,500 and last about five days. For more information call 001 404 5523645.

#### Access All Areas

The first UK computer security and hacking conference, Access All Areas, is to be held at King's College in London the first weekend of July. It will be a chance for all sides of the computer world to get together. The conference will feature speakers with very different backgrounds such as Robert Shifreen (editor of EXE until 1990), Alec Muffett (author of free network security tools), Annaliza Savage (independent film producer, see EXE March '95 p.89). Several technical workshops will be run during the two days and Internet access (WWW, IRC, cu-see-me video) will be provided. For more information email info@phate.demon.co.uk or call 0973 500 202.

#### **Europeans better than Americans?**

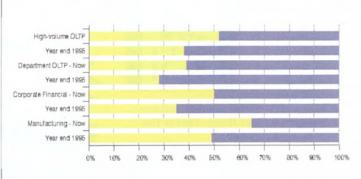
In their recent survey on software development tools, Spikes Cavell and Sentry Market Research (SMR) show that European corporate developers are more productive than their American counterparts. They attribute this difference to the

higher employment costs in Europe: employers pay more, so they expect more from their development teams. You have to bear in mind that for these research companies, 'Europe' means only UK, France and Germany, and 'America' is only North America. They surveyed 500 corporate users of IT in these four countries.

In Europe, companies spend 39% of their total budget on tools and slightly less, 37%, on salaries. According to the survey, a higher proportion of centralised IT departments in Europe (85%) compared with North America (57%) causes the discrepancy.

Spikes Cavell and SMR identified several other general trends in all the countries surveyed: development cycles are shrinking and the tools training is increasingly seen as a priority. These two findings are probably linked. As tools become more sophisticated, development time is reduced but more training is necessary. For the North American respondents, training was cited as the highest priority (48%) followed by tool integration and customisation (37%).

The rapid adoption of Client/Server and the uprising surge in object technology are the two other major general trends pointed out in the survey. David R. Broussell, SMR director explains: 'As companies seek to harness the significant information technology investments they have



made over the past years by using the Client/Server model, they are looking for an additional competitive edge. They believe object technology can give them that edge.' Some of the companies interviewed plan to double or triple the

Salaries

Services

number of pilot applications using OO technology by the end of this year. For more detailed results contact Spikes Cavell on  $01635\ 550449$ .

#### TLAs, FLAs and 5las.

The Object Management Group or OMG is fond of acronyms, for example, ORB (Object Request Broker) is well known. But have you heard of all the new ones introduced with CORBA 2.0 (Common Object Request Broker Architecture)?

SunSoft and the OMG have just released a source code implementation of a CORBA 2.0 ORB: an Internet Inter-ORB Protocol (IIOP) which provides a single standardised way of connecting ORBs from different vendors. Support for the IIOP is required for an ORB to be compliant with CORBA 2.0. At last, ORBs should be able to communicate with each other.

The code comprises four parts: a common data representation engine, a type code interpreter, the IIOP Engine framework (with a partial ORB implementation), and IIOP specific modules (to send, receive and dispatch IIOP messages). The code is written in C++ and has already been compiled using SPARCworks for SPARC, PROworks for x86, Borland C++, GNU C++ and MS Visual C++. It runs on Solaris for SPARC and x86, NextStep and Windows NT.

According to Christopher Stone, OMG's President: 'The CORBA 2.0 set of specifications for interoperability will help advance the commitment to universal networked objects (UNO). By contributing a free IIOP, SunSoft is providing vendors with a tangible and highly valuable head start moving towards CORBA 2.0 UNO compliance.' SunSoft IIOP is fully compliant with the UNO specifications. The OMG recently adopted UNO as the primary transport software for ORBs, with DCE as a secondary option.

To retrieve the software, which is licensed freely, send an email with a body line containing "help" to iiop-bridging@omg.org. Alternatively ftp anonymously to ftp.omg.org.

#### DataFlex conference

The European DataFlex users conference will be hold in Switzerland on May 11 and 12. It will start with a speech by Dr Jurg Gutknecht, the development team leader of the Oberon object oriented operating system. The two day programme will cover visual report programming and advanced development using Data Access's products. To book a seat at the conference contact Verna Ellis on 01923 242222.

#### Video's future

AT&T, Intel and Lotus have teamed together to work on real-time collaborative communications. Their first effort is to link their respective products across LAN, WAN, ISDN and via modem but their ultimate goal is to create an infrastructure where video will be as easy to use and manipulate as speech is today with phones and telephony applications such as voicemail. Trials will start this year and general availability is planned for 1996. Developers will be able to access these capabilities through Notes APIs. While Lotus will provide APIs and SDKs, AT&T will also address developers through the WorldWorx Developers' Forum. Intel is on 01793 696000.

#### From tools to components

VisualTools is no more, welcome Visual Components. Since most of its recent object based development tools were in fact components, the company decided it was time to adopt a more trendy name. VisualTools was founded in 1993, by the programming team who developed the Wingz graphical spreadsheet. Visual Components developed components such as First Impression (a photo realistic charter), Formula One (an Excel compatible spreadsheet) and VisualSpeller (a 100,000+ word spell checker). The new phone number (new only because of the added 1 of phONEday) is 01892 834343.

#### **Graphics standards**

The 2D and 3D graphics tools vendors C5G and Template Graphics Software have merged. The new company, TGS BV, will continue to specialise in delivering crossplatform graphics software tools. TGS BV's range of products covers most graphics standards: from mature ones such as GKS and PHIGS+ to new tools such as OpenGL. The company is a licensee of Silicon Graphics' Open Inventor, the first C++ graphics development toolkit. TGS BV plan to port Open Inventor to most OpenGL-capable platform. TGS BV can be reached on 0033 56133777.

#### **EXE** first

Not long now. Keep the 8th and 9th clear in your diary for the first ever EXE Show. The venue is the Royal Horticultural Halls in rosy Victoria, London. But that's not the only first...

Professional Software will be demonstrating UTAH, a cross platform C++ GUI development tool for the first time in the UK. This is based on 'smart interactor' technology from Brigham Young University which separates user interface dependencies from the underlying program. Attendees will also be able to see McCabe Toolset version 5, a source code analyser, for the first time in the UK. Another first, this time for Europe, will be Continuus Software's PC client for its Continuus/CM software configuration management tool. User Interface Technologies will be making waves on the Internet with Mariner, a new integrated Internet access package. There will also be a launch from Oxford Computer Consultants of its new Windows Help tool which packages ForeHelp 2 with 'The Help Browser', Oxford Computer's own help authoring tool.

As well as these *firsts* there will also be loads of really interesting stuff on show. For a start, the red carpet will be rolled out on the EXE stand for EXplodE, our all new World Wide Web site (http://www.exe.co.uk). Come onto the stand for a demo and a chat. And, if you care to take out a two year subscription we are giving away a CD-ROM with over £100 of software. The CD-ROM, generously donated by Lasermoon, contains PC DOS/Windows utilities, Linux + tools and Internet tools. Current readers who want to extend their subscription will also receive some freebies.

On Programmer Analysers' stand you'll be able to see LDRA Testbed, the software chosen by the FIA to check software in Formula One racing cars. T-shirts, NOVLIB and Blinker demo disks will be available from Blink Inc and Revelation Technologies will be selling OpenInsight Report Designer for Lotus Notes at a special show price. And at the Software Practices stand you can take a free 'Rights and Risks health Check' which aims to help software developers identify shortcomings in their contracts with customers and distributors.

As well as the show itself, we are also organising a programme of technical workshops running over the two days. If you hurry you may still be able to get hold of tickets. Call Tim Macpherson on 0171 287 5678 for details. Our line up of speakers includes Bertrand Meyer, who I'm sure is familiar to all regular EXE readers as the father of Eiffel. We also have Matt Pietrik, the man behind Bounds Checker, and Todd Johnson of American Cybernetics who knows more than a thing or two on Windows 95.

Tickets for the EXE Show are somewhere in this issue. So give the magazine a good shuffle right now and it should drop out (at least that's what happened when I tried). If yours are lost, please call the hotline on 0181 7102190.

#### Intersolv on a buying spree

After PVCS and Q+E, it is now the turn of C++/Views and DataDirect Developer's Toolkit for C++ to be bought by Intersolv. The former has been purchased from Liant Software and the latter from South Wind Design. Tony Hill, Intersolv UK General Manager, comments on this expansion in the C++ market: 'Like our customers, Intersolv is making a significant investment in object oriented technology. Figures from the US reflect that growth in OO is increasing rapidly, and we're seeing this trend take hold in the UK too'. International Data predicts that the OO programming tool market will reach \$2.2 billion by 1998.

C++/Views is an application framework for developing cross platform C++ applications. It consists of over 100 C++ classes for interface design, data management and event processing. With C++/Views, an application's interface, including resources, can be ported between Windows, NT, OS/2, Unix and Macintosh without any change. One of the strengths of C++/Views

Constructor is its Browser which lets the developer build applications without having having to load yet another tool. This, in addition to manipulating classes, objects and member functions. Porting an application is just a matter of performing the build process from the Browser on the target platform.

The DataDirect Developer's Toolkit for C++ is targeted at developers who needs to access databases. It is based on a C++ class library developed by South Wind Design which provides ODBC functionality in C++.

C++/Views for Windows, NT, OS/2, OSF/Motif or the Macintosh costs £700 per developer. DataDirect Developer's Toolkit for C++ is available only for Windows and NT at £480. Intersolv can be reached on 01727 812812.



## Maybem!

With all the usual overtones of inevitability, and for-your-own-good-ism, we are told that cashless money is coming.

Jules has something to say about that.

Poor souls; controlling the money supply isn't enough for them; now they want to remove the money as well. You know, it's a good job that the banks have PR departments to tell us what we pay them for. I mean, if they hadn't told me that handling cash was expensive and annoying, I wouldn't have guessed. Who would have thought that that's their primary job. They really don't want to do it any more, so they're looking at ways to replace cash with something more bank-friendly.

They're talking about electric money. You'll have a smart card, charged up with a certain amount of cash, and when you want to buy something you'll put your card into a special machine which, after checking lots of security codes, sucks money out of your card and puts it into someone else's.

Electric money is better than real money because... Well, let's ask the banks.

It's more convenient for the shopper'. Is it really? I look in my wallet, without which I never leave home, and I find no less than thirteen bits of plastic. They want to remove a few thousandths of an inch of paper, which is really no hardship to carry, and replace it with another bit of plastic that looks just like

Perhaps the card can have a little LCD telling me how much is in it, but it's still very much harder for the blind to use. What's more, I've still got to go to the bank to get the card replaced or recharged. I can't buy the card from a shop, like a phonecard, because I can't give cash for it.

'It's more secure'. We've heard that before, about credit cards, about cashpoint machines, and almost every other idea the banks have had. Let's suppose we did have any basis whatever for believing them. I need to be assured that the correct amount of money leaves the card, and the shopkeeper needs to know that the same amount is going into his, and that's got to be true no matter what electrical or mechanical breakdowns occur. There's got to be some way of putting money into a card;

how long would



counsellors and cult awareness groups around the world'.

Catalyst has accumulated literally hundreds of thousands of pages of information pertaining to cult activity. This information is constantly being stored in TIFF format and managed by EDM (Electronic Document Management). EDM is a database facility which ties documents (often in pixelated form) to indexed and memo fields allowing SQL style searches to be made looking for patterns and techniques used by cults which, incidentally, often practise under many different names making them difficult to trace.

In researching this article I scanned the Internet and CompuServe for material like that described by Catalyst. In less than an hour I had more than 2 megabytes of text files and conversations had accumulated - it's that easy! Peep into CompuServe's NEWAGE Forum, where a magazine called Share International promotes a guru called Maitraya who keeps mysteriously appearing in various locations around the world.

'Netiquette' and 'decorum in the forum'. The Internet's offerings of vast quantities of useful information also includes some tasteless titles. CompuServe (correct me if I'm wrong) is a little more restricted. Nevertheless, to the Americans, freedom of speech is of utmost importance. Like it or not, sooner or later you will expose yourself to messages you are better off not seeing, so, if you want to retain your wallet, dignity and self respect, the message is simple: Offerings of 'Heaven on Earth' should be treated with scepticism - don't take the bait, discourage them by ignoring them.

Kevin Yeandel

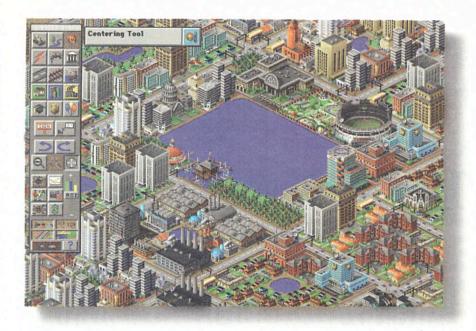
#### **Nameless Horrors**

HAT WE should do,' said the BT spokesman whose name I didn't realise I was going to need, 'is to install a large broad bandwidth network across the whole of the UK.'

'Can I just stop you one second' interrupted Peter Snow, blinking in the Newsnight lights. 'For the benefit of the viewers: what is a broad bandwidth network?'

Mr BT appeared to control a spasm of inner rage, converting it into a more or less polite sneer. 'It's a less babyish name for an Information Super Highway.'

The BT man was right: 'Information Super Highway' is a babyish term. I have a number of other problems with it too. For a start, it's not clear whether it's always to be used in the singular taking the definite article - 'I was cruising down the Information Super Highway the other day, and do you know, I couldn't find a Coke machine that was working' - or as an ordinary noun, as in



Screen grab, courtesy of Maxis, taken from the highly popular game, Sim City 2000. Maxis (0171 490 2333) were 'totally unaware' of this additional and extra-ordinary use of their product.

'They've had the street up all week putting in an information super highway - Keith says we'll be able to watch Murdoch Super Rugger on it.' ISH, as I'll call it henceforth, is too damn long for use in normal conversation - its eight syllables choke any sentence. People who have no knowledge or business with it seem to love saying the words at any opportunity, just for the sake of hearing them. My acquaintances will tell you that I have a similar problem with the phrase 'Kylie Minogue'.

It's not just that ISH is not a particularly good metaphor - I argue it's a dead or dying metaphor anyway - but that no metaphor is needed. Anybody can grasp the concept, if not the underlying technology, quite easily, without giving it this daft name. Did Victorian engineers feel the need to explain the early telegraph network as a 'Lightning Word Railway' or an 'Electric Letter Canal'?

There's the fact that ISH was coined by a US Vice President, a post I always understood to comprise a few light entertainment duties and a willingness to make a potatoehead (sic) of oneself in public, gives me further cause for doubt. Any phrase that the politicians sick onto us should be held up to the light and examined with extra care before going into general use. How was the white heat of technology for you, dear?

Where Super leads, can Hyper be far behind? Especially with a juicy alliteration waiting to be plucked?

The thing to do, of course, is to present a sensible alternative and back it, or shut up whining. Sadly this is where I flunk. In *Wired UK 1.02*, adhering to their previously-noted practice of translating every single word into

British English, they had a punter talking about the *Information Motorway*. As someone who lives a few miles from the M25 London Orbital Car Park, and who regularly gets what seem like 1200 bps connections to ftp.microsoft.com, I confess this imagery has certain appeal, although probably not what its inventor had in mind. One can sometimes avoid an ISH reference by talking about 'the Net', but the two phrases are not synonymous - the Net is at least two rungs up in the OSI Seven Layer Supermodel. I thought about trying to do something with 'WAN', until a pal dished it by pointing out that supporters of such a scheme would be known as WAN-kers.

So *EXE* readers are invited to submit their own ideas to this office. Anybody comes up with something good, we'll start a campaign to get it used. I think we will find that we do not stand alone.

Next month a few lines on that word which is a disgusting mixture of Greek and Latin stems, *television*.

WW

#### Get it off your chest

Are you an angry young programmer? Or a cynical old analyst? EXE seeks new contributors to this column. Articles should be short - 400 words is about right - and should deal with a topical issue relevant to out sector. Beer tokens will be paid for work printed here. If interested, please contact the editorial department by email, mail, fax or phone - details on the Contents page.

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#### News & Views

#### Symantec C++ 7.0

This major new release offers some unique features at a special introductory price. The object-oriented browser/editor has three views one shows classes as a graphical "tree" with drag'n'drop; another is a three pane browser, as in Smalltalk; and an advanced programmer's editor.

NetBuild lets you distribute build tasks across multiple machines on a network, detecting which ones are not being used. Optlink 6 is now a multi-threaded 32-bit linker for even faster linking. with EXE & DLL compression. Multiscope 3 includes native Win95 & WinNT support, Inspector View for multiple types, Thread View for multi-threaded apps, and new hardware

watchpoints.

The new Express Agents are similar to
Borland's Experts and Microsoft's Wizards, with
full support for MFC 2.51 & 3.0 including ODBC &
OLE 2.0. The latest language features including
exceptions, templates & run-time type identification are supported for both 16 & 32-bit

ResourceStudio lets you edit all standard Windows resources, including the new Win32 & Win95 extensions, with full undo/redo. Full on-line docs are included on the CD-ROM. At only £169, why not try it out? You'll need over 300Mb for a full install, plus over 200M more if you want the docs on your hard drive!

#### Personal Oracle7

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However, the most interesting access method for programmers is Oracle's new object-oriented database interface called Oracle Objects for OLE. This delivers high performance without the complexity of OCI or the overhead of ODBC.

For Visual Basic there is a VBX with an OLE in-process server. Excel & Word can access data via VBA. C++ developers can use class libraries for runtime binding of OWL or MFC widgets to SQL query results

You can also access remote servers via Oracle Objects for OLE, since SQL\*Net is built-in. Call us now for full details. Only £345.

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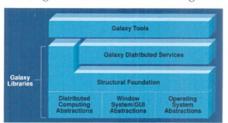
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